THE DETERMINANTS OF MALAYSIA GOVERNMENT BOND YIELDS FROM YEAR 1996:Q1 TO 2013:Q4

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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 16,849 words.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
BNM	Bank Negara Malaysia
CAPM	Capital Asset Pricing Model
CPI	Consumer Price Index
E/P	Earnings Yield
EPF	Employees Provident Fund
FGBD	Federal Government Budget Deficit
GD	Government Debt
GDP	Gross Domestic Product
GII	Government Investment Issues
IS	Investment Saving
JB	Jarque- Bera
LP	Liquidity Preference
MGS	Malaysian Government Securities
MITB	Malaysian Islamic Treasury Bills
MMT	Modern Monetary Theory
MTB	Malaysian Treasury Bills
OLS	Ordinary Least Square
SIC	Schwarz Information Criterion
STIR	Short- term Interest Rate
VIF	Variance Inflation Factor

LIST OF APPENDICES

Abstract

This paper examines the relationship between government bond yields and macroeconomic determinants such as Federal Government Budget Deficit, Government Debt, Consumer Price Index (CPI) and Short- term Interest Rate. Secondary data was collected from Datastream from year 1996:Q1 to 2013:Q4 which contain quarterly data from quarter one to four and have a total of 72 observations in this paper. Ordinary Least Square (OLS) method was employed to run the model and estimate the regression. Besides, this paper also employed the Breusch- Godfrey Serial Correlation LM test, Autoregressive Conditional Hetroscedasticity (ARCH) test, Jarque- Bera test, Ramsey RESET test and encounter that there is no serious multicollinearity problem, no autocorrelation, no heteroscedasticity, error term is normally distributed and model is correctly specified. These empirical results help investors to determine the factors that could affect the government bond yields and decision making.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

Within this paper, the first chapter will discuss on the background of Malaysia Government Bond. The knowledge of the background is necessary and important to enhance the understanding of how Federal Government Budget Deficit, Government Debt, Consumer Price Index (CPI) and Short-term Interest Rate can affect the Malaysia Government Bond Yields. Malaysia Government Bond Yields is important in the perspective of investors because the increase and decrease of yields can affect the bond price and decision making of investors. Besides, Malaysian government in financial market is an important instrument since it is highly liquid in secondary market and act as benchmark of all other bonds. Next, this chapter will continue with problem statement which gives reader an in-depth understands of this research. Then, it will further continue to the discussion on objectives and questions of this research, additional with hypotheses and significance of study. At the end of this chapter, layout will be outlined briefly and conclusion will be presented.

1.1 Research Background

1.1.1 Background of Malaysia

Malaysia is a country that located in the Southeast Asia which is between Singapore, Thailand and Indonesia. Achieved its independence since 1957, Malaysia now are celebrating the 57th years of independence soon. During this period, Malaysia keeps improving which makes Malaysia one of the tourism

attractions. Capital of Malaysia is Kuala Lumpur while its federal administrative centre is at Putrajaya. Main languages spoken are mainly Bahasa Malaysia and English. Since year 1998 to 2010, there have been an increased in tourists visitation of 19.10 million and it will keep increase in the future ("General Country Information about Malaysia", n.d.). Till date based on the demographic profile of Malaysia in 2013, Malaysia has a population of 29,628,392 ("Malaysia Demographic Profile", 2013). As the population keep increasing and so does the economy, it is necessary that Malaysia takes an extra mile to boost up the economic and maintain the stability of economic. In order to have such capital to fund the developments, Malaysia's government can issue government bond and thus able to increase the market participations.

1.1.2 Background of Government Securities in Malaysia

According to Harun (2002), government securities were first issued in year 1960s, a year after Malaysia's central bank which is the Bank Negara Malaysia (BNM) has been established. The initial purpose of the issuance is to cope up with the investment requirement of government Employees Provident Fund (EPF), banks as well as insurance companies. In late 1970s and 1980s, government helps to finance the public development sector's expenditure and as time goes by, in year 1992, Malaysian Government Securities (MGS) were used to fund part of the government's budget deficit and pay the government external loan which are expensive in mid- 1990s. Heng, Nasir, Ariff and Mohamad (2005) studies found that government over the years who has been using government securities fund to repay their debts has come to realize that they have not paying attention to the low-income investor in the market and thus effect the growth restriction and the development of financial sector. Due to these circumstances, government has decided to launch new and prudent reform policies with the purpose of returning the market to private sector so that they could help in developing the growth of market as well as economy of Malaysia with less interference from BNM.

Malaysia bond market has been considered as one of the most developed and dynamic bond markets in this region. Bond markets in Malaysia are refer as the market for a long term financial assets that consists of public and private debt instrument that have the maturities of more than one year while market for a short term financial assets will have the maturity of not more than a year. Malaysia government bond has four types mainly the Malaysian Government Securities (MGS), Malaysian Treasury Bills (MTB), Malaysian Islamic Treasury Bills (MITB) and Government Investment Issues (GII). MGS and MTB are financial assets with a long term maturity while MITB and GII are of short term maturity ("Malaysia Bond Market Guide", 2012).

According to Heng et al., (2005), Malaysian Government Securities are debt instruments issued by Bank Negara Malaysia (BNM), on behalf of the government of Malaysia. Government bond are considered the safest instrument in the market as investors recognized it as risk- free rate instrument which promised to pay fixed income to the holder. Bondholders never encounter losses in their principal investment and they do have the priority over shareholder where in case of bankruptcy, bondholders will be compensated first but this case rarely happens. Besides that, an elderly investor would likely to invest in bond as it guaranteed a fixed income and able to predict the income generated thus making their portfolio more secure and less risky. In addition to that, government bond are traded actively in secondary market as this bond is volatile and liquid. Thus, holding a bond is somehow better than stock as it fetched a better rate than the rates paid by banks ("The Advantages of Bonds", 2012).

Financial reform that had taken place during January 1989 contributed to a more active secondary market. Government bond yields are important in influencing the bond prices in the market. Based on the concept of Frederick Macaulay (Duration), when the maturity of bond is longer it will lead to higher coupon rate and eventually a higher yield in bond market (Hopewell & Kaufman, 1973). While pricing of bond are priced by the principal dealer who needs to bid a minimum of

10% from the primary issue size as required, a successful auction bidding leads to the coupon rate calculation (Heng et al., 2005).

As a conclusion, based on the findings by Yi (2014), government bond market is crucial in order to maintain the healthiness of economic of a country and helps to fix the term structure on bond market which is distorted and bond illiquidity. This is because bond market plays an important role in maintaining the financial system stability so by having a steady condition a well- government can expand more financial asset. Not only that, improvement of bond market leads to reduction of risk of investment, foreign currency instabilities, decrease of exposure to financial risks and improvement in ability to control debt management well. Hence, bond market efficiency can help develop a strong and liquid bond in a country (Silva, 2010).

1.2 Problem Statements

From the past researchers' papers, they had examined the determinants of government bond yields. Different results from different researchers are obtained based on their findings in different countries. Thus, there are some results shown positive and negative relationship between government bond yields and their selected determinants (Gruber & Kamin, 2012 ; Poghosyan, 2013).

In year 2006, Malaysian debt securities market ranked second largest in Asia after Japan by the Asian Development Bank (Bank Negara Malaysia, 2006). The ranking shows that the Malaysia bond market is well accepted and investors are confidence with it, especially the foreign investors are willing choose to hold the Malaysia government bond. According to Franklin Templeton Investments' Malaysia fixed income and sukuk head, Hanifah Hashim, stated that in year 2013, the foreign holding of Malaysia government bond was more than 40% ("Malaysian bonds in for more volatility", 2013). Besides, study on determinant of Malaysia government bond yields is rarely found. For example,

most of the studies target in United States (Castellani & Santos, 2005), China (Fan & Johansson, 2010), East Asia (Jiang & McCauley, 2004) and so on.

Government bonds issued by different countries with same maturity year have different dividend yield. For example on September 2013, the dividend yield for Malaysia government bond with 30 years maturity was 4.935 percent while with same maturity of 30 years, United State paid 3.71 percent, Thailand paid 4.6 percent and Singapore paid 3.16 percent (Chew, 2013). These figures indicate that the government bond yield may be adjusted according to different government monetary policy and different country economy condition. Thus, the level of significance of the factors that will affect the government bond yield may be different in every country. So the research done in United States, China, and East Asia may not act as benchmark or may not accurate in Malaysia.

Table 1.1: Malaysian Government Securities (MGS) Yields from 2007-2013

Year	**Malaysian Government Securities (MGS) yields, %**		
	3 years	**5 years**	**10 years**
2007	3.62	3.78	4.13
2008	2.89	2.96	3.17
2009	3.24	3.79	4.25
2010	3.11	3.34	4.00
2011	2.98	3.22	3.69
2012	2.99	3.23	3.48
2013	3.49	3.68	4.11

Source: Bank Negara Malaysia, (n.d.).

Malaysian Government Securities (MGS) as example, MGS is a long-term interest-bearing bonds issued by government of Malaysia. From the Table 1.1, the changes of Malaysian Government Securities (MGS) yields in every year end from 2007 to 2012 have raised the concern to study this research. The movements for the 3 years, 5 years and 10 years maturity bonds are quite similar. From year 2007 to 2008, all the bonds

suffered a massive drop to the lowest yield. After experienced an increase in year 2009, the bonds yield started to decline from 2010 onward. While 3 years and 5 years maturity bond enjoyed a small increased in 2012, but 10 years bond continued to decrease. In conclusion, the fluctuation of bond yield has gains the interest to this research to find out the causes of the unstable and also the decreasing trend of the yield.

1.3 Research Questions

i. Does the federal government budget deficit affect the Malaysia government bond yields?
ii. Are the government debt significantly related to Malaysia government bond yields?
iii. Does the consumer price index influence the Malaysia government bond yields?
iv. Is there any relationship between the short-term interest rate and the Malaysia government bond yields?

1.4 Research Objective

1.4.1 General Objective

This paper attempts to identify and examine the major determinants of the government bond yields in Malaysia. The variables are federal government budget deficit, government debt, consumer price index and short-term interest rate.

1.4.2 Specific Objectives

The specific objectives of this paper are listed below:

i. To identify effect of federal government budget deficit on the Malaysia government bond yields.
ii. To examine relationship of government debt and Malaysia government bond yields.
iii. To show the influence of consumer price index on the Malaysia government bond yields.
iv. To investigates the relationship between the short-term interest rate and the Malaysia government bond yields.

1.5 Hypotheses of the study

1.5.1 Federal Government Budget Deficit

H_0 : There is no significant relationship between federal government budget deficit and Malaysia government bond yields.

H_1 : There is a significant relationship between federal government budget deficit and Malaysia government bond yields.

Cebula (2008) proposed to measure the budget deficit, the paper adopts primary budget deficit, which excludes net interest payments by the Treasury. Besides that, this paper expects that a positive and significant relationship between federal government budget deficit and Malaysia government bond yields which is reject H_0.

1.5.2 Government Debt

H_0: There is no significant relationship between government debt and Malaysia government bond yields.

H_1: There is a significant relationship between government debt and Malaysia government bond yields.

Government debt is a debt that owed by a central government. It is one of the methods that government uses to finance operation. In this paper expects to reject H_0, which shows that exist a positive and significant relationship between government debt and Malaysia government bond yields.

1.5.3 Consumer Price Index (CPI)

H_0: There is no significant relationship between consumer price index (CPI) and Malaysia government bond yields.

H_1 : There is a significant relationship between consumer price index (CPI) and Malaysia government bond yields.

CPI is proxy as inflation. However, there should be a positive relationship between consumer price index and Malaysia government bond yields (Gruber & Kamin, 2012). Malaysia government bond yields will be affected when there is an increasing or decreasing of consumer price index (CPI). This paper expects that the result is reject H_0 , which means there is a significant relationship between consumer price index (CPI) and Malaysia government bond yields.

1.5.4 Short- term Interest Rate

H_0 : There is no significant relationship between short-term interest rate and Malaysia government bond yields.

H_1: There is a significant relationship between short-term interest rate and Malaysia government bond yields.

Short-term interest rate is an interest rate on debt instruments such as Treasury bills, which maturities of less than one year. This paper expect there is positive and significant relationship between short- term interest rate and Malaysia government bond yields which means to reject H_0.

1.6 Significance of the Study

From the research of this paper, this may be capable to gain some evidence about the relationship between the government bond yields and federal government budget deficit, government debt, consumer price index and short-term interest rate. Furthermore, some of the stated problems come across this topic of research will be answered by the findings from this paper.

In this paper, the determinants of government bond yields in Malaysia are examined. The purpose of this paper is to examine the relationship between the dependent variable (Malaysia government bond yields) and the independent variables (federal government budget deficit, government debt, consumer price index and short-term interest rate). The main contribution of this paper is to determine whether the Malaysia government bond yields has significant relationship with other independent variables such as federal government budget deficit, government debt, consumer price index and short-term interest rate from year 1996 to 2013. On the other hand, these independent variables occupied an important role for each segments of society like policymakers, future

researchers, institutional investors, traders, and individual investors (Gruber and Kamin, 2012; Poghosyan, 2013, and Baklaci, 2003).

As this paper able to assists policymakers to justify which factors to be concerned in implementing the suitable policies for Malaysia's economy. Policymakers can take concern on the variables that have been determined in this paper to create new policies or amend existing policies. Furthermore, this paper is beneficial to government's economy growth or the stability of politics towards their countries (Baklaci, 2003).

Thus, this paper is also essential for the institutional investors, traders and individual investors in the aspect of investing, since these three parties are the participants of bond market (Sarkar & Ariff, 2002). From the aspect of the participants of bond market in Malaysia, this paper can be a useful instrument for them to make a better decision whether to buy or sell. Especially for the institutional investors, they have to pool large sums of money to invest into bond market, thus, they have to make precise decision on their funds. This paper assists them in predetermine and avoid the fluctuation in the bond market, it also given these participants vital information on the bond yields movement in the market (Castellani & Santos, 2005).

This paper provides some concepts and hints about government bond yields in Malaysia to future researchers. When the future researchers starts their own research, they have to think through the process of the journal and find out the "why", "how", or "why not" for the topic concerned. Therefore, this paper is helpful to the future researchers in order to obtain successful results in their research and avoids mistakes. Besides that, this paper also helps them to learn more about which explanatory variables is significant or insignificant to affect government bond yields (Bernoth, Von Hagen & Schuknecht, 2012).

1.7 Chapters Layout

The rest of this paper is structured as follows. Chapter 2 reviews existing literature of four independent variables (federal government budget deficit, government debt, consumer price index and short-term interest rate). Chapter 3 identifies the scope of study and presents the research methodology while Chapter 4 interprets the empirical results. The last section of this paper is discussion, implication and conclusion.

1.8 Conclusion

In brief, Chapter 1 introduces research background, problem statement, research objectives and questions, hypotheses of study, significance of study, and chapter layout used in analyzing the Malaysia government bond yields. This paper aims to determine the determinants of government bond yields, which are federal government budget deficit, government debt, consumer price index and short-term interest rate in Malaysia.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

A number of journals on this topic in different countries have been reviewed. However, this paper found that study on determinant of government bond yields in Malaysia is rare, but have found that many of the research studying in other country. Thus, this paper mainly focuses in Malaysia. Besides that, this chapter discusses about the theoretical framework and empirical findings of each independent variables towards dependent variable.

2.1 Review of the Literature

Government bond plays a significant role in the bond market and contributes towards the expansion of economy as well as the stability of politics in their countries. Since investors are one of the bond players in the market, they are concerns on the influence of government bond yields towards federal government budget deficit, government debt, consumer price index (CPI) and short term interest rates. This enables the investors to have a proper planning in the accumulation of wealth in the future and precautions needed to avoid worse conditions that might happen. There are several studies conducted upon government bond yields and the macroeconomic variables that affect the increase or decrease of bond yields. As a result, knowledge on macroeconomics variables and economic conditions are studied by researchers and are important to market player in determining their investment. It is consider a basic understanding towards bond yields for consumers and investors.

2.1.1 Government Bond Yields

A government bond is a debt security issued by the government to investor which is denominated in the country's home currency (Mishkin & Eakins, 2012). However, the government bond issued in foreign currencies is known as sovereign bond. A bond that is issued that complies with Shariah principle is called Sukuk ("Investing in the Malaysia Capital Market: Bond", n.d.). Government bond yield is the interest rate or return of the government bond. It often refer to risk- free rate since the government bond are free of default risk because government can always print money or increase taxes to pay off its obligation (Mishkin & Eakins, 2012). The figure 2.1 has shown the trend of 10 year Malaysia government bond yields over the period of January 2001 to March 2014. It has averaged yield of 4.06% during that period. The highest yield is 5.35% which achieved in April 2004 while the lowest yield of 2.87% reached in January 2009 ("Malaysia government bond 10Y", 2014).

Figure 2.1: 10 year Malaysia Government Bond Yields Trend from January 2001 to March 2014

Note: Adapted from "Malaysia Government Bond 10Y", 2014, Trading Economics.

Numerous past researchers have examined the determinants of the government bond yields in the particular country. They carried out research to determine whether the government bond yields have positive or negative relationship with its determinants. For instance, Gruber and Kamin (2012) examine the effect of consumer price index, government debt and short-term interest rate on long term government bond yields in OECD and G-7 countries such as United States, Germany, United Kingdom, Japan, Italy, Canada and France. Besides that, Poghosyan (2013) analyze the sovereign bond yields in advanced economies by the long run determinants (debt-to-GDP ratio and potential growth) and short-run determinants (changes in inflation, debt-to-GDP ratio, real short term interest rate and output growth). The researchers (Fan & Johansson, 2010; Jaramillo & Weber, 2013) include budget deficit and inflation rate in their paper to explain the relationship with government bond yields. The results from those researchers proved that the determinants (federal government budget deficit, government debt, consumer price index (CPI) and short term interest rates) have an impact on government bond yields.

2.1.2 Federal Government Budget Deficit and Government Bond Yields

Budget deficit is the indicator of financial health of a country whereby the expenditures of a country or particular account exceeds its revenues ("Budget Deficit", n.d.). Normally budget deficit term are frequently used in referring the government spending. Instead of budget deficit sometimes it is also known as national debt. Since there exist budget deficit due to excessive expenditures of country, there exist budget surplus as well (Fatima, Ahmed & Rehman, 2012). Budget surplus in contrast have financial health better than the deficit. This is because when the country account shows budget surplus, it means that the country's save more than it spends. When the budget deficit and surplus are equal it is said that the account achieved budget balanced ("Budget Surplus", n.d.).

According to Kameda (2014), he found that there is a positive relationship exist between budget deficit and government bond yields. When budget deficit increases (a country issue additional or newly bond) it will indirectly affect and increase the bond yields of the country such as Japan where an increase of one percentage point in deficit-to-GDP ratios will raises the basis point by 26, raise of current deficit-to-GDP ratios by 27 basis point and 33 and 34 basis points in primary deficits. The results are easier to gain since Japan has a large record of budget deficit and debt. Due to Japan's large public debt, it is wise to reduce the primary deficits to curb the gradually increases of interest rates and yields that might worsens the country's economics.

Research by Kameda is also consistent with the founding from Chionis, Pragidis and Schizas (2014) where they concluded that budget deficit and unemployment variables played an important role in giving impact to the yields. Besides that, general government balance (deficit) are said to be the most significant factors that affect the long term government bond yields during the crisis although researchers who pay attention in this variable decades ago is rare. This macroeconomic factor is crucial and need concerns since it can causes the government bond to tap off from the market itself (Bernoth and Erdogan, 2012).

On the contrary, they are some researchers who found negative relationship between federal government budget deficit and government bond yields. According to Ardagna, Caselli and Lane (2004) research, they found that budget deficit and government bond yields are negatively related. When there is a decrease in the balance of budget deficit by 1 percent, 10 basis point of government bond yield will increased. Results obtained by Ardagna et al. (2004) are lower compared to Dai and Philippon (2005). Using the same indicator, they conclude that bond yields increases from 20 to 60 basis point for each point reduction in the account if budget deficit. Henceforth, Kameda (2014), Chionis et.al (2014), and Bernoth and Erdogan (2012) findings revealed a positive relationship while Ardagna et al. (2004) and Dai

and Philippon (2005) found a negative relationship in federal government budget deficit and government bond yields.

2.1.3 Government Debt and Government Bond Yields

Government debt also known as the public debt is the outstanding stock issued by government at the past that yet not be repaid (Seater, n.d.). Government debt has become vital when the policymakers have to face the rising of fiscal imbalances for the economic growth. From the economic theory, fiscal policy is able to induce growth at the moderate level of government debt (Afonso and Jalles, 2013).

Baldacci and Kumar (2010) determined that the higher public debts lead to a significant increase in long-term interest rates, the large fiscal deficits and public debts are likely to put significant upward pressure on sovereign bond yields. However, according to Baldacci and Kumar (2010) previous researchers examined the spread of EU sovereign yields over German bonds, and found that an increase in public debt has a significant but small impact on bond yields, this results only come with the high debt levels. Jaramillo and Weber (2013) suggest that higher public debt increases nominal bond yields in the emerging markets, where an environment has a large amount of insecurity involved to the growth prospects in the economy, the greater the public debt could increase the concerns on the capability of the government repaying the debts.

Baldacci and Kumar (2010), Jaramillo and Weber (2013), and Gruber and Kamin (2012) claimed that there is a positive relationship between the government debt and government bond yields. Poghosyan (2013) states that one of the key channels of government bond affect real bond yields is a higher debt may lead to a rise of sovereign bond yields via default risk premium. In addition, the sensitivity of government debt yields may rise when government debt reaches an unsustainably high level.

According to Gruber and Kamin (2012), there are few reasons that can explain the greater the government debt will causes a rise in sovereign yields. First, the larger the debt or deficits, the greater the pressure on resources to lead a rise in the equilibrium interest rate in the economy to keep output from outstripping potential. Second, larger debts might create the probability of default by government and thus require a compensating increase in bond yields.

2.1.4 Consumer Price Index (CPI) and Government Bond Yields

Consumer Price Index (CPI) is the change of prices of goods and services bought by group of income earners (Acker & Duck, 2013). CPI or known as fixed-weighted aggregative index is used to measure the price index of goods and services of different periods. It is said that the price index structure is based on the "fixed market baskets" of commodities as well as the services provided or purchased by them. It simply means that the proxy for CPI is inflation (Subhani, Gul & Osman, 2010).

The relationship between bond yields and consumer price index has been studied by some of the researcher long time ago. Theoretically, inflation is the worst enemy of bond because it decreased the purchasing power of investors and due to its high risk associated, investors opt and demand for a higher yields to compensate themselves. Thus, a higher inflation will cause yields to increase, so they are positively related.

As suggested by Acker and Duck (2013), they found that the phenomenon of dividend- yields puzzles become stable starting 1950s onwards. It concludes that the relationship between inflation and dividend yields are positive. This is consistent with the basic theory of inflation that said rise in inflation caused a positive effect on yields of bond. In addition, Campbell and Vuolteenaho (2004) also concluded that the most significant influence on bond yields is the inflation

rate. The main idea behind this research is that the nominal yields on US Treasury bond and risk- adjusted dividend should move together, so that rise in stock are consistent with rise in yields of bond and hence both remain competitive (Campbell & Vuolteenaho, 2004). Not only that, Bekaert and Engstrom (2010) found that the inflation influence the bond and equity yields positively when both variables move together at the same direction thus are said to be highly correlated with each other. It also means when inflation happens to rise during recession period, bond yields will increase followed by increase in the inflation risk components.

Though research shows that there are positive relationships between bond yields and inflation rate such as Lee (2010) who opposed on their opinions that bond yields are determined only by macroeconomic variables. Opposed researchers suggested that bond yields and inflation rate do not necessarily have a positive relationship but they can be negatively or mixed related. For example, Lee (2010) proposed that both the variables have little evidence or negatively related to each other depends on the historical circumstances. He founds that economic forces, pre- and post-war relations in U.S. contributes to the yields determination positively and negatively. Hence, inflation affects the government bond yields positively and also negatively depends on the economic conditions and other factors as well.

2.1.5 Short- term Interest Rate and Government Bond Yields

Generally, the short-term interest rate is the cost from a loan or debt like Treasury bills by having maturity period of less than a year. The pricing of fixed income instruments and their derivatives are essential by the performance of short-term interest rate (Kalimipalli & Susmel, 2004). Furthermore, Mehra (1995) found that the Federal Reserve is one of the potential roles in influencing the short-term interest rates and this perception is broadly held in the financial press and academic circles.

According to Baklaci (2003), the government bond yields will be influenced by the short-term interest rate, which means that the monetary authorities will tend to decline the interest rate and inflation when the interest rate transmission between government bond markets increases via volatility linkages. Besides, from the studies that recognized, the higher importance of domestic factors, inflation and short-term interest rates are the main significant macroeconomic factors that drive the government bond yields (Baklaci, 2003).

On the other hand, Poghosyan (2013) said that the factors that affect the government borrowing cost are long-run (like debt-to-GDP ratio and potential growth) and short-run (like inflation rate and short-term interest rates). The changes in short-term interest rate, temporary inflation shocks and changes in fiscal balances will affect the short run real government bond yields (Poghosyan, 2013).

Gruber and Kamin (2012) use the short-term interest rate, inflation, and GDP growth as the measurement on the fiscal positions and government bond yields and they found that all these macroeconomic variables have positive and significant relationship. In Roley's empirical study, he determined a positive relationship between the short-term interest rate levels and long-term (maturing in 10 years or more) Treasury yields (Sarkar and Ariff, 2002). However, from Sarkar and Ariff (2002) studies, they found out that the short-term interest rate level in the previous month has a positive; yet not very significant, effect on the government yields in current month. In overall, most of the researchers found out that there is positive and significant relationship between the short-term interest rate and the government bond yields.

2.2 Review of Relevant Theoretical Models

2.2.1 Government Bond Yields

2.2.1.1 Efficient Market Theory

The efficient market hypothesis was developed by Professor Eugene Fama in the early 1960s. This theory implies that financial markets are "informationally efficient". As a result of this, on a risk-adjusted basis, this paper unable to earn a consistently returns in excess of average market returns, with the condition that the information is available during the time the investment is made.

This hypothesis consists of three major versions, which is weak-form efficiency, semi-strong-form efficiency and strong-form efficiency. The weak-form means that prices on the financial asset such as bond already reflect all past publicly available information. Thus, there are no excess returns can be gained. The semi-strong form implies that share price reflect about publicly available new information and that prices very rapidly alter to show new public information. Therefore, no excess profit can be gained by trading on this information. However, the strong-form efficiency claims that the share price show all the information no matter it is public or hidden, and nobody can gain excess return as well.

Government bond market can say to be efficient if the investor can get to know all the public information flow in the market, which in other words is the investor expose to greatest transparency. At last, the most important is the regulators are intervene these markets wisely and able to react to the rapid technical change as well as changes of the market structures (Dunne, Moore & Pontes, 2006).

2.2.1.2 Capital Asset Pricing Model (CAPM)

This model was originally developed by Harry Markowitz in the year 1952 and is modified by others over a decade. The CAPM indicate that the expected return of stock or bond equals to the rate on a risk-free security add with the risk premium. The formula would be:

$$\text{CAPM} = r_f + \beta_a(\bar{r}_m - r_f)$$

Where:

r_f = Risk free rate

β_a = Beta of the security

$\bar{r}_m$ = Expected market return

$(\bar{r}_m - r_f)$ = Equity market premium

In CAPM government bond yield is the best measure of the risk-free rate, which normally is 10-year. This is because, only a long-term government bonds have the possibility subject into the interest rate risk. However, this only true if the bond is sold before maturity.

The advantages of CAPM are its simplicity and logically in measuring the relationship between risk and the expected return. It helps investors to make predictions about the expected return and investment decision. An investment should be conducted just if the expected return of the investment is at least or more than the required return. Government bond fit well to explain CAPM, just the returns may vary with time (Fearnley, 2002). However, there are some minor researcher argues that the model is not a good model because it is likely that other sources of risk exist (Fama & French, 2004).

2.2.2 Federal Government Budget Deficit

2.2.2.1 Keynesian Investment Saving (IS)/ Liquidity Preference (LP) Model

The IS/LM model was born in 1936 by an economist called John Maynard Keynes. This model implies that government budget deficits will raise the interest rate. Increase in interest rate will lead to the quantity demand for loanable fund to decrease. This is because increase in interest rate increases the cost of borrowing for borrower. If the demand for loanable fund decreases, the quantity demand for the government bond will decreases as well and will result to the decrease in bond price. At last, the prices and yields on bond are inversely related.

According to Engen and Hubbard (2005), show that the change in the interest rate is affected by the government budget deficit. The reason behind will be the government budget deficit will stimulate the aggregate demand and increase the output. However, it is different in short run and long run.

2.2.2.2 Crowding-out Theory

The idea of this model is come out by an economist called Malachy Postlethwayt in 1757. This theory states that if the government having budget deficit, means that government has to borrow a lot of money from public by issuing government bonds to public. In order to attract the investor to buy the government bonds, government will sell it at a higher interest rate. According to the research of Carlson (2011), crowding out effects will happen because the investor normally prefer the government as a borrower, this is due to government bond is less risky compare to corporate bond and the most important is government has the ability to pay a high coupon payment to investor. In addition, the lender also know that the government have the power to print money in the event that if government unable to repay the

principal plus interest. Therefore, if government borrowed heavily while investors have only limited amount they can lend, this will cause crowd out effects.

2.2.3 Government Debt

2.2.3.1 Modern Monetary Theory (MMT)

This model was first published in German in 1895 by Georg Friedrich Knapp. This theory also known as neochartalism, it is a descriptive economic theory that explains the step and effect of using government-issued tokens as the unit of money. Based on this theory saying that the government are always solvent due to government is the issuer of currency, and affordable to buy anything. MMT argues that the money itself actually is worthless, it only has value due to the government requires people to use it to pay taxes. Besides that, government can use whatever they want as money and give whatever value they chose.

According to the studies of Manasse, Roubini and Schimmelpfenning (2003), government debt may affect real bond yields because a higher debt may boost government bond yields through the increases of default risk. However, with the support of this theory, the bond issue by government will turn to zero probability of default. Thus, the lower the risk, the lower of bond yields. In contrast, there are some practitioners often argued that this theory is wrong about government bond debt. They argued that printing money will cause hyperinflation to happen.

2.2.3.2 Ricardian Equivalence Model

This model also known as the Ricardo-De Viti-Barro equivalence theorem, David Ricardo was the first to propose this model. The model indicated that investors all are forward looking, they will make their investment decisions based on

government debt or national debt. Thus, this theorem support that investors will expect higher tax rates in the case that the government faces high government debt.

According to the studies of Park (1995), there is a positive relationship exists between the expected tax rate and federal debt. Government can finance its debt by using taxes or by issuing government bonds with high yield. Since bond is a type of loan, so government will repay their bondholders the principal plus interest. In case government lack of funds, government will raise taxes in future to repay bondholders.

2.2.4 Consumer Price Index

2.2.4.1 "Fed Model" of Equity Valuation

"Fed Model" was based on a reference in Alan Greenspan's 1997 congressional testimony. This model relates the yield on stocks to the yield on nominal treasury bonds, which is compares the stock market's earnings yield (E/P) to the yield on 10-year Treasury note yield (Y_{10}).

$$E/P = Y_{10}$$

Where, E/P = Earnings Yield

Y_{10} = 10-year Treasury Yield

Earnings yield is the quotient of earning per share divided by the share price, and it is measure in percentage. Whereas, the 10-year Treasury Yield is the periodic interest payments promise to pay to the government bondholder during this 10 year period.

According to Campbell and Vuolteenaho (2004), stocks and bonds compete to get the investment from the investor in portfolios. In other words, when the yield on

bonds increase, then the yield on stocks must also increase in order to maintain the competitiveness. In short, the Fed model concludes that the inflation rate play a significant role in affect the nominal bond yields, which nominal bond yields equal to the actual bond yield plus the risk premium.

2.2.4.2 Fisher Effect Theory

It is an economic theory proposed by economist Irving Fisher in year 1930. Fisher effect theory explains the relationship between inflation, real and nominal interest rates. The fisher effect stated that the nominal interest rate equals to the real interest rate plus the expected inflation rate. Therefore, based on this case the government can make a decision about how to implement the monetary policy. This can be explained when there is inflation happened in Malaysia's economic, central bank will issue the Treasury bond on behalf of government in order to reduce the money supply in economy. However, when there is deflation, central bank will buy back the Treasury bond on behalf of government from bondholder in order to increase the money supply in economy. According to Foote (2010), government control on money supply affects the nominal interest rate movement and long run inflation. As a result, the bond prices will be affected due to the demand on the Treasury bond. The increase in the bond price will lead to reduce in bond yield.

The Fisher equation as below:

$$(1 + i_{\$}) = (1 + \rho_{\$}) \text{ x E } (1 + \pi_{\$})$$

Where:

$i_{\$}$ = nominal interest rate

$\rho_{\$}$ = real interest rate

$E(\pi_{\$})$ = expected inflation rate

2.2.5 Short-term Interest Rate

2.2.5.1 "Substitution Effect" Hypothesis

Short-term interest rate is a return on debt instruments such as Treasury bills, which have maturities of less than one year. This will capture investor's attention for investment which promises a high return. As the "substitution effect" hypothesis says that an increase in short-term interest rate raised the opportunity cost of holding cash. People will choose to hold securities, stock or bond rather than hold cash.

As expected, the sign for the U.S. short-term rate which considered being the best proxy for the global risk free rate is positive indicating an increase in the U.S. T-bill rate is accompanied by an increase in risk premiums globally (Poghosyan, 2013).

2.2.5.2 Taylor's Theory

The rule was first proposed by John B. Taylor in the year 1911. Taylor rule is an important monetary-policy rule that formulate the central bank to change the nominal interest rate when there is a change in inflation, output, or other economic conditions. Normally, when there is one-percent raise in inflation, the central bank should increase the nominal interest rate by more than one percentage point.

Seyfried (2013) proved that yields on treasury bonds showed a higher rate of adjustment and higher level of persistence compared to mortgage rates. This can be explained by the Treasury market which is more active than mortgage market, and Treasury market have to adjust more frequently in order to catch up with the changes in economic conditions. Taylor's rule appears to be more efficient in providing hints in order to forecast the behavior of short-term interest rate.

2.3 Proposed Theoretical Framework

Figure 2.2: Framework for the Determinants of Malaysia Government Bond Yields

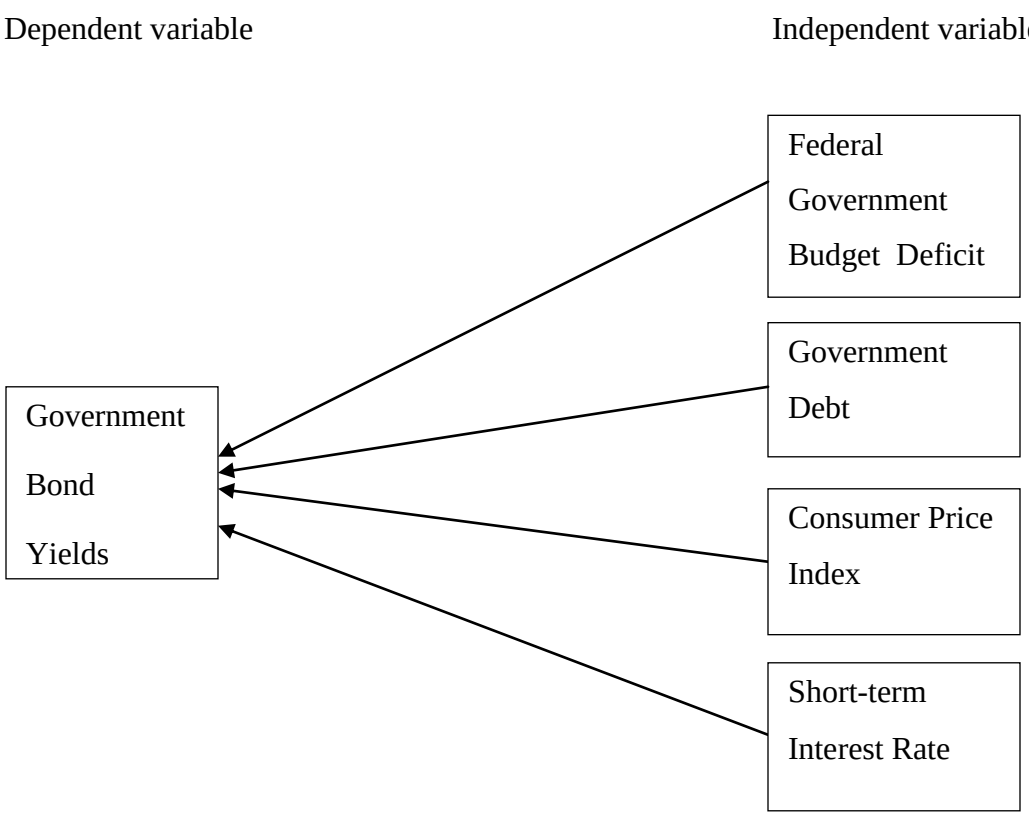


Figure 2.2 shows that there are four independent variables will affect the dependent variable. The four independent variables which are Federal Government Budget Deficit, Government Debt, Consumer Price Index and Short-term Interest Rate will affect the government bond yields in Malaysia.

2.4 Conclusion

Judge thus, in Chapter 2, each explanatory variables are studied based on the prior researchers' findings and these findings will be used to support this paper. Besides that, theoretical models are reviewed in order to develop the theoretical framework where this paper able to postulate and investigate certain relationship among the variables.

CHAPTER 3: METHODOLOGY

3.0 Introduction

Methodology is adopted with the aim of express relationship between the Government Bond Yields and its determinants such as Federal Government Budget Deficit, Government Debt, Consumer Price Index and Short-term Interest Rate. This paper employs quarterly data which range from 1996:Q1 to 2013:Q4. Chapter 3 will discuss the research design, data collection method, sampling design and data processing. The diagnostic checking and the empirical method will be further discussed in the data analysis part.

3.1 Research Design

Quantitative research aims to explain the phenomena by collecting the numerical data in order to analyze the numerical data statistically. This paper uses quantitative research to find out something to explain the phenomena. For instances, "what factors are related to the volatility of government bond yields?" Besides that, quantitative research is necessary when conducting hypothesis testing, for example, whether there is a relationship between the Government Bond Yields and Consumer Price Index (CPI). The data will be collected and the decision to accept or reject the hypothesis will be made using statistical analysis. Therefore, quantitative research is chosen for this paper since it able to determine the causal relationship between the dependent and independent variables.

3.2 Data Collection Method

Secondary data able to obtained via resources such as Datastream and World Bank. Reasons of using secondary data are because of its accuracy, low cost and time- saving. Secondary data consists of past records, historical data and summary as well which makes findings to be more effective.

3.2.1 Secondary Data

Data used in this paper are based on quarterly data obtained from Datastream which covered from 1996:Q1 to 2013:Q4 for dependent variables (government bond yields) and all the independent variables (federal government budget deficit, government debt, consumer price index and short term interest rates).

Table 3.1: Data Sources

Variables	Proxy	Description	Units	Data Sources
Government Bond Yields	GBY	Interest rates or return of government bond	Percent (%)	Datastream
Federal Government Budget Deficit	FGBD	Government spending more than government saving in quarterly basis	RM Million	Datastream
Government Debt	GD	Total of outstanding amount by public and private debt	Percent of Gross Domestic Product (% of GDP)	Datastream

Consumer Price Index	lnCPI	Consumer price index (measurement of inflation)	Percent (%)	Datastream
Short-term Interest Rates	STIR	Short term interest rates in quarterly basis	Percent (%)	Datastream

3.3 Sampling Design

3.3.1 Target Population in Malaysia

Malaysia Government Bond Market is the targeted country in this paper. It intends to measure the positive and negative relationship between independent variables and government bond yields in Malaysia. Compare to United States, Japan and some other developed countries, Malaysia is considered as a developing country. Malaysian Government Securities (MGS) was first issued in 1960 in order to finance the public sector development program. MGS is published and managed by Bank Negara Malaysia (BNM) on behalf of the Government of Malaysia (Bond Market Development in Malaysia, n.d.). According to 2014 CIA World Fact Book, the population for Malaysian stands for 29,628,392 as at July of 2013. The Malaysian bond market is one of the developed and active bond markets in the region. This can be shown by improvements of the regulatory structure of the bond market, increasing the size of the market, introducing new instruments, actively publish and trade the government bond and so on. In 2004, the Bank Negara Malaysia (BNM) has amended its Guidelines on the offering of Asset-Backed Securities.

Moreover, in year 2006, BNM has introduced electronic booking systems and published additional guidelines for bond pricing agencies. Investors in Malaysia

can buy and sell the government bond via over-the-counter (OTC) in secondary market trading ("How to Invest", n.d.). For investors who are urgently in need of cash and hold the government bond on their hand can sell their bond in the secondary market, since government bond is very liquid. Government bond is very popular in Malaysia, due to its low credit and default risk.

Nowadays, in Malaysia, almost all the government bonds are conducted electronically through BNM's Real-Time Electronic Transfer of Funds and Securities (RENTAS). The transaction is conducted in trade-by-trade basis. BNM launched the Bond Info Hub in the year of 2006, which is a one-stop center detailing all information related to bonds in Malaysia ("Market Structure Overview", n.d.). Besides, these government bonds play an important role in regulating the Malaysia's circulation of cash where this role can be achieved by issuing the Malaysia Government Bond in money and capital market of Malaysia as well as at foreign country (Mundell, 2002). This can help in expanding the Malaysia government bond market to international and global level.

3.3.2 Sampling Technique

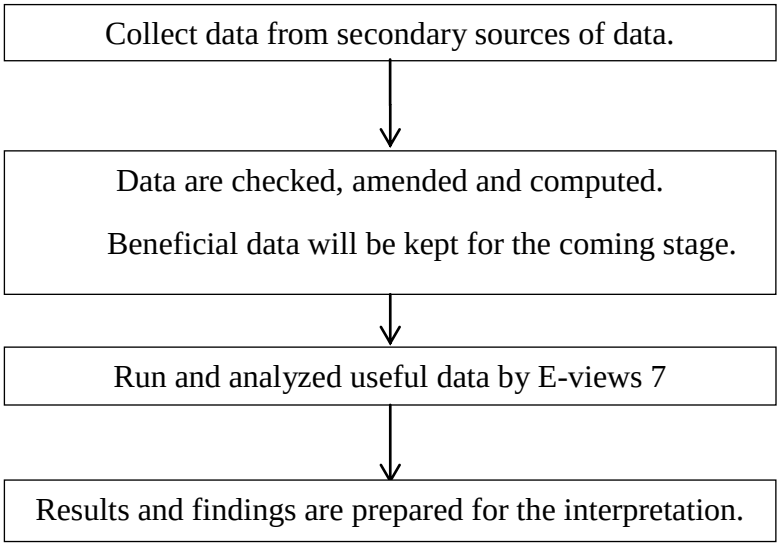
E-views 7 will be used in this paper to analyze the findings. Since, the data of this paper is using time-series data and E-views provides an average coverage of time-series data, cross-sectional data, and panel data. Besides, the 'easy understand' instructions from E-views brought convenience to the researchers to learn quickly.

Furthermore, the cointegration options and panel cointegration options has significantly supported the competitiveness of E-views in the sectors of time-series data and panel data (Mckenzie & Takaoka, 2012). Previously mentioned, this paper uses time-series data, Mckenzie and Takaoka studied that E-views is particularly powerful for time-series analysis.

From this paper, few empirical analysis will be conducted which are Ordinary Least Square (OLS), Correlation Analysis, Autoregressive Conditional Heteroscedasticity (ARCH) test, Breusch-Godfrey LM test, Jarque-Bera test and Ramsey RESET test. The economic problems in the empirical model will be detected first before proceed further. The Correlation Analysis, Autoregressive Conditional Heteroscedasticity (ARCH) test, Breusch-Godfrey LM test, Jarque-Bera test and Ramsey RESET test are used to diagnostic checking of the model from multicollinearity, heteroscedasticity, autocorrelation problems and model specification error. Subsequently, integrate the opinions and ideas from different earlier researchers; this paper attempts to use the above methods to fit into Malaysia's case.

3.4 Data Processing

Figure 3.1: Steps of Data Processing



Normally, there are the four simple steps in data processing. Firstly, the data is collected from Datastream. Next, data collected will be checked, edited and computed. Then, useful data will be obtained and kept for the next stage. Third, E- views 7 will be used to

run and analyzed the useful data. Lastly, results and findings are prepared for the interpretation.

3.5 Multiple Regression Model

Multiple Regression Models is a statistical technique that uses some explanatory to predict the outcome of a response variable. This paper uses the Multiple Regression Model of data analysis to test the relationship. This model importance to forecasts and examines the relationship between the explained and explanatory variable (Djordjevic, 2002).

Economic Function

GBY = f (Federal Government Budget Deficit, Government Debt, Consumer Price Index, Short-term Interest Rate)

Economic Model

$GBY_t = \beta_0 + \beta_1 FGBD_t + \beta_2 GD_t + \beta_3 lnCPI_t + \beta_4 STIR_t + \varepsilon_t$

N = 72 observations

Where,

GBY_t = Government Bond Yields in Malaysia at t period

$FGBD_t$ = Federal government budget deficit of Malaysia at t period

GD_t = Malaysia Government debt at t period

$lnCPI_t$ = Natural logarithm of consumer price index of Malaysia at t period

$STIR_t$ = Short Term Interest Rate of Malaysia at t period

3.6 Data Analysis

Some test will be conduct in order to analyze the relationship between the dependent variable and independent variables. The tests include Ordinary Least Square (OLS), Correlation Analysis, Autoregressive Conditional Heteroscedasticity (ARCH), Breusch-Godfrey LM, Ramsey RESET and Jarque- Bera tests.

3.6.1 Ordinary Least Square (OLS)

Ordinary Least Square (OLS) is one of the most popular methods for regression analysis and was used by many researchers in determining the normality distribution in the model. To use this test, several conditions need to be fulfilled before test can be carried out: (1) make sure model is linear regression model (2) sample size must be greater than explanatory variables, Y (3) fixed x values (4) mean value of disturbance is zero (5) homoscedasticity (constant variance of error term) (6) no autocorrelation between the independent variables and; (7) No outliers in value of X and X values must not be the same (Gujarati & Porter, 2009).

Econometric model was initially examined using OLS method before going to next progress of the research. This is because failure to fulfill the assumptions of OLS signaled problems occurs for estimation and interference in the model and mostly it is caused by theoretical problems. Thus, using OLS method and fulfilling the assumptions enable the test to be carried on and check for further econometrics problems such as multicollinearity, heteroscedasticity and autocorrelation problems.

3.6.1.1 t-test Statistic

$H_0 : \beta_1, \beta_2, \beta_3, \beta_4, = 0$ (insignificant)
$H_1 : \beta_1, \beta_2, \beta_3, \beta_4, \neq 0$ (significant)

Where,
β_1 = FGBD
β_2 = GD
β_3 = lnCPI
β_4 = STIR

t- test for each independent variables is conducted in this paper to study whether there are happened significance relationship between the explanatory variables and explained variable. The null hypothesis of t test is no significant effect of the explanatory variables on the explained variable while the alternative hypothesis is has significant effect of the explanatory variables on the explained variable. The null hypothesis is rejected when the p- value of the t- test statistic is less than significance level, otherwise do not reject the null hypothesis.

3.6.1.2 F-test Statistic

H_0: $\beta_i = 0$ (no linear relationship)
H_1: $\beta_i \neq 0$ (at least one independent variable affects Y)

Where, $\beta_i = \beta_1, \beta_2, \ldots, \beta_n$

F-test is employed to determine the significance of the whole model. The null hypothesis of F- test states that the model is not significance or no linear relationship between the variables. However, the alternative hypothesis states that the model is significance or at least one independent variable affects dependent

variable. The null hypothesis is rejected when the p- value of the F- test statistic is less than significance level, otherwise do not reject the null hypothesis.

3.6.2 Diagnostic Checking

3.6.2.1 Multicollinearity

Multicollinearity will happen when there is existence of linear relationship among some or all the independent variables of the model. Thus, normally multicollinearity will happen in cross-sectional data or time-series data. In other words, this paper is going to test for the linear relationship among Federal Government Budget Deficit, Government Debt, Consumer Price Index and Short-term Interest Rate.

Based on the prior theory before the regression model is built, for example, the estimated model has high R- square, but there are few or no independent variables found to have significant effect on dependent variable. There is high pair-wise correlation between two independent variables (Correlation $(X_{1,} X_2)> 0.1$). Hence, Variance Inflation Factor was carried out, $VIF_{X1,X2} = 1/(1-R^2_{X1,X2})$.

The degree of VIF can be explained as follow: (1) When VIF is undefined, there is perfect multicollinearity between the independent variables, (2) When VIF is defined, there is imperfect multicollinearity between the independent variables. (VIF>10 = high multicollinearity; 1<VIF<10 = multicollinearity or low multicollinearity), and (3) When VIF is equal to 1, there is no multicollinearity between the independent variables.

3.6.2.2 Autocorrelation

Autocorrelation is a relationship or correlation between the error terms. Besides that, autocorrelation is most likely occurred in time series data. Autocorrelation occurs due to three causes which are omitted relevant independent variables, incorrect functional form, and data manipulation or data problem. Therefore, when they are omitted relevant independent variables and incorrect functional form, it will lead to the estimated parameters become biased, inefficient and inconsistent. However, when there are data manipulation or data problem the estimated parameters will remain unbiased, inefficient and consistent. So, there are several tests to detect the autocorrelation problem which is Durbin-Watson Test, Durbin's h Test and Breusch-Godfrey LM Test. In addition, this paper use Breusch-Godfrey LM Test to test the autocorrelation problem because Durbin-Watson Test provides inconclusive results and cannot take into account higher orders of series correlation as well as the lagged dependent variables in the model of Durbin's h test is not applicable to use. Thus, Breusch-Godfrey LM test which can accommodate all the above cases is applied in this paper (Rois, Basak, Rahman & Majumder, 2012). The null hypothesis (H_0) present that no autocorrelation problem exists however the alternative hypothesis (H_1) indicates there is autocorrelation problem exists as below:

H_0: No autocorrelation problem exists
H_1: Autocorrelation problem exists

When the Breusch-Godfrey LM test statistic is greater than critical value or p-value of LM test is smaller than significance level, the null hypothesis is rejected, hence conclude that there is autocorrelation problem and vice versa. When the autocorrelation problem occurs, it can use the Cochrane-Orcutt procedure, instrumental variable (IV) or proxy variable, Newey- West Method and increase the sample sizes to solve the autocorrelation problem.

3.6.2.3 Heteroscedasticity

Heteroscedasticity is a Greek word. Hetero means different or unequal, while the scedasticity means spread or scatter. That is, the variance of the error term is not constant. Heteroscedasticity arises when the range between the largest and the smallest values of database is very large, the degree of growth rates between the explained variable and explanatory variables vary significantly during the modeling period and omitted an important independent variable. Heteroscedasticity will cause the OLS estimators are no longer best linear unbiased (BLUE). This is because the OLS is designed to minimize the variance, but with the present of heteroscedasticity, the variance of errors is no longer achieved at optimum level, this will then bring to t and F statistics values to be biased or wrong. Besides that, the confidence interval and p-value for the independent variable will also become biased. Therefore, it will become inefficient estimator. There is several ways to detect the heteroscedasticity, such as, Park test, Glejser test, White test, Goldfeld-Quandt test, Breusch-Pagan-Godfrey test and Autoregressive Conditional Heteroscedasticity (ARCH) test. This paper is using ARCH test which is suitable for time series data (Cappiello, Engle and Sheppard, 2003). This test is developed by Engle in 1982. The null hypothesis (H_0) present that no heteroscedasticity problem, however the alternative hypothesis (H_1) indicates there is heteroscedasticity problem as below:

H_0 : No heteroscedasticity problem exists

H_1 : Heteroscedasticity problem exists

If the test statistic greater than critical value or p-value of the ARCH test is less than significance level, null hypothesis is rejected which means that there is heteroscedasticity problem, and vice versa. White's heteroscedasticity-corrected variances and standard error method, proposed by White in 1980 is one of the remedies to solve heteroscedasticity problem. Besides, if the model is correctly specified, increase the sample sizes can also solve the heteroscedasticity problem.

3.6.2.4 Ramsey RESET Test

The Ramsey RESET designed by James B. Ramsey to detect the omitted variable and incorrect functional form for the linear regression model. First, estimate the restricted model: Y= $\beta_0 + \beta_1 X_1 + \varepsilon$ and obtain the R^2. After that, estimate the unrestricted model: Y= $\beta_0 + \beta_1 X_1 + \beta_2 Y_2 + \beta_3 Y_3 + \varepsilon$ and obtain its R^2 (Gujarati & Porter, 2009). Compute the F test by using the R^2 of the restricted model and unrestricted model. The hypothesis for the Ramsey RESET test is shown as below:

H_0 : Model is correctly specified.

H_1: Model is not correctly specified.

The null hypothesis will be rejected if the F- test statistic is greater than the critical value or the p-value is less than the significance level. This means that the model is wrongly specified. However, if the F-test statistic is less than the critical value or the p-value is greater than the significance level, the null hypothesis is not rejected and the model is correctly specified.

3.6.2.5 Jarque- Bera Test

To test the normality distribution of an econometric model, Jarque- Bera Test (JB) is used in this case. When JB test takes into account the skewness and kurtosis, this test will be useful in time series data (Bai & Ng, 2005). To conduct JB normality test, below formula is used:

$$JB = \frac{n}{6}\left[S^2 + \frac{1}{4}(K-3)^2 \right]$$

Where, n = sample size, S = Skewness and K = Kurtosis. Assumptions are made in null hypothesis (H_0) and alternative hypothesis (H_1) where:

H_0 : Error term is normally distributed

H_1 : Error term is not normally distributed

If the JB test statistic is smaller than the critical value or the p-value is more than significance level, then null hypothesis will not be rejected and can conclude that the error term is normally distributed. However, when JB test statistic is greater than the critical value or the p-value is less than significance level, the null hypothesis will be rejected and shown that the error term is not normally distributed which means the specification model is incorrect.

3.7 Conclusion

Judge thus, four independent variables which are Federal Government Budget Deficit, Government Debt, Consumer Price Index and Short-term Interest Rate have been adopted to test the relationship with respect to government bond yields. There are a set of 72 observations for each of the independent variables and dependent variable from 1996:Q1 to 2013:Q4. The data for dependent and independent variables are from the same source which is Datastream. Besides that, this paper will go for few empirical tests include Ordinary Least Square (OLS), Multicollinearity test, Autoregressive Conditional Heteroscedasticity (ARCH) test, Breusch-Godfrey LM test, Ramsey RESET and Jarque-Bera tests so as to study the relationship of explained variable with explanatory variables. The different empirical tests have different purposes to test the relationship between the independent variables and dependent variable. The empirical result will continues in Chapter 4.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

From the earlier part, the data collection, model specification and data processing are carried out. In Chapter 4, empirical result from the methodology will be interpreted and analyzed. Findings on the empirical result such as Ordinary Least Square (OLS) and diagnostic checking will be explained and discussed in details in this chapter.

4.1 Ordinary Least Square (OLS)

Equation 1:

$$GBY_t = \beta_0 + \beta_1 FGBD_t + \beta_2 GD_t + \beta_3 lnCPI_t + \beta_4 STIR_t + \varepsilon_t$$

Where,

GBY_t = Government Bond Yields in Malaysia at t period

$FGBD_t$ = Federal government budget deficit of Malaysia at t period

GD_t = Malaysia Government debt at t period

$lnCPI_t$ = Natural logarithm of consumer price index of Malaysia at t period

$STIR_t$ = Short Term Interest Rate of Malaysia at t period

Based on the original model or Equation 1 above, the model consists of autocorrelation and heteroscedasticity problems which shown in Appendix 4.4 and 4.5. However, there is no serious multicollinearity problem because the VIF for FGBD, GD, lnCPI and STIR are less than 10 as shown in Appendix 4.3. In order to solve the autocorrelation and heteroscedasticity problems, this paper initially tries to use Newey- West test and White Heteroscedasticity-Consistent Standard Errors tests, however these two tests failed to solve both problems (Appendix 4.6 and 4.7). The Ramsey RESET test of Equation 1

shows the model consists of model specification error as shown in Appendix 4.8, this means the model is wrongly specified. Thus, this paper comes out the solution to include the lag variable into the model. According to Gujarati and Porter (2009), the effects of the variable are likely to be distributed over time, due to the slow response of the variable to receive the information.

This paper estimates the models for lag 1, 2, 3 and 4 of the dependent and independent variables. After that, choose the model which has the lowest Akaike Information Criterion (AIC) or Schwarz Information Criterion (SIC). AIC is an estimate of the fixed plus relative distance between the unknown true probability function of data and the probability of the function to fit the model, hence, lower AIC means a model is considered to be nearer to the truth. SIC is an estimate of the posterior probability function of the model is right, under certain Bayesian setup, so lower SIC means that the model is regarded as more likely to be a correct model. These two criteria are based on various assumptions and estimates are asymptotic (Dziak, Coffman, Lanza & Li, 2012).

The Appendix 4.9 showed that the lag 1 of the government bond yields has the lowest AIC and SIC. Therefore, this paper include lag 1 of the government bond yields in the new estimated model which is Equation 2 as shown as below and run the empirical tests based on Equation 2.

Equation 2:

$$GBY_t = \beta_0 + \beta_1 FGBD_t + \beta_2 GD_t + \beta_3 lnCPI_t + \beta_4 STIR_t + \beta_5 GBY_{t-1} + \varepsilon_t$$

Where,

GBY_t = Government Bond Yields in Malaysia at t period

$FGBD_t$ = Federal government budget deficit of Malaysia at t period

GD_t = Malaysia Government debt at t period

$lnCPI_t$ = Natural logarithm of consumer price index of Malaysia at t period

$STIR_t$ = Short Term Interest Rate of Malaysia at t period

GBY_{t-1} = Lag 1 of Government Bond Yields in Malaysia at t period

Table 4.1: GBY is explained by FGBD, GD, lnCPI, STIR, GBY-1

Variable	Coefficient	Standard Error	t-statistics	Probability t-statistic	Probability F-statistic	R^2
Constant	4.045317	3.488674	1.159557	0.2505	0.000000	0.932909
FGBD	2.02E-05	1.20E-05	1.686614	0.0965*		
GD	0.005800	0.013143	0.441284	0.6605		
lnCPI	-0.840763	0.823359	-1.021138	0.3110		
STIR	0.090053	0.033237	2.709456	0.0086***		
GBY-1	0.806085	0.065204	12.36259	0.0000***		

Note: (-1) refers to the first lag of variable

*** Significant at 1% significance level

** Significant at 5% significance level

* Significant at 10% significance level

4.1.1 t-test Statistic

Hypothesis:

$H_0 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 = 0$ (insignificant)

$H_1 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \neq 0$ (significant)

Where,

β_1 = FGBD

β_2 = GD

β_3 = lnCPI

β_4 = STIR

β_5 = GBY-1

Decision rule:

Reject H_0, if the p- value of t- test statistic is less than significance level of 0.05. Otherwise do not reject H_0.

Conclusion:

From the above estimated result, the independent variables of FGBD, GD and lnCPI are not consistent with the theory which states that the variables are significant to explain the GBY since their p-value of 0.0965, 0.6605 and 0.3110 are greater than significance level of 0.05, so that do not reject the null hypothesis. However, STIR and GBY_{-1} are significant to explain the GBY due to their p-value of 0.0086 and 0.0000 are less than significance level of 0.05, thus reject null hypothesis.

Results of federal government budget deficit, government debt and consumer price index are against the prior expectation of this paper. Malaysia government bond yields are insignificant explained by the federal government budget deficit and government debt. This is because Malaysia only issues a small number of bonds and mostly use revenues gained from petroleum, palm oil and high domestic savings to finance budget deficit and government debt (Narayanan, 2007). The reason Malaysia government didn't issue bond in large number of unit is because Malaysia bond market faced liquidity and inactive problem in secondary market (Chan, Ahmad and Wooldridge, 2007).

Besides, this paper also found that consumer price index (CPI) is insignificant to government bond yields in Malaysia. CPI is the indicator of inflation and inflation will affect the purchasing power of a bond's future cash flows. This means that the rise of the expected future inflation rate cause the increase of the yields that investor will demand for the underlying bond to compensate for the risk. However, there have a different story in Malaysia, Malaysia remains a country with low and

stable inflation (Country Intelligence: Report: Malaysia, 2014). In another words, Malaysia government will not decide the government bond yields by taking into account of inflation rate in Malaysia. Thus, consumer price index will be insignificant to government bond yields (Jiang & McCauley, 2004).

4.1.2 F-test Statistic

F-test is applied to determine whether the whole estimated model is significant or not significant.

Hypothesis:

H_0: β_i = 0 (no linear relationship)
H_1: $\beta_i \neq 0$ (at least one independent variable affects Y)
Where $\beta_i = \beta_1, \beta_2, \dots, \beta_n$

Decision rule:

Reject H_0 if the p-value of F-test statistic is less than significance level of 0.05 and concludes that at least one independent variable is significant to explain the dependent variable. Otherwise, do not reject H_0 (Gujarati & Porter, 2009).

Conclusion:

According to Table 4.1, it presents that p-value of F-test statistic is 0.0000 which less than significance level of 0.05, so this paper rejects H_0. There is enough evidence to conclude that at least one independent variable is significant to explain the dependent variable. Thus, the model is significant at 0.05 significance level.

Since the expected sign of those independent variables are inconsistent with the theory and the result between t test- statistic of each independent variables and model's F test-statistic are contradict, this paper conclude there are econometric problems in the estimated model. Hence, the diagnostic checking is carried out to identify and detect the econometric problems that may exist in the estimated model.

4.2 Diagnostic Checking

4.2.1 Multicollinearity

Hypothesis:

H_0 : No serious multicollinearity problem exists.
H_1 : Serious multicollinearity problem exists.

Decision rules:

1) Do not reject H_0 if VIF is less than 10 which means that no serious multicollinearity problem exists in the model.
2) Reject H_0 if VIF is greater than 10 which means that a serious multicollinearity problem exists in the model (Baum, 2006).

Table 4.2: Correlation Analysis

	GBY	FGBD	GD	lnCPI	STIR	GBY_{-1}
GBY	1.000000	0.220188	-0.773235	-0.793676	0.767272	0.958704
FGBD	0.220188	1.000000	-0.266403	-0.286098	0.182639	0.153297
GD	-0.773235	-0.266403	1.000000	0.883369	-0.620456	-0.784003
lnCPI	-0.793676	-0.286098	**0.883369**	1.000000	-0.578559	**-0.798803**
STIR	0.767272	0.182639	-0.620456	-0.578559	1.000000	0.735594
GBY_{-1}	0.958704	0.153297	-0.784003	-0.798803	0.735594	1.000000

Table 4.2 shows that there are two pairs of independent variables which are highly correlated; lnCPI and GD of 0.883369, and lnCPI and GBY_{-1} of -0.798803. Thus, this paper will conduct the Auxilary Model through checking from R- square and determine Variance Inflation Factor (VIF).

Table 4.3: Variance Inflation Factor (VIF) Approach

Dependent variable	**R- square**	**VIF= 1/ 1-R- square**
FGBD	0.111846	1.1259
GD	0.803334	5.0847
lnCPI	0.818295	5.5034
STIR	0.558672	2.2659
GBY_{-1}	0.668480	3.0164

The Table 4.3 shows the R- square obtained from the auxiliary model (Appendix 4.11- Appendix 4.15) and calculated the values of VIF. From the results shown, there is no serious multicollinearity among all the variables, where the values of VIF are less than 10 (Gujarati & Porter, 2009).

4.2.2 Autocorrelation

Hypothesis:

H_0 *: No autocorrelation problem exists.*

H_1 *: Autocorrelation problem exists.*

Decision Rules:

1) Do not reject H_0 if p-value of the Chi-square greater than significance level of 0.05 which means that no autocorrelation problem exists in the model.
2) Reject H_0 if p-value of the Chi-square less than significance level of 0.05 which means that an autocorrelation problem exists in the model (Gujarati & Porter, 2009).

Table 4.4 : Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.157036	Prob.F (1,64)	0.6932
Obs*R-squared	0.173786	Prob.Chi-Square (1)	0.6768

Conclusion:

The p-value of Chi-square is 0.6768 greater than significance level of 0.05, thus this paper do not reject H_0. This paper has sufficient evidence to prove that autocorrelation problem does not exist.

4.2.3 Heteroscedasticity

Hypothesis:

H_0 *: No heteroscedasticity problem exists.*

H_1 *: Heteroscedasticity problem exists.*

Decision rules:

1) Do not reject H_0 if the p-value of Chi-square greater than significance level of 0.05 which means that no heteroscedasticity problem exists in the model.
2) Reject H_0 if the p-value of Chi-square less than significance level of 0.05 which means that a heteroscedasticity problem exists in the model (Gujarati & Porter, 2009).

Table 4.5: Heteroscedasticity Test (ARCH)

F-statistic	0.422198	Prob.F(1,68)	0.5180
Obs*R-squared	0.431934	Prob.Chi-Square(1)	0.5110

Conclusion:

The p-value of Chi-square is 0.5110 greater than significance level of 0.05, thus this paper do not reject H_0. This paper has sufficient evidence to prove that heteroscedasticity problem does not exist.

4.2.4 Ramsey RESET Test

Hypothesis:

H_0 : Model is correctly specified.
H_1: Model is not correctly specified.

Decision rules:

1) Do not reject H_0 if p-value of Chi-square greater than significance level of 0.05, indicate the model is correctly specified.
2) Reject H_0 if p-value of Chi-square less than significance level of 0.05, indicate the model is wrongly specified (Gujarati & Porter, 2009).

Table 4.6: Ramsey RESET Test

F- statistic	2.636135	Prob. F (2,63)	0.0795
Likelihood ratio	5.706197	Prob. Chi-Square (2)	0.0577

Conclusion:

The p-value of Chi-square is 0.0577 greater than significance level of 0.05, thus this paper do not reject H_0. This paper has sufficient evidence to say that the model is correctly specified.

4.2.5 Jarque- Bera Test

Hypothesis:

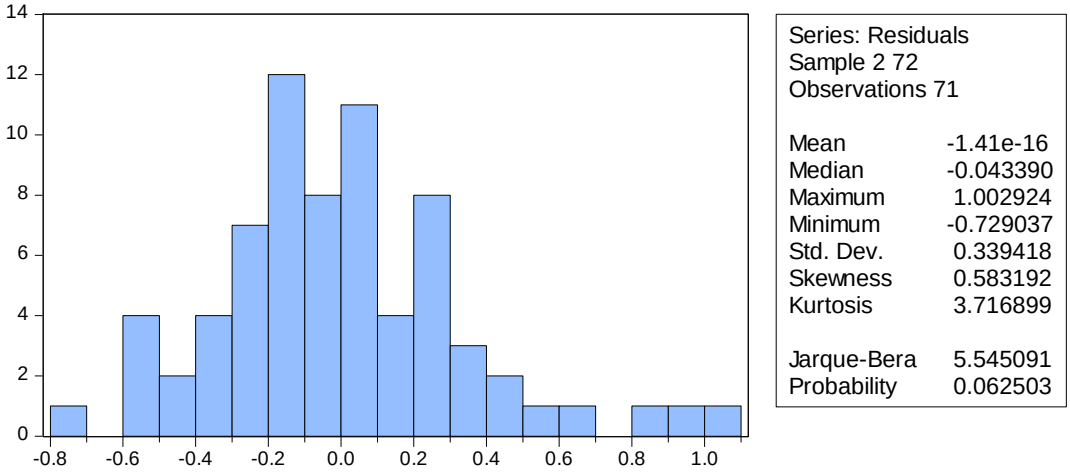
H_0 *: Error term is normally distributed.*

H_1*: Error term is not normally distributed.*

Decision rules:

1) Do not reject H_0 if the p-value for JB test- statistic is greater than significance level of 0.05, indicate the error term is normally distributed.
2) Reject H_0 if the p- value for JB test- statistic is less than significance level of 0.05, indicate the error term is not normally distributed (Gujarati & Porter, 2009).

Table 4.7: Jarque- Bera Test



Conclusion:

The p- value of JB test- statistic is 0.062503 greater than significance level of 0.05, thus this paper do not reject H_0 . There is sufficient evidence to prove that error term is normally distributed.

4.3 Conclusion

All analysis of data shown in this chapter is tabulated in table and figure form. Explanations in this chapter are clearly written. Conclusion of entire research will be carried out in the next chapter.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

Overall conclusion of this research paper will be discussed thoroughly in this chapter. This paper will present the summary and discussion first. Summary and discussion of findings are based on research objectives and hypotheses followed by the implication from this study, limitation and also recommendations for the future researchers.

5.1 Summary of Statistical Analyses

Table 5.1: Summarize of Econometric Problems

Econometric Problems	**Description on Results**
Multicollinearity	Multicollinearity problem exists but not serious
Autocorrelation	Autocorrelation problem does not exists
Heteroscedasticity	Heteroscedasticity problem does not exists
Model Specification	Model specification is correct
Normality Test	Model is normally distributed

Description:

Diagnostic checking tests are applied on economic model and passes through all the tests. Although the multicollinearity problem still exists, however as long as the variance inflation factor (VIF) does not exceed 10, then can consider no serious multicollinearity problem, thus this paper can ignore the multicollinearity problem (O'Brien, 2007).

Table 5.2: Summarize of Major Findings

Dependent Variable	**Independent Variables**	**Ordinary Least Square**
Government Bond Yields	FGBD	Insignificant at 5%
Government Bond Yields	GD	Insignificant at 5%
Government Bond Yields	CPI	Insignificant at 5%
Government Bond Yields	STIR	Significant at 5%
Government Bond Yields	GBY_{-1}	Significant at 5%

Description:

The table above shows the relationship between dependent variable and explanatory variables. FGBD, GD, CPI are insignificant to affect GBY. While, STIR and GBY_{-1} have positive and significant relationship toward GBY at 5%.

5.2 Discussions on Major Findings

According to Table 5.2, the independent variables of FGBD, GD and CPI are not consistent with the expectation which states that the variables are significant to explain GBY, while STIR and GBY_{-1} are significant to explain the GBY.

Malaysia government bond yields are insignificant explained by the federal government budget deficit and government debt because when Malaysia faced budget deficit and debt, the government will use most of the revenue from petroleum, palm oil and high domestic savings to finance the debt instead of issuing government bond (Narayanan, 2007). Therefore, this is definitely will not affect the government bond yields.

The following variable is consumer price index which is a measure of inflation. Based on prior expectation, it states that relationship between CPI and GBY is positive and significantly related which is supported by Gruber & Kamin (2012). However, the CPI has turned into insignificant relationship which is out of expectation. Malaysia remains a country with low and stable inflation (Country Intelligence: Report: Malaysia, 2014). Therefore, the inflation does not represent an important factor that can influence the government bond yields. Thus, this paper draws a conclusion by saying that CPI is insignificant to GBY (Jiang & McCauley, 2004).

Lastly, findings of Baklaci (2003) and Poghosyan (2013) discovered that the relationship between STIR and GBY will always be positive and significant. Short- term interest rate is a return of the government bond yields and investors will make the investment decision based on the percent of interest rate.

Before proceed to the research, this paper has used Ordinary Least Square to do diagnostic checking for the purpose of getting an ideal model and econometric problems free. The original model of this paper consists of autocorrelation, heteroscedasticity and model specification error problems. Thus, this paper comes out with a solution to include the lag variable into the original model. This is supported by Gujarati and Porter (2009)

who state that the effects of the variable are likely to be distributed over time due to the slow response of the variable to receive the information.

Finally, after conduct the trial and error for the entire lag 1 to 4 of independent variables and dependent variable, this paper has found that lag 1 of the government bond yields has the lowest AIC and SIC. Thus, this paper include lag 1 of the government bond yields in the new estimated model which is Equation 2.

The main purpose of this paper is to identify the major determinants of the government bond yields in Malaysia. All the findings of this paper will be useful for the bond market participants, future researchers and institutional investors that will further discuss in this paper's implications.

5.3 Implications of the Study

From the outcome of this paper it shows details information to the public and this result might be useful for different segments of the society like policy makers, future researchers, and institutional investors (Gruber & Kamin, 2012, Poghosyan, 2013 and Baklaci, 2003). Besides that, the central bank (Bank Negara Malaysia) would have more understanding on the position of Malaysia bond market tendency and the relationship between the government bond yields, federal government budget deficit, government debt, consumer price index and short term interest rate.

This paper gives the implication for the policy makers and central bank (Bank Negara Malaysia) to improve the country's capital market and serve as the benchmark for the pricing of other bonds in the market (Bank Negara Malaysia and Securities Commission Malaysia, 2009). The federal government budget deficit and government debt are insignificant to Malaysia government bond yield due to the small size of issuing numbers of bonds in Malaysia market and Malaysia main source of revenue is from palm oil, petroleum and etc. (Narayanan, 2007). Therefore, policy makers may implement

appropriate fiscal policy to reduce debt and stimulate the economy to minimize the impact of government debt (Smith, 2013). Policy makers can control the government bond yields by upgrading or downgrading the government bond through credit rating agencies. Based on research done by Hoshi and Ito (2012), downgrading a bond can lead to influence an investor perception on the bond. For example, when a bond downgrade, investors are reluctant to hold the bond and investor will expect the bond yields to increase to compensate on the high risk bond. Likewise, when a bond is upgraded it will influence investor to hold more quality bonds and since quality bond is low risk thus it does not fetch a higher yield.

In addition, the institutional investors pooled a large sum of funds to make their investment in the bond market (Castellani & Santos, 2005). Therefore, the main purpose of the institutional investor is to earn profit and minimize their losses. Thus, it is important for investors to determine the important factors that could be the guide for them to justify whether their investment is profiting or not (Fox, 2014). From this paper, short-term interest rate is significant to Malaysia government bond yield. As the short-term interest rate increase then the government bond yields increase, this will attract more investors to invest since the price of bonds is decrease. By having this information, for those investors who are risk taker, risk adverse or risk neutral, they could use this information to help them in making better investment decision in Malaysia market (Jaramillo & Weber, 2013).

Furthermore, this paper may help the future researchers who are interested in the related topics for further study. Future researchers can carry out additional studies into document term structure behavior in other Asia Treasury market before the results can be generalized to other Malaysia government bond market (Khan, Ariff & Baker, 2003). In addition, future researchers can get a stronger result by expanding the sample size with availability of a larger dataset (Baklaci, 2003).

5.4 Limitations of the Study

The major restriction of this paper is to obtain the complete or sufficient data. For instance, the data of government bond yields which is obtained from the datastream only available from 1996:Q1 to 2013:Q4 while the data for other variables are available before year 1996. Thus, this paper only able forecast with 1996:Q1 to 2013:Q4 as research period since the government bond yields is the dependent variable of this paper and is necessary to include it in. In addition, this paper uses quarterly data instead of monthly data because the monthly data is incomplete, for instance, the data of government debt and federal government budget deficit only available in March, June, September and December in a year.

Even though previous researchers studied the determinants of government bond yields in other countries such as United States, Singapore, China and European countries, however research on this topic investigated in Malaysia is rare. Thus, this paper is unable to find the journal or research on Malaysia. Since this paper only explore in Malaysia, thus the outcome and issue of this paper are applicable for the investor and policy maker in Malaysia country only. However, the result of this paper may not appropriate apply for other countries.

Finally, limited time is an obstacle for this paper to investigate the impact on the government bond yields by using same independent variables for other countries and makes comparison between Malaysia and other countries. The result may differ due to the different country's background, culture, economy position, government policy and political issues.

5.5 Recommendations for Future Research

Every research and studies have its own limitation and recommendation. Regarding the first limitation, data constraints is the main hindrance from getting an accurate and reliable result. It is true that most research uses quarterly data and examines the result from it. However, this does not apply to Malaysia since there is incomplete data found. Thus, suggestion for future researchers are to examine the data through annual basis and monthly basis so research on government bond yields can be applied for develop and developing countries that face data constraints and increase the accuracy and validity of result.

Besides, many journals on determinants of government bond yields are found based on other countries such as United States, Singapore, China and European countries. The determinants obtained from other countries might not suits the economic conditions and policy of Malaysia and thus the expected outcome may differ from the pure expectations. Hence, it is recommended that future researchers can produce more research and uses other macroeconomic factors such as exchange rate and foreign direct investment (FDI) as determinants since it plays a significant role in Malaysia economy.

5.6 Conclusion

This paper found that short-term interest rate and lagged of government bond yields has positive relationship with government bond yields. However, the federal government budget deficit, government debt and consumer price index are insignificant to explain government bond yields in Malaysia. Besides that, this paper faces some limitations and hence recommendations are suggested to future researchers in order to get better result in their future studies.

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APPENDICES

Appendix 4.1: OLS Regression Result for Equation 1

Dependent Variable: GBY
Method: Least Squares
Date: 07/02/14 Time: 20:02
Sample: 1 72
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	-6.12E-06	2.13E-05	-0.288168	0.7741
GD	-0.020456	0.022414	-0.912647	0.3647
LNCPI	-4.810754	1.299054	-3.703275	0.0004
STIR	0.305261	0.050285	6.070673	0.0000
C	26.13756	5.155491	5.069849	0.0000

R-squared	0.782586	Mean dependent var	4.845333
Adjusted R-squared	0.769606	S.D. dependent var	1.323377
S.E. of regression	0.635212	Akaike info criterion	1.997201
Sum squared resid	27.03415	Schwarz criterion	2.155302
Log likelihood	-66.89922	Hannan-Quinn criter.	2.060141
F-statistic	60.29201	Durbin-Watson stat	0.414142
Prob(F-statistic)	0.000000		

Appendix 4.2: Multicollinearity Test for Equation 1

	GBY	**FGBD**	**GD**	**LNCPI**	**STIR**
GBY	1.000000	0.227248	-0.770929	-0.801356	0.775547
FGBD	0.227248	1.000000	-0.269459	-0.292030	0.190763
GD	-0.770929	-0.269459	1.000000	0.875173	-0.620349

LNCPI	-0.801356	-0.292030	0.875173	1.000000	-0.596383
STIR	0.775547	0.190763	-0.620349	-0.596383	1.000000

Appendix 4.3: Variance Inflation Factor (VIF) Approach for Equation 1

Dependent Variable	**R square**	**VIF= 1/ 1-R-square**
FGBD	0.086297	1.0944
GD	0.781100	4.5683
lnCPI	0.773742	4.4197
STIR	0.397174	1.6589

Appendix 4.4: Breusch-Godfrey Serial Correlation LM Test for Equation 1

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	119.6202	Prob. F(1,66)	0.0000
Obs*R-squared	46.39934	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 07/02/14 Time: 20:05
Sample: 1 72
Included observations: 72
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	2.21E-05	1.29E-05	1.712829	0.0914
GD	0.004426	0.013472	0.328490	0.7436
LNCPI	0.212272	0.780704	0.271898	0.7865
STIR	0.015450	0.030244	0.510854	0.6112

C	-1.244080	3.099470	-0.401385	0.6894
RESID(-1)	0.819042	0.074887	10.93710	0.0000
R-squared	0.644435	Mean dependent var		3.32E-15
Adjusted R-squared	0.617499	S.D. dependent var		0.617060
S.E. of regression	0.381631	Akaike info criterion		0.990930
Sum squared resid	9.612389	Schwarz criterion		1.180653
Log likelihood	-29.67349	Hannan-Quinn criter.		1.066459
F-statistic	23.92404	Durbin-Watson stat		1.900899
Prob(F-statistic)	0.000000			

Appendix 4.5: Heteroscedasticity Test (ARCH) for Equation 1

Heteroskedasticity Test: ARCH			
F-statistic	31.70264	Prob. F(1,69)	0.0000
Obs*R-squared	22.35182	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/02/14 Time: 20:06
Sample (adjusted): 2 72
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.170352	0.062926	2.707164	0.0085
RESID^2(-1)	0.559031	0.099286	5.630510	0.0000
R-squared	0.314814	Mean dependent var		0.380663
Adjusted R-squared	0.304884	S.D. dependent var		0.511807

S.E. of regression	0.426712	Akaike info criterion	1.162351
Sum squared resid	12.56375	Schwarz criterion	1.226088
Log likelihood	-39.26345	Hannan-Quinn criter.	1.187697
F-statistic	31.70264	Durbin-Watson stat	1.886544
Prob(F-statistic)	0.000000		

Appendix 4.6: White Heteroscedasticity-Consistent Standard Errors

Dependent Variable: GBY
Method: Least Squares
Date: 07/02/14 Time: 20:06
Sample: 1 72
Included observations: 72
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	-6.12E-06	1.89E-05	-0.323766	0.7471
GD	-0.020456	0.018901	-1.082298	0.2830
LNCPI	-4.810754	1.165483	-4.127689	0.0001
STIR	0.305261	0.052511	5.813317	0.0000
C	26.13756	4.869068	5.368082	0.0000

R-squared	0.782586	Mean dependent var	4.845333
Adjusted R-squared	0.769606	S.D. dependent var	1.323377
S.E. of regression	0.635212	Akaike info criterion	1.997201
Sum squared resid	27.03415	Schwarz criterion	2.155302
Log likelihood	-66.89922	Hannan-Quinn criter.	2.060141
F-statistic	60.29201	Durbin-Watson stat	0.414142
Prob(F-statistic)	0.000000		

Appendix 4.7: Newey- West Test

Dependent Variable: GBY
Method: Least Squares
Date: 07/02/14 Time: 20:07
Sample: 1 72
Included observations: 72
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed
bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	-6.12E-06	1.62E-05	-0.377661	0.7069
GD	-0.020456	0.026629	-0.768203	0.4451
LNCPI	-4.810754	1.627709	-2.955537	0.0043
STIR	0.305261	0.087411	3.492244	0.0009
C	26.13756	7.065117	3.699522	0.0004

R-squared	0.782586	Mean dependent var	4.845333
Adjusted R-squared	0.769606	S.D. dependent var	1.323377
S.E. of regression	0.635212	Akaike info criterion	1.997201
Sum squared resid	27.03415	Schwarz criterion	2.155302
Log likelihood	-66.89922	Hannan-Quinn criter.	2.060141
F-statistic	60.29201	Durbin-Watson stat	0.414142
Prob(F-statistic)	0.000000		

Appendix 4.8: Ramsey RESET Test for Equation 1

Ramsey RESET Test

Equation: UNTITLED

Specification: GBY FGBD GD LNCPI STIR C

Omitted Variables: Powers of fitted values from 2 to 3

	Value	df	Probability
F-statistic	12.38247	(2, 65)	0.0000
Likelihood ratio	23.24212	2	0.0000

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	7.458359	2	3.729179
Restricted SSR	27.03415	67	0.403495
Unrestricted SSR	19.57579	65	0.301166
Unrestricted SSR	19.57579	65	0.301166

LR test summary:

	Value	df
Restricted LogL	-66.89922	67
Unrestricted LogL	-55.27816	65

Unrestricted Test Equation:

Dependent Variable: GBY

Method: Least Squares

Date: 07/02/14 Time: 20:04

Sample: 1 72

Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.

FGBD	0.000111	3.53E-05	3.132765	0.0026
GD	0.259541	0.085130	3.048768	0.0033
LNCPI	80.12091	22.33399	3.587397	0.0006
STIR	-5.467784	1.419076	-3.853059	0.0003
C	-397.6404	112.6896	-3.528635	0.0008
FITTED^2	2.996863	0.871574	3.438448	0.0010
FITTED^3	-0.161077	0.054316	-2.965573	0.0042

R-squared	0.842568	Mean dependent var	4.845333
Adjusted R-squared	0.828036	S.D. dependent var	1.323377
S.E. of regression	0.548786	Akaike info criterion	1.729949
Sum squared resid	19.57579	Schwarz criterion	1.951291
Log likelihood	-55.27816	Hannan-Quinn criter.	1.818066
F-statistic	57.97932	Durbin-Watson stat	0.443448
Prob(F-statistic)	0.000000		

Appendix 4.9: AIC and SIC for Lag 1 to Lag 4 of GBY, FGBD, GD, lnCPI and STIR

	AIC	SIC
GBY (-1)	0.831663	1.022875
GBY (-2)	0.869155	1.094004
GBY (-3)	0.900679	1.159706
GBY (-4)	0.944636	1.238395
FGBD (-1)	2.040779	2.231991
FGBD (-2)	2.063252	2.288101
FGBD (-3)	2.097399	2.356425
FGBD (-4)	2.127806	2.421564
GD (-1)	2.040609	2.231822
GD (-2)	2.063506	2.288356
GD (-3)	2.074350	2.333377

GD (-4)	2.095315	2.389073
lnCPI (-1)	2.013221	2.204434
lnCPI (-2)	2.055470	2.280320
lnCPI (-3)	2.099932	2.358959
lnCPI (-4)	2.133786	2.427544
STIR (-1)	1.965644	2.156856
STIR (-2)	1.925343	2.150192
STIR (-3)	1.926206	2.185233
STIR (-4)	1.780470	2.074229

Appendix 4.10: OLS Regression Result for Equation 2

Dependent Variable: GBY
Method: Least Squares
Date: 06/20/14 Time: 16:57
Sample (adjusted): 2 72
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	2.02E-05	1.20E-05	1.686614	0.0965
GD	0.005800	0.013143	0.441284	0.6605
LNCPI	-0.840763	0.823359	-1.021138	0.3110
STIR	0.090053	0.033237	2.709456	0.0086
C	4.045317	3.488674	1.159557	0.2505
GBY(-1)	0.806085	0.065204	12.36259	0.0000

R-squared	0.932909	Mean dependent var	4.816859
Adjusted R-squared	0.927748	S.D. dependent var	1.310395
S.E. of regression	0.352231	Akaike info criterion	0.831663
Sum squared resid	8.064339	Schwarz criterion	1.022875
Log likelihood	-23.52404	Hannan-Quinn criter.	0.907702

F-statistic	180.7658	Durbin-Watson stat	1.911606
Prob(F-statistic)	0.000000		

Appendix 4.11: Auxiliary Model for FGBD

Dependent Variable: FGBD
Method: Least Squares
Date: 06/20/14 Time: 17:34
Sample: 1 72
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GD	-26.73617	127.8406	-0.209137	0.8350
LNCPI	-7179.128	7360.313	-0.975383	0.3328
STIR	34.30860	286.8637	0.119599	0.9052
C	35727.55	29093.30	1.228034	0.2237

R-squared	0.086297	Mean dependent var	2575.196
Adjusted R-squared	0.045987	S.D. dependent var	3710.461
S.E. of regression	3624.141	Akaike info criterion	19.28257
Sum squared resid	8.93E+08	Schwarz criterion	19.40906
Log likelihood	-690.1727	Hannan-Quinn criter.	19.33293
F-statistic	2.140815	Durbin-Watson stat	2.025604
Prob(F-statistic)	0.103106		

Appendix 4.12: Auxiliary Model for GD

Dependent Variable: GD
Method: Least Squares
Date: 06/20/14 Time: 17:35
Sample: 1 72
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	-2.40E-05	0.000115	-0.209137	0.8350
LNCPI	45.99831	4.275708	10.75806	0.0000
STIR	-0.567430	0.263210	-2.155807	0.0346
C	-161.9922	19.80173	-8.180712	0.0000

R-squared	0.781100	Mean dependent var	41.89611
Adjusted R-squared	0.771443	S.D. dependent var	7.188605
S.E. of regression	3.436705	Akaike info criterion	5.360856
Sum squared resid	803.1440	Schwarz criterion	5.487338
Log likelihood	-188.9908	Hannan-Quinn criter.	5.411209
F-statistic	80.88136	Durbin-Watson stat	0.169311
Prob(F-statistic)	0.000000		

Appendix 4.13: Auxiliary Model for lnCPI

Dependent Variable: LNCPI
Method: Least Squares
Date: 06/20/14 Time: 17:35
Sample: 1 72
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.

FGBD	-1.92E-06	1.97E-06	-0.975383	0.3328
GD	0.013694	0.001273	10.75806	0.0000
STIR	-0.005350	0.004649	-1.150793	0.2538
C	3.930590	0.066493	59.11308	0.0000

R-squared	0.773742	Mean dependent var	4.479553
Adjusted R-squared	0.763760	S.D. dependent var	0.122000
S.E. of regression	0.059298	Akaike info criterion	-2.758542
Sum squared resid	0.239102	Schwarz criterion	-2.632061
Log likelihood	103.3075	Hannan-Quinn criter.	-2.708189
F-statistic	77.51374	Durbin-Watson stat	0.207670
Prob(F-statistic)	0.000000		

Appendix 4.14: Auxiliary Model for STIR

Dependent Variable: STIR
Method: Least Squares
Date: 06/20/14 Time: 17:35
Sample: 1 72
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	6.13E-06	5.13E-05	0.119599	0.9052
GD	-0.112742	0.052297	-2.155807	0.0346
LNCPI	-3.570643	3.102768	-1.150793	0.2538
C	24.40631	12.07572	2.021107	0.0472

R-squared	0.397174	Mean dependent var	3.703750
Adjusted R-squared	0.370579	S.D. dependent var	1.930896
S.E. of regression	1.531896	Akaike info criterion	3.744843
Sum squared resid	159.5761	Schwarz criterion	3.871324

Log likelihood	-130.8143	Hannan-Quinn criter.	3.795195
F-statistic	14.93404	Durbin-Watson stat	0.126937
Prob(F-statistic)	0.000000		

Appendix 4.15: Auxiliary Model for GBY(-1)

Dependent Variable: GBY(-1)
Method: Least Squares
Date: 06/20/14 Time: 17:41
Sample (adjusted): 2 72
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	-1.73E-05	2.56E-05	-0.678525	0.4998
GD	-0.119122	0.019461	-6.121163	0.0000
LNCPI	1.950024	0.220181	8.856462	0.0000
STIR	0.315175	0.060870	5.177802	0.0000

R-squared	0.668480	Mean dependent var	4.816859
Adjusted R-squared	0.653636	S.D. dependent var	1.310395
S.E. of regression	0.771203	Akaike info criterion	2.372959
Sum squared resid	39.84855	Schwarz criterion	2.500434
Log likelihood	-80.24006	Hannan-Quinn criter.	2.423652
Durbin-Watson stat	0.291206		

Appendix 4.16: Breusch-Godfrey Serial Correlation LM Test Result for Equation 2

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.157036	Prob. F(1,64)	0.6932
Obs*R-squared	0.173786	Prob. Chi-Square(1)	0.6768

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 06/20/14 Time: 17:21
Sample: 2 72
Included observations: 71
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	-7.29E-07	1.22E-05	-0.059797	0.9525
GD	-0.000188	0.013238	-0.014218	0.9887
LNCPI	-0.098433	0.865174	-0.113772	0.9098
STIR	0.002759	0.034171	0.080744	0.9359
C	0.509948	3.739883	0.136354	0.8920
GBY(-1)	-0.014212	0.074790	-0.190025	0.8499
RESID(-1)	0.056788	0.143303	0.396278	0.6932

R-squared	0.002448	Mean dependent var	-1.41E-16
Adjusted R-squared	-0.091073	S.D. dependent var	0.339418
S.E. of regression	0.354538	Akaike info criterion	0.857381
Sum squared resid	8.044600	Schwarz criterion	1.080462
Log likelihood	-23.43704	Hannan-Quinn criter.	0.946094
F-statistic	0.026173	Durbin-Watson stat	1.985460
Prob(F-statistic)	0.999917		

Appendix 4.17: Breusch-Godfrey Serial Correlation LM Test for Lag 1 to Lag 10

Lagged Length	SIC	AIC	P-value (Chi-square)
1	1.080462	0.857381	0.6768
2	1.123385	0.868435	0.5027
3	1.183278	0.896460	0.7089
4	1.154859	0.836172	0.1219
5	1.200955	0.850398	0.1476
6	1.248624	0.866199	0.1773
7	1.293076	0.878782	0.1947
8	1.294579	0.848417	0.0998
9	1.353471	0.875440	0.1439
10	1.412309	0.902410	0.1969

Appendix 4.18: Heteroscedasticity Test (ARCH) Result for Equation 2

Heteroskedasticity Test: ARCH			
F-statistic	0.422198	Prob. F(1,68)	0.5180
Obs*R-squared	0.431934	Prob. Chi-Square(1)	0.5110

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 06/20/14 Time: 17:26
Sample (adjusted): 3 72
Included observations: 70 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	0.124009	0.026682	4.647753	0.0000
RESID^2(-1)	-0.078612	0.120985	-0.649768	0.5180
R-squared	0.006170	Mean dependent var		0.114953
Adjusted R-squared	-0.008445	S.D. dependent var		0.189555
S.E. of regression	0.190354	Akaike info criterion		-0.451708
Sum squared resid	2.463953	Schwarz criterion		-0.387466
Log likelihood	17.80979	Hannan-Quinn criter.		-0.426190
F-statistic	0.422198	Durbin-Watson stat		1.979978
Prob(F-statistic)	0.518031			

Appendix 4.19: Heteroskedasticity Test (ARCH) for Lag 1 to Lag 10

Lagged Length	SIC	AIC	P-value (Chi-square)
1	-0.387466	-0.451708	0.5110
2	-0.330579	-0.427714	0.4885
3	-0.257211	-0.387770	0.7040
4	-0.181996	-0.346526	0.8469
5	-0.119588	-0.318648	0.8000
6	-0.041240	-0.275405	0.8772
7	-0.320883	-0.590743	0.2399
8	-0.238822	-0.544984	0.3438
9	-0.188479	-0.531565	0.2895
10	-0.118097	-0.498747	0.3295

Appendix 4.20: Ramsey RESET Test for Equation 2

Ramsey RESET Test
Equation: UNTITLED
Specification: GBY FGBD GD LNCPI STIR C GBY(-1)

Omitted Variables: Powers of fitted values from 2 to 3

	Value	df	Probability
F-statistic	2.636135	(2, 63)	0.0795
Likelihood ratio	5.706197	2	0.0577

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.622762	2	0.311381
Restricted SSR	8.064339	65	0.124067
Unrestricted SSR	7.441577	63	0.118120
Unrestricted SSR	7.441577	63	0.118120

LR test summary:

	Value	df
Restricted LogL	-23.52404	65
Unrestricted LogL	-20.67094	63

Unrestricted Test Equation:

Dependent Variable: GBY

Method: Least Squares

Date: 06/20/14 Time: 17:37

Sample: 2 72

Included observations: 71

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FGBD	-6.88E-05	4.40E-05	-1.563987	0.1228
GD	-0.030467	0.020816	-1.463620	0.1483
LNCPI	3.270962	2.164239	1.511368	0.1357
STIR	-0.406741	0.222142	-1.830998	0.0718

C	-6.252552	6.563487	-0.952627	0.3444
GBY(-1)	-3.126209	1.832910	-1.705598	0.0930
FITTED^2	0.842077	0.413366	2.037122	0.0458
FITTED^3	-0.046348	0.024571	-1.886253	0.0639

R-squared	0.938090	Mean dependent var	4.816859
Adjusted R-squared	0.931211	S.D. dependent var	1.310395
S.E. of regression	0.343686	Akaike info criterion	0.807632
Sum squared resid	7.441577	Schwarz criterion	1.062582
Log likelihood	-20.67094	Hannan-Quinn criter.	0.909018
F-statistic	136.3718	Durbin-Watson stat	1.833090
Prob(F-statistic)	0.000000		

Appendix 4.21: Jarque-Bera Test for Equation 2