RESPONSIVENESS OF THE MALAYSIAN GOVERNMENT SECURITIES YIELD TO THE MONETARY POLICY TIGHTENING IN MALAYSIA

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ABSTRACT

The objective of this study is to examine the responsiveness of the Malaysian Government Securities (MGS) yield to the monetary policy tightening in Malaysia. A total of 397 numbers of each dataset are observed, by using data period from the year 2004 to the year 2016. The sample of MGS yield used in this analysis is short-terms MGS yield, medium-terms MGS yield and long-terms MGS yield. This study is to investigate the reaction of MGS yield that changes to 5-, 15- and 25-days prior,post-trading days and during the trading day to OPR hike, with total days covered are 51 days. The findings also shows all of OPR hike in the various period become stationary at order one I(1), while on MGS yield, all except for the short-term MGS yield during OPR hike on 24 February 2006, medium-term MGS yield during OPR hike on 12 May 2010, short- and medium-term MGS yield during OPR hike on 5 May 2011 and medium-term MGS yield during OPR hike on 10 July 2014 which become stationary at level I(0). Moreover, the results indicate that the yields on government bond are sensitive only to the monetary policy tightening during 2005 which is consistent with the term structure of interest rate theory where the yields to maturity increase as the term to maturing increase. Furthermore, the findings also show that in term of short-run relationship results, at least eight out of twenty-four of variables in OPR hike does Granger cause to MGS yield at the 1 percent level of significance, given the p-value are less than 1 percent, 5 percent and 10 percent level respectively, while there a total of eight of MGS yield that Granger cause to OPR hike, assuming that OPR hike is a dependent variable. Nevertheless, the findings also concluded that tenth out or forty-eight of variables either both of variable between OPR hikes or MGS does not show Granger cause to each other. However, in term of long-run relationship tested results indicates no long-run relationship appears between the responsiveness of MGS yield to OPR hike, given both Max-Eigenvalue and trace -statistic test appear to have less than 5 percent and 1 percent levels of critical value. For future study, it is recommended a new research to analyse the relationship between interest rate to both MGS and Government Islamic Issuance (GII) for better understanding of Malaysia Capital Market behaviour.

Keywords: Yield Curve, Malaysia Government Securities Yield, Overnight Policy Rate, Term of Maturity, Term Structure of Interest Rate

ABSTRAK

Tujuan kajian ini adalah untuk mengkaji keberkesanan hasil sekuriti kerajaan Malaysia terhadap peningkatan kadar faedah di Malaysia. Sejumlah 397 sampel data diselidik daripada tempoh tahun 2004 hingga tahun 2016. Kajian ini menumpukan tiga tempoh jangkamasa bagi hasil bon kerajaan iaitu bon kerajaan bagi jangkamasa pendek, jangkamasa sederhana dan jangkamasa panjang. Kajian ini turut memfokuskan kadar tindak balas hasil bon kerajaan kepada tempoh masa 5-, 15- dan 25 hari sebelum, selepas dan pada hari dagangan terhadap kenaikan kadar faedah, dengan jumlah keseluruhan hari adalah sebanyak 51 hari. Hasil kajian yang dibuat membuktikan semua kenaikan kadar faedah dalam pelbagai tempoh adalah stationari bagi ujian unit root pada kedudukan urutan I (1), manakala hasil bon kerajaan menunjukkan keseluruhan tempoh jangkamasa kecuali bon kerajaan bagi jangkamasa pendek terhadap kenaikan kadar faedah pada 24 Februari 2006, hasil kerajaan bagi jangkamasa sederhana terhadap kenaikan kadar faedah pada 12 Mei 2010, hasil bon kerajaan bagi jangkamsa pendek dan sederhana terhadap kenaikan kadar faedah pada 5 Mei 2011 dan hasil bon kerajaan bagi jangkamasa sederhana terhadap kenaikan kadar faedah pada 10 Julai 2014 adalah stationari pada kedudukan tahap I (0). Secara keseluruhannya, kajian ini turut menunjukkan bahawa hasil bon kerajaan hanya sensitif terhadap kenaikan kadar faedah pada tahun 2005, di mana tindak balas keputusan kajian adalah konsisten dengan teori kadar faedah; peningkatan hasil sekuriti kerajaan meningkat apabila kadar faedah meningkat. Di samping itu, sekurang-kurangnya lapan daripada dua puluh empat pembolehubah terhadap kenaikan kadar faeah menyebabkan granger causaliti kepada hasil bon kerajaan pada tahap 1 peratus kepentingan, manakala lapan hasil bon kerajaan turut menyebabkan ujian kausaliti granger terhadap kenaikan kadar faedah, dengan mengandaikan kenaikan kadar faedah adalah pembolehubah yang bergantung. Walaubagaimanapun, penemuan hasil kajian juga menyimpulkan bahawa sepuluh daripada empat puluh lapan pembolehubah sama ada kedua-dua pembolehubah bertindak sebagai pembolehubah bergantung antara satu sama lain tidak menunjukkan ujian kausaliti granger antara satu sama lain. Walau bagaimanapun, dari segi hubungan jangkamasa panjang yang diuji tiada hubungan jangkamasa panjang yang wujud di antara tindak balas hasil bon kerajaan terhadap kenaikan kadar faedah berdasarakan keputusan ujian statistik Max-Eigenvalue dan ujian-statistik kerana keputusan ujian mendapati kesemua data sample adalah kurang daripada 5 dan 1 peratus. Untuk kajian masa hadapan, dicadangkan satu kajian menyeluruh mengenai hubungan kadar faedah terhadap semua Bon kerajaan Malaysia termasuk Bon islamik untuk memahami dengan lebih lanjut berkaitan pasaran modal di Malaysia.

Kata Kunci: Bon Kerajaan Malaysia, Kadar faedah, Tempoh Matang, Struktur Kadar Faedah

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LIST OF ABBREVIATIONS

And others	Et al
And so on	etc.
Augumented Dickey-Fuller	ADF
Bank Negara Malaysia	BNM
Base Lending Rate	BLR
Durbin Watson	DW
European Government Bond	EGB
European Monetary Union	EMU
European Union	EU
Fed Fun Rate	FFR
For example	i.e.
Government Islamic Issuance	GII
Gross Domestic Product	GDP
Japanese Government Bond	JGB
Malaysian Government Securities	MGS
Monetary Policy Committee	MPC
Overnight Policy Rate	OPR
R-Square	R^2
Securities Commission	SC
United Kingdom	UK
United States of America	USA
Unites States Treasury	UST
Vector Error Correlation Model	VECM

CHAPTER 1

INTRODUCTION

1.0 Background of Study

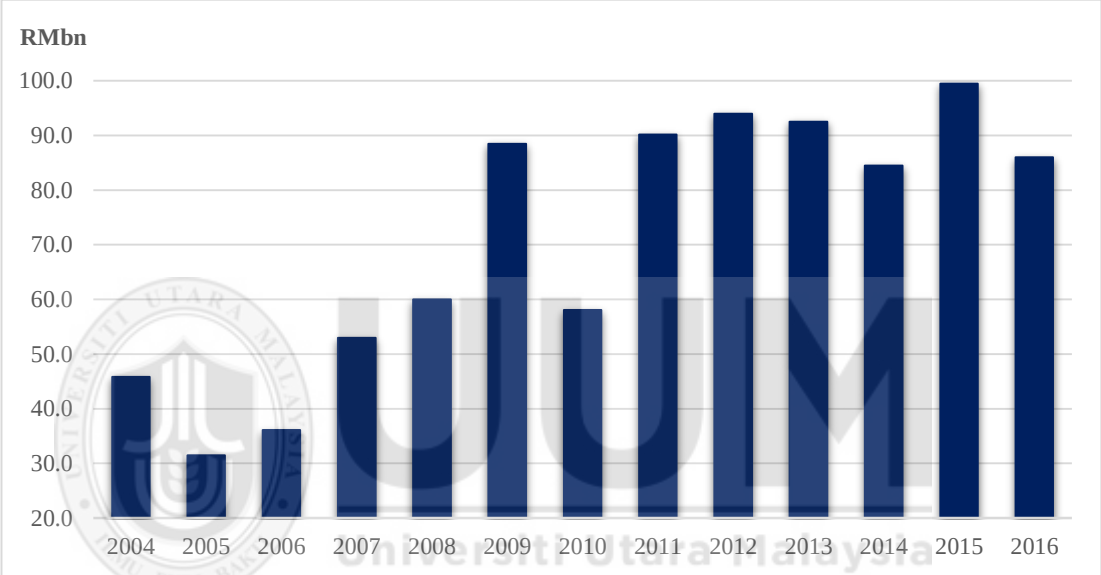
This paper is to examine the response of Malaysian Government Securities (MGS) yield to the monetary policy tightening in Malaysia. According to Dato' Salleh Harun (2002), Malaysia capital market has developed considerably in terms of market size, efficiency and range of instruments. The country's capital market is considered as a well-diversified financial base, which corresponds to the steady economic growth. As such, bond market continues to play a significant role as an alternative source of financing to support the current economic development. Besides that, Malaysia bond market, in particular, has achieved a higher level of efficiency over the years, being one of the fastest growing financial markets in Asia.

Refer to BNM (2017), Malaysian Government Securities (MGS) are interest-bearing bonds issued by the Government of Malaysia via BNM with the objective raising funds from the domestic capital market for the country development spending. MGS are most actively traded bonds in Malaysia bond market. Based on article by Advantage on bonds (2012) holding, bonds market is somehow better than the stock market as it raises a better rate than the rates paid by banks. BNM (2017), the central frequently issues the 3-, 5-, 7-, and 10- year MGS as benchmark securities for the yield curve. In addition, super-long-term MGS (15- and 20-year) maturities have also been issued to lengthen the yield curve.

Therefore, Malaysian government funding through the domestic bond market continued to improve notably showed the trends in the market value of bond issuance.

Total Malaysian government bond issuance is on a rising trend from year to year as shown in figure 1.1. In 2016, the total MGS issuance increased by RM10.0 billion to RM86.00 billion, which is higher than a tenth-year average of RM76.60 billion. As a result, the total MGS outstanding is registered at RM357.40 billion or equivalent to 29.10 percent of the Gross Domestic Product (GDP) in 2016 (BNM 2016).

Figure 1.1:
Total MGS Issuances



Source:Bank Negara Malaysia (BNM)

Refer to BNM annual report (2012); bond yield curve is a line that plots the interest rates of a series bonds of various maturities at a specific period. These bond maturities range from the shortest period of 1-month, up to 10-, or even 30- years for the more advanced markets. The shapes of the bond yield curve indicate market expectations of the future path of short-term interest rates. Research by Siregar, Shimobing, Santosa and Manurung (2014), bond investors use yield curve as a reference in predicting interest rate, specifying bond prices and stipulating a strategy to generate more profit. On the other hand, monetary policymakers use bond yield curve to formulate interest rate, target inflation rate and maintain sustainable economic growth.

According to BNM (2004), the Bank Negara Malaysia (BNM) conducts its monetary policy standpoint based on Central Bank of Malaysia Act 2009 by influencing the level of interest rates that borrowers have to pay on their loans and depositors earnings on their deposits. It is the targeted day-to-day liquidity operation of the BNM.BNM introduced new interest rate framework and adopted overnight policy rate (OPR) used for monetary direction since April 2004. OPR is determined by the central bank in the Monetary Policy Committee (MPC) meeting held throughout the year. The role of BNM is to promote monetary and financial stability, which focused on providing a favourable environment for the sustainable growth of the Malaysian economy. It is effectively the target for the average overnight interbank. The operation of the monetary policy mostly believed that actions by the central bank are directed to the economy through market interest rates. Therefore, changes in interest rate will directly affect the base lending rate (BLR), fixed deposit rate, short-term interest rates, long-term interest rates, foreign exchange rates, the amount of money and credit and ultimately, a range of economic activities, encompassing both the micro and macro factors on the economic activities.

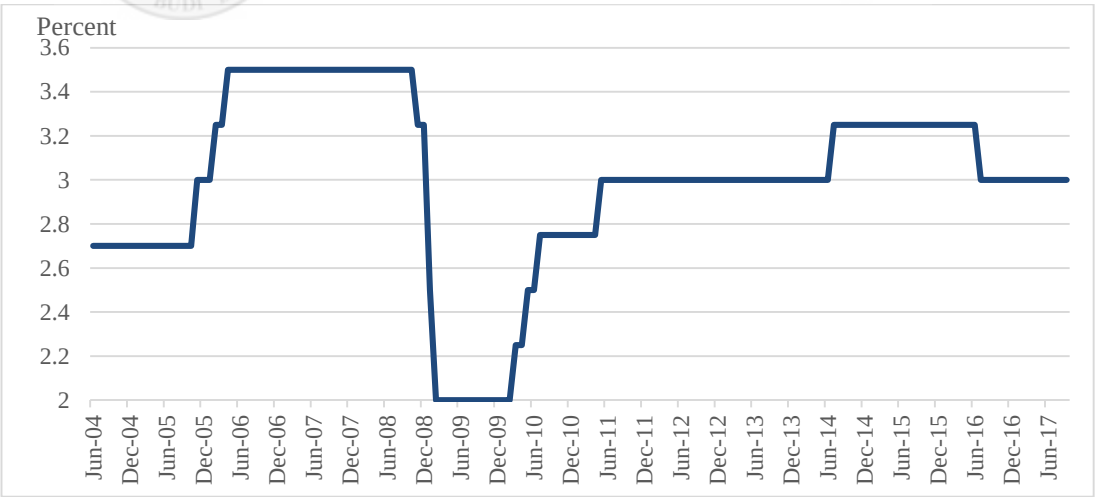
Table 1.1 and Figure 1.2 represents historical data of OPR hikes from 2004 to 2016 observations.There were eight monetary policy tightening decisions made by the central bank of Malaysia (BNM). According to BNM data statistics (2017) the average interest rate for thirteen years recorded at 2.98 percent, reaching an all-time high of 3.50 percent in April 2006 and a record low of 2.00 percent in February 2009.

Table 1.1:
Malaysia Overnight Policy Rate – Monetary Tightening

No	Date	Malaysia Overnight Policy Rate (percent)	
		Prior	Actual
1	30/11/2005	2.70	3.00
2	24/2/2006	3.00	3.25
3	26/4/2006	3.25	3.50
4	4/3/2010	2.00	2.25
5	12/5/2010	2.25	2.50
6	8/7/2010	2.50	2.75
7	5/5/2011	2.75	3.00
8	10/7/2014	3.00	3.25

Source: Bank Negara Malaysia (BNM)

Figure 1.2:
Overnight Policy Rate



Source: Bank Negara Malaysia (BNM)

Research by Ooi Sang Kuang (2008), the MGS yield changes, generally will closely follow changes in the overnight policy rate (OPR). The inter-linkages may have

resulted in stronger correlations between Malaysian interest rate and MGS yield. The yield curve provides vital information on the economic conditions prospects; therefore, it is essential to recognise the level of the co-movement between OPR hikes on Malaysian bond yields. Siregar and et al. (2014) repeated that monetary policy tightening usually results in upward yield curve with a faster short-term increase in yield. This same opinion also stated by Farber (2000) that inverse relationship between market rates of interest rate and bond prices in which the increase in the interest rate will cause the decrease of bond price. With the same view by Ken Little (2010), bond prices move inversely to interest rates, when interest rates go up, bond prices go down, and vice versa. The opinion is also supported by Left Business Observer (1996) who similarly explained that when interest rates increase, the prices of outstanding bonds decline.

Study by Philip Lowe (1995), there are divergence views in theory and reality of monetary policy decision on the movement of the bond yield. In the textbook discussions of the monetary transmission mechanism, the focus is typically on the relationship between the interest and the economy. In the actual situation, there is a whole range of interest rates that affect economic activity. Whereas the levels of the various interest rates tend to move together in the long-run, a considerable divergence between movements often occurs in the short run. There are changes in interest rates at the front-end of the yield curve lead to long-term interest rates moving in the opposite direction. Malin Andersson, Hans Dillén, Peter Sellin (2001) also discovered that unexpected changes in the repo rate (benchmark interest rate) caused a sudden movement in short end of the yield curve in Swedish central bank. Meanwhile, speeches by Executive Board members will create long-term interest rate movements. Based on Ellingsen and Soderstrom (2001), all short-term rates co-move closely with

the target rate. Meanwhile, in standard observation, the monetary policy actions are expected to have a strong, positive effect on the long-term rates. However, Ellingsen and Soderstrom holding the same views with a study by Roley and Sellon (1998), had an opposite view on the long-term rates as they concluded the actual relationship between policy actions and long-term-rates appears weaker and more variable.

According to BNM (2017), Malaysia central bank is a statutory body and started its operations on 26 January 1959. Since its establishments, BNM has served the most vital monetary policy-making body in Malaysia. Governed by the board of directors, the task of Malaysian central bank also covers with several mandates, including maintaining price stability, financial stability and sustainable economic growth. Tan Sri Zeti (2009), commented that in recent years, BNM has increasingly emphasised balancing risks to inflation and growth whenever a policy decision made. Research conducted by Zulkefly Abdul Karim (2014) also stated that BNM had changed the monetary policy strategy from monetary targeting towards interest rate since November 1995 to achieve sustainable long-run economic growth, accompanied by the price stability and financial stability. From the observations, while some target changes are fully expected by the market, some other changes take the financial markets by surprise and led to the shift in market securities substantially.

1.1. Problem Statement

Based on a study by Rodriguez et al. (2016), the first Fed rate hike in December 2015, stated that only the short-term rate increased, while intermediate-to longer-term rates fell. Based on his observation, three factors are influencing the yield movement: supply and demand, inflation, and growth. He also added that global forces, technical and fundamental elements are keeping long-term bond rates low, even as the Fed raises short-term interest rates. Han Ping (2014) discovered the development of China's bond

market should provide conditions for the country's central bank monetary policy. Although the interest rate is the primary indicator in monitoring the effects of monetary policy, the distortion and administrative of the bond market will disturb signal transfer, which will not apply the price discovery mechanism of the bond market and will cause unfavourable central bank's open market operations.

According to Fleming and Remolona (1999) and Elton, Balduzzi and Green (2001) public macroeconomic news and interpretation of the news information influenced the movement in US Treasury and changes in bond price effect flows in trading activity. Green (2004) found macroeconomics news announcements affected the role of bond trading and discovered important macroeconomic news would increase irregular bond information. Based on SEC's investor bulletin (2013), bond yield to maturity show how much investors will earn if the bond hold to maturity.

Kamin and Gruber (2012) and Poghosyan (2012) concluded that from the past research papers, the determinants of government bonds are different based on different countries. Indeed, the findings also showed that there is a positive and negative relationship between government bond yields and their selected factors.

Batten, Fetherston and Hoontrakul (2006) revealed that the interest rate was found to have a negative impact on the yield spread of USD denominated Malaysian bond. They also found that the country's growth rate, inflation rate, interest rates and stock market are the most explainable variables linked to the changes of bond yield spreads.

Following this, even though it is highly in demand, the movement of market securities rates becomes more complicated in regards to the relationship, yet not enough to explain the direction it is heading. In fact, the researcher also does not know whether the previous study which covered mostly in the United States (US), European Union

(EU), United Kingdom (UK) and Japan could be relevant to replicate in the Malaysia situations. The size of bond issuance in developed market is higher compared to the developing countries as the nature of the economic landscape is different. Japanese Government Bond (JGBs) issuance in 2002 recorded 50 percent and 30 percent higher than US Treasuries (USTs) and EU Government Bond (EGBs) respectively. The size of debt securities relative to GDP between US and EU market is around 87 percent is slightly higher than the 16 to 19 percent in Asia during the year.

From the journals observation database, there are limited studies about the impact of interest rates on the Malaysian bond yield, especially on references. Therefore, the researchers believe that this study could provide the best outcome especially it should provide an essential scenario to the impact of monetary tightening actions to the MGS yield. Apart from that, the researcher also believes that this paper should be enhanced and might be showing different results from the underlying bond concept.

Based on the issues from previous studies, the researcher interest to investigate the relationship of OPR hike on the MGS yield over 2004 to 2016.

1.2. Research Questions

This study is to analyse the behaviour of market securities rates during OPR hike. Some research questions are being formulated according to the problem statement of this paper. The details are as follows:

i. Is there any significant relationship between OPR hike and MGS yields during the observed period?

ii. Is there any significant relationship between OPR hike and short-term MGS yield than the medium-term and long-term MGS yields during the observed period?

iii. Is there any significant relationship between OPR hike and medium-term MGS yield ithan the short-term and long-term MGS yields during the observed period?

iv. Is there any significant relationship between OPR hike and long-term MGS yield than the short-term and medium- MGS yields during the observed period?

v. Is there any significant relationship on OPR hike does not effect all MGS yields during the observed period?

vi. Is there any significant relationship on OPR hike does not effect the short-term MGS yields during the observed period?

vii. Is there any significant relationship on OPR hike does not effect the medium-term MGS yields during the observed period?

viii. Is there any significant relationship on OPR hike does not effect the long-term MGS yields during the observed period?

ix. Is the relationship between MGS yield and OPR still applicable to the current Malaysian financial market development?

1.3. Research Objectives

The objectives of this study are as follows:

i. To determine the impact of interest rate on all of MGS yields during the observed period.

ii. To determine the impact of interest rate on the short-term MGS yields than the medium-term and long-term MGS yields during the observed period.

iii. To determine the impact of interest rate on the medium-term MGS yields than the short-term and long-term MGS yields during the observed period.

iv. To determine the impact of interest rate on the long-term MGS yields than the short-term and long-term MGS yields during the observed period.

v. To examine the relevant relationship between bond market and OPR to the current financial market environment.

1.4. Significance of Study

This study will increase better understanding on the relationship between the monetary policy tigthening to the Malaysia bond yield. This study also contribute to new knowledge for academic and industry in relation to Malaysia capital market. As example, for 3Q16, the capital market expanded to RM2.85 trillion compared to RM2.82 trillion in 2015 and continues to play a vital role in supporting growth via financing of infrastructure development and businesses expansion.

1.5. Scope and Limitations of the Study

The scope of this study will cover the Malaysian government securities for the period from 2004 to 2016. The MGS yield move will be used in evaluating its responsiveness to Malaysian interest rates benchmark, which is OPR. The rationale of these scope period is based on the monetary tightening actions that occurred during the economic boom. Nonetheless, limitation of the study remains, particularly in collecting data, articles and journals related to the study. There was a constraint in getting the benchmark for 7-year MGS yield database primarily due to the lack of available data during the whole period of monetary policy tightening actions. Apart from that, there was also the limited number of available journals that cover on Malaysia bond market in particular. Thus, a concentration in reading those facts and evidence is needed to get related information towards the study. The researcher also has to use other countries especially major countries such as the United States of America (USA) and European countries as a primary reference to the study.

1.6. Organization of the Thesis

This study begins with an introduction of the study, followed by the background of the study, research questions, objectives of the study, significance of the study and scope as well as limitation of the study. The following chapter, which is chapter 2 discuss the literature review which will briefly explain the facts and evidence about the study references related to the study matter. This chapter is important to develop a hypothesis for this research. Chapter 3 discuss about formulating the research design, data collection and data variables. Chapter 4 is analyse the details and empirical findings. The empirical results should explain whether to accept or reject the hypothesis of the research. Hence, chapter 5 is the main conclusion and recommendation, resulted from data analysis results.

CHAPTER 2

LITERATURE REVIEW

2.0. Introduction

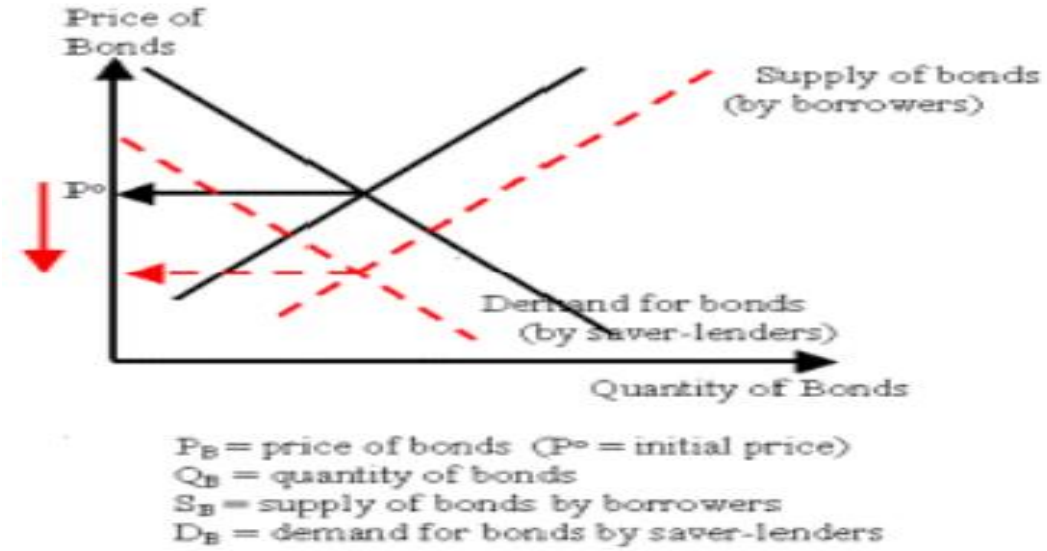
This chapter discusses the relevant literature review and past studies which related to the theories of the term structure of interest rates, bond yield, bond price and term of maturity as well as other factor that impact on the responsiveness of bond yield to the monetary policy.

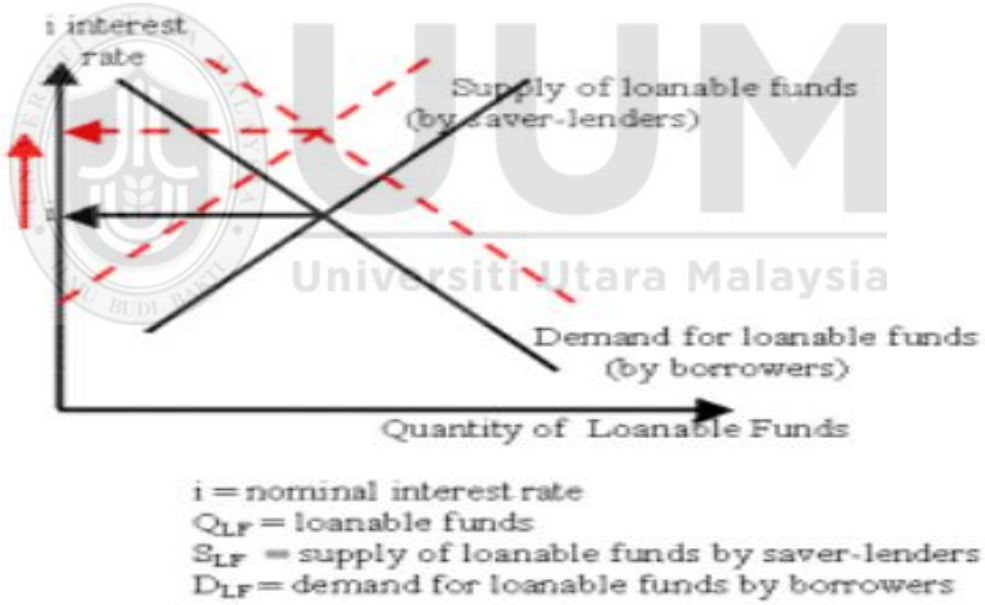
2.1. Theories of the Term Structure of Interest Rates

Mankiw (2012), one of the earliest formal dynamic models, which illustrates the relationship between inflation, nominal interest rates and the real interest rate is the Fisher effect in 1896. The theory of interest by Irving Fisher (1930) specified that supply and demand curves for bonds would move if interest rates are predicted to increase. According to the Fisher equation, a 1 percent increase in the rate of inflation in turn causes a 1 percent increase in the nominal interest rate. The one-for-one relation between the inflation rate and the nominal interest rate is called the Fisher Effect. Figure 2.1 and 2.2 explains the Fisher effect in the market for securities with the expectation of interest rate to increase. The graph below shows that the demand for bonds (and the supply of loanable funds) will decrease; while the supply of bonds (and the demand for loanable funds) will increase. It causes current bond prices to fall and current interest rates to rise.

Figure 2.1

The Fisher effect for market securities with the expectation of interest rate to increase



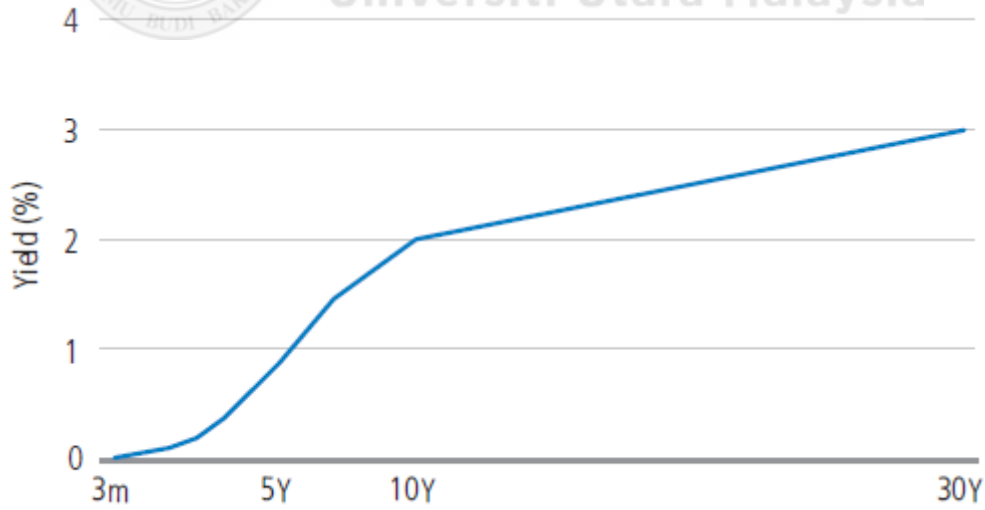


Source : Iowa State University,2003

Furthermore, John Hicks's (1939) expectation theory of term structure holds that the slope of bond yield curve reflects only investors' expectations for future short-term rates. Much of the time, investors expect interest rates to rise in the future, which accounts for a normal upward slope of the bond yield curve. This theory assumes that bonds with different maturities are perfect substitutes. Expectation theory also proves

that two facts, first, the interest rate for different maturities move together over the time and second bond yields on short-term bond more volatile than yields on long-term bonds. Historically, the slope of the bond yield curve has been a good leading indicator of economic activity as the bond yield curve can summaries where investors think interest rates are headed in the future. Given the fact that bond yield curve continuously reflects a prediction point for forecasting interest rates, bond prices and creating strategies for boosting total returns. Bond yields on long securities are higher than short-term securities. According to US Treasury Department (2011), the Treasury bond yield curve used heavily due to Treasury bonds has no perceived credit risk. Figure 2.2 shown the US Treasury bond yield curve on 1st November 2011. Details show both the 3-month and 2-year US Treasury yield below 1 percent respectively, while the 10- and 30-year offered yields about 2 and 3 percent individually.

Figure 2.2
US Treasury Yield Curve on 1 November 2011



Source : U.S Treasury Department

2.2. Bond Yield, Bond Price and Term of Maturity

According to Stifel Financial Advisors (2015), bonds are deemed a "safe" investment. Similar to the stock market, the price of bonds fluctuates. Megginson, Smart and Gitman, (2007) and Bodie, Kane and Marcus (2008) discovered that investing in bond is related to investment in the form of the debt instrument, which promises payment of a fixed amount from the income streams and the bond's principal amounts or its par value at the maturity date. Another type of bond investors is the one that is looking at benefits of the rise in the bond prices. Besides that, Lawrence J. Gotman (2006) revealed that the underlying bond fundamentals are the amount borrowed by the company and the amount outstanding to the bondholder on the maturity date. The maturity date is the time at which bond becomes due, and the principal must pay up.

Megginson, Bodies, Smart and Gitmann, (2007) explained that investing in bond is related to investment which promised to pay a fixed amount of income and principal amount at the maturity date. The basis of bond theory relationship is the ability to understand the behavioural bond price as per stated in various textbooks, including Sharpe and Alexander (1990), Kolb (1992), Jones (1998), Brealey and Myers (2003), Ehrhardt and Brigham (2006), Fabozzi (2010), and Anastasios Evgenidis Costas Siriopoulos (2014). The basis of the relationship between bond coupon rate, and bond yield and bond price has been derived by Malkiel (1962) in his five bond theorems, in which the par or principal value is paid out over time, often unpredictably, including mortgage-backed securities and collateralized mortgage obligations. In particular, if the yield equals to coupon rate, then immediately after the coupon is paid, a bond will sell for its par value. In advance, a bond will sell for a premium (discount) if the yield is less (higher) than the coupon rate.

According to Arturo Estrella and Fredric (1995), the yield curve could also provide decent information about future inflation and real economic activity in going forward. Importantly, the central bank can influence the direction of the yield curve, but cannot control it in any meaningful sense. For example, the yield curve mostly provides a reasonable prediction of inflation outlook for about three and five years ahead. Indeed, even with a weak result, the yield curve could translate into a valuable indication about the stance of monetary policy.

Specifically, in Malaysia perspective, a study by Mohammad Nazri Ali et al. (2015), bonds are important financial instruments and the largest contributor to the financial market in Malaysia. It is a loan given to buyers of bonds by issuers (such as corporate and government), and its price is determined by the yield curve. It is used to predict the level of interest, estimating the price of a security and an indicator balance between maturity and yield.

2.3. Monetary Policy Tightening

According to Arturo Estrella and Fredric (1995), during monetary policy tightening, the action taken by the central bank should have differential effects between short-term and long-term interest rates. In particular, at the short-term bond yield, the main effect of a tightening in the supply of credit is directly translated to an increase in interest rates. But, for the long-term bond yield, it is more driven by future long-term interest rate and inflation expectation. If the tightening viewed is credible, reduced long-term inflationary expectations should moderate the effect of tighter initial credit conditions. Therefore, it will lead to flattening the yield curve, where higher short-term rates than long-term, results in the narrowing spread between long-term and short-term yield spread.

A study by Marvin (1998), the term structure of interest rates has long been of interest rate to monetary policymakers and their advisers. The transmission of monetary policy is viewed as running from short-term interest rates managed by central banks to longer-term rates that influence aggregate demand. A central bank's leverage over longer-term rates comes to determine the short-term rates over the relevant horizon.

According to Kozicki and Sellon (2005), which investigated the Federal Reserve Bank of Kansas during its two episodes of policy tightening somewhere in 1999-2000 and 2004-05. The relationship between monetary policy tightening and the yield curve can be used to analyse the behaviour of the long-term rates. The results showed that this relationship is highly variable over time and complex. Similarly, Ellingsen and Soderstrom (2001) study proposed a model that incorporates different theories of the behaviour of the yield curve after a change in monetary policy. They also observed that the monetary policy response on the economic developments (endogenous policy) should move in the same direction as the short-term and long-term interest rates, but the policy preferences (exogenous policy) will only move in the opposite direction of the short-term and long-term interest rates. In China market, Balduzzi ans etl. (1997), analyse the Federal Reserve's short-term target rate and its effect on the yield curve. The analysis shows that the spread between the short-term interest rate and the overnight Federal Funds Rate (FFR) is mainly influenced by the expectation of changes in the target rate. Also, Campbell and Shiller (1991) found that a yield spread between a longer-term and a shorter-term interest rate forecasts is rising shorter-term interest rate over the long-term, but a declining yield on the longer-term bond over the short-term.

According to Kozicki and Tinsley (2001), a long-term rate is the average of a shorter term rate and a longer horizon forward rate. The long-term rate will change if the short-

term move. The most important factor influencing these two rates is likely to be investor's views about how monetary policy will evolve over the long run. Therefore, a short-term move with near-term expectations of policy often reflects cyclical considerations. In the early stages of business-cycle recoveries, policy tightening is typically needed to remove accommodation initially intended to help the economy escape from a recession. In the late stages of business-cycle expansions, policy tightening is instituted to suppress excess demand and inflationary pressures. Thus, short-term rates heavily influenced by investors' views about how monetary policy will be used to stabilise business cycle fluctuations. Hence, the long horizon of the expectations, this inflation rate can be interpreted as the market's view of the Federal Reserve's inflation objective.

Balduzzi, Bertola, and Foresi (1997) analyse the importance of central banks official rates in the United States (US). The research finds that the spread between the short-term interest rate and the target rates is mainly influenced by expected changes in the target rate. Meanwhile, Longzhen Fan a and Anders C. Johansson b,(2010) also discovered a similar result in the case of the monetary policy framework in the US and the European Union. The results showed that the short-term interest rate would be more significant to the monetary policy action, but the market reaction will determine the direction of medium-term and long-term interest rates. Similarly, a study by Rodriguez et al (2016), the Federal Reserve of United States will change the interest rate to influence the short-term yields. Therefore, there is a relationship between the monetary policy and the short-term yield curve. Nonetheless, the long-term securities are more concerned about inflation and risk premium. The Federal Reserve measures it by managing the supply of money in the economy that affects future market expectations about inflation, which is likely to influence the long-term interest rates.

For instance, if the expectation about the central bank is to fight against inflation, then the long-term rates will decline and vice versa.

2.4. Other Factor Impact on Responsiveness of Bond Yield to the Monetary Policy

Dwyer and Hafer (1989) and Hardouvelis (1988) observed an announcement of information giving a higher tendency of information asymmetry in the US treasury market. Effect of external interventions in the markets by the Federal Reserve causes jumps. Supply shocks are another factor; as regular debt refunding's inject sufficient volume to increase price effects. Johannes (2004) agreed that monetary policy is one of the prominent influences on the short-term interest rate. However, there are also other factors that influenced the interest rate decision such as the current domestic, external economic developments and political issues that should also move the short-term interest rate results.

Sanjiv R. Das (2001) surveyed a surprise element as a significant factor that could substantially impact yields, bond prices and bid-ask spreads in fixed income market. For example, demand shocks like market behaviour at Treasury auction often result in jumps concurrent with economic news announcements. He extended his research and highlighted that the jumps in the FFR are more apparent when the Federal Open Market Committee is conducting its meetings. There are some reasons why increases may occur in interest rates, including central bank interventions, macroeconomic surprises, shocks in the exchange rate, and extreme market events. Andersson et al. (2006) analysed how different monetary policy signals influence interest rates. Using signs such as repo rate changes, inflation reports, public speeches and reports from meetings, they show that monetary policy signals have significant effects on the Swedish yield curve.

Besides that, Matthew B. Canzoneri and Behzad T. Diba (2005) detected that indeterminacy of real bond balances is related to price indeterminacy. To deliver local determinacy in the monetary policy response to inflation, the specification of fiscal policy effects is essential. Therefore, apart from monetary policy, fiscal policy also plays a potential role in price determination. A research study by Bodo Herzog and Johannes Müller (2014) stated that weak government policies and the effects of asymmetric information could lead to substantial disconnect of bond spreads from the individual bonds underlying fundamental value in Euro area sovereign bond markets especially in 2010. Therefore, market incentives via consistent rules, pre-emptive austerity measures in good times and a resolution scheme for heavily indebted countries are an important initiative for the Euro area government to enhance economic growth.

Dionisis Philippas and Costas Siriopoulos, (2014) also discovered that the bond yields is not a constant effect to the introduction of Monetary Union (EMU) of European (EU) government bonds. Based on money market determinants, there is a nominal convergence between EMU bond yields. In this crisis mode, external shocks and investors sentiments are the essential factors towards bond market convergence. Therefore, coordination of monetary and fiscal policy actions in EU countries is vital to secure the growth. Meurer, Santos and Turatti (2015) research on monetary policy action in Brazilian central bank stated that the communication between the central bank and the market would affect expectations and asset values. Based on Ken Szulczyk's (Ja) analysis, there are factors that shift supply and demand functions, which change the bond market regarding quantity, price, and interest rate. These features determine interest rate behaviour during business cycles and recessions, which was introduced by the Fisher effect (1930).

2.5. Empirical Review

Fundamental bond valuation (2002), indicates that bond prices and market interest rates are a move in opposite directions as interest rates rise, the price of a bond will decrease and vice versa. This relationship between bond prices and interest rates arises directly from the present value relationship that governs bond prices. According to Robert Berec (2010), the sensitivity of bond prices to changes in interest rates is measured by bond duration. Bonds with high durations are highly sensitive to interest rate changes and vice versa. The formula is as below :-

$$\text{PV of Bond} = \sum_{t=1}^{t=N} \frac{\text{Coupon}_t}{(1+r)^t} + \frac{\text{Face Value}}{(1+r)^N}$$

Where Coupon_t is coupon expected in period t, Face value is face value of the bond and r is discount rate for the cash flows. Any increase in interest rates, will lower the present value of the stream of expected cash flows and hence the value of the bond. Any decrease in interest rates will have the opposite impact. Study by Berker and Demerzo (2011), the interest rate sensitivity of bonds indicates that the price of the longer-dated for a 30-year bond with high coupon rate its sensitive to a change in yield is less than the 15-year zero coupon bond.

Study Bank of International Settlements (2005) and European Central Bank (2008), discovered that the Nelson-Siegel (NS) model is widely used by central banks and monetary policymaker for bond term structure model. Uhrig-Homburg and Dullman (2000) use the NS model to describe the yield curve of Deutsche Mar-denominated bonds to calculate the risk structure of interest rate. Nielson and Siegel (1987) and

Svensson (1994,1996) recommended the model are adequate to define bond term structure shape, which is to extrapolate the bond yield curve, predicts the level, slope and curvature components of the bond yield curve. Furthermore, about level, slope and curvature factors present in the Nelson-Siegel approach, the Svensson model contain a second trough factor which allows for a broader and more complicated range of term structure shapes. Nelson-Siegel method states that the estimated bond price equation is given as follow:

$$P^{NS}(m) = \sum_{i=1}^{n} CF_i \exp\left\{-\left(\beta_0 + \beta_0\left(\frac{1-e^{-\frac{m}{\tau_1}}}{\frac{m}{\tau_1}}\right) + \beta_2\left(\frac{1-e^{-\frac{m}{\tau_1}}}{\frac{m}{\tau_1}} - e^{-\frac{m}{\tau_1}}\right)\right)\right\}$$

where βo , $\beta 1$, $\beta 2$ and $\tau 1$ are parameters to be estimated based on the initial conditions. $\beta 0$ represents the long-term interest rates. $\beta 1$ and $\beta 2$ also determine the form of the slope and curvature parameters. $\tau 1$ determines the position or the presence of the arc. $\beta 0$, $\beta 0 + \beta 1$, $\tau 1$ must be a positive value.

2.6. Chapter Summary

In this chapter, the researcher had discussed the previous study; It includes the theories of the term structure of interest rates, bond yield, bond prices and interest rates. Next, the monetary policy action environment and other factors influence on the responsiveness of bond yield to monetary policy action, followed by the empirical review. The next chapter, chapter three will discuss the methodology for the study.

CHAPTER 3

METHODOLOGY

3.0 Introduction

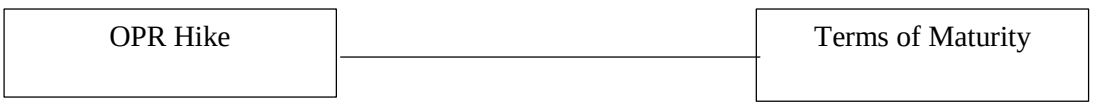
The purpose of this study is to examine the theory and the reality of responsiveness of Malaysia Government Securities (MGS) yield to the monetary policy tightening actions

3.1 Research Framework

The monetary policy decision is a significant indicator in determining the same direction to short-term and long-term interest rates. According to Arturo Estrella and Fedric (1995), the yield curve based on the respective term of maturity (short-term, medium-term and long-term bond years) mostly provides a better forecast for growth and inflation outlook for more than five years ahead.

In this section, the researcher developed hypothesis according to the previous studies by defining the Malaysian Government Securities (MGS) reactions to the 5-, 15- and 25- days prior and post-trading days and during an announcement of Overnight Policy Rate (OPR) hike (T-day). Figure 3.1 shows research framework of this study, which aims to examine the responsiveness of MGS yield to OPR hike. The details as follows:

Figure 3.1
Research Framework



In this paper, the researcher examines the determinants of the term of maturity, where short-term, medium-term and long-term bond yield used as a dependent variable. Meanwhile, the independent variable is OPR during the monetary policy tightening periods.

3.2 Hypothesis Development

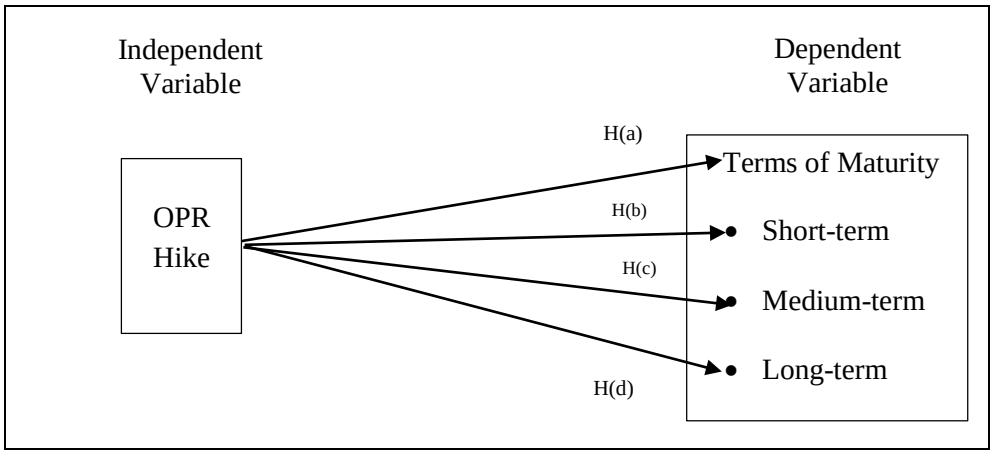
A study by Rodriguez (2016) showed that an inverse relationships between short-term bond yield versus intermediate and longer-term bond yield during the first Fed fund rate hike in December 2015. The study stated that short-term rate increased, while intermediate-to longer-term rates fell in response to interest rate hike. In other research paper by Longzhen Fan a and Anders C. Johansson (2010) did a study in monetary policy framework in US and the European revealed that the changes in monetary policy only effect the short-term interest rate whereby the changes in medium to long-term interest rate is determined by the market reaction. In argument, Kozicki and Tinsley (2001), the medium-term changed whenever there is change in the interest rate and his study are focused on 10 years bond maturity.

Therefore, based on previous studies in the developed economies, the researcher established two main part of hypothesis cover the sensitivity and non sensitivity of OPR hike to MGS yields within observation period.

3.2.1 Sensitivity Hypothesis

There are four hypothesis developed for sensitivity study as shown in the figure 3.2 below.

Figure 3.2:
Sensitivity Hypothesis



H(a): OPR hike is more sensitive to All MGS yields during the observed periods.

This study hypothesised that OPR hike is more sensitive to all MGS yields during the observed periods.

H(b): OPR hike is more sensitive to the short-term MGS yield than the medium-term and long-term bond yields during the observed periods .

This study hypothesised that the OPR hike is more sensitive to the short-term MGS yield than medium-term and long-term bond yields during the observed periods.

H(c): OPR hike is more sensitive to the medium-term MGS yield than the short and long-term bond yields during the observed periods.

This study hypothesised that OPR hike is more sensitive to the medium-term MGS yield than the short and long-term bond yields during the observed periods.

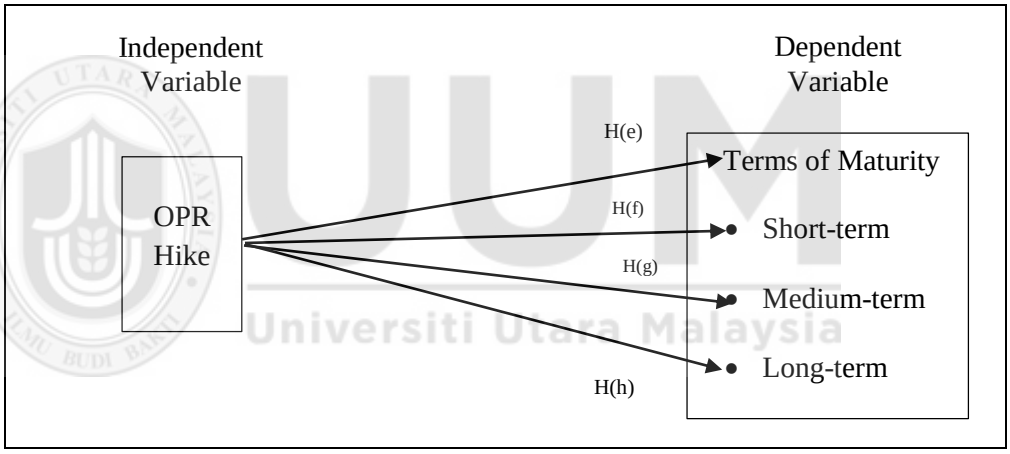
H(d): OPR hike is more sensitive to the long-term MGS yield than the short and medium-term bond yields during the observed periods.

This study hypothesised that the OPR hike is more sensitive to the long-term MGS yield than the short and medium-term bond yield during the observed periods.

3.2.2 Non-Sensitivity Analysis

There are four hypothesis developed for non-sensitivity study as shown in the figure 3.3 below.

Figure 3.3:
Non-Sensitivity Hypothesis



H(e): OPR hike is not sensitive to All MGS yields during the observed periods.

This study hypothesised that OPR hike is not sensitive to all MGS yield during the observed periods.

H(f) : OPR hike is not sensitive to the short-term MGS yield than the medium-term and long-term bond yields during the observed periods .

This study hypothesised that OPR hike is not sensitive to the short-term MGS yield than medium-term and long-term bond yields during the observed periods.

H(g): OPR hike is not sensitive to the medium-term MGS yield than the short-term and long-term bond yields during the observed periods.

This study hypothesised that the OPR hike is not sensitive to medium-term MGS yield than the short-term and long-term during the observed periods.

H(h): OPR hike is not sensitive to the long-term MGS yield than the short-term and medium-term bond yields during the observed periods.

This study hypothesised that the OPR hike is not sensitive to long-term MGS yield than the short-term and medium-term bond yields during the observed periods.

3.3 Research Design

This study has investigated the reaction of MGS yield that changes to 5-, 15- and 25-days prior and post-trading days and include the T-day to OPR hike. A study by Zikmund et al.(2010) showed that research design is an expert organisation that indicates methodology for gathering and dividing the required data available. It provides an arranged information in the study. Therefore, research design is the blueprint of research that consists of an explanation of each of research process and how it related to each other. The short and medium-term during the observed periods.

Figure 3.4:
Research Design of the Sample

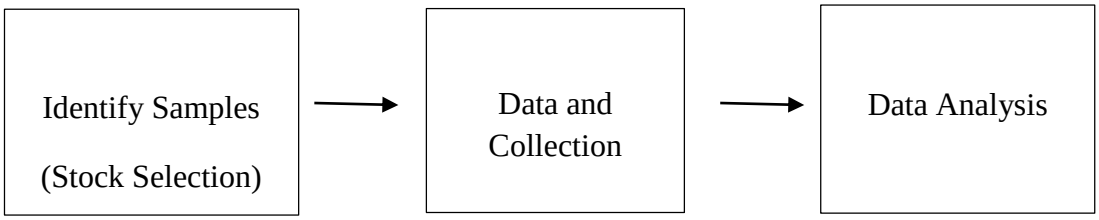


Figure 3.4 above describes the planned research process. The research methodology will provide a guide to examine the bond yields movement due to monetary policy tightening actions.

3.4 Variable Selection

In this study, the researcher examines OPR hike as the independent variable and MGS yield as the dependent variable. MGS yield has a significantly different maturity date. The characteristic of this study is to examine the reaction of MGS yield changes to OPR hike prior, on and after the announcement of monetary policy tightening by the central bank.

3.5 Data Collection

All data in this study are secondary data. The collection of data consists of three sample stock codes of MGS yield from different maturities. Periods of the analysis cover 5-days,15-days and 25 days prior and post-trading days and during the announcement of OPR hike day (T-day). In this study, all datasets for MGS yield are taken from Bloomberg, while all OPR hike data information is extracted from the BNM website.

3.6 Sampling

Table 3.1 below shows samples of three main MGS stock codes observed in this study namely, the benchmark for 3-year MGS is be considered as the short-term MGS yield, the benchmark for 5-year MGS yields is known as the medium-term MGS yield, and the 10-year MGS yield is being categorised as the long-term MGS yield.

Table 3.1
Details of Sample Stock Codes

No	Stock Codes	Maturity
1	MAGY3YR Index	MGS short-term
2	MAGY5YR Index	MGS medium-term
3	MAGY10YR Index	MGS long-term

Source: Bank Negara Malaysia (BNM)

Meanwhile, table 3.2 below shows an eight of Malaysian OPR during monetary policy tightening. The historical rates of monetary tightening at each period are around 25 bps.

Table 3.2:
Malaysia Overnight Policy Rate – Monetary Tightening

No	Date	Malaysia Overnight Policy Rate (percent)	
		Prior	Actual
1	30/11/2005	2.70	3.00
2	24/2/2006	3.00	3.25
3	26/4/2006	3.25	3.50
4	4/3/2010	2.00	2.25
5	12/5/2010	2.25	2.50
6	8/7/2010	2.50	2.75
7	5/5/2011	2.75	3.00
8	10/7/2014	3.00	3.25

Source: Bank Negara Malaysia (BNM)

3.7 Data Collection Procedures

The sample of MGS yield used in this analysis is short-terms MGS yield, medium-terms MGS yield and long-terms MGS yield. The study will concentrate on the MGS

yields reaction to OPR hike towards the time horizon. The time horizon is based on prior, on and after an announcement of OPR hike according to observed periods. Furthermore, to examine the result from a wider angle, a total of 397 numbers of each dataset are examined. There will be a 5-,15- and 25- days prior and post-trading days and the day of OPR hike announcement (- 5 + T-day + 5), the 15 days (- 15 + T-day + 15) and the 25 days (- 25 + T-day + 25). Total days covered will be 51 days. The research period is from the year 2004 to the year 2016.

3.8 Techniques of Data Analysis

In this study, the researcher is focused on several tests in an aims to evaluate the responsiveness of Malaysian bond yields to OPR hike during observed periods. There are several tests need to be performed in this study such as :

i. Data descriptive is used to perform the basic features of data statistic in the study. According to Thompson (2008), the descriptive statistics are summarize of sample behavior which can detect sample charateristics that may influence the conclusion.

ii. Testing for stationary is vital for standard econometric theory. The unit root test using Augmented Dickey-Fuller (ADF) (1979) is tested for stationary to tackle autocorrelation problem. Unit root tests are generated using two hypothesis. In statistics, the null hypothesis is defined as the presence of unit root and the alternative hypothesis is whether stationarity, trend stationarity or explosive root depends on the test used.

iii. After testing unit root for all variables, the equation of the model is tested using simple linear regression, a form of an equation or model connecting the response of variable (Y) and explanatory variable of (X). Through simple linear regression, the

estimation is extremely fast as the s the analysis is done on the term structure dynamics. This allows the researcher to interpret bond yield in the event of interest rate tighthening. Adrian, Crump and Moech (2012) also used the simple linear regressios to the US Treasury yield curve at the daily frequency. The regression model will be based on an observation period as follows:-

Figure 3.5 :
Simple Linear Regression Equation

Short-term bond yield (MGS short-terms) =	a+b (Interest Rate) +c
Medium- term bond yield (MGS medium-terms) =	a+b (Interest Rate) +c
Long- term bond yield (MGS medium-terms) =	a+b (Interest Rate) +c

Figure 3.5 represents the MGS yield considered is a dependent variable, in which an as a constant value, b representing coefficient for independent variable and c is a random error term. The interest rate is based on the time where the central bank is tightening the monetary policy. Five components are selected to measure the results of this study, which are the R squared, the coefficient, the p-value, the probability F-statistic and the Durbin Watson (DW) (1971). Obtaining a high R squared does not necessarily mean that there is a meaningful relationship. However, it could be a potential problem if the data does not show the true relationship between the two variables. The coefficient of determination is also used to explain the power of the equation, with the range determinant from 0 to 1, which is to measure how well the regression equation fits the data. It acts as a tool to determine the percentage change of the dependent variable to the independent variable. In addition, the p-value and the

probability F-statistic are also referred to measure how well the probability of finding is observed as well as the overall equation in the model. Apart from that, in the model, the researcher also evaluates the Durbin Watson (DW) statistic, which is used to test for autocorrelation in the residual with a statistical regression model. The DW is considered between 0 and 4, where the researcher indicates the value of 1.5 to 2.5 which means that their model is free from autocorrelation problem.

After completing the stationary test for each variable, the level of cointegration is also investigated using Johansen test of cointegration. In this study, the VECM is to measure whether the variable has a long-term equilibrium relationship, while the standard Granger causality test is to check for the causal relationship between the variable. A study by Norliza et al. (2009) showed after correcting the statistical value, both trace-statistical and max-eigenvalue under the VECM model, both test presence a single co-integration vector in the model were confirming the existence long-run stable linear equilibrium relationship between corporate bond and MGS.

Furthermore, the causal relationship is check using the Granger Causality (1987). The Granger causality will check whether it is bi-directional or uni-directional by examining the null hypotheses whether the MGS yield has Granger-cause to OPR hike or OPR hike has Granger-cause to MGS yield. In the same study by Norliza et al. (2009), the existence of cointegration proved by the significance of at least Granger Causality Test although the adjustment from short-run dis-equilibrium to long-run dis-equilibrium not necessarily from the same channel. The study showed a mixed result from government bond to industrial production, consumer price index, and interest rate.

3.9. Chapter Summary

This chapter explains in detail the overall methodology procedures to be used by the researcher in this study. The researcher begins with an introduction to the overview of methodology concept, followed by the research framework and hypotheses of the study. Then, the researcher discovered the research design, variables selection, data collections, sampling and data collection procedures of the research to be conducted in this study respectively. Furthermore, the technique of data analysis especially to propose the reliability measurement of methodology in this study is also explained in in the final part in the methodology of this research.

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Introduction

This chapter will focus on examining the response of Malaysian Government Securities (MGS) yield to Malaysian Overnight Policy Rate hike (OPR). In this analysis, the researcher segregated the bond yield based on terms of maturity. There are three broad categories, including the short-term bond yield (3-year MGS yield), the medium-term bond yield (5-year MGS yield) and the long-term bond yield (10-year MGS yield). Each of the benchmark MGS yields will be based on 5-, 15- and 25-prior-trade days, during the announcement ORP hike day (T-day) and the 5-, 15- and 25- after-trade days. Below are the details of analysis that will be tested for this study;

4.1 Descriptive Statistics of OPR hike and the benchmark for the short-term, medium-term and long-term MGS yields

Table 4.1 represents the descriptive statistics of OPR hikes and the MGS yields. The dependent variables are the terms of maturity based. The independent variable is the OPR rates hike. In this study, the observation years are from 2004 until 2016.

Table 4.1

Descriptive Statistics of OPR Rates Hike to Term of Maturity (Short-term, Medium-term and Long-term)

Variables	OPR hike	Short-term MGS yield	Medium-term MGS yield	Long-term MGS yield
			Percent (%)	
Number of variables	397	397	397	397
Mean	2.81	3.41	3.71	4.13
Minimum	2.00	2.96	3.28	3.84
Maximum	3.50	4.36	4.60	4.95
Standard Deviation	0.41	0.27	0.23	0.20

Source: Data Analysis, excel 2013

Table 4.1 above is the summary of descriptive statistics for OPR hike and the terms of maturity. The total number of observations recorded at 397. Four variables are used in this analysis, including mean, minimum, maximum and standard deviation.

All samples have a positive mean, with the short-term MGS yield is at 3.41 percent, the medium-term MGS yield is at 3.71 percent, and the long-term MGS yield is at 4.13 percent respectively. Meanwhile, for OPR hike the mean is at 2.81 percent. The minimum and maximum level on the terms of maturity are recorded 2.96 percent and 4.36 percent for short-term bond yield individually, while the minimum and maximum rate for the medium- and longer term bond yield are at 3.28 percent, 3.84 percent, 4.60 percent and 4.95 percent respectively. Meanwhile, the minimum and maximum for OPR hike are at 2.00 percent and 3.50 percent. Standard deviation, which is used to measure the volatility and the riskiness of the instrument also show higher standard deviation in short-term bond yield, followed by medium-term and longer-term bond yield respectively. The benchmark for short-term MGS yield is at 0.27 percent, while 5- and long-term MGS yield registered at 0.23 percent and 0.20 percent respectively.

4.2 The Augmented Dickey-Fuller (ADF) Test

The Augmented Dickey-Fuller (ADF) using e-views econometrics was performed to examine each variable for unit root test. On MGS yield, all at levels that show the existence of a unit root based on the p-value is above 0.05 percent. From observations, the MGS yield becomes stationary after first differencing them with the given p-value is below than 0.05 percent, except for short-term MGS yield during OPR hike on 24 February 2006. Also the medium-term MGS yield during OPR hike on 12 May 2010, short- and medium-term MGS yield during OPR hike on 5 May 2011 and medium-term MGS yield during OPR hike on 10 July 2014 which become stationary at the level based on the p-value below than 0.05 percent.

The results of ADF test for all data of OPR hike in the various periods at the level that shows the existence of a unit root based on the p-value higher than 0.05 percent. That means an increase of OPR is not stationary in levels but become stationary after first differencing based on the p-values is less than 0.05 percent.

Therefore, the results of testing for stationary can be concluded via two characteristics. Firstly, the test used integration of order at first difference, I (1), which is based on the MGS yield is at D(yield) and OPR hike at D(OPR). The equation is; D(MGS yield) = D(OPR hike) + c. Secondly, in the case of the other series, the MGS yield is significant at the level. Therefore, the series can be said to be difference order integration, with MGS yield and D (OPR). Hence, the equation is (MGS yield) = D (OPR hike) + c.

4.3. The 5-, 15 and 25- days prior and post-trade and T-day to the OPR hike for the short-term MGS yield

The table 4.2, 4.3 and 4.4 below summarises the results of the 5-, 15- and 25 days prior and post-trade and T-day of the short-term MGS yields to OPR hike. The benchmark

3-year MGS yield is grouped as short-term paper, the benchmark for 5-year MGS yield as medium-term paper, and the benchmark for 10-year MGS yield are known as longer-term paper. There will be a total of eight OPR hike, in which the data analysis is focusing on a total number of 5-, 15- and 25- day's periods before the trade, T-day and after the trade.

Table 4.2

Descriptive Statistics for the 5-days prior and post-trade and T-day to the OPR hike for the benchmark short-terms MGS yield

No.	Date	Prior OPR	Actual OPR	R^{2*}	Coefficient	Durbin-Watson
1	***30 November 2005***	2.70	3.00	76.0	0.23	1.84
2	24 February 2006	3.00	3.25	0.007	-0.12	1.18
3	26 April 2006	3.25	3.50	9.0	0.08	1.68
4	***04 March 2010***	2.00	2.25	54.0	-0.15	2.11
5	12 May 2010***	2.25	2.50	0.003	-0.01	1.43
6	08 July 2010	2.50	2.75	35.0	0.01	2.10
7	05 May2011	2.75	3.00	22.0	0.02	0.67
8	10 July 2014	3.00	3.25	0.003	0.00	1.19

R^2 in percent (percent)
*P-value *** significant at 1percent, ** significant at 5percent, * significant at 10percent*
*Prob (f-stat) *** significant at 1percent, ** significant at 5percent, * significant at 10percent*
Source: Simple Linear Regression, E-view 9

Table 4.2 shows an increase of OPR on 30 November 2005 is statistically significant to predict the short-term MGS yield. The results show a very high correlation of 76 percent, as the p-value is 1 percent level of significance and probability F-statistic indicates that the joint effect of two variables is significant at 1 percent level. Also, the results show a positive coefficient, which indicates that 1 percentage point increase of OPR hike can explain an increase of 0.23 percentage point in short-term MGS yield. The result is consistent with the researcher's prediction. Also, the model is also free

from the effect of serial correlation because the value of Durbin Watson (DW) is in the range of 1.5 to 2.5.

Meanwhile, the short-term MGS yield during OPR hike on 4 March 2010 shows that the regression model is fitted firmly to the observation data, evident by higher correlation, with the p-value and probability F-statistic statistically significant to the short-term MGS yield. The results prove that the correlation is at 54 percent, while the p-value and probability F-statistic are at 1 percent level of significance, indicating that overall variable is significant for the model. However, the relationship for OPR hike on 4 March 2010 is inconsistent with the researcher's prediction, as backed by a negative coefficient result. For instance, an increase of OPR by one percentage point can explain a decrease of 0.15 percentage point in the short-term MGS yield. The overall model is also free from the effect of serial correlation because the value of Durbin Watson (DW) is between 1.5 and 2.5.

The results also indicate a very low correlation and positive coefficient during OPR hike on 26 April 2006, 8 July 2010 and 5 May 2011. Meanwhile, the p-value and probability F-statistic are at more than 1 percent, 5 percent and 10 percent significant levels, which mean that the model is deemed to be inconsistent in explaining that the short-term MGS yield influences OPR hike during these observed periods.

Table 4.3

Descriptive Statistics for the 15-days prior and post-trade and T-day to the OPR hike for the short-term MGS yield

No.	Date	Prior OPR	Actual OPR	R2	Coefficient	Durbin Watson
1	30-Nov-05***	2.70	3.00	71.0	0.18	2.24
2	24-Feb-06	3.00	3.25	5.0	-0.22	1.37
3	26-Apr-06***	3.25	3.50	88.0	-0.14	1.60
4	***4-Mar-10***	2.00	2.25	67.0	-0.14	2.02
5	12-May-10***	2.25	2.50	88.0	0.04	1.85
6	8-Jul-10	2.50	2.75	2.0	-0.08	1.20
7	5-May-11***	2.75	3.00	67.0	0.04	2.16
8	10-Jul-14	3.00	3.25	2.0	-0.03	0.75

R^2 in percent (percent)
*P-value ***significant at 1percent, **significant at 5percent, *significant at 10percent*
*Prob (f-stat) ***significant at 1percent, **significant at 5percent, *significant at 10percent*
Source: Simple Linear Regression, E-view 9

Table 4.3 shows the empirical results by using first-order autoregressive which indicates a very high correlation of OPR hike on 12 May 2010, 30 November 2005 and 5 May 2011. The R square resulted during this period are 88 percent, 71 percent and 67 percent respectively with a positive coefficient of 0.04, 0.18 and 0.04 respectively. The relationship is in line with the researcher's prediction. The probability F-statistic indicates that overall variable is significant at 1 percent significant level. Also, DW suggests that the model is free from autocorrelation problem as DW is within the target range of 1.5 to 2.5.

The findings result also show an inverse relationship between OPR hike and short-term MGS yield during OPR hike on 26 April 2006 and 4 March 2010. Despite higher correlation, both coefficients during this period are at negative 0.14 indicating an increase of 1 percentage point of OPR which leads to a decrease of both 0.14 percentage point respectively. Despite the relationship moving against the researcher's

prediction, the p-value and the probability F- statistic is recorded at 1 percent significant level. Moreover, DW also indicates that the model is free from autocorrelation problem.

In addition, the empirical results show a very low correlation during OPR hike on 24 February 2006 and 10 July 2014, with a negative coefficient. The negative relationship is also consistent with the p-value and the probability F-statistic as being not significant at 1 percent, 5 percent and 10 percent level. Apart from that, DW also exhibits autocorrelation problem.

Table 4.4

Descriptive Statistics for the 25-days prior and post-trade and T-day to the OPR hike for the short-term MGS yield

No.	Date	Prior OPR	Actual OPR	R^2	Coefficient	Durbin Watson
1	**30-Nov-05***	2.70	3.00	78.0	0.27	2.28
2	24-Feb-06***	3.00	3.25	45.0	-0.04	2.31
3	26-Apr-06***	3.25	3.50	92.0	-0.14	2.37
4	***4-Mar-10***	2.00	2.25	49.0	-0.22	0.92
5	12-May-10***	2.25	2.50	90.0	0.01	1.68
6	8-Jul-10***	2.50	2.75	38.0	-0.04	2.20
7	5-May-11***	2.75	3.00	87.0	0.05	2.08
8	10-Jul-14***	3.00	3.25	66.0	-0.01	1.83

R^2 in percent (percent)
*P-value ***significant at 1percent, **significant at 5percent, *significant at 10percent*
*Prob (f-stat) ***significant at 1percent, **significant at 5percent, *significant at 10percent*
Source: Simple Linear Regression, E-view 9

Table 4.4 shows a positive or direct association between OPR hike and MGS yield. The empirical results by using first-order autoregressive indicate a very high correlation during OPR hike on 30 November 2005, 12 May 2010 and 5 May 2011. The R square resulted during this period are 78 percent, 90 percent and 87 percent respectively with a positive coefficient of 0.27, 0.01 and 0.05 respectively. The

positive relationship in this equation is in line with the researcher's prediction. Moreover, the probability F-statistic indicates overall variable is significant at 1 percent level. In addition, DW also shows that the model is free from autocorrelation problem as DW is within the target range of 1.5 to 2.5.

Moreover, only OPR hike on 4 March 2010 shows a high correlation of 49 percent, with the inverse relationship with short-term bond yield during the observed period. But, the p-value and the probability F-statistic are at 1 percent significant level.

4.4.The 5-,15- and 25-days prior and post-trade and T-day to the OPR hike for the medium-term MGS yield

The table 4.5, 4.6 and 4.7 below summarises the results of the 5-, 15- and 25 days prior and post-trade and T-day of the medium-term MGS yields to OPR hike.

Table 4.5

Descriptive Statistics for the 5-days prior and post-trade and T-day to the OPR hike for the medium-term MGS yield

No.	Date	Prior OPR	Actual OPR	R^2	Coefficient	Durbin Watson
1	30-Nov-05	2.70	3.00	4.0	0.06	0.92
2	24-Feb-06	3.00	3.25	0.0	0.01	2.32
3	26-Apr-06	3.25	3.50	1.0	-0.05	0.54
4	***4-Mar-10**	2.00	2.25	68.0	-0.02	0.78
5	12-May-10***	2.25	2.50	82.0	0.01	0.93
6	**8-Jul-10**	2.50	2.75	41.0	-0.51	2.18
7	*5-May-11*	2.75	3.00	32.0	-0.08	0.89
8	10-Jul-14	3.00	3.25	1.0	-0.02	1.05

R^2 in percent (percent)

*P-value *** significant at 1percent, ** significant at 5percent, * significant at 10percent*

*Prob (f-stat) *** significant at 1percent, ** significant at 5percent, * significant at 10percent*

Source: Simple Linear Regression, E-view

From table 4.5, the medium-term MGS yield, results show a very high correlation of 82 percent recorded during OPR hike on 12 May 2010, which does have a positive relationship at a coefficient of 0.01. As such, the result translates to 1 percentage point increase of OPR that led to the rise of 0.01 percentage point in medium-term MGS yield during the observed period by taking the lag one autocorrelation. Although the p-value suggests the changes in the OPR hike not correlated to change in the medium-term MGS yield, the probability F-statistic is at 1 percent level of significance, which indicates that the overall model regression is significant. However, the model has shown the effect of serial correlation because the value of Durbin Watson (DW) is less than 1.5 to 2.5 range.

Meanwhile, the medium-term MGS yield during OPR hike on 4 March 2010, 8 July 2010 and 5 May 2011 shows that the regression model is fitted strongly to the observed period, evident by the higher correlation of 68 percent, 41 percent and 32 percent respectively. In addition, these period also are significant in the p-value and probability F-statistic of the medium-term bond yield. Despite the model being statistically significant, the results indicate that the relationship between OPR hike and the medium-term MGS yield to be inconsistent with the researcher's prediction, backed by a negative coefficient. The coefficient for these particular periods is recorded at negative 0.20, negative 0.51 and negative 0.08. Apart from that, only OPR hike on 8 July 2010 shows that it is free from the effect of serial correlation because the value of Durbin Watson (DW) is in the range of 1.5 to 2.5 for the above observation.

Table 4.6

Descriptive Statistics The 15-days prior and post-trade and T-day to the OPR hike for the medium-term MGS yield

No.	Date	Prior OPR	Actual OPR	R^2	Coefficient	Durbin Watson
1	***30-Nov-05***	2.70	3.00	27.0	3.07	0.51
2	***24-Feb-06***	3.00	3.25	55.0	0.20	1.22
3	26-Apr-06***	3.25	3.50	93.0	-0.21	1.57
4	***4-Mar-10***	2.00	2.25	91.0	-0.30	1.82
5	12-May-10**	2.25	2.50	27.0	-0.01	1.70
6	***8-Jul-10***	2.50	2.75	65.0	-0.65	2.13
7	5-May-11***	2.75	3.00	35.0	-0.07	1.91
8	10-Jul-14***	3.00	3.25	59.0	-0.02	1.88

R^2 in percent (percent)

*P-value ***significant at 1percent, **significant at 5percent, *significant at 10percent*

*Prob (f-stat) ***significant at 1percent, **significant at 5percent, *significant at 10percent*

Source: Simple Linear Regression, E-view 9

Table 4.6 shows a positive or direct association between OPR hike and MGS yield. The empirical findings indicate a high correlation of 27 percent and 55 during OPR hike on 30 November 2005 and 24 February 2006 individually. An increase of 1 percentage point of OPR hike can be translated by an increase of 3.07 and 0.20 percentage point respectively during the period observed. In addition, the p-value and the probability F- statistic also indicate that the variable and the relationship of this model are at 1 percent significant level.

Meanwhile, by using second-order autoregressive in the time series model, OPR hike on 4 March 2010 recorded a very high correlation of 91 percent, with the negative coefficient of 0.30, which is against the researcher's prediction. Apart from that, DW also indicates that the model is free from autocorrelation problem as the findings are within a range of 1.5 to 2.5. In addition, by using first-order autoregressive in the time series model, results show a very high correlation of 93 percent during OPR hike on

26 April 2006 and a higher correlation of 27 percent and 59 percent during OPR hike on 12 May 2010 and 10 July 2014 respectively. Despite strong correlation, the coefficient is at the negative territory 0.21 percentage point, 0.01 percentage point and 0.02 percentage point respectively. Although the relationship is against researcher's prediction, the probability F- statistic is indicated overall variable is significant at 1 percent level.

Table 4.7

Descriptive Statistics for the 25-days prior and post-trade and T-day to the OPR hike for the benchmark medium-term MGS yield

No.	Date	Prior OPR	Actual OPR	R^2	Coefficient	Durbin Watson
1	30-Nov-05***	2.70	3.00	72.0	0.15	2.42
2	24-Feb-06***	3.00	3.25	81.0	-0.10	2.60
3	26-Apr-06***	3.25	3.50	97.0	-0.21	1.65
4	4-Mar-10***	2.00	2.25	91.0	-0.08	1.81
5	12-May-10***	2.25	2.50	37.0	-0.01	1.78
6	***8-Jul-10***	2.50	2.75	75.0	-0.74	1.72
7	***5-May-11	2.75	3.00	1.0	3.55	1.15
8	10-Jul-14***	3.00	3.25	32.0	-0.01	2.32

R^2 in percent (percent)
*P-value ***significant at 1percent, **significant at 5percent, *significant at 10percent*
*Prob (f-stat) ***significant at 1percent, **significant at 5percent, *significant at 10percent*
Source: Simple Linear Regression, E-view 9

Table 4.7 shows that the empirical results using first-order autoregressive indicate a high correlation of 72 percent during OPR hike on 30 November 2005 for the medium-term MGS yield, with a positive coefficient of 0.15. The result is in line with the researcher's prediction. Although the p-value is not significant at 1 percent, 5 percent and 10 percent, the probability F-statistic indicates overall variable is significant at 1 percent significant level. In addition, DW also shows that the model is free from autocorrelation problem as DW is within the target range of 1.5 to 2.5. The findings

also witness that OPR hike on 5 May 2011 only recorded very low correlation of 1 percent, but recorded a higher coefficient of 3.55. Apart from that, the p-value of the variable is significant at 1 percent level, but the probability F-statistic is not significant which means that the overall variables in the model are inconsistent.

Table 4.7 also indicates all except OPR hike on 30 November 2005 and 5 May 2011 are at higher correlation for medium-term MGS yield. Nonetheless, the coefficient of the results is negative, which indicates 1 percentage point increase in OPR hike can be translated to a decrease by another percentage point of medium-term MGS yield.

Apart from that, OPR hike on 8 July 2010 only is the p-value and probability F- statistic is recorded at 1 percent significant level, with the model is free from autocorrelation problem as DW is within a range of 1.5 to 2.5.

4.5. The 5-,15- and 25-days prior and post-trade and T-day to the OPR hike for the long-term MGS yield

Table 4.8

Descriptive Statistics for the 5-days prior and post-trade and T-day to the OPR hike for the benchmark long-term MGS yield

No.	Date	Prior OPR	Actual OPR	R^2	Coefficient	Durbin Watson
1	**30-Nov-05**	2.70	3.00	38.0	0.10	1.28
2	24-Feb-06	3.00	3.25	17.0	-0.08	0.60
3	*26-Apr-06*	3.25	3.50	27.0	2.25	1.34
4	***4-Mar-10***	2.00	2.25	67.0	-0.01	0.42
5	**12-May-10**	2.25	2.50	46.0	-3.92	0.82
6.	8-Jul-10	2.50	2.75	21.0	-0.08	0.65
7	5-May-11	2.75	3.00	2.0	0.03	1.40
8	***10-Jul-14***	3.00	3.25	53.0	-2.87	1.25

R^2 in percent (percent)

*P-value ***significant at 1percent, **significant at 5percent, *significant at 10percent*

*Prob (f-stat) ***significant at 1percent, **significant at 5percent, *significant at 10percent*

Source: Simple Linear Regression, E-view 9

Table 4.8 shows that OPR hike on 30 November 2005 and 26 April 2006 have a positive or direct association with MGS yield, in which the model shows a positive correlation and coefficient with the line fitted slopping upwards. A high correlation reported each at 38 percent and 27 percent whereas the coefficient recorded at 0.10 and 2.25 respectively. Therefore, an increase of 1 percentage point OPR hike will lead to an increase of 0.01 and 2.25 percentage point respectively during the particular period observed and consistent with the researcher's prediction, where the p-value and probability F-statistic are both at 5 percent significant level.

Meanwhile, the significance results also show that high correlation does not translate to a positive coefficient, evident by a negative coefficient result during OPR hike on 4 March 2010, 12 May 2010 and 10 July 2014. The regression model indicates that R squared are at 67 percent, 46 percent and 53 percent respectively, while a negative coefficient is at negative 0.01, negative 3.92 and negative 2.87 individually. Although the empirical findings show an inverse relationship to the researcher's prediction, the p-value and probability F-statistic show a 1 percent and 5 percent significant levels, which indicates that the relationship between these two variables is a good predictor.

Table 4.9

Descriptive Statistics for the 15-days prior and post-trade and T-day to the OPR hike for the benchmark long-term MGS yield

No.	Date	Prior OPR	Actual OPR	R2	Coefficient	Durbin Watson
1	30-Nov-05***	2.70	3.00	44.0	-0.02	2.14
2	24-Feb-06***	3.00	3.25	61.0	-0.02	1.88
3	26-Apr-06***	3.25	3.50	87.0	-0.06	1.87
4	*4-Mar-10***	2.00	2.25	88.0	-0.12	2.18
5	12-May-10***	2.25	2.50	87.0	-0.31	1.90
6	8-Jul-10***	2.50	2.75	87.0	-0.02	1.75
7	5-May-11***	2.75	3.00	71.0	-0.10	1.69
8	***10-Jul-14***	3.00	3.25	76.0	-1.65	0.73

R^2 in percent (percent)

*P-value ***significant at 1percent, **significant at 5percent, *significant at 10 percent*

*Prob (f-stat) ***significant at 1percent, **significant at 5percent, *significant at 10percent*

Source: Simple Linear Regression, E-view 9

Table 4.9 shows a positive or direct association between OPR hike and MGS yield. The empirical results from first-order autoregressive in the time series model indicate that all observed period of OPR hikes impact to long-term MGS yield is at higher correlation. Nonetheless, the coefficient of the results is at the negative, which indicates that 1 percentage point increase of OPR hike can be translated to a decrease by another percentage point of 10- MGS yield. Despite the p-value not within 1 percent, 5 percent and 10 percent significant level except during OPR hike on 4 March 2010 and 10 July 2014, all probability F- statistic is recorded at 1 percent significant level. Furthermore, all except during OPR hike on 10 July 2014 indicate that the model is not free from autocorrelation problem as DW is within the range of 1.5 to 2.5.

Table 4.10

Descriptive Statistics for the 25-days prior and post-trade and T-day to the OPR hike for the benchmark long-term MGS yield

R^2 in percent (percent)

No.	Date	Prior OPR	Actual OPR	R^2	Coefficient	Durbin Watson
1	***30-Nov-05***	2.70	3.00	49.0	0.27	1.92
2	24-Feb-06***	3.00	3.25	62.0	-0.01	1.94
3	26-Apr-06***	3.25	3.50	92.0	-0.03	1.92
4	4-Mar-10***	2.00	2.25	94.0	-0.10	2.21
5	12-May-10***	2.25	2.50	74.0	-0.06	2.34
6	8-Jul-10***	2.50	2.75	92.0	-0.02	2.23
7	5-May-11***	2.75	3.00	82.0	-0.06	1.75
8	10-Jul-14***	3.00	3.25	92.0	-0.32	2.03

*P-value ***significant at 1percent, **significant at 5percent, *significant at 10percent*
*Prob (f-stat) ***significant at 1percent, **significant at 5percent, *significant at 10percent*
Source: Simple Linear Regression, E-view 9

Table 4.10 shows that the empirical results shown by using first-order autoregressive in the time series model indicate that all observed period of OPR hikes impact to long-term MGS yields is at higher correlation.The R squared resulted during OPR hike on 30 November 2005 is at 47 percent with a positive coefficient of 0.27. The relationship is in line with the researcher's prediction. Moreover, the p-value and probability F-statistic is recorded at 1 percent significant level. Additionally, OPR hike during the period indicates that the model is free from autocorrelation problem as DW is within the range of 1.5 to 2.5.

Nonetheless, except during OPR hike on 30 November 2005, the coefficient of the results is at a negative, which indicates 1 percentage point increase of OPR hike can be translated to a decrease by another percentage point of long-term MGS yield. Moreover, all probability F- statistic is recorded at 1 percent significant level. Additionally, all during OPR hike indicates that the model is free from autocorrelation problem as DW is within the range of 1.5 to 2.5.

In conclusion, the above analysis produced a mixed result of OPR hikes to the short, medium and long-term MGS yields during the observed period. Therefore, Vector Error-correction Model (VECM) is used to test for existence of cointegration for long-run relationship and standard Granger causality test is to examine the short-run association between an increase of OPR and MGS yield.

4.6. Granger – Causality Test

The standard Granger causality using eviews econometrics is used to test for short-run cointegration between OPR hike and MGS yield. At least eight out of twenty-four of variables in OPR hike does Granger cause to MGS yield at the 1 percent level of significance, given the p-value are less than 1 percent, 5 percent and 10 percent level respectively. For example, assuming MGS yield as a dependent variable, the results can be concluded for OPR hike on 10 July 2014, in which Granger causes to long-term MGS yield at 1 percent significant level. Meanwhile, OPR hike on 12 May 2010 and 8 July 2010 also have Granger cause at 1 percent level of significance to short-term MGS yield respectively. In addition, OPR hike on 4 March 2010, have Granger caused to MGS yield for benchmark short-term and medium-term at 1 percent level of significance, while OPR hike on 26 April 2006 has Granger cause to short-term MGS yield at the 10 percent level of significance.

Conversely, there are a total of eight of MGS yield that Granger cause to OPR hike, assuming that OPR hike is a dependent variable.The benchmark for medium-term MGS yield during OPR hike on 30-November 2005, the benchmark for medium-term and long-term MGS yield during OPR hike on 8 July 2010 and the benchmark for long-term MGS yield during OPR hike on 5 May 2011 have Granger cause to OPR hike at 1 percent significant level. Also, the benchmark for long-term MGS yield

during OPR hike on 30 November 2005 and the benchmark for medium-term MGS yield during OPR hike on 24 February 2006 have Granger cause on OPR hike at 5 percent level of significance. That means the coefficient of MGS yield with the OPR hike as the dependent variable can affect the future performance of OPR hike.

The findings also concluded that both long-term MGS yield and OPR hike on 30 November 2005 and 24 February 2006 shows Granger cause for each other respectively. For example, OPR hike during 30 November 2005 indicates Granger cause to long-term MGS yield at 1 percent level of significance, and the benchmark for long-term year MGS yield show Granger cause to OPR hike at 10 percent level of significance. Meanwhile, OPR hike during 24 February 2006 indicates Granger cause to long-term MGS yield at 1 percent level of significance, and the benchmark for long-term MGS yield show Granger cause to OPR hike during this period at 1 percent level of significance.

Nevertheless, the findings conclude in short-term MGS yield during OPR hike on 24 February 2006, medium-term and long-term MGS yield during OPR hike on 26 April 2006. Furthermore the long-term MGS yield during OPR hike on 4 March 2010, medium-term and long-term MGS yield during OPR hike on 12 May 2010, short-term and medium-term MGS yield during OPR hike on 5- May 2011 as well as short-term MGS yield and medium-term MGS yield during OPR hike on 10 July 2014 does not show Granger cause to each other.

Table 4.11:
Granger causality Test

No.	Date	MGS Tenors	IR	MGS
1		MGS3Y	0.4507	0.021**
	30-Nov-05	MGS5Y	0.960	0.001***
		MGS10Y	0.001***	0.076*
2		MGS3Y	0.558	0.818
	24-Feb-06	MGS5Y	0.811	0.021**
		MGS10Y	0.002***	0.004***
3		MGS3Y	0.087*	0.603
	26-Apr-06	MGS5Y	0.622	0.041
		MGS10Y	0.180	0.126
4		MGS3Y	0.000***	0.723
	04-Mar-10	MGS5Y	0.001***	0.810
		MGS10Y	0.749	0.416
5	12-May-10	MGS3Y	0.007***	0.7136
		MGS5Y	0.516	0.841
		MGS10Y	0.137	0.913
6	08-Jul-10	MGS3Y	0.002***	0.146
		MGS5Y	0.347	0.001***
		MGS10Y	0.841	0.003***
7	05-May-11	MGS3Y	0.800	0.111
		MGS5Y	0.191	0.636
		MGS10Y	0.554	0.001***
8	10-Jul-14	MGS3Y	0.993	0.316
		MGS5Y	0.124	0.685
		MGS10Y	0.001***	0.270

*Note; *** significant level at 1percent, ** significant level at 5percent and *significant level at 10percent.*
Source: Granger-causality test, E-view 9

4.7. Vector Error Correction Model

All except for MGS medium-term during OPR hike on 24 February 2006, MGS long-term during OPR hike on 24 February 2006, MGS short-term during OPR hike on 4 March 2010, MGS short-term and MGS medium-term during OPR hike on 8 July 2010

are at optimum lag length 1. For MGS medium-term and MGS-10 year during OPR hike on 24 February 2006, they are at optimum lag length 2 and 3 respectively. The benchmark MGS short-term during OPR hike on 4 March 2010 is at optimum lag length 4. Meanwhile, MGS short-term and MGS medium-term during OPR hike on 8 July 2010 are at optimum lag length 3 and 4 respectively. Therefore, the Johansen cointegration test after obtaining the optimum lag resulted in both Max-Eigenvalue and trace statistic test indicating two variables have no long-run relationship, as both Max-Eigenvalue and trace statistic appears to have less than 5 percent and 1 percent levels of critical value of 3.76 percent and 6.65 percent respectively.

Table 4.12:
Johansen –Juselius Cointegration Tests

No.	Date	MGS Tenors	Max-Eigenvalue	Trace Statistic
1		MGS3Y	0.030	1.517
	30-Nov-05	MGS5Y	0.056	2.830
		MGS10Y	0.017	0.815
2		MGS3Y	0.021	1.052
	24-Feb-06	MGS5Y	0.012	0.561
		MGS10Y	0.024	1.126
3		MGS3Y	0.001	0.302
	26-Apr-06	MGS5Y	0.018	0.880
		MGS10Y	0.001	0.055
4	04-Mar-10	MGS3Y	0.032	1.483
		MGS5Y	0.005	0.227
		MGS10Y	0.012	0.588
5	12-May-10	MGS3Y	0.026	1.303
		MGS5Y	0.022	1.073
		MGS10Y	0.020	0.998
6	08-Jul-10	MGS3Y	0.004	2.125
		MGS5Y	0.022	1.041
		MGS10Y	0.015	0.749
7	05-May-11	MGS3Y	0.071	3.627
		MGS5Y	0.016	0.805
		MGS10Y	0.020	0.945
8	10-Jul-14	MGS3Y	0.034	1.674
		MGS5Y	0.029	1.422
		MGS10Y	0.016	0.785

Source: Vector Error Correction Model (VECM), E-view 9

CHAPTER 5

CONCLUSION

5.0. Introduction

This chapter presents the findings with discussions and suggestion for future study. This final chapter focuses on introductions, discussion of the study, lastly discusses on the limitation and suggestion for future study

5.1. Findings on this Study

The main objective of this paper is to evaluate the responsiveness of Malaysian government securities (MGS) yield in the event of overnight policy rate (OPR) tightening. The study should provide a better understanding to the researcher whether the traditional wisdom, where an increase of OPR directly led to the rise in MGS yield, will give the same answer to the current financial market development.

Regarding relationship, only OPR hike on 30 November 2005 shows that the overall results are statistically significant. Based on the observed period, the statistical result demonstrates that an increase of OPR will lead to the rise in MGS yield for short-term, medium and long-term bond yield. Therefore, the model indicates that the relationship between these variables are strong in the early years when Bank Negara Malaysia (BNM) established the OPR for their monetary policy direction. The researcher discovered on the period of the sudden announcement by the BNM to dismantle the pegging of Malaysian ringgit against US Dollar caused a stir in the Malaysian financial market.

However, the remaining empirical findings concluded that despite the model producing a positive correlation, the relationship between OPR hike and an increase of MGS yield is inconsistent, which suggests that an OPR hike is becoming less relevant to the changes in the bond yield. Hence, this also in line with most of the literature review that suggests the short-term bond yield is more sensitive to an increase of interest rate hike compared to medium and long-term bond yield. Therefore, although only one period of OPR hike supports the relationship for short-term bond yield, the rest of the results including the medium-term and the long-term bond yield is evidence that they are unresponsive toward an increase of OPR hike.

In term of short-run relationship, at least eight out of twenty-four of variables in OPR hike does Granger cause MGS yield at the 1 percent level of significance, given the p-value is less than 1 percent, 5 percent and 10 percent level respectively. Meanwhile, there a total of eight of MGS yield that Granger cause to OPR hike, assuming that OPR hike is a dependent variable. Nevertheless, the findings also concluded that tenth out or forty-eight of variables either both of variable between OPR hike or MGS does not show Granger cause to each other. However, in term of long-run relationship tested results indicates no long-run relationship appears between the responsiveness of MGS yield to OPR hike, given both Max-Eigenvalue and trace statistic test appear to have less than 5 percent and 1 percent levels of critical value.

5.2 Limitation

There are several limitations resercher found during the process of doing this study. Firstly, the researcher believe that the limitation of data on Malaysian government bond yields used in this study should be extended to longer number of days than the proposed study. Secondly, the researcher also found difficulties in term of limitations of references as most of the previous studies are more focused on developed countries

such as the United States of America, United Kingdom and Japan. This is also become a constraint to the researcher as the developed markets does not provide a best characteristics to the Malaysian bond market.

5.3 Recommendation for Future Study

Currently, this study has focused on the direct relationship of the MGS yield to the monetary policy tightening in Malaysia. The study suggests that monetary policy tightening is not the only prominent variable leading to the changes in the bond yield further investigation should be taken into consideration to be developed for this study such as periods of the study examined should be extended beyond than what is proposed in this paper. This is because the researcher thinks that the results are not strong as the researcher had predicted given the researcher's belief that investors have anticipated the movement in bonds yield before the actual day of BNM announcement. Furthermore, the researcher limit to MGS (conventional bond) only and not including of Government Islamic Issuance (GII), thus it would be more interesting to know about which bond market are more sensitive to OPR hike.

5.4. Conclusion

From the findings, it can be concluded that overall objectives that were developed in this study. The data findings has fully reflected all the research question and has shown the relationship on OPR hike to MGS yield does not follow the term structure of interest in this study. The findings also witnessed a surprise element which some of the samples are contradicted with the theory.

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APPENDICES

The Augmented Dickey-Fuller

Null Hypothesis: IR300505 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.000000	0.7465
Test critical values:	1% level	-3.568308	
	5% level	-2.921175	
	10% level	-2.598551	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR300505)
Method: Least Squares
Date: 04/12/18 Time: 17:56
Sample (adjusted): 10/27/2005 1/04/2006
Included observations: 50 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR300505(-1)	-0.040000	0.040000	-1.000000	0.3223
C	0.120000	0.114158	1.051177	0.2984

R-squared	0.020408	Mean dependent var	0.006000
Adjusted R-squared	-0.000000	S.D. dependent var	0.042426
S.E. of regression	0.042426	Akaike info criterion	-3.442914
Sum squared resid	0.086400	Schwarz criterion	-3.366433
Log likelihood	88.07284	Hannan-Quinn criter.	-3.413789
F-statistic	1.000000	Durbin-Watson stat	2.001667
Prob(F-statistic)	0.322325		

Null Hypothesis: D(IR300505) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.000000	0.0000
Test critical values:	1% level	-3.571310	
	5% level	-2.922449	
	10% level	-2.599224	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR300505,2)
Method: Least Squares
Date: 04/12/18 Time: 17:58
Sample (adjusted): 10/28/2005 1/04/2006
Included observations: 49 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IR300505(-1))	-1.020833	0.145833	-7.000000	0.0000
C	0.006250	0.006250	1.000000	0.3224

R-squared	0.510417	Mean dependent var	0.000000
Adjusted R-squared	0.500000	S.D. dependent var	0.061237
S.E. of regression	0.043301	Akaike info criterion	-3.401310
Sum squared resid	0.088125	Schwarz criterion	-3.324092
Log likelihood	85.33209	Hannan-Quinn criter.	-3.372014
F-statistic	49.00000	Durbin-Watson stat	2.000887
Prob(F-statistic)	0.000000		

Null Hypothesis: ST240206D has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.215469	0.0249
Test critical values:	1% level	-3.568308	
	5% level	-2.921175	
	10% level	-2.598551	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ST240206D)
Method: Least Squares
Date: 04/12/18 Time: 18:00
Sample (adjusted): 1/23/2006 3/31/2006
Included observations: 50 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ST240206D(-1)	-0.329348	0.102426	-3.215469	0.0023
C	1.189299	0.369187	3.221404	0.0023

R-squared	0.177226	Mean dependent var	0.002380
Adjusted R-squared	0.160085	S.D. dependent var	0.050820
S.E. of regression	0.046575	Akaike info criterion	-3.256324
Sum squared resid	0.104123	Schwarz criterion	-3.179843
Log likelihood	83.40809	Hannan-Quinn criter.	-3.227199
F-statistic	10.33924	Durbin-Watson stat	2.447493
Prob(F-statistic)	0.002332		

Simple Linear Regression

Dependent Variable: ST300505
Method: Least Squares
Date: 10/30/17 Time: 17:53
Sample: 11/23/2005 12/07/2005
Included observations: 11

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR300505	0.225444	0.042219	5.339846	0.0005
C	2.872500	0.121065	23.72691	0.0000

R-squared	0.760089	Mean dependent var	3.518091
Adjusted R-squared	0.733432	S.D. dependent var	0.040513
S.E. of regression	0.020917	Akaike info criterion	-4.733557
Sum squared resid	0.003938	Schwarz criterion	-4.661213
Log likelihood	28.03456	Hannan-Quinn criter.	-4.779160
F-statistic	28.51395	Durbin-Watson stat	1.835282
Prob(F-statistic)	0.000469		

Dependent Variable: MT240206
Method: Least Squares
Date: 04/12/18 Time: 18:11
Sample: 2/03/2006 3/17/2006
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR240206	0.200900	0.033478	6.000894	0.0000
C	3.088700	0.104838	29.46156	0.0000

R-squared	0.553920	Mean dependent var	3.717323
Adjusted R-squared	0.538538	S.D. dependent var	0.034282
S.E. of regression	0.023288	Akaike info criterion	-4.619432
Sum squared resid	0.015727	Schwarz criterion	-4.526917
Log likelihood	73.60119	Hannan-Quinn criter.	-4.589274
F-statistic	36.01073	Durbin-Watson stat	1.223159
Prob(F-statistic)	0.000002		

Dependent Variable: IR240406
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 04/12/18 Time: 19:03
Sample: 3/22/2006 5/31/2006
Included observations: 51
Convergence achieved after 15 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LT240406	-0.032437	0.602735	-0.053817	0.9573
C	3.521711	2.625077	1.341565	0.1862
AR(1)	0.965561	1.298904	0.743366	0.4610
SIGMASQ	0.001218	0.001426	0.853761	0.3976

R-squared	0.922033	Mean dependent var	3.377451
Adjusted R-squared	0.917056	S.D. dependent var	0.126220
S.E. of regression	0.036351	Akaike info criterion	-3.663197
Sum squared resid	0.062106	Schwarz criterion	-3.511681
Log likelihood	97.41152	Hannan-Quinn criter.	-3.605298
F-statistic	185.2729	Durbin-Watson stat	1.924403
Prob(F-statistic)	0.000000		

Inverted AR Roots	.97

Granger Causality Test

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 04/12/18 Time: 19:08
Sample: 1/20/2006 3/31/2006
Included observations: 48

Dependent variable: D(ST240206D)

Excluded	Chi-sq	df	Prob.
D(IR240206)	1.703648	2	0.4266
All	1.703648	2	0.4266

Dependent variable: D(IR240206)

Excluded	Chi-sq	df	Prob.
D(ST240206D)	0.811199	2	0.6666
All	0.811199	2	0.6666

Vector Error Correlation Model

Date: 04/12/18 Time: 19:07
Sample (adjusted): 1/25/2006 3/31/2006
Included observations: 48 after adjustments
Trend assumption: Linear deterministic trend
Series: ST240206D IR240206
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.218575	12.94898	15.49471	0.1167
At most 1	0.022869	1.110440	3.841466	0.2920

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.218575	11.83854	14.26460	0.1169
At most 1	0.022869	1.110440	3.841466	0.2920

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values