MACROECONOMETRIC MODEL:

MALAYSIA MODEL

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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 24,974.

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AR	Autoregressive
GDP	Gross Domestic Product
ICT	Information Communication Technology
MAPE	Mean Absolute Percent Error
MEM	Macroeconometric Model
OLS	Ordinary Least Square
RMSE	Root Mean Square Error
SITC	Standard International Trade Classification
US GDP	United Stated Gross Domestic Product

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PREFACE

The macroeconometric model: Malaysia model had reached a maturity stage in developed countries and it had been widely used by government, banks and organizations for forecasting and policy simulation purposes. However, the application of macroeconometric model is still not that common in Malaysia. Therefore, we complete our Final Year Project with this title: Macroeconometric Model: Malaysia Model. We hope that this research can provide future researcher a better understanding on economy conditions in Malaysia which is reflected through the macreconometric model built.

Abstract

The macroeconometric model of Malaysia has been constructed using the annual data from year 1978 to 2009. This study consist a total of 42 variables which are 28 endogenous and 14 exogenous. There are 24 equations and five identities which categorized into four blocks: production, aggregate demand, government budget and price. The equations are estimated using Ordinary Least Square (OLS). Ex-post forecasting for year 2010 is done to evaluate the performance of the model simulation. The forecasting has been done for year 2011 and 2012 based on the assumptions set for two scenarios which is related to the US GDP.

CHAPTER 1: INTRODUCTION

1.1 Introduction

The following section shows a big picture about the backbone of Malaysia economy on each period after the independence of Malaysia. Malaysia economy in the earlier post-independence depends more on primary commodity, especially the tin and rubber (Economic Planning Unit, 2011a). During 1980s, there was a structural change happened in the production sector (Economic Planning Unit, 2011b). Manufacturing sector starts to play an import role in contributing to the growth of economy, in the same time, government promoted the export oriented industries and heavy industries (Economic Planning Unit, 2011b).

Come to period around 1990s, the resources were allocated more on the human resources development and industrial development programs because government believed that the human resources will be the important factor in leading productivity growth (Economic Planning Unit, 1996). During 2000s, Malaysia was moving towards knowledge driven economy in order to further improve the value added for all productivity activities in Malaysia (Economy planning Unit, 2001).

On the other hand, in the period from 1970s to 2010s, Malaysia has faced few financial crises and price crises (Economic Planning Unit, 2011a; Economy planning Unit, 2011b). For instance, oil price crisis in year 1974 and 1979 respectively, commodity price crisis in year 1985, Asian Financial Crisis in year 1997, world trade recession in 2001 and the latest one is the Subprime Financial Crisis in year 2009 (Economic Planning Unit, 2011a; Economy planning Unit, 2011b).

1.2 Research Background: Backbone of Malaysia Economy

Hereby, this section presents the background of Malaysia economy which highlighted the roles of economy sectors in each different stage of Malaysia economy.

1.2.1 Period: 1957 - 1970

During this period, Malaysia was a primary commodity based country, i.e. the economy growth was highly relied on the primary commodities especially tin and rubber (Economic Planning Unit, 2011a). The rubber and tin has contributed a lot to the economy growth in this period and this statement can be proved by the fact that they have contributed 70% of total export earnings, 28% of government revenue and 36% of total employment (Economic Planning Unit, 2011a).

Thus, government has carried out many plans to improve the productivity of agriculture sector because Malaysia was still highly relied on the foreign trade in this period (Economic Planning Unit, 2011a). The main purpose of high dependence on the foreign trade is to generate foreign exchange earnings in order to finance the development projects (Economic Planning Unit, 2011a). In year 1970, the share of tin and rubber on the total export accounted 53.8% (Economic Planning Unit, 1971). Besides that, the export volume of tin and rubber raised by an average of 4.3% and 6.9% per year respectively over the period from year 1966 to 1970(Economic Planning Unit, 1971).

In order to improve the productivity of the agriculture sector, government has focused on the diversification and modernization of the agriculture production as well as the rural development (Economic Planning Unit, 2011a). According to Azmi Shahrin (n.d.), the allocation of 47.5% of the total public development expenditure has been provided to the agriculture and rural development under the First Malaya Plan (1956-1960).

Besides that, in the First Malaysia Plan (1966-1970) and the Second Malaya Plan (1961-1965), the government has continued put effort in the development of the agricultural sector (Azmi Shahrin, n.d.). For example, FELDA and FELCRA have been set up under these two medium plans (Azmi Shahrin, n.d.). FELDA was set up to reallocate the lower-income residents of rural areas to a newly developed area in order to improve their economic status (Felda, 2012). Meanwhile, the objective of establishing FELCRA is to develop the rural population by providing assistance to the rural folk to participate in national economic activities in order to improve their living standards and quality of life (Fedcra 2012). Moreover, government has also implemented the rubber replanting scheme, which about 304,100 acres were replanted in West Malaysia and more than 12, 000 acres were replanted in East Malaysia (Economic Planning Unit, 1971).

1.2.2 Period: 1971-1980

During this period, manufacturing sector became the key sector of the economy because Malaysia transformed from the heavy reliance on mining and agriculture to manufacturing sector (Ang, J.B., 2007). Manufacturing sector was expanding rapidly because government has encouraged and promoted the export oriented industries through the establishment of the free trade zone in early 1970s (Ang, J.B., 2007). This action has led to a rapid development of the export-oriented and labor-intensive industries, such as textiles, wood and electronic product (Economic Planning Unit, 1981).

The manufacturing sector grew at an average annual rate of 22.9%, accounted for 21.6% of GDP in year 1980. (Ang, J.B., 2007). Furthermore, the commodities export volume for the manufacturing sector grew at an average rate of 26.2% during this period (Economic Planning Unit, 1981). The average annual grow rate of the economy was 7.8% due to the expansion of these industries (Economic Planning Unit, 1981).

Apart from this, oil palm was growing faster and it has become the mainstream of the growth in agriculture sector during this period. The rapid expansion of the oil palm output has contributed 40% to the total output of agriculture sector, at the same time, the output of the rubber has declined.(Economic Planning Unit, 1981). The export volume of palm oil grew at an average rate of 18.8% but the export volume of rubber was only growing at an average rate of 1.9% (Economic Planning Unit, 1981). This phenomenon was caused by the less favorable of the rubber to the international market (Economic Planning Unit, 1981).

Meanwhile, for the mining sector, the output of tin production continue reducing due to the higher operation cost. Thus the production of tin declined from 53% to 33% during this period (Economic Planning Unit, 1981). The main product produced in the mining and quarrying sector was replaced by the petroleum production (Economic Planning Unit, 1981). The contribution of petroleum in the total output of mining sector was increased from 29% to 63% (Economic Planning Unit, 1981).

From other perspectives, in this period, Malaysia has faced oil price crisis in year 1975 and energy crisis in 1979 (Ang, J.B., 2007; The Malaysia economy and the monetary policy, 2000). The oil price crisis happened in year 1975 has led to the world recession which also affected the performance of Malaysia economy (Ang, J.B., 2007). Besides that, the inflation rate has increased rapidly from 3.2% in year 1972 to 17.3% in year 1974(Ang, J.B., 2007). Thus, these two events have caused the real GDP declined sharply from 8.3% in year 1974 to 0.8% in year 1975 (Ang, J.B., 2007).

In order to recover from the financial crisis, the government has injected a huge amount of public investment to stimulate the economy growth (Economic Planning Unit, 1986). Hence, the public investment has been increased rapidly during this period to sustain the

economy recovery and eventually the economy was rebounded to 9.3% in year 1979 (Ang, J.B., 2007).

After the incident of the oil price crisis, there was a second crisis happened which the energy crisis was happened in year 1979 but Malaysia economy was not badly affected (The Malaysia economy and the monetary policy, 2000). In fact, Malaysia has gained in this event because the crude oil price has increased doubled from RM2.2 billion to RM4.2 Billion and this trend was favorable to the export of petroleum (The Malaysia economy and the monetary policy, 2000). However, the prolonged world recession has slowed down the economy of Malaysia. The output of production sector especially the agriculture and manufacturing sector as well as the export were affected by the recession (Economic Planning Unit, 1986).

1.2.3 Period: 1981-1990

The GDP during 1980s has an average annual growth rate of 6%, which is 200 basis points lower than past decade (Economy Planning Unit, 1991).The decreasing in GDP growth was caused by world economy recession in year 1979 and the sharp fall in the world commodity price in year 1985 (Ang, J.B., 2007; Economy Planning Unit, 1991). Thus, the GDP has registered a negative growth of 1.1% once in this period (Ang, J.B., 2007; Economy Planning Unit, 1991).

The average growth rate of the agricultural sector was 4.2%. The oil palm was still the main contributor to the total output because it has contributed 70% of the total output of agricultural sector (Economic Planning Unit, 1986).

Besides this, according to Economic Planning Unit (1990), the average growth rate of manufacturing sector was at 13.7% during 1986 to 1990. This is because there was a major impetus for the development of heavy industry by the government (Economic Planning Unit, 1981). The heavy industrial program was carried out through a public sector agency which is Heavy Industrial Corporate of Malaysia (HICOM), mainly in producing hot briquetted iron, steel billet plant, cement plant and small engine project (HICOM, n.d.).

Moreover, the public expenditure rose rapidly because government has started several infrastructural and heavy industrial programs which lead to budget deficit in the balance of payment and high debt level. Then the sharply decrease in the export commodity price in 1985 has led to a decrease in the total export income by 1.6% and 6.2% in year 1985 and 1986 respectively (Ang, J.B., 2007). This incident also led to a further deterioration on the balance of payment. In order to correct the imbalance in the balance of payment, cutting the public expenditure is needed. Therefore, government encouraged private sector to play a major role in the economy through privatization, tax incentives and deregulation instead of only relying on government investment (Abe.S, n.d.).

In year 1987, the external demand started to pick up and caused the commodity price to be rebounded. Besides that, this condition has increased the demand for manufacturing goods, particularly in semi-conductor and textiles as well (Economic Planning Unit, 1991). The devaluation of ringgit Malaysia and the low interest rate further facilitated the economy recovery process which was contributed by the rapid growth of export since year 1987 (Economic Planning Unit, 1991). Moreover, the fast expanding of the manufacturing sector and high demand for manufacturing goods indicated a major structural transformation of the economy. The manufacturing sector has grew at 10.4% per annum and it has surpassed the contribution of agriculture sector to GDP in year 1987 which the manufactured sector contributed 22.6% in GDP (Economic Planning Unit, 2011b)

1.2.4 Period: 1991-2000

During 1990s, the declaration of the Vision 2020 is served as the guidance for Malaysia to become a developed nation by 2020 (Economic Planning Unit, 2011a). Furthermore, government believed that human resource is important to achieve the productivity-led economic growth, so human resource base is being strengthened by the government by increasing the investment in education and training (Economic Planning Unit, 1996).

At the first half of the 1990s, the major expenditure of government was used to accelerate the process of the industrial development (Economic Planning Unit, 1991). Besides that, resources are allocated to the human resources development and industrial restructuring program, especially improving the quality of education and having more training to train the skilled manpower in order to increase the productivity and enhance the efficiency of labor force (Economic Planning Unit, 1991).

According to Economic Planning Unit (1996), the average growth rate of the economy in year 1991-1995 is 8.79%. The economy was mainly led by private sector whereas public sector only provided support to the development (Economic Planning Unit, 1996). Furthermore, the strong growth of the economy was mainly due to the promotion of the private sector as the main driver of the economy (Ang, J.B., 2007). Besides that, Ang (2001) stated that, the foreign direct investment to GDP ratio has increased significantly from 3.3% during 1981-1990 to 6.6% during 1991 to 1996, which accounted 23% of the total investment. The better performance of the foreign direct investment was mainly due to the low corporate tax and high investment allowance promoted by government (Economic Planning Unit, 1996).

In addition, the gross export grew at an average rate of 18.4% per annum between 1991 and 199. Manufacturing sector has contributed 25.8% to the total export while the electronic, machinery and appliances has become the major components of the export,

which accounted 65.7% of total manufacturing export (Economic Planning Unit, 1996). Moreover, the production of service sector grew at an average of 9.3 % and the biggest contributor to the service sector was the wholesale and retail sales, hotel and restaurant (Economic Planning Unit, 1996).

However, the performance of the economy Malaysia was affected by Asian Financial Crisis in year 1997, the economy growth rate even reached a negative growth rate of 7.8%, private investment had a negative growth of 11.6% and export had the slowly growth of 0.5% in year 1998 (Economic Planing Unit, 2001). The financial crisis occurred because of the attack of the speculation on East Asia currencies, including Ringgit Malaysia. In response to the crisis, the government adopted a tight monetary policy to increase the interest rate and cut off the public expenditure by 20% in order to reduce the current account deficit to prevent ringgit Malaysia further depreciate (Economic Planning Unit, 2011; Economic Planning Unit, 2001).

The economy condition was worsened. Government has adopted simulative fiscal policy and monetary policy to stimulate the economy activities (Economic Planning Unit, 2001). Besides, capital control was implemented and ringgit Malaysia was pegged at RM3.8 to USD in order to stabilize the exchange rate (Economic Planning Unit, 2011a).

After the event of financial crisis, the main impetus of the growth was mainly due to the external demand for electronic product and the depreciation of the ringgit Malaysia. The average growth rate of the economy was 7.2% during 1999 and 2000 (Economic Planning Unit, 2011a; Economic Planning Unit, 2001). From the year 1998 to 2000, additional measures were used to boost the productivity, for example, reallocating more resources on the research and development, education and training, and technology improvement (Economic Planning Unit, 2001).

1.2.5 Period: 2001 -2010

In 2000s, according to the Economic Planning Unit (2001), the main intention of government was to enhance the economy competitiveness, strengthen the total factor productivity and improve the economy resilience. By doing this, the government has to shift the growth strategy from input-driven toward knowledge driven, so this will enhance output growth and accelerate the agriculture, manufacture and service sectors (Economy planning Unit, 2001). Moreover, this measure can enhance the value added of all productivity activities through knowledge utilization and also create new knowledge-based economy (Economy planning Unit, 2001).

In order to create knowledge intensive industries, the FDI particularly for the high technology manufacturing and ICT were promoted by government to bring significant benefits, such as human resource development and technology transfer (Economy planning Unit, 2001). This is because the development of knowledge based economy required mature development of human resource, strength research and development, upgraded ICT infrastructure and appropriate financing facilities (Economy planning Unit, 2001).

According to Ang (2007), although the growth of the economy fell to 0.3% and private investment was contracted by 19% in year 2001 due to the world trade recession, the real GDP still grew at an average rate of 4.5% per annum during 2001 to 2005 (Economy planning Unit, 2006). In these five years, the real GDP was mainly supported by domestic demand and export (Economy planning Unit, 2006). As the formation of knowledge based economy has been highly emphasized, the productivity and efficiency has been further improved. The total factor productivity contributed to GDP has accounted 29% during 2005 compared with 24% in 2000 (Economy planning Unit, 2006). The contribution of the labor to GDP was higher at 33.2% in 2005 compared to 30.8% in 2000 while capital to GDP ratio was declined to 37.8% in 2005 compared to 45.2% in

2000. This indicates that the economy has been shifted slowly toward productivity driven growth (Economy planning Unit, 2006).

During 2001-2005, the agriculture sector grew at an average rate of 3% and palm oil was still the major contributor in the agricultural sector which accounted for 36.7% of the total agricultural sector in year 2005 (Economy planning Unit, 2006). For the manufacturing sector, the average growth rate is at 4.1 % and the main contributor to the growth of manufacture sector was the chemical product, food processing, rubber product and paper product (Economy planning Unit, 2006). Meanwhile, for the service sector, it was recorded at an average growth rate of 6.1% and the major contributor for the service sector were finance, insurance, business service and real estate (Economy planning Unit, 2006).

During the 2006 to 2010, the average growth rate of the economy was registered at 4.2% which was lower by 0.3% compared to year 2001 to 2005 (Economy Planning Unit, 2011b). This phenomenon was mainly due to the recession occurred in the United State in 2008 and caused the economy growth recorded at negative growth rate of 1.7% in year 2009 (Economy planning Unit, 2011b). Besides, the private investment had the negative growth of 17.2% in 2009 (Economy planning Unit, 2011b). In response to the recession, the government has introduced two stimulus packages in 2009 and 2010 to boost the economy (Economy planning Unit, 2011b).

In addition, during 2006-2010, agriculture sector was recorded at 3% average growth rate, manufacturing sector was recorded at 1.3% average growth rate and the service sector remain strong, registered 6.8% average growth rate (Economy planning Unit, 2011b). The slow growth rate of the agriculture sector was mainly due to the decline in the output of rubber caused by reduction in rubber hectare and the decline in the output of saw logs caused by logging controlling (Economy planning Unit, 2011b). The reason for the

decline of the output of the manufacturing sector was mainly due to largely deterioration of the demand for export in year 2009 (Economy planning Unit, 2011b).

In conclusion, the agriculture sector, manufacturing sector and service sector have played the important role in different periods of Malaysia economy. Those three sectors have supported Malaysia to achieve economic growth and economic development processes. Nowadays, service sector is then being focused on the economy growth and Malaysia is moving towards to a knowledge-based society (Economy planning Unit, 2001). Therefore, Malaysia will move toward to a resilient and competitive economy in the future.

1.3 Problem Statement

Recently, Malaysia has experienced the economy slowdown caused by the U.S financial crisis in year 2008 (Economic Planning Unit, 2011b). The U.S. financial crisis caused by subprime mortgage crisis has erupted and brought negative effect on both developed and developing countries. Moreover, the impact of the Subprime Financial Crisis has spread over the world and it eventually causes downturn in global economics (Goh & Lim, 2010).

The economic slowdown in Malaysia is associated with the U.S financial crisis via the relationship of trade and financial linkage between these two countries (The impact of the Global Economic Slowdown on Malaysia, 2009). U.S financial crisis adversely affected Malaysian economy because U.S has reduced its import from Malaysia and this condition has led to declining in Malaysia trade surplus (Goh & Lim, 2010).

Malaysia is a highly open economy so the effect of the global recession can be seen from performance of the sectors that related to external trade (Goh & Lim, 2010). Bank Negara Malaysia (2009) stated that the slowdown in developed country economies

started to affect Malaysian economy in the fourth quarter of 2008 because the export has been decreased by 7.4%.

Therefore, it is important for us to analyze the impact of external shock on the external trade of Malaysia. Thus, we can suggest the course of actions that should be taken by government to maintain the Malaysia external trade.

The research questions of this research are:

i) What is the impact of the changes of the global economy condition on the Malaysian external trade?

ii) What is the best course of action for policymakers to maintain the trade surplus under various circumstances?

1.4 Objective

1.4.1 General Objective

Building macroeconometric model is mainly for the purpose of forecasting the future economy conditions and carry out policy simulation which served as a guideline for policymaker to design their policy. Macroeconometric model reached maturity stage in developed country but not that common in developing country, same as Malaysia. Therefore, as undergraduate students, we are doing this research by building a macroeconometric model for Malaysia for policy simulation and forecasting purposes.

1.4.2 Specific Objective

As we can see from the research background, government has carried out different plans to promote the economies at different stages over the last 53 years. The economic plans are designed to stress on different areas of economy according to the conditions of economy during that time. Thus, it is necessary to build the macroeconometric model to forecast the growth rate of the macroeconomics variables. The forecasting is completed based on assumptions made. Besides, we also aim to evaluate the significance of the impact of different events such as the structural break and financial crisis occurred over the 53 years stated in research background.

1.5 Significance of Study

This research is significant because we are able to identify the impact of external trade on Malaysia economy. The identification on the effect of external trade is essential since Malaysia economy is an open economy. If there is any economic events happened in other countries, Malaysia economy will be affected by those countries through international trade. Due to this reason, this research also examines the spill over linkage of global economy slowdown and Malaysia international trade. Thus, effective policies can be recommended to strengthen Malaysia international trade.

1.6 Chapter Layout

Chapter 1: Introduction

The overview of this chapter presents the research background, problem statement, objective, and research question, significance of study and chapter layout.

Chapter 2: Literature Review

This chapter presents the overview of literature that relevant to the field of the research. The introduction of macroeconometric model and its application will be explained in this chapter.

Chapter 3: Methodology

This chapter presents the research methodology, data sources, model structure, and data adjustment.

Chapter 4: Data Analysis

Estimation of the model and model simulation are reported in this chapter. Model evaluation and scenario forecasting are carried out by applying the model. E-view is the analysis tool used in the data analysis in this research project.

Chapter 5: Discussion, Conclusion and Implication

Summary of statistic analysis is presented in this chapter. It further illustrates the major finding and implication of the study of the research. Recommendation for future researchers is recorded in this chapter.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction of Macroeconometric Model

Macroeconometric model is very useful for forecasting, policy simulation and also identifying structural change for an economy (Solheim, 2005 & Valadkhani, 2003). Valadkhani (2003) defined macroeconometric model as an economy quantitative analysis that applies economic theory, data and econometrics knowledge to estimate or compute equations of an interrelated system. The construction of macroeconometric model can be used to accomplish three purposes including structural analysis, forecasting and policy simulation (Valadkhani, 2003). Solheim (2005) stated that macroeconometric model acts as an important tool to guide decision making for both public and private macroeconomic institution over the last 40 years.

Situation of an economy is reflected via building a macroeconometric model based on the historical data of the economy for further forecasting and evaluation purposes. In the study of Garcia, Garcia, Magendzo and Restrepo (2003), they mentioned that the purpose of building and specifying a macroeconometric model is to reflect an economy's main characteristics. Besides, it is also used to forecast macroeconomics variables and simulate a policy.

2.1 .1 Why the Macroeconometric Model is Used?

Basically, there are two types of macroeconomic models which are macroeconometric model (MEM) and computable general equilibrium (CGE). CGE model is a

macroeconomic model used to conduct policy analysis and to estimate the reaction of an economics to the changes in policy.

Macroeconometric model was chosen as the method in this research due to the following reasons. Valadkhani (2003) stated that the early CGE only reflected the situation of macroeconomy without providing any information on the dynamic and adjustment process. Although that was research done by Dixon and Malakkelis (1995) applied CGE models for dynamic adjustment process for both short term (3-5 years) and medium term (5-7 years) , the CGE model did not provide applicable information for forecasting and policy analysis. However, there is no other approach can substitute the macroeconometric model in policy analysis and forecasting. The reason is macroeconometric model be able to deliver information on dynamic adjustment process for short term and medium term forecasting and policy analysis (Hall, 1995).

Furthermore, the formation of macroeconometric model can reflect an economy in an organized way (Garcia, Garcia, Magendzo & Restrepo, 2003). Valadkhani (2003) defined macroeconometric model as a quantitative analysis of an economy condition to accomplish three objectives: forecasting, structural analysis and policy evaluation. He explained that the model can be built by estimating an interrelated system of equations using economic data with the supplement of economic theories and econometrics skills.

In addition, Solheim (2005) stated that macroeconometric model acts as an important tool to guide decision making for both private and public macroeconometric institutions over the last 40 years.

There were studies done by Cheong (1976) and Leow (n.d) applied macroeconometric model to examine the effect of government policy on Malaysian economy. Thus, the researches served as a basic for us to use the same technique in this research to rerun the

macroeconometric model of Malaysia economy using different set of economics data which starts from the year 1978 till 2009.

2.2 Development of Macroeconometric Model

This section discusses the origin of macroeconometric model and the effect of Lucas Critique on the macroeconometric modelling in forecasting and policy analysis. After that, it is followed by the usage of macroeconometric model in recent years.

2.2.1 Origin of Macroeconometric Model

In the early 1930's, econometrics was first developed to solve the problems of single equations. However, this solution cannot provide explanation for many economic relationships. Hence, the macroeconometric model with the structural equation systems has solved the problem of explaining relationship among variables in macroeconomics (Solheim, 2005).The structural equations system which consist of the structural equations are referring to those equations represent the relationships between variables based on theory. (Solheim, 2005).

The date backed to 1930's. Keynes made the first contribution in macroeconomics. However, there was no formal measurement on actual data, so researchers were unable to test the implication on those actual data. This situation happened because the collection of macroeconomics variables was still at infant stage and researchers had limited ability to apply the available data during 1930's. Thus, the formulation of macroeconometric model had helped to translate the theories into measurement and became a tool which serves as a guideline for government and central bank to make decisions during 1950's (Valadkhani, 2003).

Jan Tinbergen was the pioneer in developing macroeconometric model. During 1945, he built a macroeconometric model for Dutch economy and assisted Dutch Central Planning Bureau in designing applicable economic policy (Valadkhani, 2003). After that, the model was widely used by European countries and North-America which they mainly used for analyzing policy indicators and forecasting (Solheim, 2005).

2.2.2 Criticism of Macroeconometric Model

The recent study of Wickens (2008) showed the limitation of traditional macroeconometric model. He noticed that the integration of macroeconomic theory and microeconomics theory that based on micro-foundation was getting common. Evaluating Socio Economic Development (2009) explained this by further elaborating that this situation has caused the reducing application of time series model. This is because the models purely built from statistically study on time series data relationship has no micro foundation while modern macroeconomics tend to explain the aggregate economy using both theories and micro-foundations (Evaluating Socio Economic Development,2009).

Date backed to 1970's; macroeconometric model was criticized by different parties from the year onwards. According to Pesaran (1995), there was criticism on macroeconometric model based on Cowles commission approach and the criticism can be categorized into 6 problems:

(i) Forecasting inadequacy

(ii) Structural instability

(iii) Arbitrary assumptions of zero restrictions

(iv) Theoretical contrast with rational expectations theory

(v) The endo-exogeneous division of the model variables in order to pass the identification conditions

(vi) The existence of the unit roots problem and ignorance of the time-series properties

Nonetheless, Lucas critique was the most influential because the Lucas critique has led to the decline in the application of macroeconometric model in analyzing policy. This is supported by the literature done by Valadkhani (2003). Robert Lucas published an influential paper arguing that the failure of the Philips curve in the 1970s was one example of a general problem with empirical forecasting models (Valadkhani, 2003). Those empirical forecasting models were built to observe the relationship between macroeconomic quantities over time and the relationship depends on the policy takes place at the time (Valadkhani, 2003). Lucas Critique also elaborated that policymaker cannot predict the effects of a new policy through empirical forecasting model based on historical data where the policy was not in place (Valadkhani, 2003).

Blanchard (2006) stated that under Lucas critique, macroeconometric model does not help to simulate a policy because the models captured the relationship of economics variables under past policies. When the policy is changed, people will change the way of forming their expectations as well. Thus, policy design using macroeconometrics model serves as a poor guide for policy maker because they cannot simulate the effect of new policy which is estimated based on past policies (Blanchard, 2006).

Valadkhani (2003) mentioned that Lucas rejected the application of macroeconometric model to analyse policy. The estimated coefficients from the macroeconometric model will be different due to the changes in policy which in turn can cause the changes in economic structure (Valadkhani, 2003).

2.2.3 Response to The Criticism of Macroeconometric Model

According to Valadkhani (2003), there were three methodological alternatives of modeling against the criticism of Cowles Commission Approach on macreconometric model:

(i) Sim's vector autoregression model (VAR)

(ii) Leamer's methodology

(iii) Hendry methodology

First, Sim's methodology indicated that traditional macroeconometric model was under identified, so VAR is allowed to estimate in an unrestricted reduced form. However, multicollinearity problems and "overparameterization" will emerge when the variables are more than five. Second, the Leamer's methodology is a method that uses the exogenous variable which do not used by Lucas Critique and it is focused heavily on OLS method. Third, Hendry methodology is a method that determining the explanatory variables by using theories while the relationship which is static or dynamic are shown by the data. However, this methodology is necessary to go through different types of diagnostic test and it relies heavily on data (Pagan, 1987 & Danell and Evans, 1990).

Moreover, Klein (1989a) refuted the Lucas Critique by stating that the structure of economic relationship was more persistence than change. Although the economy has changed, the parametric structure did not change (Klein, 1989a). The main factor that caused the changes in economy might come from random errors and exogenous variables (Klein, 1989a).

2.2.4 Macroeconometric Model Nowadays

Macroeconometric model is still widely used by government and central bank in recent years in both developed and developing countries. Arestis and Sawyer (2002) mentioned that the Bank of England has used macroeconometric model to find out the effectiveness of using interest rates to control the inflation rate. Besides, the Bank of England also sought to know the implication of macroeconometric model on monetary policy (Arestis and Sawyer, 2002).

In the paper of Wallis (2008), Latin America is currently using macroeconometric model for economic projections and policy analysis. Besides, a quarterly macroeconometric model was developed to help Iceland Central Bank to analyze the current economy (Daníelsson et al., 2006). It was used by Iceland Central Bank for forecasting and identifying the impact of various policies and shocks on economy (Daníelsson et al., 2006). It also played a role in dealing with risks and uncertainties faced by the country (Daníelsson et al., 2006).

Maroney, Hassan, Basher and Isik (2004) estimated a macroeconometric model for Bangladesh to analyze the strength of different factors such as short run and long run monetary policies, fiscal policies and innovation on the macro-economy in the country. This model was constructed using annual data from the year 1974 to 2000 (Maroney, Hassan, Basher and Isik, 2004). The authors concluded that the monetary policy is more important than fiscal policy in Bangladesh (Maroney, Hassan, Basher and Isik, 2004).

On the other hand, the macroeconometric model is also built in Singapore to examine the relationship of various macroeconomic relationships in the Singapore economy (Peebli & Wilson, 1996). The research clearly presented the steps of building the macroeconometric model. The first step in the paper is model specification which is followed by model estimation (Peebli & Wilson, 1996).

After the result of estimation was known, the authors proceed to the model simulation section which consists of simulation and ex-post forecasting (Peebli & Wilson, 1996). Simulation was used to examine whether the model can simulate the past condition of the economy well by observing whether the equations simulated path was closely traced to the actual path (Peebli & Wilson, 1996). The ex post forecasting can provide a further evaluation on the performance of the model built (Peebli & Wilson, 1996).

Last step is the application of the macroeconometric model which can be separated to the multiplier analysis and forecasting (Peebli & Wilson, 1996). The effect of multiplier on exogenous is presented under this section. The assumptions have been made to complete the forecasting for the economy (Peebli & Wilson, 1996).

2.3 Application of Macroeconometric Model

This section reviews the application of macroeconometric model in developed countries, developing countries and Malaysia.

2.3.1 Developed Countries

Macroeconometric model has reached a maturity stage in developed countries such as Netherland, US, Australia and others (Valadkhani, 2003). Prior to World War II, Dutch economy applied macroeconometric model to design appropriate economic analysis. Jan Tinbergen was the pioneer in macroeconometric modeling (Valadkhani, 2003).

After that, Netherland, US economy also applied macroeconometric model for analysis purpose (Valadkhani, 2003). Bodkin, Klein and Marwah (1991) stated that Tinbergen performed business cycle analysis for US economy during year 1939. In the mid of 1940s, Klein built a macroeconometric model for the same country (Valadkhani, 2003). After World War II, macroeconometric model was continuing developed in US economy when Marschak organized a special team at the Cowles Commission (Valadkhani, 2003). Klein joined the team and completed macroeconometric modeling for US economy in the mid 1940s (Valadkhani, 2003).

Lawrence Klein and Goldberger built the Klein-Goldberger model for the US economy to forecast economic trend (Valadkhani, 2003). With the creation of the model for US, Lawrence Klein was awarded Nobel Prize in Economic Sciences in 1980 (Valadkhani, 2003). During 1960s, Klein and Duesenberry constructed a Brookings quarterly macroeconometric model which integrated input-output table (Vane & Mulhearn, 2005). This macroeconometric model was applied to forecast the short term development of US economy (Vane & Mulhearn, 2005).

In 1961, UK model was built by Klein with Ball and Vandome (Wallis, 1988). Richard Stone continue maintained the UK model and later named the model as Cambridge Growth Project Model (Wallis, 1988). The model was more like a planning framework than fully estimated macroeconometric model (Wallis, 1988). By 1969, the National Institute and the Treasury was doing economic forecasting using a full model (Wallis, 1988).

From previous literatures, macroeconometric models are constructed on a single economy. However, economy of one country can be affected by other countries since most of the countries are open economy nowadays. The following examples are the efforts done by different institutions to internationalize macroeconometric model in order

to assess the international transmission mechanism. Project Link[1] was established in 1968 to take independent country models and link them together via merchandise flows and prices, for example price linkages, exchange rates and trade flows (About Project Link, n,d).

The macroeconometric model done by Project Link included almost 100 independent models by the end of 1980s (Bodkin, 1988b). Project Link contained 79 macroeconometric models of individual countries (Bodkin, 1988b). The models were mainly for forecasting purpose (Bodkin, 1988b). In the journal written by Valadkhani (2003), it showed that Project Linked has internationalized macroeconometric model over the last three decades.

International Monetary Fund has developed the MULTIMOD[2] econometrics model to examine the transmission of shock across the selected countries (MULTIMOD Econometric Model, n.d.). Organization for Economic Cooperation and Development (OECD[3]) initially used trade flows to link national models which then developed into a complete integrated model called Interlink (Helliwell, Sturm, Jarrett and Salou, n.d). US Federal Reserve built a Multi-country Model (MCM) which aims the financial linkages issues for these countries: US, Canada, West Germany, Japan and United Kingdom and an abbreviated model representing the rest of the world. The Multi-country model has highlighted the relationship of main domestic variables and international transactions of

[1] Project LINK is a large cooperative, non-governmental, international research consortium and recognized as a leading centre of quantitative international economic analysis. It is based on a world-wide network of participants in more than 60 countries in the industrial and developing world. The activities of Project LINK are coordinated jointly by the Project LINK Research Centre at the University of Toronto and the Department for Economic and Social Affairs of the United Nations.

[2] MULTIMOD is a modern dynamic multicountry macro model of the world economy that has been designed to study the transmission of shocks across countries as well as the short-run and medium-run consequences of alternative monetary and fiscal policies.

[3] OECD is an organization composes 34 member nations that promotes economic stability and democracy in its member countries and in developing nations

the countries mentioned above (Hernandez-Cata, Howe, Kwack, Stevens, Berner and Clark,n.d.) .

Observatoire Francais des Conjunctures Economiques (OFCE[4]) and Centre d'Etudes Propectives et D'Informations Internationales (CEPII[5]) developed a macroeconometric model for the world of the economy called MIMOSA (Artis & Holly, 1992). The multicountries model was constructed to analyze the effect of different kinds of monetary and fiscal policies (Dovi, Coudert and Henry,n.d.).

2.3.2 Developing Countries

According to Valadkhani (2003), the earliest model for developing countries was used to capture the demand side of the economy. Nugent (1975) mentioned that the early models have been improved by incorporating macroeconometric model with neoclassical formulation, emphasized the importance of expectations and lag formulations, macroeconometric joint with input-output table in the production side and linking macroeconometric model with long run planning models.

Macroeconometric model is widely use in developing countries due to economics obstacle like stagflation, trade deficit, budget deficit and huge debt burden (Valadkhani, 2003). However, Seers (1963) criticized that the models suitable for developed countries might not appropriate for developing countries because the different purpose of the model and diversification of economic structures. Klein (1989a) pointed out that Keynesian

[4] OFCE operates as a university research centre and an institution for forecasting and evaluating public policies

[5] CEPII is the main independent French institute for research into international economics.

macroeconometric modeling is suitable for developing countries under the condition of relevant modification to be made especially the investment and production function.

India is the first developing countries applying macroeconometric model. Narasimham (1956) under the supervision of Tinbergen has done macroeconometric modeling for India which the model is the first model for developing country. The model was used to examine the relationship between various economic sectors, between market and policy variables as well as the details of these relationships at different level of disaggregation (Narasimham, 1956). However, the policy simulation has not applied in real world, neither for forecasting nor decision making (Narasimham, 1956).

There were another 10 developing countries: Brazil, Chile, Hong Kong, India, Korea, Mexico, Philippines, Taiwan, Thailand and Venezuela have constructed macroeconometric model for simulation (Adam and Vial, 1991). However, the authors pointed out four problems after evaluating the macroeconometric modelling simulation for the 10 countries. The four problems highlighted are:

(i) Inflation is strongly related to the monetary sector performance

(ii) The impact of government consumption is higher than government investment on economic growth which the outcome is out of the expectation and the model associated with mis-specification problems

(iii) The performance of macroeconometric model on simulation shows more accurate result for shorter observation period

(iv) The model builder pays little attention on the supply side in the long run

Other organization also constructed macroeconometric model for developing countries. For example, Economic Commission for Asia & the Far East (ECAFE[6]) (1968) and The United Nations Conference on Trade and Development (UNCTAD[7]) (1973) built a series of macroeconometric model for around 40 developing countries to forecast the foreign capital required by developing countries (Valadkhani, 2003).

2.3.3 Malaysia

The following are the studies related to the macroeconometric model of Malaysia. The macroeconometric models of Malaysia were built for different purposes and thus the models were structured in different methods. Moreover, there were different amount of equations, endogenous variables as well as exogenous variables used in each macroeconometric model of Malaysia.

For example, Abe (1987) has completed Malaysia Model II by using annual data from year 1970 to 1989 to reflect the condition of Malaysian economy for that period and carry out policy simulation from the year 1989 to 1995. The model created by Abe (1987) has been categorized into 7 blocks which are production block, employment block, aggregate demand block, price block, government budget block, balance of payment block and money supply block. The model consisted of 44 equations with 41 endogenous variables and 14 exogenous variables.

In contrast, Leow (n.d) has constructed macroeconometric model for Malaysia's manufactured exports which aimed to study Malaysia macroeconomic behaviour and highlighted the market shares of manufactured exports in the East Asian region using

[6] ECAFE is the commission of the Economic and Social Council of the United Nations that is concerned with economic development of countries in Asia and the Far East.

[7] UNCTAD was established in 1964 as a permanent intergovernmental body. It is the principal organ of the United Nations General Assembly dealing with trade, investment, and development issues.

annual data from year 1980 to 2006. The model done by Leow (n.d.) was estimated in four sectors which included private sector, government sector, external trade sector and monetary sector. There were 11 behavioural equations and 13 identities which made up of 27 endogenous variables and 21 exogenous variables.

On the other hand, Cheong (1976) designed a macroeconometric model for West Malaysia to quantitatively analyze the relationship between various sectors of West Malaysia. Furthermore, this macroeconometric model allowed the forecasting on the effects of policy (Cheong, 1976). The model was structured into eight sectors which are demographic, employment, consumption, fixed investment and capital stock, wages and prices, taxation, income and output, and foreign trade (Cheong, 1976). The model contained 38 endogenous variables and 13 exogenous variables (Cheong, 1976).

2.4 Simulation

One of the main purposes that researchers construct macroeconometric model is to simulate an economy of a country. The following sections explain the simulation model and simulation techniques.

2.4.1 Introduction of Simulation

Simulation means constructing an artificial model of a real system in order to examine the system (Intriligator, 1978). In economics, simulation involves in repeating solving the specification of a mathematical model with different parameters in order to examine the relationships of different variables and illustrate concepts (Schmidheiny, 2010). For the simulation that we carried out in this study, we used the mathematical model which is

fitted with the historical economics data of Malaysia and it will be served as a proxy for the actual Malaysian economy.

2.4.2 Simulation Techniques

Seddighi, Lawler and Katos (2000) mentioned that the Monte Carlo simulation experiments are used to obtain the properties of estimators. The properties of an estimator are fully described by its probability distribution which can be used to perform tests using hypothesis (Schmidheiny, 2010). It is possible to calculate the sampling distribution from the econometric model. But it is difficult or not possible especially for small samples. Thus, we can use Monte Carlo approach to study the properties of estimators with small sample size (Intriligator, 1978). In economic theory, Monte Carlo techniques are used to explore the quantitative properties of models with stochastic elements.

Intriligator (1978) pointed out that the Monte Carlo approach was used to choose the alternative estimators and also used to influence the sample size, multicollinearity and other factors on the various possible estimators. However, we should take note that the Monte Carlo approach was applied in simultaneous equation estimation result for certain specific model (Intriligator, 1978). Such an application should be made only after extensive testing and systematic treatment if various possible changes in the formulation of the model (Intriligator, 1978).

Nonetheless, Monte Carlo simulation is used to calculate the forecasting variances particularly for nonlinear model (Pindyck & Rubinfeld, 1998) It provides the simulation yield point that reflects the probability distribution of a variable's forecasted value and it also shows the confidence interval of a forecast value (Pindyck & Rubinfeld, 1998).

CHAPTER 3: METHODOLOGY

3.1 Model Structure

This study is a study of small scale macroeconometrics model which consists of 24 equations and five identities. These equations and identities are estimated in four different blocks which include the production block, aggregate demand block, government budget block as well as price and money block.

The article, Malaysia Model II (Abe, 1985) is the main reference article for choosing the variables for each equation. Another article, Modeling of the Singapore economy (Peebli & Wilson, 1996) is the reference article for placing the sequence of the equations to avoid the simultaneity problem. If the endogenous variable becomes the exogenous variable in the subsequent equation, a new series of the endogenous variable will be estimated to replace the origin series for the estimation.

A dummy variable is added to each equation to find out the effect of the structural break happened in year 1997 to the economic activities. Gujarati (2003) stated that the dummy variable is a variable used to quantify the qualitative variable to show certain event or characteristics. The observations before year 1997 are given the dummy variable that takes the value of 0 and for the observations begin from 1997 are given the dummy variable that takes the value of 1. If the p-value of the dummy variable is less than 0.05, the dummy variable has significant relationship with the dependent variable and it reflects the structural break has affected the dependent variables.

3.1.1 Production Block

According to Case & Fair (2007), production is a process of conversion of the natural resources into the manufactured goods and services by using the three key factors of production. The three key factors of production include land, capital and labour. As the number of land is limited and fixed, the production function is regressed as a function of capital per labour which is same as the work done by Abe (1985). Besides, this function is the aggregate production function used to identify the economic growth, i.e. the GDP is derived from the supply side. (Blanchard, 2006).

There are three sectors in the production which are primary, secondary and tertiary sectors. The contribution of the these three sectors to GDP are studied by fragmenting them into five categories, which are (i) agriculture, forestry and fishing, (ii) mining and quarrying, (iii) manufacturing, (iv)services and (v) construction. Primary sector plays a role of changing the raw material into the primary products, thus, the primary sector comprises the first two categories which are (i) agriculture, forestry, fishing and (ii) mining, quarrying. Meanwhile, secondary sector is the sector that transforms the primary products into finished goods, i.e. the manufacturing industry and construction industry. On the other hands, tertiary sector is the sector that provides services, which is the service sector.

From the study of research background in chapter 1, the role of service sector becomes more important in recent year because government has the intention to build an ICT-driven and knowledge-based society. Therefore, the service sector is currently playing a more important role in contribution to the national output compared to last decade. (Economic Planning Unit, 2011f).

Each category of the production is assigned one production function and the notation of the production is as following:

Y1: Production of agriculture, forestry and fishery

Y2: Production of mining and quarrying

Y3: Production of manufacturing

Y4: Production of service sector

Y5: Production of construction

3.1.1.1 Production: agriculture, fishery and forestry

The function of the production of the agriculture, forestry and fishery is as following.

$$Y1L_t = f(IG1_t) + \text{dummy variable}$$

$Y1L_t$ is the production of agriculture, fishery and forestry sector per labour (measured in RM thousand) at year t; $IG1_t$ is the public investment per labour (measured in RM thousand) at year t. Labour refers to the labours work in the agriculture, fishery and forestry sector. Public investment per labour is expected to have positive relationship with production per labour because the investment encourages the production growth.

3.1.1.2 Production: Mining and Quarrying

The function of the production of mining and quarrying is as following.

$$Y2L_t = f(IG2_t) + \text{dummy variable}$$

$Y2L_t$ is the production of mining and quarrying sector per labour (measured in RM thousand) at year t; $IG2_t$ is the public investment per labour (measured in RM thousand) at year t. Labour refers to the labours work in the mining and quarrying sector. Public investment per labour is expected to have positive relationship with production per labour.

3.1.1.3 Production: Manufacturing

The function of the production of manufacturing is as following.

$$Y3L_t = f(TI3_t) + \text{dummy variable}$$

$Y3L_t$ is the production of manufacturing sector per labour (measured in RM thousand) at year t; $TI3_t$ is the total investment per labour (measured in RM thousand) at year t. Labour refers to the labours works in the manufacturing sector. Total investment per labour is expected to have positive relationship with production per labour.

3.1.1.4 Production: Service sector

The function of the production of service is as following.

$$Y4L_t = f(TI4_t) + \text{dummy variable}$$

$Y4L_t$ is the production of service sector per labour (measured in RM thousand) at year t; $TI4_t$ is the total investment per labour (measured in RM thousand) at year t. Labour refers to the labours works in the service sector. Total investment per labour is expected to have positive relationship with production per labour.

3.1.1.5 Production: Construction

The function of the production of construction function is as following.

$$Y5L_t = f(TI5_t) + \text{dummy variable}$$

$Y5L_t$ is the production of construction sector per labour (measured in RM thousand) at year t; $TI5_t$ is the total investment per labour (measured in RM thousand) at year t. Labour refers to the labours work in the construction sector. Total investment per labour is expected to have positive relationship with production per labour.

The identity of the GDP is as following:

Identity: GDP = Y1 +Y2 + Y3+ Y4+Y5

3.1.2 Aggregate Demand Block

GDP is a measurement of the total value of final goods and services produced by a country for a period of time, which usually measured in market price (Case & Fair, 2007). There are two methods to calculate the GDP, which are expenditure approach and income approach (Case & Fair, 2007).Expenditure approach is used in this study.

Expenditure approach is a method that adds up all the spending spent on final goods to compute the GDP (Case & Fair, 2007), in other words, we are calculating the aggregate demand. In this research, the categories of expenditure follow the usual form, which includes the private consumption, investment, government net expenditure and net export. All variables except the government net expenditure will be discussed in aggregate demand block.

3.1.2.1 Private consumption

According to Case & Fair (2007), private consumption is the expenditure spent by households on the goods and services. As stated by Peebli & Wilson (1996), there are

many theories explaining the consumer behaviour, for instance the permanent income hypothesis, life cycle hypothesis, habit persistence model and relative income hypothesis. The explanatory variables extracted from these theories and models are similar and the variables include real disposable income, lagged consumption variable and wealth variable (Peebli & Wilson, 1996). As stated in the General theory, Keynes claimed that the consumption spent by the households is directly related to their income and the relationship between consumption and income is positive as shown by the consumption function (Case & Fair, 2007). According to Abe (1985), private consumption was designed as a function of real disposable income and wealth variable which represented by the real money balance.

$$PC_t = f(YD_t, M2_t) + \text{dummy variable}$$

PC_t is the real private consumption (measured in RM Billion) at year t; YD_t is the real disposal income (measured in RM Billion) at year t; $M2_t$ is the real money supply (measured in RM Billion) at year t. Real disposable income and real money supply M2 are expected to have positive relationship with private consumption because when the disposable income and wealth increase, the private consumption will increase.

3.1.2.2 Investment

Case & Fair (2007) indicates that private investment is the spending used by firms and household for acquiring new capital, for example the purchase of new machinery and plant. According to Blanchard (2006), private investment is mainly affected by the level of sales and the real interest rate. Thus, as designed by Abe (1985), private investment is a function of the level of GDP and real interest rate.

$$TI_t = f(RGDP_t, RIR_t) + \text{dummy variable}$$

TI_t is the private investment (measured in RM Billion) at year t; $RGDP_t$ is the real GDP (measured in RM Billion) at year t; RIR_t is the real average lending rate (measured in%) at year According to Blanchard (2006), the real GDP is expected to have positive relationship with private investment while the real interest rate is expected to have negative relationship with private investment. Higher GDP means higher output and the higher output will increase the investment and development project (Blanchard, 2006). Meanwhile, for the real interest rate, the higher the interest rate means the higher cost of borrowings and it discourages the investment injected in the projects (Blanchard, 2006).

3.1.2.3 Government net expenditure

The government net expenditure is computed by subtracting the government revenue from the government expenditure. The changes of government revenue and government expenditure depend on government policy and economy condition (Case & Fair, 2007). The detail of government net expenditure will be discussed in the section 3.1.3 Government Budget Block.

3.1.2.4 Net export

Net export is the difference between export and import. According to Blanchard (2006), import is determined by the level of domestic income and the real exchange rate while the export is determined by the level of foreign income and the real exchange rate. Referring to Abe (1985), import of goods and services is determined by adjusted import price index, real disposable income and exchange rate while the export of goods and services is determined by GDP of United State of American, adjusted export price index and domestic production.

In Malaysia, all of the import and export of goods and services are categorized based on Standard International Trade Classification (SITC), labelled differently from SITC 0 to SITC 9 according to their types and features (FMM Directory 2010). The detail of the SITC is recorded in table 1. According to the Abe (1985), the total import and export are studied by regrouping the SITC into several groups. In this research, export will be regrouped into three groups while import will be regrouped into five groups which are the same work done by Abe (1985).

Table 3.1: Standard International Industrial Classification.

SITC	Description
0	Foods
1	Beverages and Tobacco
2	Crude Materials, Inedible
3	Mineral Fuels, Lubricants, and Other
4	Oils & Animal and Vegetable fats
5	Materials Chemistry
6	Manufactured Goods (including tin)
7	Machinery and Transport Equipment
8	Miscellaneous Manufactured Articles
9	Miscellaneous Transactions and Commodities

Source: *Department of Statistics, Malaysia Official Website* (2011). Time Series Data.

Export:

Group 1: Crude material, inedible, mineral fuel, lubricants, materials chemistry and others (SITC 2, 3, 5)

Group 2: Manufactured goods and miscellaneous manufactured articles (SITC 6, 8)

Group 3: Others (SITC 0, 1, 4, 7, 9)

Import:

Group 1: Foods, oils & animal and vegetable fats (SITC0, 4)

Group 2: Crude material, inedible, mineral fuel, lubricants, materials chemistry and others (SITC 2, 3, 5)

Group 3: Manufactured goods and miscellaneous manufactured articles (SITC 6, 8)

Group 4: Machinery and transport equipment (SITC 7)

Group 5: Others (SITC 1, 9)

$$IM_t = f(AIMPI_t, RGDP_t, EER_t) + \text{dummy variable}$$

$$EX_t = f(USGDPt, AEXPI_t, Y_t, EER_t) + \text{dummy variable}$$

IM_t is the real import (measured in RM Billion) at year t ;$AIMPI_t$ is adjusted import price index (measured in index) at year t ; $RGDP_t$ is the real GDP of Malaysia (measured in RM Billion) at year t; RER_t is real effective exchange rate index (measured in RM/USD) at year t.

According to Blanchard (2006), real GDP is expected to have positive relationship with import while the real exchange rate will have negative relationship with import. The higher the real GDP means the higher the income of the nation and it will increase the demand for imported goods (Blanchard, 2006). Meanwhile, when the real exchange rate (RM/USD) increase, it means that RM has depreciated and this will discourage the demand for the imported goods (Blanchard, 2006). The adjusted import price index is

expected to have negative relationship with import because when the import price is higher, the demand for imported goods will decrease.

EX_t is the real export (measured in RM Billion) at year t ; $USGDP_t$ is real GDP of United State (measured in RM Billion) at year t; $AEXPI_t$ is the adjusted export price index (measured in index) at year t and Y_t is the real output of respective production sector (measured in RM Billion) at year t.

According to Blanchard (2006), when the GDP of the foreign country is higher, the export of home country to these countries is higher. Therefore, the GDP of USA is expected to have positive relationship with export. The GDP of USA has been chosen because it is the main exporting partner of Malaysia (Malaysia's top 10 trade statistic for the year 2010 (Country), 2011) and it was the origin of the Subprime Financial Crisis in year 2008. The adjusted export price index is expected to have positive relationship with export because when the export price index is higher, the country can gain more revenue from the export and it will encourage the export. For the third variable, production of each sector, the higher the export, the higher the production of the respective goods. Lastly, the real exchange rate (RM/USD) is expected to have positive relationship with export. The higher the real exchange rate means that RM has depreciated and this will encourage the exports to foreign countries because of the relative cheaper price of home country goods.

Identity:

Total IM = sum of five group IM

Total EX = sum of three group EX

GDP = C + I + G + NX

3.1.3 Government Budget Block

The objective of studying government sector is to find out the relationship of the government revenue and government expenditure. The study of the effect of domestic borrowings and foreign borrowings on the government surplus is also one of the interests in this government budget block.

3.1.3.1 Tax revenue

Government revenue mainly contributed by the tax revenue in the form of direct tax, indirect tax and other taxes. Referring to Leow (n.d.), the tax revenues and national income are assumed to grow in the same direction with national income.

$$TD_t = f(RGDP_t) + \text{dummy variable}$$

TD_t is the real direct tax (measured in RM Billion) at year t ; $RGDP_t$ is the real GDP (measured in RM Billion) at year t. The real GDP is expected to have positive relationship with real direct tax because direct tax is calculated by multiplying the tax rate with national income.

$$EX_t = f(TEX_t) + \text{dummy variable}$$

TEX_t is real export tax (measured in RM Billion) at year t; EX_t is real export (measured in RM Billion) at year t. The real export tax is expected to have negative relationship with the real export. Real export is act as the endogenous variable instead of exogenous variable in this equation because export is the respondent variable of the export tax. Export tax is one of the tax policy instrument used by government to control the export volume.

$IM_t = f(TIM_t)$ + dummy variable

TIM_t is real import tax (measured in RM Billion) at year t; IM_t is real import (measured in RM Billion) at year t. The real import tax is expected to have negative relationship with the real import. The reason that real import acts as the endogenous variable instead of exogenous variable in this equation is same as the export tax equation .Import tax is also one of the tax policy instrument used by government to control the import volume.

$TOR_t = f(RGDP_t)$ + dummy variable

TOR_t is combination of the real indirect tax (except export tax and import duties) and other real non tax revenue (measured in RM Billion) at year t; $RGDP_t$ is real GDP (measured in RM Billion) at year t. The real GDP is expected to have positive relationship with real other taxes and non-tax revenue because the higher the national income, the higher the tax revenue received from the household and companies.

Identity: Government revenue = TD + TEX +TIM + TOR

3.1.3.2 Government expenditure

Government expenditure includes the expenditures consumed by the state and federal government, however, the transfer payments is excluded in the government expenditures.

$GC_t = f(RGDP_t, FB_t, DB_t, GI_t)$ + dummy variable

GC_t is the real public consumption, i.e. government expenditure (measured in RM Billion) at year t ; $RGDP_t$ is the real GDP (measured in RM Billion) at year t ; FB_t is the real foreign borrowings(measured in RM Billion) at year t ; DB_t is the real domestic borrowings (measured in RM Billion) at year t ; GI_t is the real public investment (measured in RM Billion) at year t.

Real GDP is expected to have positive relationship with government expenditure because when the GDP is higher, it means the economy is expanding and government will use more money. Meanwhile, the real foreign borrowings and real domestic borrowings are expected to have positive relationship with government expenditure because when the debt level is higher, the interest payment will be higher. Finally, the real government investment is also expected to have positive relationship with government expenditure because investment is one of the expenses for the government.

3.1.3.2 Government surplus

Government surplus is the difference between government revenue and government expenditure. Besides that, government surplus can be expressed by the domestic borrowings and the foreign borrowings.

$$GS_t = f(FB_t, DB_t) + \text{dummy variable}$$

GS_t is the real public surplus (measured in RM Billion) at year t ; $RGDP_t$ is the real GDP (measured in RM Billion) at year t ; FB_t is the real foreign borrowings(measured in RM Billion) at year t ; DB_t is the real domestic borrowings (measured in RM Billion) at year t .

Foreign borrowings and domestic borrowings are expected to have negative relationship with the government surplus. When the foreign borrowings and domestic borrowings increase, government need to use government revenue to repay the interest payment i.e. decreases the government revenue and increases the government expenditure.

3.1.4 Price and Money Block

Price level is important for several objectives in economics. The general price level allows us to know the inflation rate and the cost of living in a particular country (Peebli & Wilson, 1996). Besides that, the price level can be used to find out the real term of the variable such as converting the nominal GDP to real GDP. The price level is generally represented by the consumer price index (CPI) and the GDP deflator.

The price block consists of three equations namely the consumption price deflator, production price deflator and money supply M2.

3.1.4.1 Consumption price deflator

$$CPI_t = f(M2_t) + \text{dummy variable}$$

CPI_t is consumer price index for year t and the base year is 1981; $M2_t$ is money supply M2 (measured in RM Billion). The money supply M2 is expected to have positive relationship with consumer price index. When the money supply increases, it will increase the inflation in the future which in turn causes the increase in consumer price index.

3.1.4.2 Producer Price Deflator

$$PPI_t = f(M2_t) + \text{dummy variable}$$

PPI_t is consumer price index for year t and the base year is 1981; $M2_t$ is money supply M2 (measured in RM Billion). The money supply M2 is expected to have positive relationship with producer price index and the reason is the same as the CPI function.

3.1.4.3 Money Supply M2

Money supply is an instrument used in the monetary policy and the money supplied to the economy can affect the investment, consumption and price level (Case & Fair, 2007). As stated by Abe (1985), the government budget and the balance of payment can affect the monetary base which in turns affects the money supplied to the market.

$$M2_t = f(GDPV_t, BOPDGB_t) + \text{dummy variable}$$

$M2_t$ is the money supply M2 (measured in RM Billion) at year t; $GDPV_t$ is the gross domestic production (measured in RM Billion) at year t; $BOPDGB_t$ is the sum of the balance of payment and government borrowings (measured in RM Billion) at year t. As the money supply equation is estimated, the values of all independent variable are in term of nominal value instead of constant value. The gross domestic product is expected to have positive relationship with money supply M2 while the balance of payment plus domestic government borrowing is expected to have negative relationship with money supply M2.

3.2 List of Endogenous and Exogenous Variables

There are 28 endogenous variables and 14 exogenous variables used in this study. The list of the endogenous and exogenous variables is shown in the table below.

Table 3.2 List of Endogenous Variables

List of endogenous variable	
CPI	Consumer Price Index (1981=100)
EX	Total export (RM Billion in constant price , 1981=100)
GC	Government consumption (RM Billion in constant price , 1981=100)
GDPV	Nominal GDP (RM Billion in current price)
GR	Government Revenue (RM Billion in constant price , 1981=100)
GS	Government Surplus (RM Billion in constant price , 1981=100)
IM	Total Import (RM Billion in constant price , 1981=100)
M2	Money supply M2 (RM billion current price)
MF	Import of SITC 0,4 (RM Billion in constant price , 1981=100)
MI	Import of SITC 7 (RM Billion in constant price , 1981=100)
MM	Import of SITC 6,8 (RM Billion in constant price , 1981=100)
MO	Import of other SITC groups (RM Billion in constant price , 1981=100)
MR	Import of SITC 2,3,5 (RM Billion in constant price , 1981=100)
PC	Private consumption (RM Billion in constant price , 1981=100)
PPI	Producer Price Index (1981=100)
RGDP	Real GDP (RM Billion in constant price , 1981=100)
TD	Direct tax (RM Billion in constant price , 1981=100)
TI	Total Investment (RM Billion in constant price , 1981=100)
TOR	Other tax revenue and non-tax revenue (RM Billion in constant price , 1981=100)
XM	Export of SITC 6,8 (RM Billion in constant price , 1981=100)
XO	Export of other SITC group (RM Billion in constant price , 1981=100)
XR	Export of 2,3,5 (RM Billion in constant price , 1981=100)
Y1	Production of agriculture , forestry and fishery per labour (RM thousand in constant price , 1981=100)
Y2	Production of mining and quarrying per labour

	(RM thousand in constant price , 1981=100)
Y3	Production of manufacturing per labour (RM thousand in constant price , 1981=100)
Y4	Production of service sector per labour (RM thousand in constant price , 1981=100)
Y5	Production of construction per labour (RM thousand in constant price , 1981=100)
YD	Disposable Income (RM Billion in constant price , 1981=100)

Source: Developed for the research

Table 3.3 List of Exogenous Variables

List of exogenous	
BOPDGB	Balance of payment plus domestic borrowings (RM billion in current price)
DB	Domestic Borrowings (RM Billion in constant price , 1981=100)
DUMMY	Dummy variable for structural break in 1997
DUMMYFC	Dummy variable for financial crisis
DUMMYR	Dummy variable for rice price bubble
FB	Foreign borrowings (RM Billion constant price , 1981=100)
IG1	Public Investment per labour for production of agriculture, fishery and forestry (RM thousand constant price , 1981=100)
IG2	Public Investment per labour for production of mining and quarrying (RM thousand constant price , 1981=100)
TI4	Total Investment per labour for production of service (RM thousand constant price , 1981=100)
TI5	Total Investment per labour for production of construction (RM thousand constant price , 1981=100)
RIR	Real interest rate
TEX	Export tax (RM Billion in constant price , 1981=100)

TIM	Import tax (RM Billion in constant price , 1981=100)
USGDP	GDP of United State of American (RM Billion in constant price , 1981=100)

Source: Developed for the research

Domestic borrowings and foreign borrowings has been chosen as exogenous variables because they are controlled by the government to achieve the borrowings requirement and they have effect on the government surplus. Therefore, the summation of the balance of payment and domestic borrowings has been chosen to serve as the exogenous variable which affects the money supply M2 in Malaysia.

The effective exchange rate index and the US GDP haven been chosen as the exogenous variables to look at their effect on the import and export of respective SITC groups. Meanwhile, the export tax and import tax have been treated as exogenous variables because they are the policy tools used by government to control the volume of import and export.

The real interest rate is the exogenous variables for the investment equation. The investment per labour for each production sector is served as the exogenous variable to the production function. Finally, the dummy variable is used to quantify the event or incident that brings effect to the macro-economic variables.

3.3 Data Source

The sample period of this research is starting from year 1978 until year 2009, which having total 32 observations. Most of the secondary data are extracted from the Malaysia Economics Statistics Time Series 2009 published by Department of Statistic Malaysia

(Time Series Data, 2011). Meanwhile, other data are extracted from several sources, includes Bank Negara Malaysia (Rate and Statistic, 2012), Ministry of Finance Malaysia (Economic Data, 2011), World Bank (Data, 2012), International Monetary Fund (World Economic Outlook Database, 2012) and United Conference on Trade and Development (UNCTADStat, 2011).

3.4 Data adjustment

Although the data can be extracted from the sources, data adjustment is still needed because of the data inconsistency. Some of the data have several series to be chosen and some of the data have the omitted figure to be filled up. Thus, ratio adjustment and conventional forecasting method have been employed in the data adjustment process.

Ratio adjustment is used to adjust the data of a variable that having more than one series of information. The series with the most observation is chosen as the benchmark series and the data of the other series are adjusted accordingly to the average ratio, subsequently, form a complete data series.

On the other hand, some figures of the variables are not available in the data sources especially the figures for year 1978 and year 1979. Therefore, exponential smoothing method is used to forecast backward on the omitted number. According to Brooks (2002), exponential smoothing method is one type of techniques that model the linear combination of previous value and use the model for forecasting. Among the exponential smoothing method, double smoothing is used in this research because double smoothing is allowed for trends (Brooks, 2002).

As most of the data are measured in term of RM Million, the figures are converted to the unit measurement of RM Billion to avoid the problem of inconsistency error term

variance. According to Gujarati (2003), heteroskedasticity problem will arise when the variance of the error term is not consistent and this problem will cause the estimator no longer the best estimator because there is no minimum variance. In other words, the standard error of the estimator will be underestimated or overestimated (Gujarati, 2003).

Moreover, all variables are converted to real term to eliminate the effect of price level changes over time. Year 1981 has been chosen as the base year because Tun Dr. Mahathir bin Mohamad sworn in as the forth prime minister of Malaysia on 16 July 1981(*Mathathir bin Mohamad*,n.d). Malaysia has achieved different stage of economic growth since year 1957, in which 1981 can be served as the point of inflection of the economy growth curve which indicates the transformation of low growth economy to high growth economy.

3.5 Methodology

The method used in this research for the equation estimation is Ordinary Least Square (OLS). Although it is better to use simultaneous equation estimations methods such as two-stage least square (2SLS) to provide more appropriate result, however, the shortcoming of the insufficient data has made this method not applicable because there are not enough degree of freedom for coefficient estimates in a block of simultaneous equations (Peebli & Wilson, 1996). As stated by Peebli & Wilson (1996), OLS can give robust estimate when the short time series data is available.

The OLS estimator is an unbiased and consistent estimator when the sample size is large and asymptotic distribution, namely greater than 30 observations (Stock and Watson, 2007). Gujarati (2006) stated that the asymptotic distribution can be accurate because the variances of the t test and the standard normal variable do not have great difference. Besides, Gujarati (2006) mentioned that as long as the model can fulfil the ten classical

linear regression model assumptions, the OLS estimator can perform BLUE (Best Linear Unbiased Estimator) properties. The generalized least square (GLS) is used for the remedy when the equation is found to have heteroskedasticity and autocorrelation problem.

After estimating the equation, the p value of each variable is checked and the p value should be less than 0.05 in order to reject the null hypothesis, i.e. there is relationship between independent variable and dependent variable. Besides that, R square is reviewed because it represent the percentage of variation in dependent variable which explained by all the independent variable (Gujarati, 2003). The high value of R square represents the independent variables can well explain the dependent variable.

Subsequently, each equation needs to be tested for the multicollinearity problem, autocorrelation problem, heteroskedasticity problem and model misspecification problem as well as the residual distribution normality. The multicollinearity problem is tested by referring to the value of correlation between two independence variables. If the correlation has the higher value, the multicollinearity problem arises. Then autocorrelation problem is tested by using Breusch-Godfrey Serial Correlation LM Test while the heteroskedasticity problem is tested by using ARCH test. Meanwhile, Ramsey RESET test is used to test for the model misspecification problem and Jarque-Bera test is used to test the normality distribution of the residual. The p-value of these four tests need to be greater than 0.05, so we do not reject the null hypothesis. All of these tests are run by the E-views software. Besides that, Durbin Watson D statistic is reviewed to check for the autocorrelation problem (Gujarati (2003). According to Gujarati (2003), if there is a lagged dependent variable act as the independent variables in the equation, the assumption of Durbin Watson D test is violated and the Durbin Watson H statistic should be reviewed.

In this research, we are interested in studying the elasticity of the independent variable to the respective dependent variable rather than the absolute change effect of the independent variable to the dependent variable. According to Gujarati (2003), double log model is popular to study the effect of independent variable percentage changes to the dependent variable percentage changes. In addition, Brooks (2002) stated that the logarithms model can transform the multiplicative model into additive modes and make the model be the standard linear bivariate regression equation. Thus, OLS can be used to estimate the regression equation.

After ensure the validity of each equation, the equations will be added into a system and run for model simulation. Although the goodness of fit of the individual equation is performed well, the goodness of fit of the model might not performed well as the individual equation does (Pindyck & Rubinfeld, 1998).Thus, to test the overall significance validity of the whole model, the root mean square error (RMSE) and mean square error (MSE) are used (Ducanes,G., Cagas,M.A., Qin,Duo., Quising,P. &Magtibay-Ramos,N., 2005; Leow, n.d.). According to Stock and Watson (2007), RMSE is a measure to test the size of the forecast error.

CHAPTER 4: DATA ANALYSIS

The residual of each equation has been checked to ensure their stationarity because the stationary residual provides the valid OLS estimator. The p-value and the standard error of each variable in the equations are presented. Meanwhile, the R square is presented in each equation to indicate the goodness of fit for the equations and the Durbin Watson D statistic is presented to indicate the autocorrelation problem. Durbin Watson H statistic is also presented in some equations if the equations include the lagged dependent variable as the independent variable. AR term is used as the independent variable to solve the problem of the autocorrelation.

4.1 Equation Model

4.1.1 Production block

EQ1: Production of Agriculture, Fishery and Forestry

$$\widehat{\log(Y1L)} = 7.7567 + 0.2061 \log(IG1_{t-12}) + [AR(1) = 0.7434]$$

P-value	(0.0209) **	(0.0002) ***
Standard error	(0.0804)	(0.1561)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.7821

Durbin Watson D Statistic: 1.6748 Durbin Watson H Statistics: 0.9672

The public investment per labour is found to have positive relationship with the production per labour. When there is a 1% increase in the public investment per labour, the production per labour increases by 0.2061%. However, the public investment per labour is only found significant until lagged 12 years. This phenomenon might be caused by the geographic factor for example the land fallow and makes the investment injected 12 years ago only has its effect on current year production.

EQ 2: Production of Mining and Quarrying

$\widehat{\log(Y2L)} = 7.1117 + 0.4682 \log(IG2_{t-5}) + [AR(1) = 0.7557]$

P-value	(0.0037) ***	(0.0000) ***
Standard error	(0.1449)	(0.1284)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.9088

Durbin Watson D Statistic: 2.1129 Durbin Watson H Statistic: -0.3808

The public investment per labour has the consistent result with the sign expectation which is having positive relationship with the production per labour. When there is a 1% increase in the public investment per labour, the production per labour increases by 0. 4682%. However, the public investment per labour that has significant relationship with production is the public investment injected five years ago. The reason that explains this phenomenon is the training given to the labour. The labour must be trained before working in the production field and the training process do takes time.

EQ3: Production of Manufacturing

$\widehat{\log(Y3L)} = 1.0304 \log(Y3L_{t-8}) + [AR(1) = 0.3464]$

P-value	(0.0002) ***	(0.0931)*
Standard error	(0.0019)	(0.1969)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.9494

Durbin Watson D Statistic: 1.9017 Durbin Watson H Statistics: 0.7163

After estimating the equation, it is found that there is no relationship between the total investment per labour and the production per labour. However, the production of manufacturing is explained by itself which is the lagged 8 year manufacturing production. When there is an increase 1% in previous eight years manufacturing production, there is an increase of 1.03% in current manufacturing production. Besides that, a business cycle of eight years has been found when checking for the residual of the manufacturing production. Thus, it is believed that the business cycle has brought affect to the current production.

EQ 4: Production of Service

$\widehat{\log(Y4L)} = 6.0602 + 0.3770 \log(TI4) + 0.1913 DUMMY$

P-value	(0.0000) ***	(0.0000) ***
Standard error	(0.0420)	(0.0272)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.8458 Durbin Watson D Statistic: 1.258

The total investment per labour has the positive relationship with the production per labour as expected. When there is 1% increase in the total investment per labour, it increases the production per labour by0.3770%. The effect of structural break does exist in this equation. Compare to the period before structural break, the production of the services after structural break is RM0.1913 billion higher.

EQ 5: Production of Construction

$\widehat{\log(YSL)}$ = 0.8888 + 0.7342 log(TI) + [AR(1) = 0.6547]

P-value	(0.0000) ***	(0.0001) ***
Standard error	(0.1122)	(0.1393)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.6423

Durbin Watson D statistic: 1.9632 Durbin Watson H Statistic 0.1625

The total investment per labour is found to have positive relationship with the production per labour as expected. When there is an increase 1% in the total investment per labour, the production per labour will increase by0.7342%

4.1.2 Aggregate Demand Block

EQ 6: Aggregate Demand of Private Consumption

$\widehat{\log(PC)}$ = 0.70071 log (PC_{t-1}) + 0.2729 log (YD) + 0.07290 DUMMYR - 0.07182 DUMMYFC

P-value	(0.0000) ***	(0.0002) ***	(0.0497) **	(0.0004) ***

Standard error	(0.0724)	(0.0624)	(0.0355)	(0.0178)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 leveL

R square: 0.9937

Durbin Watson D statistic: 1.8239 Durbin Watson H statistics: 0.5357

The money supply M2 has found no relationship with the private consumption. The lagged private consumption is found to have positive relationship with private consumption. When the lagged private consumption increases by 1%, the private consumption will increase by 0.7007%.

Besides that, the expected sign of disposable income is consistent with the theory i.e. it has positive relationship with private consumption. When the disposable income increases by 1%, the private consumption will increase by 0.2729%.

The dummy variable that indicates the structural break in year 1997 is found to have no relationship with private consumption. However, the event of financial crisis happened in year 1980-1981 , 1985-1987 and 1997-1998 are found to have negative relationship with private consumption while the rice price bubbles happened in year 2007-2008 are found to have positive relationship with the private consumption. The event of financial crisis is measured by the DUMMYFC while the event of rice price bubbles is measured by DUMMYR. The similar magnitude of the estimate of these dummy variables reflects the two events have the similar effect on the private consumption. Comparing to the years which do not face the financial crisis and price bubbles, the private consumption of the year that faced the financial crisis is RM71.8 million lower but the private consumption of the year which faced price bubble is RM 72.9 million higher.

EQ 7: Aggregate Demand of Investment

$\widehat{\log(TI)}$ = -1.3897 + 0.5590 $\log(TI_{t-1})$ +0.6985 log(RGDP) - 0.01707 RIR + 3.4131 DUMMY - 0.7246 DUMMY*log(RGDP)

P-value	(0.0013) ***	(0.0075) **	(0.0074) ***
	(0.0695)**	(0.0494) **	
Standard error	(0.1548)	(0.2399)	(0.0059)
	(1.7996)	(0.3508)	

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.9469

Durbin Watson D statistic: 2.1179 Durbin Watson H statistics: -0.6473

The result shows that the previous year total investment and current real GDP has positive relationship with the current total investment. When there is an increase 1% in the previous year private investment, it will increase current private investment by 0.5590%. This explained most of the investment projects need fund injection for consecutive two years. Meanwhile, when the current real GDP increase by 1%, it will cause the total investment increase by 0.6985%. This result explains that when the real GDP increase, it reflects the economy is growing and expanding and it will encourage more investment especially in the nation development projects.

The real interest rate has the negative relationship with the total investment. When the increase in 1% on the real interest rate, it will decrease the real private investment by 0.0171%. It is reasonable because the higher the real interest rate means the higher the cost of borrowings which discourage the investment. The dummy variables that shows the effect of the structural break in year 1997 has the positive relationship with total investment. The result shows that, compare to the year before 1997, the total investment after year 1997 is RM3.413 billion higher.

EQ 8: Aggregate Demand of Export of SITC 2, 3, 5

SITC 2, 3, 5 refers to the (i) crude materials and inedible, (ii) mineral fuels, lubricants and others, (iii) chemistry materials respectively. The production of mining and quarrying is serves as the independent variable. The adjusted export price index and the effective exchange rate are found no relationship with the export.

$$\widehat{D(XR)} = 1.4805\ D(Y2) + 0.000869\ D(USGDP) + [AR(1) = 0.3786]$$

P-value	(0.0000) ***	(0.0174) **	(0.0572) **	*Standard error*
(0.1286)	(0.0000343)	(0.1905)		

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.8507 Durbin Watson D statistics: 1.9911

The first differencing method has been used in this equation and the first differencing is the difference of the value of variables between current year and previous year. The first differencing method also shows that there is short run relationship between the independent variables and the dependent variables.

The result shows that the first difference of production of mining and quarrying as well as the first difference US GDP has positive relationship with current export of SITC group 2, 3, 5. An increase RM 1 billion in the changes of the production of mining and quarrying, the changes of export group 2, 3, 5 will increase by RM 1.4805 billion. Meanwhile, when there is RM 1 billion increase in the changes of US GDP, the changes of export will increase by RM0.869 million, ceteris paribus.

EQ 9: Aggregate Demand of Export of SITC 6, 8

SITC 6, 8 refers to the product of manufactured goods and miscellaneous manufactured articles respectively. The changes of production of manufacturing, changes of US GDP and structural break in year 1997 are thus used as the independent variables. The adjusted export price index and the effective exchange rate are found no relationship with the export.

$$\widehat{D(XM)} = -0.5583 + 0.5240\ D(Y3) + 0.001309\ D(USGDP) + 1.6287\ DUMMY$$

P-value	(0.0000) ***	(0.0000) ***	(0.0211) **
Standard error	(0.1343)	(0.000271)	(0.6650)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.6116 Durbin Watson D Statistic: 2.4035

The result shows that the changes of the manufacturing production and the changes of US GDP have positive relationship with the changes of export of manufacturing good. When there is RM 1 billion increase in the changes of manufacturing production, the changes of export group 6, 8 will increase by RM0.524 billion,. Besides this, when RM 1 billion increase in the US GDP, the changes export of manufacturing good will increase by RM 1.3 million. Furthermore, the structural break has brought effect to the export of SITC, 6 8. Compare to the year prior to 1997, the export of manufactured products after year 1997 is RM 1.6287 billion higher.

EQ 10: Aggregate Demand of Export of Other SITC Groups

The last group of the export includes the goods of foods, beverage and tobacco, oils & animals and vegetable fats, machinery and transport equipment as well as the miscellaneous transaction and commodities. The changes of US GDP are used as the independence variable. The adjusted export price index, production and the effective exchange rate are found no relationship with the export.

$\widehat{D(XO)}$ = 0.007819 D(USGDP)

P-value	(0.0000) ***
Standard error	(0.000678)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.4763 Durbin Watson D Statistic: 1.7094

The changes of US GDP have a positive relationship with the changes of export of other group. When US GDP increases RM 1 billion, the export will increase by RM7.8 million.

EQ 11: Aggregate Demand of Import of SITC 0, 4

SITC 0, 4 are foods and oils & animal and vegetable fats respectively. The real GDP and structural break in year 1997 are use as the independence variable. The adjusted import price index and the effective exchange rate are found no relationship with the import.

$\widehat{D(MF)}$ = 0.06151 D(RGDP) + 1.7928 DUMMY + [AR(1) = -0.4192]

P-value	(0.0000) ***	(0.0000) ***	(0.0000) ***
Standard error	(0.003086)	(0.1151)	(0.0781)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.2762

Durbin Watson D statistic: 1.7525 Durbin Watson H statistics: 0.7502

The real gross domestic product and dummy variable has a positive relationship with the import of SITC 0, 4. When the changes of real GDP increase RM 1 billion, the changes of 0 and 4 import good will increased by RM61 million. Besides, comparing with the year before 1997, the export of the SITC 0, 4 for years after 1997 is RM 1.792 billion higher.

EQ 12: Aggregate Demand of Import of SITC 2, 3, 5

SITC 2, 3, 5 group are the products of (i) crude materials and inedible, (ii) mineral fuels, lubricants and others, (iii) chemistry materials respectively. The adjusted import price index and the effective exchange rate are found no relationship with the import.

$$\widehat{\log(MR)} = 0.4312 + 0.8319\log (MR_{t-1}) + 0.009327D (RGDP) + 0.2845\ DUMMY$$

P-value	(0.0000) ***	(0.0031) ***	(0.0005) ***
Standard error	(0.0380)	(0.0028)	(0.0714)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.9922

Durbin Watson D statistic: 2.1259 Durbin Watson H statistic: -0.3586

The result shows that the previous year real mining and quarrying product import, the changes of real GDP and dummy variable have the positive relationship with current year real import. When the previous year import increases by 1%, the current year export will increase by 0.8319%. Meanwhile, if there is RM 1 billion increase in the change of RGDP, the import will increase by RM 9.327 million. By comparing to the years prior to 1997, the import of mining and quarrying product after 1997 is RM 0.2845 billion higher.

EQ 13: Aggregate Demand of Import of SITC 6, 8

SITC 6, 8 refers to the products of manufactured goods and miscellaneous manufactured article respectively. The adjusted import price index and the effective exchange rate are found no relationship with the import.

$\widehat{\log(MM)}$ = -5.4330 + 1.8071 log RGDP + [AR (1) = 0.7732]

P-value	(0.0000) ***	(0.0002) ***
Standard error	(0.2255)	(0.1775)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.9930

Durbin Watson D statistic: 2.0166 Durbin Watson H statistic: -0.3027

The real GDP has a positive relationship with the import manufacturing good. When there is 1% increase in the real GDP, the import of the manufacturing good will increase by 1.8071%,

EQ 14: Aggregate Demand of Import of SITC 7

SITC 7 refers to the product of machinery and transport equipment. The adjusted import price index and the effective exchange rate are found no relationship with the import.

$\widehat{\log(MI)}$ = -3.3738 + 1.1113 log RGDP + 0.5625 log MI_{t-1} + 5.5526DUMMY - 1.0728 DUMMY*log (RGDP)

P-value	(0.0281) **	(0.0035) ***	(0.0034) ***
	(0.0033) ***		

Standard error	(0.4779)	(0.1751)	(1.7209)
	(0.3331)		

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.9947 Durbin Watson D statistics: 1.7386

The result shows that the real GDP, previous year machinery and transport equipment import and the dummy variables have the positive relationship with the current year machinery and transport equipment import. When there is a 1% increases in real GDP, the import will increase 1.1113%. Meanwhile, when the previous year import increases by 1%, the current year import will increase 0.5625%. Finally, by comparing to the years prior to 1997, the import of machinery and transport equipment import after 1997 is RM 5.5526 billion higher.

EQ 15: Aggregate Demand of Import of Other SITC Groups

The last equation of the import is the equation that examines the relationship between real GDP and the import of other goods which are the beverage and tobacco as well as the miscellaneous transactions and commodities. The adjusted import price index and the effective exchange rate are found no relationship with the import.

$\widehat{\log(MO)}$ = -14.1055 + 3.2776 log (RGDP) + 15.6246 DUMMY + 0.07496 DUMMY*MO - 3.2646 DUMMY*log(RGDP)

P-value	(0.0000) ***	(0.0007) ***
	(0.0362)**	(0.0005) ***
Standard error	(0.2677)	(4.0454)
	(0.0339)	(0.8189)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.9788 Durbin Watson D statistics: 1.8322

The result shows that the real GDP has positive relationship with the import of other goods. When there is a 1% increase in real GDP, the import of other goods increase by 3.2776%. This indicates that the import of other goods is very sensitive to the growth of real GDP. Moreover, the dummy variable has the positive relationship with the import of other goods and it means the structural break in year 1997 has brought effect to the import. Prior to year 1997, the import of other goods after 1997 is RM 15.6246 billion higher.

4.1.3 Government Budget Block

EQ 16: Government Budget of Direct tax

$$\widehat{\log(TD)} = -1.5005 + 0.4490 \log(TD_{t-1}) + 0.6108 \log (RGDP)$$

P-value	(0.0043) ***	(0.0012) ***
Standard error	(0.1444)	(0.1689)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared; 0.9660

Durbin Watson D statistic: 1.7632 Durbin Watson H statistics: 1.1093

As expected, the real GDP has positive relationship with the real direct tax. When the real GDP increases by 1%, the direct tax will increase by 0.6108%. Moreover, the previous year direct tax has positive relationship with the real direct tax. When there is an increase 1% in previous year direct tax, there will an increase of 0.4490% in current direct tax.

EQ 17: Export tax

$\widehat{\log(EX)} = 0.4578 - 0.1108 \log (TEX) + 0.9214 \log (EX_{t-1})$

P-value	(0.0173) **	(0.0000) ***
Standard error	(0.0438)	(0.0244)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.9931 Durbin Watson D statistics: 1.2711

The real export tax supposed to be treated as the dependent variable while the aggregate export should be treated as the independent variable in this equation. However, it is reasonable to exchange their position because export tax is one of the tax policy instrument used by government to control the export value, and thus, the real export is the respondent variable. The export tax rate has the negative relationship with real export and this result is consistent with the expectation. When there is 1% increase in the export tax, it will decrease the export by 0.1108%. Meanwhile, the larger portion of the effect on the real aggregate export is due to the previous year aggregate export. When previous year real aggregate export increase by 1%, the current year real aggregate export increase by 0.9214%.

EQ 18: Government Budget of Import tax

$D\left(\widehat{\log(TIM)}\right) = 0.3174 - 0.06762 \log(IM)$

P-value	(0.0321) **
Standard error	(0.03002)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.1489 Durbin Watson D statistics: 2.3588

The real aggregate import is found to have negative relationship with the import tax rate. When there is 1% increase in aggregate import, the difference between current import tax and previous year import tax decreases by 0.0676%, i.e. the previous year import tax is

higher than current year import tax. This result explains that the imported goods have been imposed tax because the goods are sold in Malaysia.Thus, when the current year aggregate import increases, the previous year import tax is higher than current year.

EQ 19: Government Budget of Other Tax Revenue and Non-Tax Revenue

$\widehat{\log(TOR)}$ = -2.7997+ 1.1173 log (RGDP) + [AR (1) = 0.7030]

P-value	(0.0000)***	(0.0000)***
Standard error	(0.1185)	(0.1264)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.9780

Durbin Watson D statistic: 2.2104 Durbin Watson H statistic: -0.8245

The real GDP has positive relationship with the other revenue and non-tax revenue and this result is consistent with the expectation. When the real GDP increases by 1%, the other tax revenue and non tax revenue will increase by 1.1173%.

EQ 20: Government Budget of Government Expenditure

$\widehat{(DGC)}$ = 0.3300 + 0.1243 D(RGDP) + 0.01281 DUMMY*RGDP

P-value	(0.0737) *	(0.0044) ***
Standard error	(0.0669)	(0.00414)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.3294 Durbin Watson D statistics: 2.0598

The domestic borrowings, foreign borrowings and public investment are found no relationship with the government expenditure. The first differencing is also employed in this equation. It means that the real GDP and the government expenditure have the short run relationship. When there is 1% increase in the difference of real GDP, there is 0.1243% increase in the difference of government expenditure. The result is consistent with the sign expectation which is positive, i.e. when the economy is expanding, the government expenditure will be increased especially the operating expenses.

EQ 21: Government Budget of Government Surplus-Borrowings

$\widehat{GS}$ = -0.4942 -0.9147 FB -0.9268DB

P-value	(0.0000) ***	(0.0000) ***
Standard error	(0.1508)	(0.0715)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R Squared: 0.8698 Durbin Watson D statistics: 1.8314

The foreign borrowings and domestic borrowings have negative relationship with government surplus. When the foreign borrowings increases by RM 1 billion, the government surplus will be decreased by RM0.9147 billion Meanwhile, when the domestic borrowing increases by RM1 billion, the government surplus will be decreased by RM0.9268 billion. The effect of the foreign borrowings and domestic borrowings to the government surplus are similar.

4.1.4 Price and Money Block

EQ 22: Price and Money of Consumer Price Deflator

$\widehat{\log(CPI)}$ = 2.4040+ 0.2156 log (M2) + [AR (1) =0.7554]

P-value	(0.0000) ***	(0.0000) ***
Standard error	(0.0139)	(0.1136)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.9962

Durbin Watson D: 1.7383 Durbin Watson H Statistics: 0.9406

The result shows that the M2 has a positive relationship with consumer price index. When there is an increase of 1% increases in M2, the consumer price index will increase by 0.2156%. This condition is very common whenever there is an increase in money supply, it will increase the inflation in future which in turns increases the consumer price index.

EQ23: Price and Money of Producer Price Deflator

$\widehat{PPI}$ = -0.1601 + 23.1640log ($M2_{t-1}$) + [AR (1) =0.894398675033]

P-value	(0.0013) ***	(0.0000) ***
Standard error	(6.4565)	(0.0840)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.9746

Durbin Watson D statistics 1.435 Durbin Watson H statistics 1.742

The result shows that the previous year M2 has a positive relationship with the producer price index. When previous year M2 increases by 1%, the current producer price index

will increase by 23.1640 indexes. The increasing money supply M2 will cause the inflation which in turn affects the producer price index.

EQ 24: Price and Money of Money Supply M2

$$\widehat{M2} = -30.709 + 0.4788GDPV - 0.8412\ BOPDGB_{t-9} + 0.8293\ M2_{t-1} - 26.084DUMMY$$

P-value	(0.0002) ***	(0.0032) ***	(0.0000) ***	(0.0168) **
Standard error	(0.1028)	(0.2475)	(0.0698)	(9.8971)

*** significant at 0.01 level ** significant at 0.05 level * significant at 0.1 level

R square: 0.9979

Durbin Watson D statistic: 2.607 Durbin Watson H Statistic: -1.5446

The result shows that the GDP and previous year money supply have positive relationship with current money supply. When there is RM 1 billion increase in nominal GDP, the money supply will increase by RM 0.4788 billion. Furthermore, if there is RM 1 billion increases in previous year money supply M2, it drives the current money supply to increase by RM0.8293 billion.

On the other hand, the combination of balance of payment and domestic government borrowing show a negative relationship with M2. Balance of payment is expected to have positive relationship with M2, while domestic government borrowing is expected to have negative relationship with M2. Since the combination of balance of payment and domestic government borrowing show a negative relationship, it means that, the value of domestic government borrowing is more than the value of balance of payment. When there is an RM 1 billion increase in the previous nine years BOPDGB, the money supply M2 will decrease by RM0.8412 billion. The previous nine year BOPDGB brings effect to the current year money supply M2 because the bond selling by the government to the public has 9 years maturity.

The dummy variable that indicates the structural break in year 1997 has negative relationship with the money supply M2. Comparing to the year prior to 1997, the money supply M2 after year 19997 is RM 26.08 billion lower.

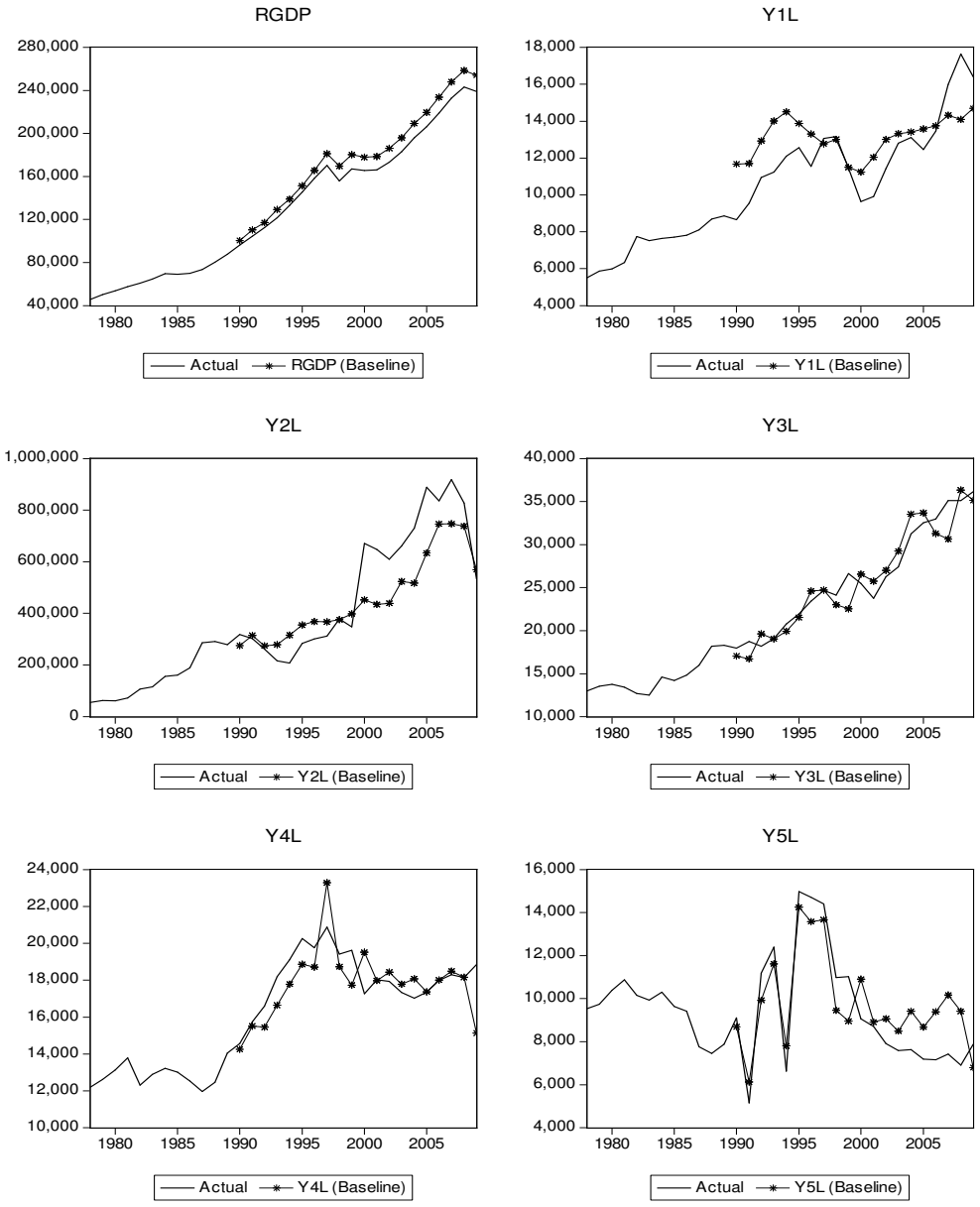
4.2 Simulation

4.2.1 Model Evaluation

Overall, the model simulates the past well but the aggregate demand block provides relative weak result.

The simulation of the production block is shown as following:

Figure 4.1 The Simulation of The Production Block



e in the
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2012).
one of

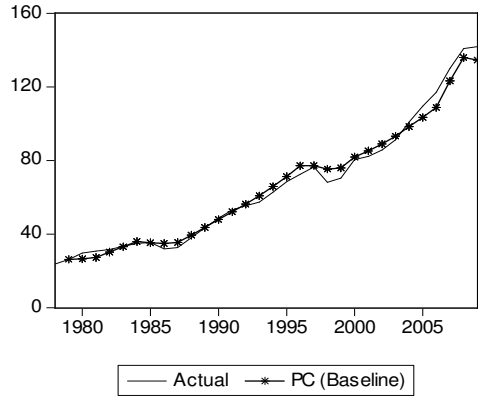
the main exporting commodities of Malaysia exports (Economic Planning Unit, 2011b).

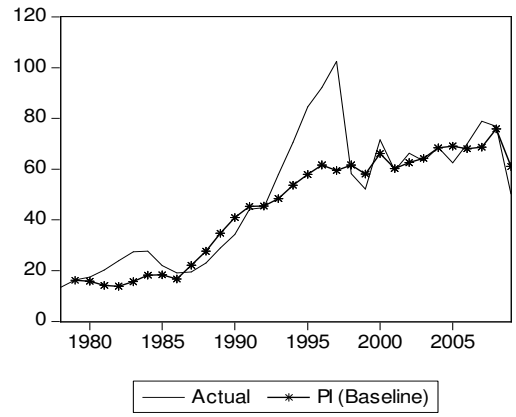
For the equation of Y2L (the production of mining and quarrying), the simulated path is different from the actual path after year 2000. As the main product of mining and quarrying production is petroleum and gas, the production was largely affected by the fluctuation of the world oil price. The nominal price of crude oil has increased from $16.56 per barrel in year 1999 to $27.39 per barrel in year 2000 and has been doubled in year 2005 which is $50.04 per barrel (Historical Crude Oil Price Chart, 2012). Meanwhile, the oil price in year 2008 reached the highest price between the periods of year 1990 to 2009 which is $91.48 per barrel (Historical Crude Oil Price, 2012).

Lastly, the simulated path for the production of service sector, Y4L has shown a rapid growth in year 1997 but the simulated value of production was higher than the actual value. The reason that production per labour is lower is due to the increasing of labour force instead of deceasing production (Economic Planning Unit, 1996).This phenomenon is further elaborated that government emphasized on the development of human resource after the financial crisis and thus , the labour participation has been increased a lot (Economic Planning Unit, 1996).

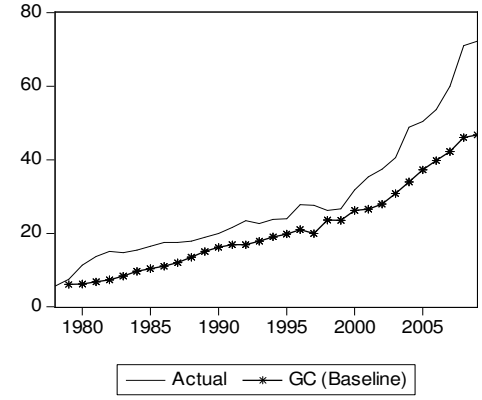
The simulation of the aggregate demand block is showed as below:

Figure 4.2 The Simulation of The Aggregate Demand Block

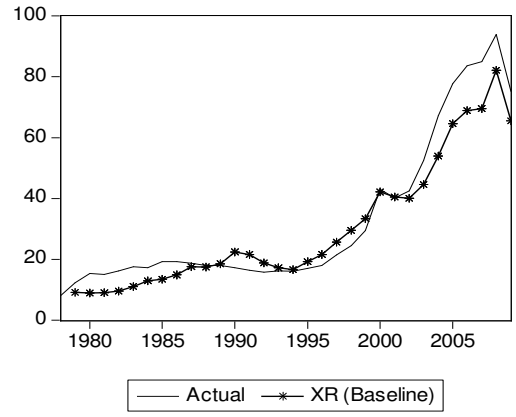




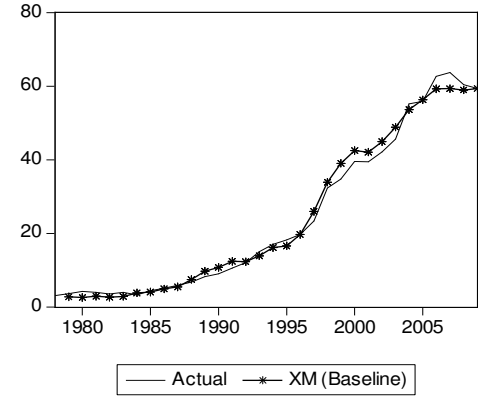
GC



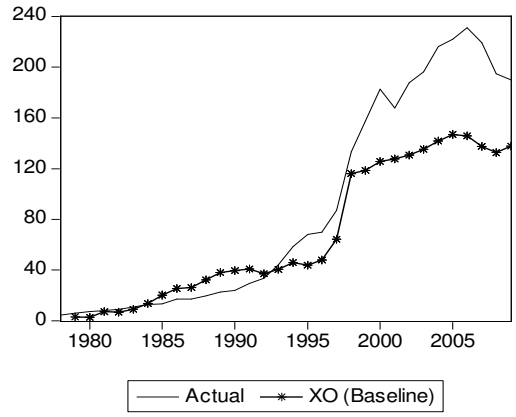
XR

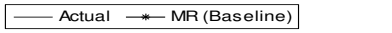


XM

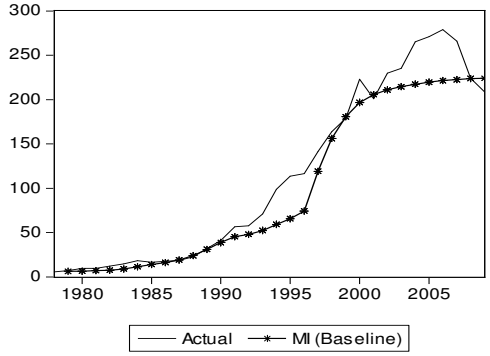


XO

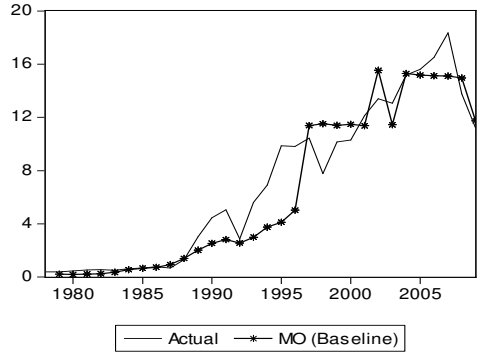




MI



MO



The simulated path of the total investment is traced closely to the actual path but the simulated path is unable to capture the increasing total investment in the period between 1992 to 1997.As mentioned by Peeble & Wilson (1996), simulation for the total investment is not easy because investor expectation has big effect on the erratic fluctuation of investment.

Next, the simulated path for the government expenditure cannot trace the actual path but the pattern and the trend of the simulated path is similar to the actual path.

For the simulation of export equation, the simulated path of equation XR (export of mining and quarrying product) and equation XM (export of manufactured goods) performance well but the simulated path of equation XO (export of other goods) has gap with actual path since year 1998. This result has also caused the simulated path of total export differ with the actual path starting from year 1998.

The simulation of import equation has performed relative weak result compare with export equation. This result has been shown because the simulation for the equation of MM (import of manufactured goods), MI (import of machinery and transport equipment) and MR (import of mining and quarrying) is not performing well. The higher actual value of import is due to the higher demand caused by the expanding economy and the inflated price of imported goods.

The gap between the simulated path and actual path of real GDP is caused by the non-performing well simulation of the total investment, government consumption and import.

The simulation of the government budget block and price and money block is shown as following.

Figure 4.3 The Simulation of The Government Budget Block

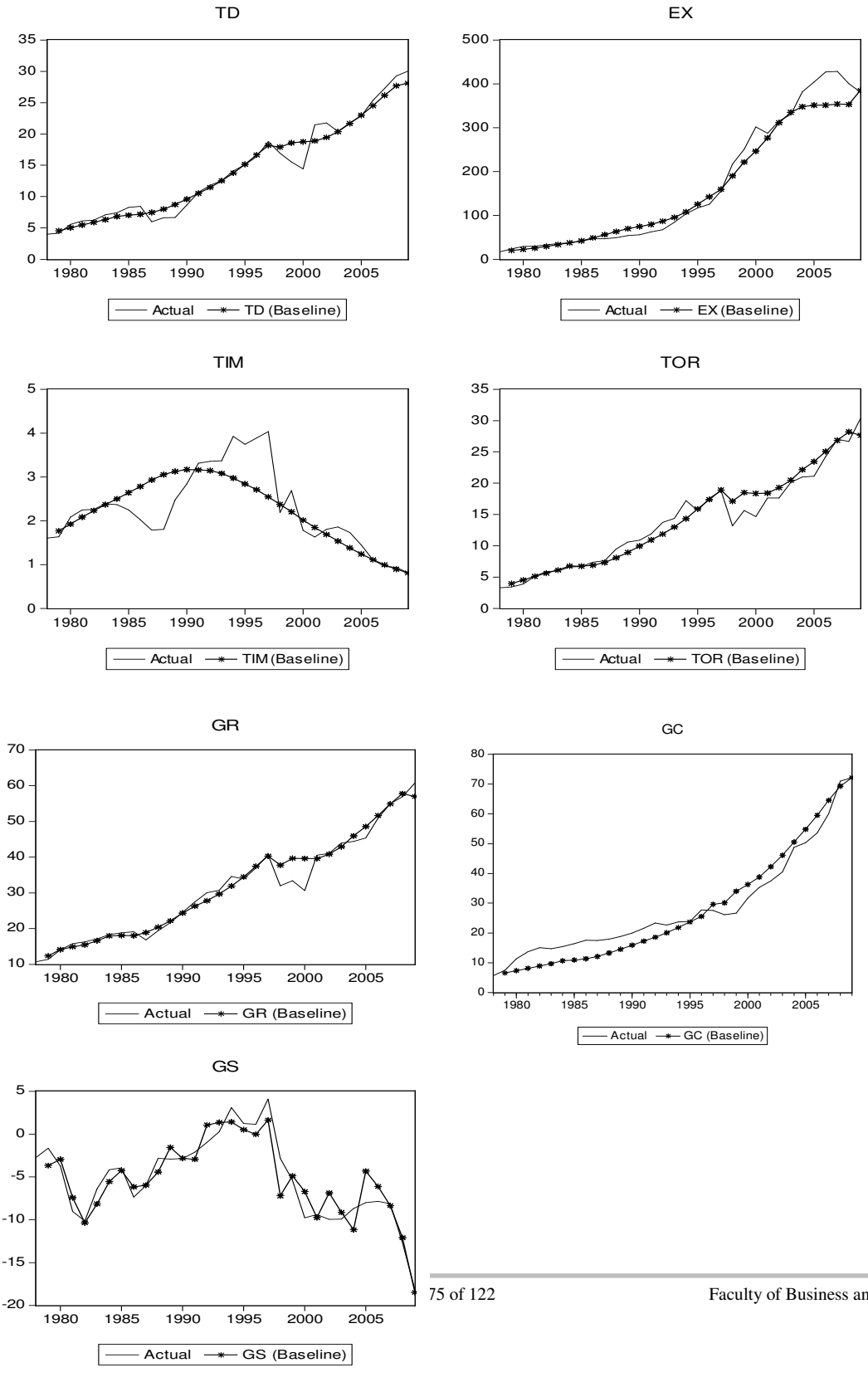
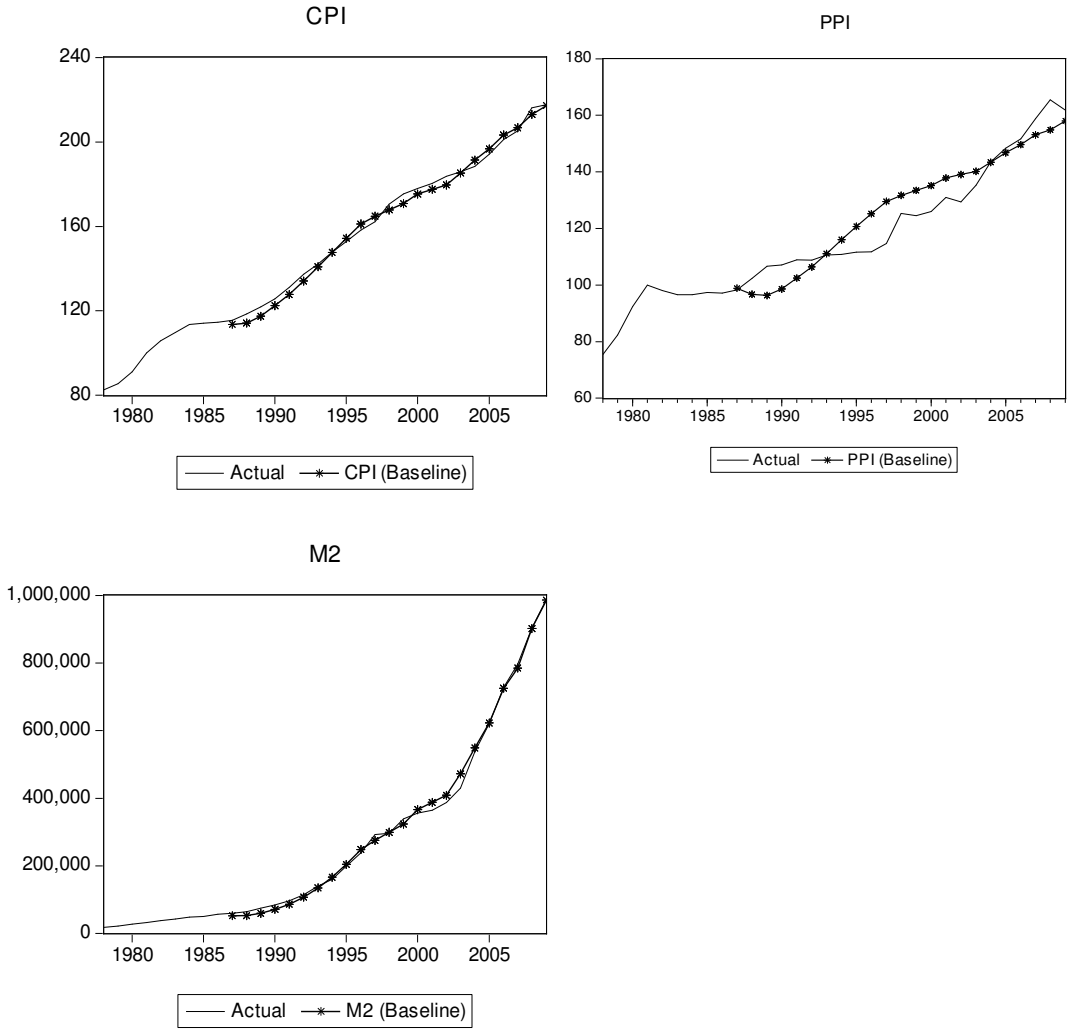


Figure 4.4 The Simulation of The Price and Money Block



The simulation for both blocks performs well because almost all the simulated paths are closely traced to their actual paths. For the government budget block, the import tax provides relative weak result in simulation. Meanwhile, in the price and money block, the simulated path of PPI is not closely traced to the actual path as another two equations do.

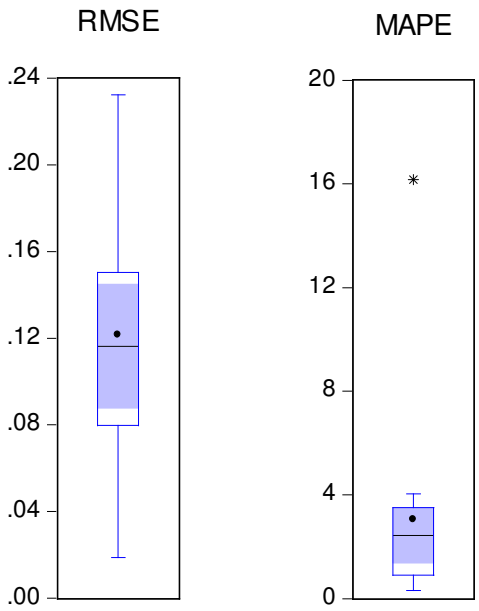
The Root Mean Square Error (RMSE) and the Mean Absolute Percent Error (MAPE) are used to measure the goodness of fit of the model. The result of the RMSE and MAPE of selected variables are shown in the table and the boxplot of the RMSE and MAPE are presented.

Table 4.1 The Results of RMSE and MAPE

Dependent variable	RMSE	MAPE
log(YIL)	0.0985	0.8297
log(Y2L)	0.2324	1.5418
log(Y3L)	0.0735	0.5852
log(Y4L)	0.0708	0.5289
log(Y5L)	0.1804	1.7401
log (PC)	0.0548	1.1166
log (TI)	0.1384	2.9683
log (MR)	0.1242	3.7545
log(MM)	0.1163	3.1185
log(MI)	0.1131	2.4400
log(MO)	0.2203	16.1714
log(TD)	0.1167	4.0486
log(EX)	0.1544	2.9518
log(TOR)	0.1094	3.6490
log(CPI)	0.0188	0.3162

Source: Developed for the Research

Figure 4.5 The Boxplot of The RMSE and MAPE



The RMSE of the variables estimated in the logarithm form is recorded and the range of RMSE is from 0.0188 to 0.2203. Meanwhile, the range of MAPE is from 0.3162 to

16.1714 and there are one outlier shown in the boxplot which the import of other goods (MO).

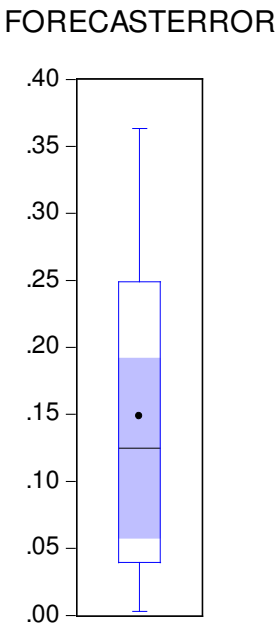
4.2.2 Ex-Post forecast

Ex post forecast can be used to further evaluate the performance of the model (Peeble & Wilson, 1996). The estimated equations are used to forecast the value of the macroeconomic variables in year 2010. As the information of the dependent variables in year 2010 is available, the forecast error can be calculated by comparing the actual value and the forecast value of the dependent variables. The forecast error for each dependent variable is recorded in the table and the boxplot of the forecast error is presented.

Table 4.2 The Forecast Error for Each Dependent Variable

Dependent variable	Actual value	Forecast value	Forecast error
Y1L	20051.71	14623.75	27.07%
Y2L	631665.13	542392.10	14.13%
Y3L	38667.92	36920.66	4.52%
Y4L	20837.15	19499.78	6.42%
Y5L	8833.91	11166.00	26.40%
PC	166.31	144.09	13.36%
TI	99.10	63.94	35.48%
XR	88.85	71.54	19.48.%
XM	64.63	62.43	3.41%
XO	198.99	126.64	36.36.%
MF	30.70	41.61	35.52.%
MR	100.58	124.15	23.43%

Figure 4.6 The Boxplot of The Forecast Error



MM	86.49	114.27	32.12%
MI	231.90	236.53	1.99%
MO	10.63	10.90	2.55%
TD	28.71	31.04	8.11%
EX	410.84	399.18	2.84%
TIM	0.7144	0.7267	1.73%
TOR	29.13	32.77	12.50%
GC	68.53	80.81	17.92%
GS	-15.72	-13.99	11.04%
CPI	221.27	220.62	0.30%
PPI	174.04	160.18	7.97%
M2	989.34	1113.04	12.50%

Source: Developed for the research

The range of the forecast error is between 0.30% and 36.36%. There are few variables have the forecast error that greater than 20% which are production of agriculture, forestry and fishery sector (Y1), production of construction sector (Y5), total investment (TI), export of other goods (XO), import of food and oil (MF) and import of manufactured goods (MM).

The forecast error of Y1L is 27.07%. The actual value of the production Y1L is larger than the forecast value because the higher actual value was caused by the dramatic increase of the palm oil price (Leong, H.Y., 2012). The production of palm oil has big effect on the production Y1L because it is one of the main exporting commodities and having the larger portion in the total production (Economic Planning Unit, 2011b).

Moreover, the forecast error of Y5L, the production of construction also has the relative large value which is 26.40%. The actual value is smaller than the forecast value because the investment has been injected into the construction projects but the project is not completed (Goh & Lim, 2010).

Meanwhile, the total investment has a forecast error of 35.48% because the actual value is larger than the forecast value. The Subprime Financial Crisis happened in year 2008 has discouraged the investment and thus, the investment value is relative smaller in the year 2008 and 2009 (Economic Planning Unit, 2011b). The recovery of the financial crisis has changed the investors' expectation and increased the investment (Economic Planning Unit, 2011b). Thus, these two effects have caused the total investment having the relative larger forecast error.

On the other hand, the export of other goods (XO) is the variable that having the largest forecast error which is 36.36%, i.e. its actual value is higher than the forecast value by 36.36%.

For the import of food and oil, MF and the import of the manufactured goods, MM have the lager forecast error, which are 35.52.% and 32.12% respectively. Both variables have the higher forecast value compared to the actual value. The lower actual value of MF can be explained that Malaysia has the sufficient supply of the food and oils which allows Malaysia relies less on the imported product. Meanwhile, the lower actual value of the MM can be explained that Malaysia import less intermediate manufactured goods but increase the import of the finished goods The increasing import of the finished goods can be reflected by the higher actual value of the import of machinery and transport equipment, MI.

4.3 Application

4.3.1 Forecasting 2011 and 2012

As mentioned by Peeble & Wilson (1996), prediction is another function of macroeconometric model. The estimated equations are used to do the prediction of the value of dependent variables in year 2011 and 2012 by making some assumptions. There are two scenarios studied in this research, thus there are two set of assumptions.

The assumptions of first scenario are as following:

Table 4.3 The Assumption of First Scenario

	2011 (growth)	2012 (growth)
US GDP	1.00%	3.00%
Public investment for each production sector	2.00%	2.00%
Disposable income	3.50%	4.50%
Labour force	1.00%	1.50%
Export tax	1.00%	1.00%
Import	1.00%	1.50%
Domestic Borrowings	5.00%	10.00%
Foreign Borrowings	-10.00%	-12.00%
BOPDGB	15%	20%
Real Interest rate	1.00%	1.00%
Effective Exchange rate	Remain	Remain

Data Source: Developed for the research

The US GDP is expected to grow 1% in year 2011 and 3% year 2012 because US is expected to recover from the subprime crisis and increasing their production output. US GDP is also the proxy of the condition of global economy in this research.

As the global economy is expected to grow, the public investment for each production sector is expected to grow 2% for each year. As the GDP is expected to grow with the pace of global economy growth, the disposable income is expected to increase by 3.5% in year 2011 and 4.5% in year 2012. Besides that, the labour force is expected to increase by 1% in year 2011 and 1.5% in the subsequent year due to the expanding economy and higher production. The export tax is expected to increase by 1% for each year. Meanwhile, the import is expected to grow at 1% in year 2011 and 1.5% in year 2012.

Moreover, domestic borrowings are expected to increase at 5% in year 2011 and 10% in year 2012 because government intends to reduce the foreign borrowings and substitute the foreign borrowings with the domestic borrowings. As the domestic borrowings are expected to increase, the BOPDGB is also expected to increase because BOPDGB is the summation of balance of payment and domestic borrowings. The real interest rate is increased by 1% for each year.

Based on the assumption, the prediction for year 2011 and 2012 is tabulated in the table following:

Table 4.4 The Prediction For Year 2011 and 2012 (First Scenario)

Variable	2011 (Growth)	2012 (Growth)
Y1	4.89%	5.58%
Y2	4.42%	7.86%
Y3	17.04%	6.01%
Y4	0.75%	0.75%
Y5	1.46%	1.46%
RGDP	6.06%	8.97%
PC	5.95%	5.39%

TI	2.59%	-0.45%
XR	3.45%	6.49%
XM	12.54%	6.59%
XO	1.39%	4.15%
MF	6.78%	7.71%
MR	6.28%	15.32%
MM	11.11%	16.85%
MI	0.62%	0.68%
MO	7.40%	11.08%
TD	8.36%	9.27%
EX	3.26%	3.00%
TIM	-10.30%	-10.39%
TOR	6.73%	10.11%
GC	7.64%	8.89%
GS	13.00%	-24.33%
CPI	2.67%	2.28%
PPI	0.97%	1.72%
M2	13.18%	11.07%

Source: Developed for the research

In the second scenario, the growth rate of US GDP is constant in year 2012 instead of increasing by 3% assumed in the first scenario.

The assumptions of the second scenario are as following:

Table 4.5 The Assumption of Second Scenario

	2011 (growth)	2012 (growth)
US GDP	1.00%	1.00%
Public investment for each production sector	2.00%	3.00%
Disposable income	3.50%	3.50%
Labour force	1.00%	1.50%
Export tax	1.00%	1.00%
Import	1.00%	1.00%
Domestic Borrowings	5.00%	15.00%
Foreign Borrowings	-10.00%	-15.00%
BOPDGB	15%	20%
Real Interest rate	1.00%	-1.00%
Effective Exchange rate	Remain	Remain

Source: Developed for the research

When the US GDP has the constant growth rate in year 2012, the disposable income is expected to have constant growth rate because private consumption is very sensitive to the change of the external environment. Meanwhile, the public investment increases by 3% in year 2012 because Malaysia GDP is expected to grow higher than year 2011 although the global economy is expanding in the same proportion as year 2011. Thus, the real interest rate is expected to decrease by 2% to encourage the increase in investment. As the global economy is growing slowly, the growth rate of foreign borrowings is expected to decrease by 5% and the growth rate of domestic borrowings is expected to increase by 10%. The growth rate of all other variables is assumed to be the same as in first scenario.

Based on the new assumption, the prediction for year 2011 and 2012 is tabulated in the table below:

Table 4.6 The Prediction For Year 2011 and 2012 (Second Scenario)

Variables	2011 (Growth)	2012 (Growth)
Y1	4.89%	5.58%
Y2	4.42%	7.86%
Y3	17.04%	6.01%
Y4	0.75%	0.75%
Y5	1.46%	1.46%
RGDP	6.06%	8.97%
PC	5.95%	5.11%
TI	2.59%	3.00%
XR	3.45%	5.96%
XM	12.54%	5.75%
XO	1.39%	1.38%
MF	6.78%	7.71%
MR	6.28%	15.32%
MM	11.11%	16.85%
MI	0.62%	0.68.%
MO	7.40%	11.08%
TD	8.36%	9.27%
EX	3.26%	3.00%
TIM	-10.30%	-10.36%
TOR	6.73%	10.11%
GC	7.64%	8.89%
GS	13.00%	-20.71%
CPI	2.67%	2.28%
PPI	0.97%	1.72%
M2	13.18%	11.07%

Source: Developed for the research

The growth rates for the production of Y1L to Y5L are the same in two scenarios although there is a change of the growth rate of US GDP in year 2012. This phenomenon reflects that the domestic production, i.e. the supply of the product is not affected by the fluctuation of the economic growth of the developed country because all of the supply is able to be absorbed by the global economy. The growth rate of Y1L and Y2L increases each year while the growth rate of Y4L and Y5L remain constant for year 2011 and 2012 in two scenarios. However, the growth rate for the Y3 is lower in year 2012 compared to year 2011 in two scenarios. The real GDP is derived from the value-added approach, which is on the supply side and its growth rate is increasing for each year in two scenarios.

The private consumption is sensitive to the change of the global economy. In the first scenario, the US GDP and the disposable income are assumed have the increasing growth rate but the growth rate of private consumption has decreased by 56 basis points. Moreover, in the second scenario, the US GDP and the disposable income are assumed to have the constant growth rate; the private consumption has decreased at even larger percentage which is 84 basis points. This result shows that the consumers have the pessimistic expectation on the future economy especially the happen of the financial crisis (*consumer confidence drops 10 points, most pessimistic future outlook since early 2009*, 2011).

On the other hand, in the first scenario, the growth rate of total investment has been decreased by 304 basis points in year 2012, i.e. the growth rate of total investment is only -0.45% in year 2012 because the real interest rate has the constant growth rate of 1 % in year 2012. However, in the second scenario, the growth rate of total investment is only increased by 41 basis points in year 2012 when the real interest rate is assumed to be decreased by 200 basis points. This outcome shows that the real interest rate has big effect on the total investment especially when the real interest rate is higher.

The US GDP growth rate has effect on the growth rate of export. Compare to the first scenario, the second scenario has lower growth rate in the export in year 2012 and these figures show that export is sensitive to the external economy growth. When the US GDP has the increasing growth rate, the growth rates of export of XR (mining and quarrying products), XM (manufactured products) and XO (other products) in year 2012 are 6.49%, 6.59% and 4.15% respectively. Yet, when the US GDO has only the constant growth rate, the growth rates of these three export groups are 5.96%, 5.75% and 1.38% respectively.

The growth rate of the import of all SITC groups remains the same in two scenarios and this explains that the imports are not affected by the US economy condition. Among the five groups of import, the import of MR (mining and quarrying products) and MM (manufactured goods) have the higher increasing growth , which increased by 904 basis points and 574 basis points respectively. When the real GDP is higher, the import of the mining and quarrying products and the manufactured goods are even higher. This phenomenon indicates that when the Malaysia economy is expanding, more intermediate goods are required for the industrial purpose.

For the government revenue equation, the growth rate of direct tax as well as the other tax revenue and non- tax revenue are not affected by the growth rate of US GDP. The growth rate of direct tax remains at 8.36% in year 2011 and 9.27% in year 2012 in two scenarios while the growth rate of the other tax revenue and non-tax revenue remains at 6.73% and 10.11% in year 2011 and 2012 respectively in two scenarios.

Meanwhile, the increase of 1% on export tax for each year has discouraged the aggregate export growth. The growth rate of the aggregate export in year 2012 has been decreased compared to year 2011, which are 3% and 3.26% respectively. Thus, the conclusion for the export is that the growth rate of disaggregate export relies on the growth rate of the global economy condition while the growth rate of aggregate export is mainly affected by

the export tax imposed by government. Again, the export tax is one of the tax policy instruments used by government to control the export volume.

For the case of import tax, in both scenarios, when the import increases, the import tax has been decreased. In the first scenario, the growth rate of import decreased by 9 basis points while in the second scenario, the growth rate of the aggregate import only decreased by 6 basis points. These results show that the government uses the import tax to control the volume of the import.

For the government expenditure equation, the government consumption is not affected by the growth rate of the US GDP. Its growth rate remains at 7.64% in year 2011 and 8.89% in year 2012 in two scenarios.

Meanwhile, the growth rate of the government surplus has been changed due to the changes of the growth rates of domestic borrowings and foreign borrowings growth rate. In the first scenario, the increasing of domestic borrowing is assumed to be greater than the decreasing in foreign borrowings; the growth rate of government surplus is decreased by 3733 basis point in year 2012. In the second scenario, the decreasing of foreign borrowings is substituted by even higher domestic borrowings; the government surplus is decreased by 3371 basis point in year 2012. This result shows that the growth rate of government surplus relies more on the change of the domestic borrowings relatively.

The increasing growth rate of the BOPDGB has driven the decrease in the growth rate of money supply M2.The growth rates of money supply M2 are the same in two scenarios .It is lower in year 2012 compared to year 2011 which is 11.07% and 13.17% respectively.

Meanwhile, the growth rate of CPI followed the direction of money supply M2, which the growth rate decreases from 2.67% in year 2011 to 2.28% in year 2012 in both

scenarios. The growth rate of PPI relies more on the growth rate of last year money supply M2 instead of the growth rate of current year money supply M2.Thus, it has the opposed direction of the growth rate with money supply M2, which the growth rate of PPI increase from 0.97% in year 2011 to 1.72% in year 2012 in both scenarios.

CHAPTER 5: DISCUSSION, CONCLUSION, AND IMPLICATIONS

5.1 Introduction

Macroeconometric model is a tool that commonly used by different countries for forecasting and policy simulation. It is useful in forecasting and policy simulation because it can provide information on the dynamic adjustment process.

The US economic downturn which driven by the Subprime Financial Crisis happened in year 2008 has affected the Malaysia economy especially the external trade. Thus, in this research, the effect of the external economy condition on Malaysia external trade has been studied. The suitable model has been built to forecast the growth rate of the macroeconomic variables under different assumptions. The significances of the study are to study the policy tool that can overcome the negative impact of financial crisis on external trade and the spill over linkage between the global economy slowdown and the international trade. Moreover, this study is significant because it provides more information about the macroeconometric model of Malaysia economy to the future researchers.

5.2 Summary of Statistical Analysis

In this study, the macroeconometric model consists of 24 equations and five identities. There are total 42 variables which includes 28 endogenous variables and 14 exogenous variables. The 24 equations and five identities are estimated in four different blocks which are production block, aggregate demand block, government budget block and price and money block.

The OLS estimation method is used to estimate the equations before the model simulation and forecasting. The diagnostic checking has been carried out to ensure that OLS estimator provides good properties and to ensure that all of the equations are valid. After checking the goodness of fit of the individual equations, the goodness of fit for the model simulation is checked by using Root Mean Square Error (RMSE) and the Mean Absolute Percent Error (MAPE). The forecast error is calculated after doing the ex post forecasting for year 2010.

5.3 Discussions of Major Findings

For the model simulation, overall model fits well but the aggregate demand block provides relatively weak result. In the aggregate demand block, there are few equations that the simulated paths are not closely traced the actual paths which are government consumption, export of other goods, import of mining and quarrying products and import of manufactured goods.. Thus, the simulation of the real GDP has not performed well due to the discrepancies of these equations.

The Root Mean Square Error (RMSE) and the Mean Absolute Percent Error (MAPE) are performed to indicate the goodness of fit of the model simulation. The range of the

RMSE is from 0.0188 to 0.2203. Meanwhile, for the MAPE, the range is from 0.3162 to 16.1714 and one outlier is found which it is the import of other goods. After that, ex post forecast is performed to further examine the performance of the model and the forecast error has been calculated. The range of the forecast error is between 0.30% and 36.36%.

The macroeconometric model is then applied in the forecasting for year 2011 and year 2012 by creating two scenarios with their own assumptions. The two scenarios are related to the growth rate of US GDP, which is also the proxy of the global economy growth. In the first scenario, the US GDP is expected to grow at 1% in year 2011 and 3% in year 2012 while in the second scenario, the US GDP is expected to grow at constant growth rate of 1% in year 2011 and 2012.The assumptions for year 2011 are same in two scenarios but the assumptions for year 2012 are different.

The changes of US GDP growth rate has the positive impact on the export based on the SITC groups but not on the aggregate export. The aggregate export is affected by export tax imposed by government instead of being affected by the global economy condition. Besides that, the disaggregate import is affected by the real GDP and the import tax is used to control the volume of aggregate import.

On the other hands, we found that the consumers have the pessimistic expectation on future economy because the private consumption increases at a decreasing rate although the external and national economy growth rate is expected to increase at an increasing rate.

The growth rate of domestic borrowings and foreign borrowings has affected the growth rate of government surplus. The decreasing real interest rate has encouraged the growth of total investment. The real GDP growth rate is derived from the supply side, i.e. derived from the production of each sector. The change of the growth rate of global

economy has no effect on the production and this condition reflects that the domestic production is able to be absorbed by the global economy.

5.4 Implication of the Study

For forecasting purpose, the estimated equations are used to do the prediction for the value of dependent variables in year 2011 and 2012 based on two scenarios with different sets of assumptions. By comparing the first scenario and second scenario, the US GDP growth rate has affected the disaggregate export growth rate but there are no changes on the growth rate of aggregate export.This result has shown that the disaggregate export is sensitive to the external economy factor but the aggregate export is mainly affected by the export tax.

As the US economy is expected to recover from the subprime financial crisis and going to grow (Lee, 2010), and the evidence shown by the forecasting result of the first scenario and second scenario, policymaker is suggested to decrease the growth rate of export tax to increase the aggregate export. The export can even reach a higher level because it can be driven by the growth of the global economy. The increase in export not only can reduce the trade deficit but also increase the GDP of Malaysia.

5.5 Limitation of the Study

This research is compounded by two main problems: data and time constraints. The data required for the analysis are gathered from different data sources and the information of data have discrepancies due to different computational methods. Moreover, even the data can be extracted from the same source; there are few series of data to be chosen. In addition, there are some missing values for the series especially the data of the past few

decades. Therefore, the stage of collecting and adjusting the data has become the most challenges stage in performing the macroeconometric modeling.

As mentioned in the previous chapters, macroeconometric model is useful for forecasting and policy simulation. However, it is time consuming for completing a macroeconometric model from pre-model structure until application of macroeconometric model. At the stage of pre-model structure, data collecting and data adjustment is needed. Next, the researchers need to ensure the validity of the estimated equation before proceed to the model simulation because if one of the individual equations is not performed well, it will directly affect the performance of the model simulation. Even though the individual equation has the goodness of fit, the estimation of the block might not perform well.

After doing the model simulation, the goodness of fit of the model has to be checked before proceed to forecasting. If the simulation is not performed well, the forecast error will be larger which causes the result meaningless. The following step is completing the ex-post forecasting to further evaluate the performance of the model. Finally, the forecasting for the scenario can only be done to study the objectives of the study.

If the research intends to go forward for the policy simulation, he needs to do the multiplier analysis. The researcher needs to change the parameter of the multiplier to test the effect on the dependent variables. Thus, he will be able to choose the most efficient tools to achieve the target of the policy design. The researcher has fully utilized the function of macroeconometric modeling if he reaches this stage. Therefore, the four steps involved in accomplishing this research which are model specification, model estimation, model simulation and application are very time consuming.

Hence, we cannot fully utilize the function of macroeconometric because we only able to complete the scenario simulation but not the multiplier analysis. This is because longer time frame is required if we need to analyze the changes of the parameter of the independent variables on their impact on the dependent variables. Therefore, the multiplier analysis is not accomplished within our time frame.

5.6 Recommendation for Future Research

The simulation of the production block has shortcomings. Although the production block is simulated the past well but the baseline for the production block is starting from year 1990.The simulated path of baseline from year 1978 till 1989 is not shown because the lagged 12 years dependent variable is added as the independent variable in the equation Y1L.

We encounter this problem by assuming that the forecasted value and the baseline are closely traced from year 1978 to 1989 because the overall result for the simulation evaluation is performed well. However, it is possibly that important variable or economic effect has been omitted in the equations. Thus, future researcher is recommended to find other proxies to capture the external factors and replace them for lagged term used in the equations.

Moreover, that is business cycle appears in the production block when the residual graph is studied. However, we did not capture the effect of business cycles in the equation. Hence, the futures researcher is recommended to find a proxy to capture the effect of business cycle in the production block because it might show the significant relationship with the production.

For the simulation of aggregate demand block, there are few equations having the discrepancies between the actual path and the baseline. The behavior of total investment is usually hard to predict because it relies more on the investor's expectation. Future researcher is recommended to find the suitable combination of the independent variables to estimate the effect on the dependent variables.

Future researchers are also recommended to rerun the model after a certain time interval because macroeconometric model unable to capture the economic effect for the period beyond the sample period. In the same manner, some of the outlier found in the macroeconometric model might due to the lag effect of the economic variables in the past time.

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APPENDICES

Appendix 4.1: Diagnostics Checking For Production of Agriculture, Fishery and Forestry

Equation 1: $\widehat{\log(Y1L)} = 7.7567 + 0.2061 \log (IG1_{t-12}) + [AR(1) = 0.7434]$

R Squared	0.7821
Normality Test (Jarque Bera Test)	0.8668
Breusch- Godfrey Serial Correlation LM test	0.5358
Heteroskedasticity Test - ARCH	0.6989
RAMSEY Reset test	0.4700
Durbin Watson d-test	1.6748
Durbin Watson h-test	0.9672

Multicollinearlity

	LOG(Y1LW1)	LOG(IGLW1(-12))
LOG(Y1LW1)	1.0000	0.7725
LOG(IGLW1(-12))	0.7725	1.0000

Appendix 4.2 : Diagnostics Checking For Production of Mining and Quarrying

Equation 2: $\widehat{\log(Y2L)} = 7.1117 + 0.4682 \log(IG2_{t-5}) + [AR(1) = 0.7557]$

Normality Test (Jarque Bera Test)	0.2090
Breusch- Godfrey Serial Correlation LM test	0.7882
Heteroskedasticity Test - ARCH	0.9788
RAMSEY Reset test	0.3706
R Squared	0.9088
Durbin Watson d-test	2.1129

Durbin Watson H-test	-0.3808

Multicollinearlity

	LOG(Y2LW2)	LOG(IGLW2(-5))
LOG(Y2LW2)	1.0000	0.9378
LOG(IGLW2(-5))	0.9378	1.0000

Appendix 4.3 : Diagnostics Checking For Production of Manufacturing

Equation 3: $\widehat{\log(Y3L)} = 1.0304 \log(Y3L_{t-8}) + [AR(1) = 0.3464]$

R Squared	0.9494
Normality Test (Jarque Bera Test)	0.8729
Breusch- Godfrey Serial Correlation LM test	0.5754
Heteroskedasticity Test - ARCH	0.7007
RAMSEY Reset test	0.1946(fitted value 2)
Durbin Watson d-test	1.9017
Durbin Watson h-test	0.7163

Multicollinearlity

	LOG(Y3L)	LOG(Y3L(-8))
LOG(Y3L)	1	0.9679
LOG(Y3L(-8))	0.9679	1

Appendix 4.4 : Diagnostics Checking For Production of Service

Equation 4: $\widehat{\log(Y4L)}$ = 6.0602 + 0.3770 log(TI4) + 0.1913 DUMMY

R Squared	0.8458
Normality Test (Jarque Bera Test)	0.1577
Breusch- Godfrey Serial Correlation LM test	0.2752
Heteroskedasticity Test - ARCH	0.8502
RAMSEY Reset test	0.1099
Durbin Watson d-test	1.258

Multicollinearlity

	LOG(Y4L)	LOG(TI4)	DUMMY
LOG(Y4L)	1.000	0.7639	0.6459
LOG(TI4)	0.7639	1.0000	0.1872
DUMMY	0.6459	0.1872	1.0000

Appendix 4.5: Diagnostics Checking For Production of Construction

Equation 5: $\widehat{\log(Y5L)}$ = 0.8888 + 0.7342 log(TI) + [AR(1) = 0.6547]

R Squared	0.6423
Normality Test (Jarque Bera Test)	0.9460
Breusch- Godfrey Serial Correlation LM test	0.6632
Heteroskedasticity Test - ARCH	0.3853
RAMSEY Reset test	0.3420
Durbin Watson d-test	1.9632
Durbin Watson h-test	0.1625

Multicollinearlity

	LOG(Y4L)	LOG(TI4)	DUMMY
LOG(Y4L)	1.0000	0.7639	0.6459
LOG(TI4)	0.7639	1.0000	0.1872
DUMMY	0.6459	0.1872	1.0000

Appendix 4.6 : Diagnostics Checking For Aggregate Demand of Private Consumption

Equation 6: $\widehat{\log(PC)}$ = 0.70071 log (PC_{t-1}) + 0.2729 log (YD) + 0.07290 DUMMYR - 0.07182 DUMMYFC

R square	0.9937
Normality Test (Jarque Bera Test)	0.4941
Breusch- Godfrey Serial Correlation LM test	0.8380
Heteroskedasticity Test - ARCH	0.5739
RAMSEY Reset test	0.5119
Durbin Watson D statistic	1.8238
Durbin Watson H statistic	0.5357

Multicollinearlity

	LOG(PC)	LOG(PC(1))	LOG(YD)	DUMMYR	DUMMYFC
LOG(PC)	1.0000	0.9933	0.9855	0.4302	-0.3662
LOG(PC(-1))	0.9933	1.0000	0.9830	0.4131	-0.3080
LOG(YD)	0.9855	0.9830	1.0000	0.3670	-0.3179
DUMMYR	0.4302	0.4131	0.3670	1.0000	-0.1548
DUMMYFC	-0.3662	-0.3080	-0.3179	-0.1548	1.0000

Appendix 4.7 : Diagnostics Checking For Aggregate Demand of Investment

Equation7: $\widehat{\log(TI)}$ = -1.3897 + 0.5590 $\log(TI_{t-1})$ +0.6985 log(RGDP) - 0.01707 RIR + 3.4131 DUMMY - 0.7246 DUMMY*log(RGDP)

R square	0.9469
Normality Test (Jarque Bera Test)	0.4528
Breusch- Godfrey Serial Correlation LM test	0.4348
Heteroskedasticity Test - ARCH	0.1056
RAMSEY Reset test	0.7523
Durbin Watson D statistic	2.1179
Durbin Watson H statistic	-0.6469

Multicollinearlity

	LOG(TI)	LOG(TI(-1))	LOG(RGDP)	RIR	DUMMY	DUMMY*LOG(RGDP)
LOG(TI)	1.0000	0.9455	0.9080	-0.3567	0.6478	0.6479

LOG(TI(-1))	0.9455	1.0000	0.9315	-0.2253	0.7355	0.7350
LOG(RGDP)	0.9080	0.9315	1.0000	-0.3408	0.8242	0.8312
RIR	-0.3567	-0.2253	-0.3408	1.0000	-0.3437	-0.3484
DUMMY	0.6478	0.7355	0.8242	-0.3437	1.0000	0.9992
DUMMY*LOG(RGDP)	0.6479	0.7350	0.8312	-0.3484	0.9992	1.0000

Appendix 4.8 : Diagnostics Checking For Aggregate Demand of Export of SITC 2, 3, 5

Equation 8: $\widehat{D(XR)}$ = 1.4805 D(Y2) + 0.000869 D(USGDP) + [AR(1) = 0.3786]

R Squared	0.8507
Normality Test (Jarque Bera Test)	0.6961
Breusch- Godfrey Serial Correlation LM test	0.4825
Heteroskedasticity Test - ARCH	0.3955
RAMSEY Reset test	0.7736
Durbin Watson D statistic	1.9911

Multicollinearlity

	D(XR)	D(Y2)	D(USGDP)
D(XR)	1.0000	0.8890	0.0441
D(Y2)	0.8890	1.0000	-0.1471
D(USGDP)	0.0441	-0.1471	1.0000

Appendix 4.9 : Diagnostics Checking For Aggregate Demand of Export of SITC 6, 8

Equation 9: $\widehat{D(XM)}$ = -0.5583 + 0.5240 D(Y3) + 0.001309 D(USGDP) + 1.6287 DUMMY

R Squared	0.6116
Normality Test (Jarque Bera Test)	0.0989
Breusch- Godfrey Serial Correlation LM test	0.4716
Heteroskedasticity Test - ARCH	0.9756
RAMSEY Reset test	0.9230
Durbin Watson D statistic	2.4035

Multicollinearlity

	D(XM)	D(Y3)	D(USGDP)	DUMMY
D(XM)	1.0000	0.3059	0.5640	0.3956
D(Y3)	0.3059	1.0000	-0.2407	-0.0957
D(USGDP)	0.5640	-0.2407	1.0000	0.2287
DUMMY	0.3956	-0.0957	0.2287	1.0000

Appendix 4.10: Diagnostics Checking For Aggregate Demand of Export of Other SITC Groups

Equation 10: $\widehat{D(XO)}$ = 0.007819 D (USGDP)

R Squared	0.4763
Normality Test (Jarque Bera Test)	0.9613
Breusch- Godfrey Serial Correlation LM test	0.7544
Heteroskedasticity Test - ARCH	0.0399

RAMSEY Reset test	0.2021
Durbin Watson D statistic	1.7094

Multicollinearlity

	D(XO)	D(USGDP)
D(XO)	1.0000	0.7051
D(USGDP)	0.7051	1.0000

Appendix 4.11: Diagnostics Checking For Aggregate Demand of Import of SITC 0, 4

Equation 11: $("D(MF")^{\wedge}$ = 0.06151 D(RGDP) + 1.7928 DUMMY + [AR(1) = -0.4192]

R Squared	0.2762
Normality Test (Jarque Bera Test)	0.7256
Heteroskedasticity Test - ARCH	0.9404
Durbin Watson D statistic	1.7525
Durbin Watson H statistic	0.7500

Multicollinearlity

	D(MF)	D(RGDP)	DUMMY
D(MF)	1.0000	0.2718	0.5176
D(RGDP)	0.2718	1.0000	-0.0008
DUMMY	0.5176	-0.0008	1.0000

Appendix4.12: Diagnostics Checking For Aggregate Demand of Import of SITC 2, 3, 5

Equation 12: $\widehat{\log(MR)}$ = 0.4312 + 0.8319log (MR_{t-1}) + 0.009327D (RGDP) + 0.2845 DUMMY

R Squared	0.9922
Normality Test (Jarque Bera Test)	0.7873
Breusch- Godfrey Serial Correlation LM test	0.5623
Heteroskedasticity Test - ARCH	0.7049
RAMSEY Reset test	0.6345
Durbin Watson D statistic	2.1259
Durbin Watson H statistic	-0.3586

Multicollinearlity

	LOG(MR)	LOG(MR(-1))	D(RGDP)	DUMMY
LOG(MR)	1.0000	0.9933	0.2306	0.8951
LOG(MR(-1))	0.9933	1.0000	0.2005	0.8767
D(RGDP)	0.2306	0.2005	1.0000	-0.0008
DUMMY	0.8951	0.8767	-0.0008	1.0000

Appendix 4.13: Diagnostics Checking For Aggregate Demand of Import of SITC 6, 8

EQ 13: $\widehat{\log(MM)}$ = -5.4330 + 1.8071 log RGDP + [AR (1) = 0.7732]

R Squared	0.9930
Normality Test (Jarque Bera Test)	0.6932
Breusch- Godfrey Serial Correlation LM test	0.3444

Heteroskedasticity Test - ARCH	0.7021
RAMSEY Reset test	0.4744
Durbin Watson D statistic	2.0166
Durbin Watson H statistic	-0.3027

Multicollinearlity

	LOG(MM)	LOG(RGDP)
LOG(MM)	1.0000	0.9947
LOG(RGDP)	0.9947	1.0000

Appendix 4.14: Diagnostics Checking For Aggregate Demand of Import of SITC 7

Equation 14: $\widehat{\log(MI)}$ = -3.3738 + 1.1113 log RGDP + 0.5625 log MI_{t-1} + 5.5526DUMMY - 1.0728 DUMMY*log (RGDP)

R Squared	0.994170
Normality Test (Jarque Bera Test)	0.3570
Breusch- Godfrey Serial Correlation LM test	0.6957
Heteroskedasticity Test - ARCH	0.0733
RAMSEY Reset test	0.7933
Durbin Watson D statistic	1.7386

Multicollinearlity

	LOG(MI)	LOG(RGDP)	DUMMY	DUMMY*LOG (RGDP)	LOG(MI(-1))
LOG(MI)	1.0000	0.9855	0.8322	0.8339	0.9950
LOG(RGDP)	0.9855	1.0000	0.8242	0.8312	0.9892
DUMMY	0.8322	0.8243	1.0000	0.9992	0.8437

DUMMY*LOG (RGDP)	0.8339	0.8312	0.9992	1.0000	0.8468
LOG(MI(-1))	0.9950	0.9892	0.8437	0.8468	1.0000

Appendix 4.15: Diagnostics Checking For Aggregate Demand of Import of Other SITC Groups

Equation 15: $\widehat{\log(MO)}$ = -14.1055 + 3.2776 log (RGDP) + 15.6246 DUMMY + 0.07496 DUMMY*MO - 3.2646 DUMMY*log(RGDP)

R Squared	0.9788
Normality Test (Jarque Bera Test)	0.0630
Breusch- Godfrey Serial Correlation LM test	0.7851
Heteroskedasticity Test - ARCH	0.6537
RAMSEY Reset test	0.1048
Durbin Waston D statistic	1.8322
Durbin Watson H statistic	1.1520

Multicollinearlity

	LOG(MO)	LOG(RGDP)	DUMMY	DUMMY*LOG (RGDP)	DUMMY*MO
LOG(MO)	1.0000	0.9700	0.7551	0.7572	0.7544
LOG(RGDP)	0.9700	1.0000	0.8192	0.8257	0.8224
DUMMY	0.7551	0.8192	1.0000	0.9993	0.9610
DUMMY*LOG (RGDP)	0.7572	0.8257	0.9993	1.0000	0.9672
DUMMY*MO	0.7544	0.8224	0.9610	0.9672	1.0000

Appendix 4.16: Diagnostics Checking For Government Budget of Direct Tax

Equation 16: $\widehat{\log(TD)} = -1.5005 + 0.4490 \log(TD_{t-1}) + 0.6108 \log (RGDP)$

R Squared	0.9660
Normality Test (Jarque Bera Test)	0.1568
Breusch- Godfrey Serial Correlation LM test	0.6496
Heteroskedasticity Test - ARCH	0.4562
RAMSEY Reset test	0.4156
Durbin Watson D statistic	1.7632
Durbin Watson H statistic	1.1093

Multicollinearlity

	LOG(TD)	LOG(TD(-1))	LOG(RGDP)
LOG(TD)	1.0000	0.9747	0.9768
LOG(TD(-1))	0.9747	1.0000	0.9715
LOG(RGDP)	0.9768	0.9715	1.0000

Appendix 4.17: Diagnostics Checking For Government Budget of Export Tax

Equation 17: $\widehat{\log(EX)} = 0.4578 - 0.1108 \log (TEX) + 0.9214 \log (EX_{t-1})$

R Squared	0.9931
Normality Test (Jarque Bera Test)	0.6345
Breusch- Godfrey Serial Correlation LM test	0.3616
Heteroskedasticity Test - ARCH	0.9537
RAMSEY Reset test	0.5233
Durbin Watson D statistic	1.2711

Multicollinearlity

	LOG(EX)	LOG(TEX)	LOG(EX(-1))
LOG(EX)	1.0000	-0.8013	0.9957
LOG(TEX)	-0.8013	1.0000	-0.7798
LOG(EX(-1))	0.9957	-0.7798	1.0000

Appendix 4.18: Diagnostics Checking For Government Budget of Import Tax

Equation 18: $\mathbf{D}\left(\widehat{\log(\mathbf{TIM})}\right) = 0.3174 - 0.06762 \log(IM)$

R Squared	0.1488
Breusch- Godfrey Serial Correlation LM test	0.5329
Heteroskedasticity Test - ARCH	0.4176
RAMSEY Reset test	0.2826
Durbin Watson D statistic	2.3587
Durbin Watson H statistic	-1.9372

Multicollinearlity

	D(LOG(TIM))	LOG(IM)
D(LOG(TIM))	1.0000	-0.3858
LOG(IM)	-0.3858	1.0000

Appendix 4.19: Diagnostics Checking For Government Budget of Other Tax Revenue and Non-Tax Revenue

Equation 19: $\widehat{\log(TOR)}$ = -2.7997+ 1.1173 log (RGDP) + [AR (1) = 0.7030]

R Squared	0.9772
Normality Test (Jarque Bera Test)	0.2023
Breusch- Godfrey Serial Correlation LM test	0.4006
Heteroskedasticity Test - ARCH	0.2709
RAMSEY Reset test	0.1640
Durbin Watson D statistic	2.2104
Durbin Watson H statistic	-0.8245

Multicollinearlity

	LOG(TOR)	LOG(RGDP)
LOG(TOR)	1.0000	0.9768
LOG(RGDP)	0.9768	1.0000

Appendix 4.20: Diagnostics Checking For Government Budget of Government Expenditure

Equation 20: $\widehat{(DGC)}$ = 0.3300 + 0.1243 D(RGDP) + 0.01281 DUMMY*RGDP

R square	0.3294
Normality Test (Jarque Bera Test)	0.2068
Breusch- Godfrey Serial Correlation LM test	0.6532
Heteroskedasticity Test - ARCH	0.9990
RAMSEY Reset test	0.1697

Durbin Watson D statistic	2.0598
Durbin Watson H statistic	-0.2079

Multicollinearlity

	D(GC)	D(RGDP)	DUMMY*RGDP
D(GC)	1.0000	0.3163	0.4967
D(RGDP)	0.3163	1.0000	0.0590
DUMMY*RGDP	0.4967	0.0590	1.0000

Appendix 4.21: Diagnostics Checking For Government Budget of Government Surplus Borrowings

Equation 21: $\widehat{GS}$ = -0.4942 -0.9147 FB -0.9268DB

R Squared	0.8698
Normality Test (Jarque Bera Test)	0.9885
Breusch- Godfrey Serial Correlation LM test	0.4703
Heteroskedasticity Test - ARCH	0.9669
RAMSEY Reset test	0.4046
Durbin Watson D statistic	1.8314

Multicollinearlity

	GS	FB	DB
GS	1.0000	-0.3051	-0.8349
FB	-0.3051	1.0000	-0.1236
DB	-0.8349	-0.1236	1.0000

Appendix 4.22: Diagnostics Checking For Price and Money of Consumer Price Deflator

Equation 22: $\widehat{\log(CPI)}$= 2.4040+ 0.2156 log (M2) + [AR (1) =0.7554]

R Squared	0.9962
Normality Test (Jarque Bera Test)	0.7963
Breusch- Godfrey Serial Correlation LM test	0.6713
Heteroskedasticity Test - ARCH	0.9458 (lag2)
RAMSEY Reset test	0.8421
Durbin Watson d-test	1.7383
Durbin Watson h-test	0.9406

Multicollinearlity

	LOG(CPI)	LOG(M2)
LOG(CPI)	1.0000	0.9956
LOG(M2)	0.9956	1.0000

Appendix 4.23: Diagnostics Checking For Price and Money of Producer Price Deflator

$\widehat{PPI}$ = -0.1601 + 23.1640log ($M2_{t-1}$) + [AR (1) =0.894398675033]

R Squared	0.9746
Normality Test (Jarque Bera Test)	0.3712
Breusch- Godfrey Serial Correlation LM test	0.4239
Heteroskedasticity Test - ARCH	0.2779
RAMSEY Reset test	0.1876
Durbin Watson d-test	1.4354
Durbin Watson h-test	1.7419

Multicollinearlity

	PPI	LOG(M2(-1))
PPI	1.000000	0.947598
LOG(M2(-1))	0.947598	1.000000

Appendix 4.24: Diagnostics Checking For Price and Money of Money Supply M2

Equation 24: $\widehat{M2}$ = -30.709 + 0.4788GDPV – 0.8412 $BOPDGB_{t-9}$ + 0.8293 $M2_{t-1}$ – 26.084DUMMY

Normality Test (Jarque Bera Test)	0.9779
Breusch- Godfrey Serial Correlation LM test	0.2827
Heteroskedasticity Test - ARCH	0.1170
RAMSEY Reset test	0.2676
R Squared	0.9979
Durbin Watson d-test	2.607
Durbin Watson h-test	-1.5446

Multicollinearlity

	M2	GDPV	BOPDGB(-9)	M2(-1)	DUMMY
M2	1.0000	0.9891	0.2851	0.9970	0.7574
GDPV	0.9891	1.0000	0.3190	0.9847	0.7930
BOPDGB(-9)	0.2851	0.3190	1.0000	0.3173	0.2098
M2(-1)	0.9970	0.9847	0.3173	1.0000	0.7659
DUMMY	0.7574	0.7930	0.2098	0.7659	1.0000