DETERMINANTS OF STOCK PRICE MOVEMENT IN U.S. MARKET

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DECLARATION

We hereby declare that:

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

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

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

(4) The word count of this research report is 13,278 words.

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LIST OF ABBREVIATIONS

NBER	National Bureau of Economic Research
ARMA	Autoregressive Moving Average Model
OLS	Ordinary Least Square
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
ADF	Augmented Dickey-Fuller
CAPM	Capital Asset Pricing Model
SML	Security Market Line
APT	Arbitrage Pricing Theory
PP	Phillips Perron
JB	Jarque-Bera
MS	Money Supply
EXPEC_INF	Expected Inflation
VIF	Variance Inflation Factor
GDP	Gross Domestic Product

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Abstract

Knowledge of stock price behavior is very important for investor. In this paper, we examine the factors which affect the stock price movement in the US market. This paper shows the different effects of inflation, expected inflation, money supply and Treasury bill rate on stock price. In order to examine the significant effects on the stock price movement, we had collected the data during the period from 1991-2011 years. Specifically, an empirical analysis, based on the OLS regression, Unit Root test and Granger Causality shows our results that the four independent variables have different effects on this sector. It indicates that there is a positive relationship between the stock price and Treasury bill rate. In addition, the money supply and expected inflation have a negative relationship with the stock price. In general, we found out that the inflation is insignificant to stock price due to the reason of the existence of expected inflation in the model. This is because the stock price will not have any changes when the actual inflation happens if the factor of expected inflation had been taken into the model.

Keywords: Stock Prices, Inflation, Expected Inflation, Money Supply, Treasury bill rate.

CHAPTER 1: INTRODUCTION

1.0 Introduction

In this study, the first chapter will discuss about the selected research area's background. The knowledge of the background is used to enhance the understanding of how inflation, expected inflation, money supply and Treasury bill rate affect the stock price movement in United States. This will then continue with a well-defined problem statement, which will help the reader to develop an in-depth picture of the research area. Next, this chapter will discuss on research objectives, research questions, hypothesis and significance of the study. Lastly, chapter layout which briefly outlined each chapter in this study and conclusion will be presented in the end of this chapter.

1.1 Research Background

The United States stock market entered the new millennium with five consecutive years of exceptional gains. Based on the S&P 500 index, there was a gain of more than 18 percent of the index in each of the five years since 1995 and its value has triple up. The movement of the stock price is the main concern of most of the investors as it will directly affect their wealth. The overall performance of the economy will be influenced by the stock price movement as the consumption and investment spending will be affected (Shen, 2000).

Standard & Poor's Corp was formed in 1941 when Poor's Publishing merged with the Standard Statistics. It is one of the three United States rating agencies that over the last century (Wilson, 2011). The S&P 500 stock index was introduced in 1957 and became the world's pre-eminent index for investors. During that time it was just covering 233 companies and today it was expanded to include 500 companies. The S&P 500 is maintained by the S&P Index Committee, whose members include Standard and Poor's economists and index analysts. In 1983, Chicago Mercantile Exchange begins trading futures based on the S&P 500. Standard & Poor's expands global operations to many countries such as Hong Kong, Singapore, Mexico, Toronto and so on in mid to late 90s.

There are some eligibility criteria for company to be selected in the list of S&P 500. Originally, only United States companies can be included. The primary listing of the common stock is NYSE and NASDAQ. Besides that, the company should possess at least US$ 4.0 billion of the market capitalization. Next, the criteria would be in terms of liquidity. The ratio should be 1.00 or above for the annual dollar value traded to float adjusted market capitalization. Furthermore, the Initial Public Offerings (IPOs) can only be considered 6 to 12 months after their launch (S&P Indices, 2012). In terms of financial viability, those 500 companies should have four consecutive quarters of positive reporting (Admin, 2008). As-reported earnings are Generally Accepted Accounting Principles (GAAP) net income excluding discontinued operations and extraordinary items (S&P Indices, 2012).

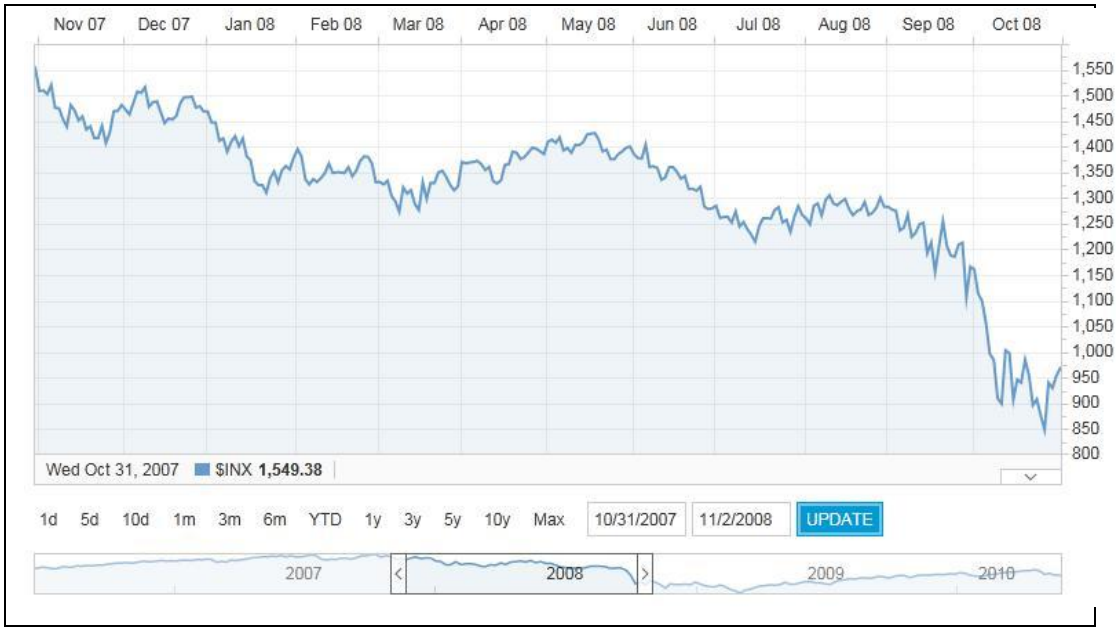
In the year of 1929, there was a worldwide depression that lasted for 10 years which so-called the Great Depression. This incident had caused 12.9 million shares of stock sold in one day which is triple of the normal amount. The side effect of this tragedy was the falling of the share price by 23 percent after few days and this is known as the stock market crash of 1929 (Amadeo, 2010). The stock prices in the United States continued to fall during the next three years because investors liquidate their holdings, until by late 1932, they had dropped to only about 20 percent of their value in 1929. As a consequence, many banks were

forced into insolvency and by 1933, 11,000 out of 25,000 United States banks had failed (Nelson, n.d.).

The leading sources of recovery from the Great Depression are the currency devaluation and monetary expansion. The money supply of the American had increased about 42 percent between year 1933 and 1937. Just because of the inflow of substantial gold to the United States, political tensions was arise in Europe and eventually led to World War II. Worldwide monetary expansion had also created expected inflation and so most of the potential borrowers choose to borrow because they have more confident that their wages and profits would be enough to cover their loan payments. In United States, government regulation of the economy had increased substantially by established the Securities and Exchange Commission in 1934 to regulate new stock issues and stock market trading practices (Romer, 2003).

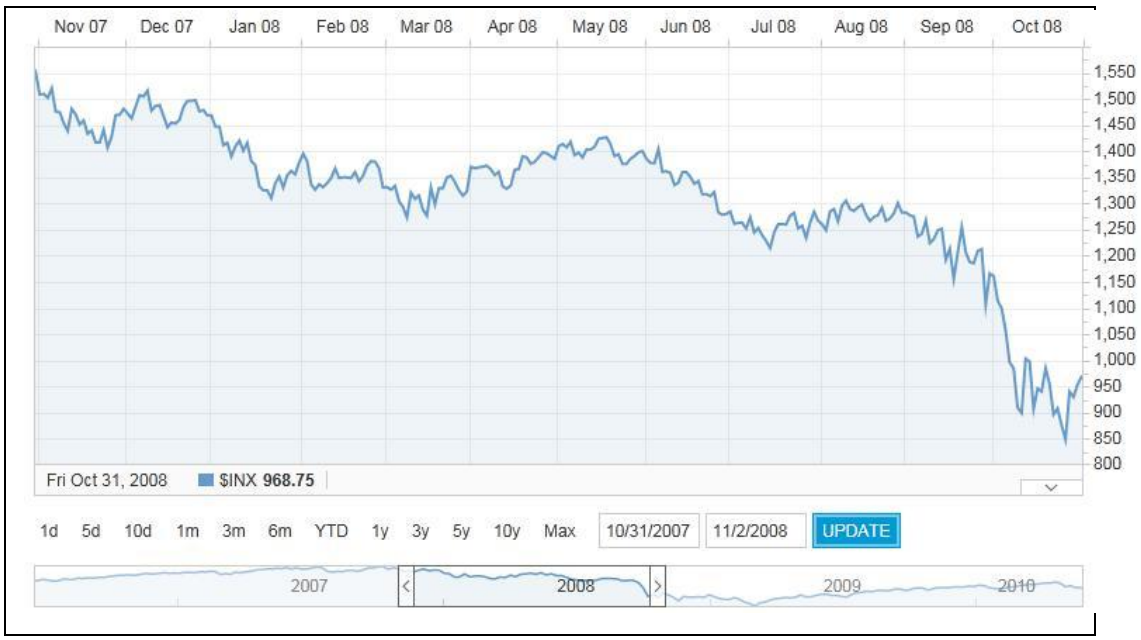
After the stock market of United States had been recovered from the Great Depression, it is once again attacked by a severe financial crisis which is known as Great Recession. This crisis happened during year 2007-2009. However, this incident was still less severe compared to the Great Depression. At the beginning of the crisis, the stock prices which have been increasing as measured by the S&P500 began to decline in October 2007. Figure 1.1 & 1.2 shows that the S&P 500 was decreased 37 percent from 31st October 2007 to 31st October 2008, which is from index 1549.38 to index 968.75 (Hurd & Rohwedder, 2010). Figure 1.3 & 1.4 shows that the S&P Index has dropped 17 percent in the month of October 2008 alone, which is from index 1161.06 to index 968.75 (Hurd & Rohwedder, 2010).

Figure 1.1: S&P 500 Index on 31st October 2007



Source: MSN Money

Figure 1.2: S&P 500 Index on 31st October 2008



Source: MSN Money

Figure 1.3: S&P 500 Index on 1st of October, 2008

Source: MSN Money

Figure 1.4: S&P 500 Index on 31st of October, 2008

Source: MSN Money

According to Lau (2008), people tend to become more conservative during recession. As investors who turn unemployment will start to sell off their investment as they need money to sustain their life before they get a new job. Thus, the stock market started to fall sharply when increased numbers of investors selling their stocks. The National Bureau of Economic Research (NBER), an independent group of economists, acknowledged that the recession officially ended in June 2009. Few months after the end of Great Recession, confidence is slowly return to the stock market in United States and the S&P is back to the level it reached (Farmer, 2009).

1.2 Problem Statement

From the year 1929 until 1932, the stock market of the United States falls continuously due to the worldwide depression. There were few causes that lead to this crisis; they are stock market crash 1929, bank failure, reduction in purchasing across the board, American economic policy with Europe and drought condition. In order to figure out more of the causes that will affect the stock price in United States, we are motivated to carry out the research in order to identify how significantly do inflation, expected inflation, money supply and Treasury bill rate affect the stock price.

It is important to further examine whether money supply, inflation, expected inflation and Treasury bill rate has a positive or negative effect on the stock price movement in the United States. Money supply is an important element to determine the demand of the level for goods and services because the changes in demand will affect the corporate earnings. Inflation can be a crucial determinant to affect the stock price movements because inflation will lead to an increase in interest rate. Peoples will find it expensive to borrow and thus require higher return on stock. Earning on a stock is difficult to increases; therefore the stock price has to be adjusting downward.

In general, the expectation of inflation always sets the nominal interest rate while the real interest rate is set by the fundamental real economic forces. A rise in the rate will lead to an increase in the cost of financing the federal government debt and thus increase the budget deficit. It is important to keep the expected inflation low and to prevent a higher interest rate and higher deficit. Treasury bill rate or can referred to as federal fund rate, are determined by U.S. Federal Reserve in order to control inflation. Changes in the federal fund rate will affect not only consumer behavior and businesses but also stock price. The method of valuing a company is through summing up all the expected future cash flow of the particular company and discounted back to present value. Thus to measure a stock price, it is to sum up all the discounted future cash flow and divide by the number of shares available. Different federal fund rates will cause to the price fluctuation and investors will have different expectation about the company.

1.3 Research Objectives

1.3.1 General Objective

In this research, our main objective is to examine determinants of the stock price movement in the United States. The variables are money supply, inflation, expected inflation and Treasury bill rate.

1.3.2 Specific Objectives

The specific objectives of this study are listed below:

1. To identify whether the money supply has any influence on stock price movement.
2. To determine the influence of inflation on stock price movement.
3. To test whether there is any effect of expected inflation on stock price movement.
4. Lastly, to determine the influence of Treasury bill rate on stock price movement.

1.4 Research Questions

1. How does money supply affect stock price movement?
2. How does inflation influence stock price movement?
3. What is the effect of expected inflation on stock price movement?
4. How does stock price movement affected by Treasury bill rate?

1.5 Hypotheses of the study

This study is conducted to test the significance of the effects of money supply, inflation, expected inflation and Treasury bill rate on stock price movement.

Hypothesis 1

- H_0 = There is no significant relationship between money supply and stock price movement.
- H_1 = There is a significant relationship between money supply and stock price movement.

Hypothesis 2

- H_0 = There is no significant relationship between inflation and stock price movement.
- H_1 = There is a significant relationship between inflation and stock price movement.

Hypothesis 3

- H_0 = There is no significant relationship between expected inflation and stock price movement.
- H_1 = There is a significant relationship between expected inflation and stock price movement.

Hypothesis 4

- H_0 = There is no significant relationship between Treasury bill rate and stock price movement.
- H_1 = There is a significant relationship between Treasury bill rate and stock price movement.

Hypothesis 5

- H_0 = The four independent variables (i.e. money supply, inflation, expected inflation, and Treasury bill rate) are not significantly explained by variance on stock price movement.
- H_1 = The four independent variables (i.e. money supply, inflation, expected inflation, and Treasury bill rate) are significantly explained by variance on stock price movement.

1.6 Significance of the Study

Past researchers have examined factors that affect stock price movements. However, different researchers have different results. Some of the results indicate a bidirectional relationship, and some of the results state that there is no relationship between the variable and stock price movement. Thus, through our research, we may be able to obtain some evidence regarding the relationship between money supply, inflation, expected inflation, Treasury bill rates and stock price movement. Some of the stated problems surrounding the topic of research can be answered by the finding of this study.

It is very important to study the impact of money supply, inflation, expected inflation, and Treasury bill rates on stock prices movement as stock market development is based on stock price movement where the stock market is an engine of growth for United States. The economy and the stock market are closely related. There is little evidence that the stock market causes the economy to rise or fall. The study of the determinants on stock prices movement enables government to predict the future economic growth. As such, U.S government would be able to improve the stock market by controlling money supply, inflation, expected inflation, and Treasury bill rates.

The understanding of the relationship between the money supply and stock price is important for government in formulating policies because an increase or decline in money supply will give different effects to stock price movements. Therefore this study aims to assist government in their decision making by providing a clear reference of how money supply affects stock prices movement.

Furthermore, this study attempts to provide an answer as to how inflation and expected inflation affect stock prices movement. It is important to determine this because stock price movement is usually affected by inflation, in return the economy will be affected by stock price movements. Inflation not only influences the economy of a country but also increase the burden of society which leads to a decline in stock market activity. Thus, it will affect the stock prices movements indirectly. This study is beneficial to investors as the knowledge of stock price behavior is very important for investors in making their decisions on investments especially during a period of inflation.

Lastly, after the study, we can clarify the determinants of U.S. stock prices movement specifically the relationship between money supply, inflation, expected inflation, Treasury bill rates (all are independent variables), and stock price movements (the dependent variables). The aspects mentioned above are important in assisting governments to implement sound and wise monetary policies, as well as strategies. Therefore, we hope that our research could contribute to the society as well as the country as a whole in the expansion and development of the U.S.

1.7 Chapter Layout

This study has been organized and divided into 5 chapters, which are:

Chapter 1: Introduction

This chapter provides an introduction of the subject matter of interest to the readers through the presentation of research background and problem statement, while the research objectives address the purpose of the investigation. Then, research questions and hypotheses are highlighted to specify the direction of this study. The significance of research briefly explains the contribution of this study;

Chapter 2: Literature Review

The review of all relevant theoretical models is arranged in this chapter as grounds to develop the proposed theoretical framework and hypotheses. This prepares researchers to the next chapter to define the research methodology and technique;

Chapter 3: Research Methodology

This chapter basically focuses on examining the determinants of stock price movement in U.S. (S&P 500 Index). Research techniques used in this research are applied on data supplied by Datastream. However, the research instruments, measurements, process and analysis are essential to provide assurance to lead researchers to the next chapter for analysis;

Chapter 4: Research Results

Research results are discussed in this chapter, then investigated and identified towards the research objective, hypotheses, and problem formulated earlier. Ordinary Least Square (OLS) is used in this chapter to discuss the overall results and findings from Chapter 3, charts and tables are illustrated. Conclusion of the entire research will be carried in chapter 5;

Chapter 5: Discussion and Conclusion

This chapter includes implications, recommendations and suggestions in order to further proving the discussed issues. The limitation of the research study are identified and discussed to provide platforms for future research.

1.8 Conclusion

In a nutshell, this chapter is basically a review about the background of the research area, problem statement, research objective, research question, hypothesis of the study, significance of the study and the chapter layout. All of these themes are to be used to analyze how money supply, inflation, expected inflation and Treasury bill rates affect the stock price movement in United States. The following chapter will be further explained about the literature review regarding to our research.

Chapter 2: Literature Review

2.0 Introduction

This research is conducted to re-examine the relationship between money supply, inflation, expected inflation, Treasury bill rate and stock price movement as previous research's results on this study were remained uncertain. This chapter consists of four sections; the first section focus on the theoretical and empirical findings of money supply and stock price movement; the second section focus on the theoretical and empirical findings of inflation and stock price movement, third section focus on the theoretical and empirical findings of expected inflation and stock price movement; and the fourth section focus on the theoretical and empirical findings of Treasury bill rate and stock price movement.

2.1 Review of the Literature

2.1.1 Money Supply and Stock Price Movement

In the research of Rogalski and Vinso (1977), their results showed that there is a bi-directional theory of causality between money supply and stock prices as there are times when changes in money supply may lead to changes in stock price while the changes in stock price may also lead to money changes. The changes in money supply where there is a result of changes in Federal Reserve policies will have a direct impact on stock price movement. Because of ignorance of information lag by most of previous researchers, it leads to robust results in the

research. In order to identify whether dependence can be established and in which direction the causality is showed, the studies of Rogalski and Vinso (1977) have conducted the research to re-investigate the relationship between money supply and stock prices by using Granger Causality test and autoregressive moving average model (ARMA).

According to Sorensen (1982), Homa and Jaffee (1971), and Keran (1971), where high money supply leads to higher stock price. In Sorensen (1982) used OLS method while Homa and Jaffee (1971) used OLS and Hildreth-Lu procedure (H-L) in their research. The stock prices will rise as the expected growth rate of dividends is increased, riskless rate of interest is reduced, and it lowers down the risk premium by reducing the uncertainty associated with the future stream of earnings and dividends. Keran (1971) stated that increase in money supply will lower down the interest rate and lead to an increase in stock price.

Hamburger and Kochin (1972) used OLS method in their study. Almon distributed lag technique was also used by Hamburger and Kochin (1972) to determined lag structure. They have found that the level of stock prices will be lowered as a result of higher variation in money supply. According to their previous study, the responsiveness of the purchasers to changes in money supply may lead to changes in stock prices in short run. From another perspective, stock prices movement is determined by the changes in demand for goods and services as a result of changes in money supply. There is evidence showed that money supply is a crucial element to determine the demand level for goods and services, and corporate earnings are also responsive to the changes in demand.

There are few conclusions on the short-run reaction of stock price to changes in money supply made by Pearce and Roley (1983) by using Ordinary Least Square (OLS) method. Firstly, the result is consistent with the prediction made by efficient markets hypothesis which is the stock prices respond only to the unexpected change in the money supply. Secondly, there is a negative relationship between unexpected announced money supply and stock prices. Thirdly, there is

only limited evidence that the changes in Federal Reserve policies lead to changes in stock prices.

The results of Pearce and Roley (1983) were similar with earlier studies of Pearce and Roley (1985) where money supply has a negative relationship with stock prices. Unanticipated high money supply leads to an increase in interest rate and lower down the stock prices. There are two explanations for this result. First, agents believe that the Federal Reserve will implement restrictive monetary policy immediately which would lead to higher interest rate when there is an unexpected high money growth. The interest rates are forced to rise as a result of immediate selling of securities after the anticipation of higher rates in near future and this may lead to lower stock price. The second interpretation is that the agents expect there is inflation when positive money supply exists. Stock prices will be lowered when there is inflation.

Highlighted from Bailey (1989) and Hardouvelis (1984) there is a negative relationship between money supply and stock prices. Both of them also used the same method in their research which is OLS method. However, reduced-form equation has been applied in the study of Bailey (1989) to obtain unbiased and consistent result from simultaneous-equations model of Bank of Canada. The previous study of Lynge (1981) also indicates that higher money supply lower down the stock prices. His results do not bear directly on the efficient market issue because he did not differentiate anticipated from unanticipated money growth.

Thorbecke (1997) has conducted a research by examining how stock return responds to monetary policy by using vector autoregressive (VAR) methodology. He found that expansionary monetary policy increase stock return by increasing future cash flows or by decreasing the discount factors. The research of Darrat (1990) by using FPE/multivariate Granger-causality modeling technique indicated that the stock prices will be lowered by the result of expansionary fiscal policies. This policy has leads to an increase in money supply. Thus, it is due to the impact of income upon desired money holding, thus increase in money supply will lower down the stock prices.

2.1.2 Inflation and Stock Price Movement

According to Du (2006), the relationship between stock returns and inflation depends on both the monetary policy and the relative importance of demand and supply shocks. In order to identify the structural breaks in the relationship between stock returns and inflation, Du (2006) used a new econometric technique which is developed by Bai and Perron (1998, 2001 & 2003). The reason that they used this technique is because the structural break date and the problematic approaches which used by other researches in their identification was lack of consensus. Furthermore, VAR and ARMA model were being used in Du's research. Kaul (1987) supports that the relationship between stock return and inflation can be either negative or positive depending on whether monetary policy is counter or pro-cyclical. During the period of Great Depression, the monetary policy was pro-cyclical and thus there is a positive relationship between stock returns and inflation. Meanwhile, during the period of post World War II, there is a negative relationship between stock returns and inflation when the monetary policy was counter-cyclical (Kaul, 1987).

A structural break which is based on a change in the monetary policy regime without consideration of the changes in the demand and supply shocks was chosen by Kaul (1987). However, the relationship between stock returns and inflation are difficult to determine by using such analytical way. The new techniques used in Du investigation has proved that Kaul then fails to identify the two structural breaks due to the changes in the relative importance of demand and supply shocks. Based on the models of Lintner (1975) & Aarstol (2000), supply shocks generate a negative relationship between stock return and inflation while demand shocks results in a positive one. Hess and Lee (1999) supports that the post war negative relationship between stock returns and inflation is consistent with the relative importance of post war supply shocks. This is because increased in money supply results in higher inflation and stock price. While the pre war positive relationship is consistent with the relative importance of pre war demand shocks because increased in oil prices results in higher inflation and lower stock price.

Based on the Fisher (1930) hypothesis, many economists thought that real stock returns and inflation should be positively or at least non-negatively related. However, most past empirical literature shows that stock returns are negatively correlated with inflation. Summers (1981a, 1981b) argues that an increase in profits that is due to inflation is taxed. This is due to the interaction of the inflation and the tax system. Hence, the increase in inflation will reduce the real stock return. By using monthly, quarterly and annual real stock return regressions, Fama (1981) explained that there were two propositions for this negative relationship by linking the real stock return and inflation through real output. First, the relationship between inflation and real output is negative. Second, the relationship between real output and real stock return is positive. However, Ram and Spencer (1983) decline Fama's hypothesis because according to Mundell-Tobin hypothesis, the relationship between inflation and real output is positive, while the relationship between real output and real stock return is negative. They explore the causal relationship between inflation and stock returns by using Sim's test and reverse regression, the results is consistent with Mundell hypothesis but inconsistent with Fama.

By referring to the data on India which is explored by Chatrath et al. (1996), it concluded that the partial of Fama's hypothesis is supported. This is because the unexpected component of inflation is negatively related to real stock return and Fama's two propositions that link the relationship through real output hold up for this unexpected component. Durai & Bhaduri (2009) conclude that there is a strong negative relationship between inflation and stock return for short and medium term. They proposed wavelet analysis for investigating the relationship between real stock returns and inflation over different time scales.

Boudoukh and Richardson (1993) stated that long-run relationship between stock returns and inflation are important to be examined as most of the empirical studies focus on relatively short horizon, typically less than a year. This is due to majority of the investors hold stock for a long period and thus it is important to know the manner in which stock price move with inflation over longer horizons. Boudoukh and Richardson estimate the correlation between stock

return and inflation via ordinary least squares and variance-covariance matrix. The result shows that there is a strong positive relation between stock returns and inflation at long horizons. Kim and In (2005) also support this positive relationship by using wavelet analysis over different time scales. The benefit of using this analysis is because it is able to decompose the date into several time scales.

Solnik and Solnik (1997) used an instrumental variable approach to test the Fisher Model and the results shows that there is a positive relationship between stock return and inflation. It is contrast with the finding of Boudoukh and Richardson (1993) which the Fisher model only holds at a very long horizon but not at a 1 year horizon. Cambell and Shiller (1988) explain that there are two effects of inflation on stock returns by using vector autoregressive (VAR) framework. Firstly, there is a negative relationship between stock returns and inflation. This is because higher inflation will lead to a higher discount rate and thus reduces the stock returns. Secondly, the positive relationship between stock returns and inflation is due to the higher future dividends that was caused by an increase in inflation and thus lead to a higher stock return.

2.1.3 Expected Inflation and Stock Price Movement

By using interest rates as a proxy for expected inflation, the data provided by Solnik (1983) hypothesized that stock price movement has a negative relationship with expected inflation. Solnik (1983) produced this result by constructing Durbin-Watson tests, F-tests and ARIMA transfer function model, a method followed by Geske and Roll. This result is supported by Geske and Roll model. Geske and Roll, (1983) stated that stock returns are negatively affected by expected inflation, unexpected inflation and changes in expected inflation. However, the reasonable theory shows that stock returns should be positively related to both expected and unexpected inflation. When expected inflation increased, the real risk premium on stocks should decrease and therefore stock

price will increase, ceteris paribus. However, the empirical results show that when expected inflation increases, stock prices fall.

According to Hondroyiannis & Papapetrou (2006), there is no relationship between stock returns and expected inflation. By using MSMH-VAR methodology, they found that the stock returns movements are regime dependent. They used this methodology is because it perform better than the linear VAR in modeling stock returns. However, Fama and Schwert (1977), Gallagher and Taylor (2002), Geske and Roll (1983) and others show that stock return was negatively related to expected inflation. This is based on the changes in Treasury bill yields, and contemporaneous stock market returns. The simply change in the Treasury bill rate was indicate a change in expected inflation. According to classic Fisher model, stock should provide a natural hedge against inflation. Since expected inflation might affect both the expected cash flows and the discount rates, so it should be the basic influence in asset pricing.

Schmeling and Schrimpf (2010) used Newey-West HAC-based t-statistics to test for whether the increasing or decreasing of the expected inflation can forecast stock returns. The results show that future aggregate stock returns are significantly affected by expected inflation. Rational investors often considered that expected inflation is positively correlated with some unobserved macrovariable or risk aversion (Fama 1981; Brandt and Wang, 2003) and therefore when there is a higher expected inflation, the equity premium and thus, expected stock returns will be higher. Similarly to Titman and Warga (1989), they attempted to study the relationship between stock returns and expected inflation through the approach of assuming rational expectations and they found that there is a positive relationship between stock returns and expected inflation.

Kaul (1990) states that changes in monetary policy regimes will affect the relationship between stock returns and changes in expected inflation. He also found that there is a negative relationship between stock returns and changes in expected inflation for those countries that have no change in the policy regime. Specifically, the relationship between stock returns and changes in expected

inflation is significant and negative during interest rate regimes as compared to money supply regimes. In order to estimates the expected inflation, Kaul (1990) used ARIMA time series models. During post-war period, a counter-cyclical monetary response will led to strong negative relations between stock returns and changes in expected inflation (Kaul, 1987). Moreover, Kaul (1987) do found that for those countries that experienced only one type of monetary regime, there is no change in the stock-return changes in expected inflation.

2.1.4 Treasury Bill Rate and Stock Price Movement

Some studies reported a negative effect of Treasury bill rate on stock price while some studies explored positive relationship between these two variables. For example, the positive relationship between stock price and Treasury bill rate is reported by Ratanapakorn and Sharma (2007), and Whitelaw (1994) who used OLS method while negative relationship between these two variables is found by Humpe and Macmillan (2009). Humpe and Macmillan (2009) determined the effect of macroeconomic variables on stock market movements in US and Japan. The long run relationship between the variables was tested by using Johansen (1991) procedure which is based on a vector error correction model (VECM). In addition, Augmented Dickey-Fuller and Philips-Perron tests were also has been used in this study. As Treasury bill rate is risk free rate, they are free from default risks. So the investors will less likely to invest into stocks which include higher risk if the Treasury bill rate is higher. After the demand for stocks decrease, the stock prices will in decrease as well.

In the study of Zafar, Urooj and Durrani (2008), they used ARCH model and GARCH model to model and forecast the stock market volatility. The Jarque-Bera statistic has also been used to test whether the data have the skewness and kurtosis matching a normal distribution. From their result, the interest rate which is representing by Treasury bill rate has a negative impact on market stock returns. The interest rate movements will affect the value of a company's stocks and thus stock returns. When interest rate increased, the risk of

stocks will also increase so the company has to pay higher required rate of return to investors. Due to a rise in cost of capital, the profits of company will go down which in turn lead to a decline in stock price. The results of Shanken (1990), Campbell (1987), Ndri Konan Leon (2008), and Rigobob and Sack (2004) are consistent with the result of Zafar, Urooj and Durrani (2008) which is negative relationship between Treasury bill rate and stock prices. Expectation theories for 2-month bills, 20-year bonds, and stocks were tested by using OLS method in the study of Campbell (1987).

Breen, Glosten, and Jagannathan (1989) stated that Treasury bill rate has negative impact on stock index return. They have used Cumby-Modest and Henriksson-Merton tests of market timing ability to evaluate the forecasting model. Based on their research, the distribution of stock index excess returns can be forecasted by using Treasury bill rate when the index is the value weighted portfolio. The stock index excess returns are less volatile and more likely to be positive during forecasted up markets. Besides that, Fama and Schwert (1977) also found the same result as Breen, Glosten, and Jagannathan (1989) which is negative relationship between stock returns and nominal interest rate which is represent Treasury bill rate. Box and Jenkins methodology was used by Fama and Schwert (1977) to describe the process and behavior of its sample autocorrelations. When the expected nominal risk premium on stocks is negative, the negative relationship between stock returns and interest rate can be used to forecast times. However, when stocks do worse than bills, this negative relationship is not useful in predicting times.

According to the research of Hsing (2011) on central European country, he found that the stock price has a negative relationship with the Treasury bill rate by using Augmented Dickey-Fuller (ADF) test which implies that risk free interest rate is negatively related to stock price. In Pakistan, a research has conducted by Sohail and Hussain (2009) on long run and short run relationship between macroeconomic variables and stock prices by using Augmented Dickey Fuller test, Phillips-Perron test, KPSS unit root tests to test the stationary of the variables which were non stationary time series. After that, the equilibrium or a long run

relationship among the variables was identified by using cointegration test. The result of them is contrary with the result of Hsing (2011) where Sohail and Hussain (2009) found that three month Treasury bills rate has positive but insignificant relationship with stock price in the long run.

Based on the studies of Henriksson and Merton (1981), they have found there is a negative relationship between stock returns and nominal interest rate which is representing the Treasury bill rate. In their study, the forecasting ability between any two securities was evaluated by using nonparametric test. Besides that, the portfolio's return as a result of contributions from micro and macro forecasting were also identified by using parametric test. They concluded that when the value weighted index of stocks in the New York Stock Exchange is used as the stock index portfolio, the portfolio strategy use this negative relationship to time the market. The reason of portfolio strategy is valuable in part is similar to the study of Breen, Glosten, and Jagannathan (1989).

2.2 Theoretical Models

2.2.1 Capital Asset Pricing Model (CAPM)

According to Perold (2004), Capital Asset Pricing Model (CAPM) was developed by William Sharpe (1964), Jack Treynor (1962), John Lintner (1965a, b) and Jan Mossin (1966) in the early 1960s. This is the model that was used to describe the relationship between expected return and risk (Fama and French, 2004). By using CAPM, investors can have an understanding of what kind of risk is related to return.

There are four assumptions for CAPM. First, all investors are risk averse and evaluate their investment portfolios over the same single holding period.

Second, the capital markets are perfect, thus, transaction costs, short selling restriction or taxes are not taken into account. Third, same investment opportunities have been accessed by all investors. Fourth, investors have the homogenous expectations about individual asset expected returns, standard deviations of return and the correlations among asset returns.

By using CAPM, investors have to know two things which are the risk premium of overall stock market and the stock's beta versus the market when they want to calculate the expected return of a stock. The formula for CAPM is as follow:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

Where,

- $E(R_i)$ is the expected return on the capital asset,
- R_f is the risk-free rate of interest,
- β_i is the sensitivity of the expected asset returns to the expected market returns,
- $E(R_m)$ is the expected return of the market,
- $E(R_m) - R_f$ is also known as the *market premium* which is the difference between the expected market rate of return and the risk-free rate of return and
- $E(R_i) - R_f$ is also known as the *risk premium.*

The results from CAPM formula is graphed by the security market line (SML). The x-axis represents beta while the y-axis represents the expected return. The market risk premium is determined from the slope of the SML. The CAPM has a few vital implications. First, the expected return of a stock does not depend on its stand-alone risk. Second, a method of measuring the risk of an asset that cannot be diversified away is offered by beta. Third, the stocks expected return does not depend on the growth rate of its future cash flows.

2.2.2 Arbitrage pricing theory (APT)

Besides CAPM, there is another model of asset pricing. Roll and Ross (1980) presents an alternative model of asset pricing called the Arbitrage pricing theory (APT). The Arbitrage Pricing Theory is a multi-factor model that was developed by Steven Ross in 1976. The APT is a linear equation in which a series of input variables, such as economic indicators and market indices, are each assigned to the betas to determine the expected return of a target asset. These factor-specific betas have the sensitivity of the target asset's rate of return to the particular factor.

Arbitrage pricing theory (APT) assumes that the returns of securities are dependent on theoretical market indices of macroeconomic factors where sensitivity to changes in each factor is represented by a factor-specific beta coefficient. Some may reflect macroeconomic factors such as inflation, and interest rate risk, whereas others may reflect characteristics specific to a firm's industry or sector.

APT assumes that each stock's return to the investor is influenced by several independent factors. The key to the APT is that absence of arbitrage requires that such a pair of portfolios must have identical expected returns in financial market equilibrium. Thus, APT used risky asset's expected return and the risk premium of a number of macro-economic factors. Suppose that asset returns are driven by common systematic factors and non-systematic noise are expressed as follow:

$$r_i = E(r_i) + b_{i1} F_1 + b_{i2} F_2 + \cdots + b_{in} F_n + \varepsilon_i$$

Where,

- $E(r_i)$ is the expected return on asset i,

- $F_1, \ldots, F_n$ are the latest data on common systematic factors driving all asset returns,
- b_{in} is how sensitive the return on asset i with respect to news on the $n\text{-}th$ particular factor and
- ε_i is the idiosyncratic noise component in asset's return that is unrelated to other asset returns where it has a mean of zero.

The formula for APT's expected return is as follow:

$$E(r_j) = r_f + b_{j1}RP_1 + b_{j2}RP_2 + b_{j3}RP_3 + b_{j4}RP_4 + \ldots + b_{jn}RP_n$$

Where,

- $E(r_i)$ is the asset expected rate of return,
- r_f is the risk-free rate,
- b_j is the sensitivity of the asset's return to the particular factor, and
- RP is the risk premium associated with the particular factor.

Therefore, APT can explain the expected return on a financial asset of the macroeconomic or specific influences and the asset's sensitivity to those influences. As it is assumes that returns are generated by a factor model and then it shows that, with no arbitrage, each asset's expected return is a linear function of the asset's return to the particular factor. The results of the APT can describe the relationship in the form of the linear regression formula above.

2.3 Theoretical Framework

Inflation is defined as a sustained increase in the general level of prices for goods and services. There are two situations where inflation occurs which are demand-pull inflation and cost-push inflation. Demand-pull inflation is a result of too much money chasing after too few goods (Mofatt, n.d.). The prices will increase because aggregate demand is more than aggregate supply. On the other hand, cost-push inflation is a result of the increase in prices by companies to maintain their profit margins because of a rise in their costs (Riley & College, 2006). When there is inflation, the dollar value is not stable and the purchasing power of money will decline. A decline in purchasing power will make consumers less likely to spend and this slows down the economy (Reed, n.d.). Stock prices will be affected as a result of instability in the economy. The government will then implement restrictive monetary policy in order to solve the inflation problem. In order to implement this kind of policy, the government will increase the interest rate to discourage borrowing by making borrowing expensive. This will lead to a decline in money supply. Thus, the problem of inflation will be solved as consumer demand for goods and services is lessen. Based on our a-priori expectation, there is negative relationship between stock price and inflation.

Money supply is the total amount of money available in an economy at a specific time (Johson, 2005). Money supply is measured by M1, M2 and M3. M1 includes currency, travelers' checks, and checking account deposits, and checking accounts that pay interest while M2 includes everything in M1 plus savings accounts, time deposits under $100,000, and money market mutual funds. M3 includes M2 plus large time deposits and term repos (Money in Terms of Liquidity, 2012). In order to prevent recession or inflation, government will manage the money supply by changing the amount of money in circulation. Money supply will be increased when there is recession by buying government bonds in the open market. On the other hand, government will sell these securities to reduce the money supply when there is inflation. Based on our a-priori

expectation, there is positive relationship between stock price and money supply as when money supply increases, investors have more money to invest.

Expected inflation is the investor and public's expectations of current or future inflation (Expected rate of inflation, n.d.). These expectations may affect how the market reacts to changes in target interest rates although they may or may not be rational. According to Thoma (2007), he stated that keeping the expected inflation low is very important for economists as high expected inflation will induce changes in economic behavior that impose costs on the economy. For example, when they expect there will be inflation in the future, most of them will invest their income in real assets as their purchasing power will decline. Economists will conduct consumers' surveys, financial market data, and their prediction to measure the inflation expectations. Based on our a-priori expectation, there is positive relationship between stock price and expected inflation as when investors expect there will be inflation in future, their purchasing power will decline. Therefore, they will invest more in stocks now in order to generate more money.

Treasury bill is a short-term debt obligation backed by the U.S. government with a maturity of less than one year (Treasury bill, n.d.). Treasury bills (T-bills) is considered as the safest short-term financial instrument because it is secured by government and have no default risk. Based on the research, there is a negative relationship between stock price and Treasury bill rate. When interest rate goes up, the premium rate of government securities will raise which means that investors can get a higher return without taking any risks by investing in government securities. Therefore, investors will shift their fund from stocks to government securities as they do not want to take so much risk and this lead to a decline in stock prices. However, some researchers' result showed that there is positive relationship between stock price and Treasury bill rate. Based on our a-priori expectation, there is negative relationship between stock price and inflation.

2.4 Hypothesis Development

2.4.1 Hypothesis 1 (Money Supply)

H_0 = There is no significant relationship between money supply and stock price movement.

H_1 = There is a significant relationship between money supply and stock price movement.

Based on the research of Homa and Jaffe (1971), they were stated that there has a positive relationship between the stock price and money supply. But, this hypothesis had been argued by the Pesando (1974) which said that the model used by the Homa and Jaffe inability to prove this positive relationship. According to the Kraft and Kraft (1977), he stated that there was no significant relationship between stock price and money supply. By the support of the Engle-Granger cointegration test and the Granger causality test, the result is showing that there was no significant relationship between money supply and stock price.

2.4.2 Hypothesis 2 (Inflation)

H_0 = There is no significant relationship between inflation and stock price movement.

H_1 = There is a significant relationship between inflation and stock price movement.

Inflation is one of the factors that were found to affect the stock price movement in United States. Based on Durai & Bhaduri (2009), they show that

there is a significant negatively relationship between inflation and stock return in the short and medium term, thus H_1 was supported. This hypothesis was supported by applying the Wavelet methodology and Fama's hypothesis is hold. On the other hand, according to Li, Narayan & Zheng (2010), it is shown that the inflation and stock returns are negatively correlated based on the method of autoregressive integrated moving average (ARIMA) model.

2.4.3 Hypothesis 3 (Expected Inflation)

H_0 = There is no significant relationship between expected inflation and stock price movement.

H_1 = There is a significant relationship between expected inflation and stock price movement.

According to Stulz (1986), there is a negative relation between the return of stocks and expected inflation. Moreover, by using interest rates as a proxy for expected inflation, Solnik (1983) conclude that the stock price movements have a negative revision in inflationary expectations. This hypothesis was supported by the Geske and Roll model. In contrast, by using the model-free tests based on relations of subjective investor expectations about future output growth, inflation and stock returns, Schmeling & Schrimpf (2011) found that there is no significant relationship between expected inflation and stock returns.

2.4.4 Hypothesis 4 (Treasury Bill Rate)

H_0 = There is no significant relationship between Treasury bill rate and stock price movement.

H_1 = There is a significant relationship between Treasury bill rate and stock price movement.

By using the nominal interest rate represent the Treasury bill rate, Breen, Glosten, and Jagannathan (1989) used the Cumby-Modest and Henriksson-Merton test results that Treasury bill rate has negative impact on stock return. This results was supported by the Fama and Schwert (1977) and Henriksson and Merton (1981). In addition, according to the Hsing (2011), it is shown that the stock price has a negative relationship with the Treasury bill rate. This hypothesis was supported by the GARCH model. But, the researches of Sohail and Hussain (2009) state that Treasury bills rate has positive but insignificant relationship with stock price in the long run.

2.5 Conclusion

Throughout this chapter, we have discussed about the independent and dependent variables in our study. Besides that, theoretical model and hypothesis study are also constructed in this chapter. In order to let the readers to get more understanding about our study, we are trying to explain in a simple way. In the following chapters, we will use those independent and dependent variables, theoretical model and hypothesis that we mentioned previously.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter discusses the theoretical background of our study and the empirical framework of our analysis to answer the research questions that laid out in Chapter 1. The purpose of this empirical analysis is to determine the relationship between independent variables (inflation, money supply, expected inflation, Treasury bill rate) and dependent variable (stock price). We used time series analysis and conducted various methodologies such as Augmented Dickey-Fuller (ADF) and Phillips Perron tests to determined unit root and stationary of the variables. In addition, Ordinary least square (OLS) method was employed in this research. Under OLS, we employed correlation analysis, LM test, ARCH test in order to determine whether the model has the problem of multicollinearity, autocorrelation, heteroscedasticity. The model has also been tested to determine whether it is correctly specified, and whether error term is normally distributed by using Ramsey Reset test and Jarque-Bera test. After that, Granger Causality Test is used to test whether the independent variable causes the dependent variable or the dependent variable causes the independent variable or there is no causal effect at all in short run.

3.1 Econometric Methods

In this study, we employ time series method to investigate our research model because it is suitable for researches that focus on only one country with a series of time periods. According to Prins (2012), time series analysis accounts for the fact that data points taken over time may have an internal structure (such as autocorrelation, trend, or seasonal variation) that should be accounted for. Our study is to test on how inflation, money supply, expected inflation and Treasury bill rate affect the stock price movements in United States. There are three time series approaches that we employ in the next session which are Augmented Dickey-Fuller (ADF), Phillips Perron (PP) and Granger Causality.

3.1.1 Augmented Dickey-Fuller (ADF) Test

The purpose we use the ADF Test is to determine whether a data series contains any unit roots and thus be non-stationary. This test is used for larger and more complicated set of time series models and it is considered as a version of the Dickey-Fuller test. Below is the equation for the ADF test:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\beta_1} + \boldsymbol{\beta_{2t}} + \theta \boldsymbol{Y_{t-1}} + \boldsymbol{\alpha i} \Sigma \Delta \boldsymbol{Y_{t-t}} + \boldsymbol{\varepsilon_t}$$

In this equation, Y_t is our variable of interest, Δ is the differencing operator, t is the time trend, $\boldsymbol{\varepsilon}$ is the white noise residual and β_1, β_2, θ, α_1, …, α_m is a set of parameters to be estimated.

The null and alternative hypotheses are:

H_0: θ = 0 (Yt is unit root/ non-stationary)

H_1: θ ≠ 0 (Yt is stationary)

If t-test statistic is less than the ADF critical value, the null hypothesis will not be rejected, which mean that the unit root exists, and the value series is non-stationary. If t-test statistic greater than the ADF critical value, the null hypothesis will be rejected, means that the unit root does not exists, the value series is stationary.

3.1.2 Phillips Perron (PP) Tests

Phillips Perron test is another type of test used in time series analysis to test the null hypothesis that a time series which is integrated order. The Phillips Perron test statistic can be considered as a stronger form of the Dickey Fuller statistic that have been made robust to serial correlation by using the Newey-West heteroskedasticity and autocorrelation consistent covariance matrix estimator. The advantage of PP tests over the ADF tests is that we do not need to specify the lag length for the test regression. Below is the equation for the PP test:

$$\Delta Y_t = \beta' D_t + \rho Y_{t-1} + \varepsilon_t$$

The null and alternative hypotheses are:

H_0: $\boldsymbol{\rho} = 0$ (Y_t is unit root/ non-stationary)

H_1: $\boldsymbol{\rho} \neq 0$ (Y_t is stationary)

If t-test statistic less than the PP critical value, the null hypothesis will not be rejected, which mean that the unit root exists, the value series is non-stationary. If t-test statistic greater than the PP critical value, the null hypothesis will be rejected, means that the unit root does not exists, the value series is stationary.

3.1.3 Granger-Causality

This test is conducted in order to identify the short-run relationship between of stock price and the independent variables which are inflation, expected inflation, money supply and Treasury bill rate. There are three possible types of Granger Causality as shown below:-

i) Unidirectional (Y_t causes X_t or vice versa),
ii) Bi-directional (causality among variables), and
iii) Two variables are independent (no relationship at all)

A simple test that defined causality was developed by Granger (1969). A variable Y_t is said to Granger-cause X_t, if X_t can be predicted with greater accuracy by using past value of the Y_t variable rather than not using such past value, all other things remain constant. Researchers do not need to identify whether which variables are exogenous or endogenous as Granger causality will assume all the variables are endogenous.

Both of the null and alternative hypotheses are:

H_0 = No causal interaction

H_{1a} = Y_t affect X_t

H_{1b} = X_t affect Y_t

If the probability is less than the significant level, we reject the null hypothesis which means that there is a causal relationship between the two variables.

3.2 Diagnostic Checking

Econometrics problems such as autocorrelation, heteroscedasticity, model specification and normality of error term might exist in the estimated model. Therefore, there are several of diagnostic test used for checking those problem as below:

3.2.1 Breusch-Godfrey Serial Correlation LM Test

The BG serial correlation LM test help to regress the residuals on the original regressors and lagged residuals up to specified lag order. The null hypothesis H_0 is that there is no serial correlation problem and the alternative hypothesis H_1 state that there is serial correlation problem as below:

H_0: There is no serial correlation problem

H_1: There is serial correlation problem

If the p-value of the LM test is > 0.01, H_0 is no rejected which means that there no serial correlation problem.

3.2.2 ARCH Test for Heteroscedasticity

Heteroscedasticity explain that the standard deviation and variance of each error term u_i is constant to σ^2 which is equal variance. Symbolically it means:

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

If there is a heteroscedasticity on the model, then the variance of Y_i increases as X increases which mean that the variance of Y_i are not the same:

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

Therefore, ARCH test is helpful for checking the existence of heteroscedasticity problem in the estimated model. The null hypothesis H_0 is that there is no heteroscedasticity problem and the alternative hypothesis H_1 state that there is heteroscedasticity problem as below:

H_0: There is no heteroscedasticity problem.

H_1: There is heteroscedasticity problem.

If the p-value of F-statistics > 0.01,we do not reject the H_0, which means that there is no heteroscedasticity problem.

3.2.3 Ramsey RESET Test

The Ramsey RESET test is a model specification test for the linear regression model. From this test, say for example $Y = \beta_0 + \beta_0 X_1 + \varepsilon$ is a estimated restricted model with R^2 ,then rerun to obtain estimated unrestriced model with a new R^2 . The new R^2 is used together with the R^2 of the original equation to perform the F-test. For this test, the hypothesis is stated as below:

H_0: Model specification is correct.

H_1: Model specification is incorrect.

When comparing the F-value with the critical value, we are not sufficient evidence to reject the H_0 if the F-value is > 0.01. Therefore, there is said that the model is correctly specified.

3.2.4 Jarque-Bera (JB) Test for Normality

The JB test is a test to determine whether the sample data have matched with normal distribution. This test conclude the skewness and kurtosis to measure the OLS residual by using the following test statistic:

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

This test statistic used to test the hypothesis that the data are from the normal distribution. Therefore, the null hypothesis is stated that the error term is

normally distributed while the alternative hypothesis is stated that the error term is not normally distributed as following:

H_0: The error term is normally distributed.

H_1: The error term is not normally distributed.

By referring the p-value of JB statistic, there is no sufficient evidence to reject the H_0 if the p-value of JB statistic is > 0.01 which meanings that the error term is normally distributed.

3.3 Data sources and Description

The empirical analysis is carried out by using time series data of money supply, inflation, expected inflation and Treasury bill rate for the period of 1991-2011 which is obtained from data stream. The obtained data is being transformed from monthly to quarterly in order to ensure the accuracy of the data. After that, we transform the series data of money supply into growth rate of money supply. The series data of stock price also being convert into the form of changes of stock return. Both of the data were transformed by using the formula of $(P_1 – P_{1-t}) / P_{1-t}$ through Microsoft Excel. No conversion is needed as all of the data is in local currency. The series of data is then imported to the Eviews Workfile. Due to the unit measurement of series data of inflation is in index form, so it is being transformed to percentage by generate the formula of genr lcpi = log(cpi) by using Eviews.

3.4 Conclusion

This chapter describes the methodology of how this study was being carried out. Besides that, the methods that we used are supported by listing its justification. The results of our research that investigate and identify our research objective, hypotheses, and problem formulated earlier will be discussed in next chapter.

CHAPTER 4: RESULTS AND INTERPRETATION

4.0 Introduction

This chapter presents the impact of money supply, inflation, and expected inflation and Treasury bill rate on stock price (S&P 500 index). Ordinary least square (OLS) method was employed in this research. Under OLS, we employed correlation analysis, LM test, ARCH test, Ramsey Reset test, and Jarque-Bera test in order to determine whether the model has the problem of multicollinearity, autocorrelation, heteroscedasticity. Besides that, the model has also been tested to determine whether it is correctly specified, and whether error term is normally distributed. For the former case, we may reject the null hypothesis of the above tests when p-value is smaller than the significant level, and conclude that the model has the problems that we mentioned above.

In addition, unit root tests such as Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) were used to evaluate the variables whether are stationary or non-stationary. When the p-value is less than the significant level, we may reject the null hypothesis of unit root and conclude that the series is stationary. Based on the Schwarz Information Criteria (for ADF test) and New-West Banwidth (for PP test), we have selected the optimal number of lags length in order to avoid autocorrelation problem.

4.1 Ordinary Least Square (OLS)

We begin with Equation (1) which consists of *TB, CPI, EXPEC_INF* and *MS* on the right hand side of the equation. This equation consists of high R^2 which is 0.7680. According to the results, its show that *TB* and *CPI* are significant while *EXPEC_INF* and *MS* are insignificant. This equation is free from model specification and normality problem. However, it has serious multicollinearity problem as the Variance Inflation Factor (VIF) is 16.6340 and it is also suffered from heteroscedasticity and autocorrelation poblems. To solve these problems, we proceed to Equation (2) with log. This equation consists of low R^2 which is 0.0234 and it is indicates a poor goodness of fit. From the Equation (2), it shows that *TB* and *EXPEC_INF* are significant while *CPI* and *MS* are insignificant. There is only a minor multicollinearity problem found in the Equation (2) with the VIF of 1.7232 and the overall equation is not suffered from most of the econometric problems, which are heteroscedasticity, autocorrelation, model specification and normality problem. Due to the existing of insignificant variables in Equation (2), we will solve it by separating the equation become two equations which are Equation (3) and Equation (4).

The Equation (3) which consists of *TB, CPI* and *MS* on the right hand side of the equation consists of low R^2 and indicates a poor goodness of fit. All of the independent variables are insignificance. Besides that, the overall equation does not suffer from most of the econometric problems, which are heteroscedasticity, autocorrelation, model specification and normality problem and only minor multicollinearity problem as the calculated VIF is low. Next, we proceed to form Equation (4) by including *TB, EXPEC_INF* and *MS* as the independent variables. The goodness of fit has improved significantly with R^2 increasing to 0.2043. *TB* and *EXPEC_INF* are significant at 1% level of significance and *MS* is significant at 10% level of significant. This equation is free from heteroscedasticity, autocorrelation, model specification and normality problem and there is only a minor multicollinearity problem found in the Equation (4) with the VIF of 1.2715.

Table 4.1: Ordinary Least Square Regression Test for Equation (1), (2), (3) and (4)

	(1)	(2)	(3)	(4)
C	**-6.5792 (335.7984)**	**2.0872 (0.0604)**	**-0.4149 (0.0550)**	**3.6590 (0.0198)**
MS	**-1.1452 (0.0885)**	**-1.6591 (0.8567)**	**-0.6048 (0.9224)**	**-1.7462*** (0.8530)**
EXPEC_INF	**-1.4905 (37.7816)**	**-4.3378* (0.0080)**	**---**	**-4.2577* (0.0076)**
TB	**5.2786* (17.6703)**	**2.0800** (0.0029)**	**1.1154 (0.0032)**	**3.0756* (0.0025)**
CPI	**4.8949* (3.9892)**	**-0.9386 (0.0002)**	**0.3676 (0.0003)**	**---**
R^2	**0.7680**	**0.2132**	**0.0234**	**0.2043**
Diagnostic Checking				
Multicollinearity (VIF)	**16.6340**	**1.7232**	**1.7232**	**1.2715**
LM Test	**0.0000**	**0.5258**	**0.0480**	**0.5335**
ARCH	**0.0000**	**0.0384**	**0.2134**	**0.1179**
Ramsey Reset	**0.9512**	**0.9022**	**0.9804**	**0.9697**
Jarque-Bera	**0.5613**	**0.0874**	**0.1692**	**0.0830**

*Note: *, **, *** indicate rejection of the null hypothesis at 1%, 5%, 10% level of significance respectively. The figure in (…) denote as Standard Error.*

4.2 Interpretation of equation

After conducting some tests for Equation (1), (2), (3) and (4), Equation (4) is chosen. The interpretations of the estimated coefficient in this model are as follow:

S_P_500 = - 0.02284 + 0.0000948CPI – 0.5579MS + 0.0036TB (3)

S_P_500 = 0.0725 – 0.1439EXPEC_INF – 1.4894MS + 0.0076TB (4)

$R^2 = 0.2043$

D-W test statistics = 1.8077

The coefficient of expected inflation is negatively related to stock price which is not consistent with our a priori expectation but is consistent with the findings of Solnik (1983), Fama and Schwert (1977), Gallagher and Taylor (2002), Geske and Roll (1983), Kaul (1990). The negative relationship is based on the changes in Treasury bill yields, and contemporaneous stock market returns. Besides that, during the post-war period, a counter-cyclical monetary response would have led to strong negative relations between stock returns and changes in expected inflation. In addition, higher expected inflation will cause an increase in the required rate of return, thus stock price will decrease as a result of higher expected inflation.

The coefficient of money supply is negatively related to stock price which is not consistent with our a priori expectation but is consistent with the findings of Hamburger and Kochin (1972), Pearce and Roley (1983), Bailey (1989), Hardouvelis (1984), Lynge (1981), Darrat (1990). Unanticipated high money

supply leads to an increase in interest rate and lower down the stock prices. This is because agents believe that the Federal Reserve will implement restrictive monetary policy immediately which would lead to higher interest rate when there is an unexpected high money growth. After they anticipate interest rates will increase in near future, they will sell securities on hand immediately and this force interest rate to rise. This may lead to a decline in stock price. Another reason is that the agents expect there is inflation when positive money supply exists. Stock prices will be lowered when there is inflation.

The coefficient of Treasury bill rate is positively related with stock price which is not consistent with our a priori expectation but is consistent with the finding of Ratanapakorn and Sharma (2007), Sohail and Hussain (2009). When federal fund rate increase, it becomes more expensive for banks to borrow money from federal. Thus, the money that the bank can lend out will be reduced and money supply also will be reduced. When money supply is too few in the market, the economy will be affected. Then, government will implement expansionary monetary policy by lower the interest rate to increase money supply in market. Stock price will increase as a result of lower interest rate. Furthermore, interest rate on fixed rate mortgages will rise when the Treasury bill rate rise. This will lead to a decrease in demand for houses as publics have to borrow loan at higher cost to buy houses. Thus, it will negatively affect the economy and cause GDP to slow down. GDP slow down means US' currency will depreciate. Depreciation of US currency makes more foreign investors to invest in US and will push up the stock price.

In Equation (4), EXPEC_INF and TB are statistically significant at 1% level of significance while MS is statistically significant at 10% level of significance. The interpretations on the coefficients are as follows: The coefficient of EXPEC_INF is interpreted as 1% increased in expected inflation results in 0.1439% decreased in stock price. This shows that expected inflation has a negative effect on the stock price. The coefficient of MS is interpreted as 1% increased in money supply results in 1.4894% decreased in stock price. This shows that money supply has a negative effect on the stock price. The coefficient

of TB is interpreted as 1% increased in Treasury bill results in 0.0076% increased in stock price. This shows that Treasury bill has a positive effect on the stock price. Equation (4) has an R^2 of 0.2043 which means 20.43% of the variation in the dependent variable can be explained by the variation in the independent variables.

4.3 Unit root test

The result of Augmented Dickey Fuller (ADF) test and Phillips Perron (PP) test at level and first differenced form was shown in Table 4.2 and 4.3 respectively. The result of these tests considered the effect of the case of intercept and trend. Based on the Schwarz Information Criteria (for ADF test) and New-West Banwidth (for PP test), we have selected the optimal number of lags length. Based on the result of Table 4.2, the t-statistics of all variables except LCPI for ADF test are significant to reject the null hypothesis of one unit root at 1%, 5%, and 10% significant level at level form with trend and intercept. This means that S_P_500, MS, TB, and EXCPEC_INF variables are stationary at level form while LCPI is non-stationary at level form. Thus, we proceed to the first differenced form. As a result, the t-statistic of LCPI in this case is significant to reject the null hypothesis at first level of difference. Therefore, we can conclude that the series LCPI is stationary at first difference.

Table 4.2: Unit Root Test for Augmented Dickey Fuller (ADF)

Order of difference	Level		1st Diff.	
	Intercept	Trend and intercept	Intercept	Trend and intercept
S_P_500	-6.8719*	-6.8439*	-8.9248*	-8.8644*
LCPI	-6.7065*	-2.8362	-5.4520*	-7.0724*
MS	-6.5631*	-6.7146*	-10.9680*	-10.8935*
EXPEC_INF	-3.7437*	-3.7802**	-9.2566*	-9.2716*
TB	-2.1706	-3.1619***	-3.6346*	-3.6235**

*Note: *, **, *** indicate the rejection of the null hypotheses at 1%, 5%, and 10% significant levels. Values represent t-statistics of ADF test. Schwarz information criterion with a lag length of 11 is used in the ADF unit root test.*

To reinforce the result of ADF test, PP test is conducted on the same series. The result of PP test is shown in the Table 4.3 which is the t-statistics for series S_P_500, MS, EXPEC_INF for PP test are significant to reject the null hypothesis at 1%, 5%, and 10% significant level at level form with trend and intercept. This results show that they are stationary at level form. For the TB and LCPI, they are insignificant to reject null hypothesis and therefore are non-stationary at level form. At first difference of the PP test with trend and intercept, both the t-statistic for LCPI and TB are significant to reject the null hypothesis at 1% level of significance. Thus, we can conclude that the series LCPI and TB are stationary at first difference.

Table 4.3: Unit Root Test for Phillips Perron (PP)

Order of difference	Level		1st Diff.	
	Intercept	Trend and intercept	Intercept	Trend and intercept
S_P_500	-6.8918*	-6.8629*	-33.6252*	-45.9839*
LCPI	-5.4049*	-2.5643	-5.4824*	-7.1373*
MS	-6.5887*	-6.7307*	-21.6787*	-21.4983*
EXPEC_INF	-3.7375*	-3.8184**	-10.0518*	-10.1216*
TB	-1.6605	-2.2955	-6.6087*	-6.5710*

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

4.4 Granger Causality

Table 4.4: Granger Causality Result

Independent variables					
Dependent variables	χ^2 – statistics of lagged 1st differenced term				
	ΔS_P_500	ΔLCPI	ΔMS	ΔEXPEC_INF	ΔTB
ΔS_P_500	--	0.97 [0.615]	0.74 [0.691]	10.44* [0.005]	2.97 [0.227]
ΔLCPI	5.60** [0.061]	--	0.41 [0.815]	12.89* [0.002]	0.47 [0.791]
ΔMS	4.19 [0.123]	5.14*** [0.077]	--	0.50 [0.781]	4.74*** [0.094]

ΔEXPEC_INF	1.37 [0.505]	2.38 [0.305]	3.40 [0.183]	--	0.24 [0.885]
ΔTB	6.23** [0.044]	4.74*** [0.093]	2.67 [0.263]	1.09 [0.581]	--

*Note: *, ** and ***denotes significant at 1%, 5%, and 10% significance level, respectively. The value represent t-statistic and the figure in the square brackets […] represent as p-value.*

According to Table 4.4, it shown there is a unidirectional relationship short run from expected inflation (EXPEC_INF) to stock price (S_P_500), and it is found that there is no reverse causal effect. In other words, stock price Granger causes by expected inflation. In our opinion, when there is an increase of the expected inflation, the publics' purchasing power will be drop. Therefore, investor will required higher require rate of return in order to invest in the stocks. Thus, the stock price will drop as a result of there is a higher required rate of return. Besides that, when governments expect there is inflation in future, they will implement restrictive monetary policies by increasing the interest rate in order to reduce the money supply in market and prevent inflation to happen. As a result, when the interest rate has increase, the stock price will be reduced.

The result has shown that the Treasury bill (TB) does not has Granger cause to stock price but stock price has unidirectional relationship short run Granger cause to Treasury bill. The stock price has causal effect to Treasury bill it is because the investor willing invests in high risk stock when there is higher rate of return from stock. Thus, demand for Treasury bill decrease, this will lead to a decline in Treasury bill rate. Based on our result also shows there is a unidirectional relationship short run Granger cause from stock price to inflation (CPI) in order word is that inflation does not have Granger cause to stock price. In addition, it was found that expected inflation has Granger causal effect to inflation. In our opinion, when the government expected that inflation will be happened in

future but they did not implement any action or policies to prevent it from happen. Thus, the inflation has occurred.

Besides that, the finding shows that Treasury bill rate has Granger causal effect to money supply (MS), this happen when there are many investors buy Treasury bill from government thus cause money supply to reduce in market. Furthermore, inflation has found to have Granger causal effect to money supply. However, it was observed that money supply does not Granger cause to stock price and vice versa. Some of the variables such as money supply, Treasury bill or inflation do not have Granger causality in short run to stock price but they might have causality effect in long run. Stock market is one of the leading indicators which affect the other indicators in the economy. In other words, we are saying that before any incidents happen in the economic, the stock market will show the symptoms.

Diagram 1: The result of Granger Causality

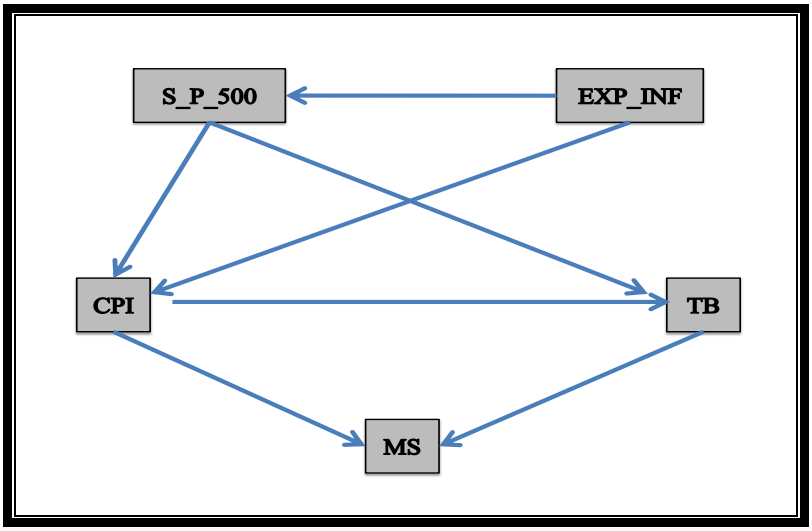


Diagram 1 above is the summary of Granger Causality result in Table 4.4.

4.5 Conclusion

All the analysis of data has been completed through Ordinary Least Square (OLS) test and Unit Root test. The results of our study are shown in this chapter through the tables and charts. Conclusion of the entire research will be carried in chapter 5.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

Our objective of this paper is to investigate the impact of inflation, money supply, and expected inflation and Treasury bill rate on stock price from year 1991 to 2011. There have a number of studies have been done to examine the relationship of stock price, inflation, money supply, expected inflation, and Treasury bill rate, by using different methodologies. However, there are few studies that relating to this topic that is done by comparing different countries. Therefore, our research aims to study the relationship of stock price, inflation, money supply, expected inflation, and Treasury bill rate on a single country, United State. We will summarize the study's finding in this chapter. After that, we will suggest few policies implications. Last but not least, we will discuss about limitations of the study and propose some recommendations for future research.

5.1 Summary of Statistical Analyses and Findings

Table 5.1: Result of OLS regression

Variables	P-value	Result
Expected inflation	0.0001	Significant
Money supply	0.0847	Significant
Treasury bill rate	0.0029	Significant
Diagnostic Checking		
LM test	0.5335	No autocorrelation problem
ARCH test	0.1179	No heteroscedasticity problem
Ramsey RESET Test	0.9697	Model is correctly specified.
Jarque-Bera test	0.0830	Error term is normally distributed

We have conducted various tests to examine the relationship of stock price with inflation, expected inflation, money supply, and Treasury bill rate. All of the research questions will be answered by our empirical study. After performing OLS regression, we choose the best equation to explain the relationship between expected inflation, money supply, Treasury bill rate and stock price. Based on our OLS result, we can conclude that expected inflation, money supply and Treasury bill rate have significant effect on stock price. Expected inflation and money supply have negative relationship with stock price while Treasury bill rate has positive relationship with stock price. This equation is free from autocorrelation and heteroscedasticity problem. Besides that, the model is correctly specified and the error term is normally distributed. In addition, based on the result of Granger causality test, only the factor of expected inflation has short run effect on stock price. Although the rest of the factors do not have short run effect on stock price, they may have long run effect on it.

5.2 Implications of the Study: Implications of government policy

Based on our research, stock price and inflation have positive relationship. However, inflation is not significant to stock price in our research. This is maybe expected inflation already has been taken into account to reflect the stock price in the market. So when there is actual inflation happen in economy, the stock price will not have any changes. Thus, government does not need to focus more on inflation to control stock price.

The negative relationship between stock price and money supply serve as a reminder for government control the money supply in the market. Government is proposed to increase the required reserve rate in order to reduce money supply as the money that the bank can lend out has been reduced. Besides that, government can also sell treasury securities such as T-bill and bonds in open market. This can absorbs cash from the economy by replacing the cash with government securities. Even though restrictive monetary policy is one of the methods to reduce money supply, government not encouraged to implement this policy. This is because government will increase interest rate in this policy and higher interest rate will cause stock price to decrease.

Besides that, the negative relationship between stock price and expected inflation also serve as a warning to the government to control money supply as money supply and expected inflation is interrelated. Government should not set the interest rate in too low. Thus, inflation will not occur as money supply being control in certain level. In addition, government is proposed to impose higher required reserve rate when they forecast inflation will happen in future as it reduce the amount of money that the bank can lend out. When money supply has been reduced, the probability of inflation happen in future will be lower.

Our research shows that Treasury bill rate has positive relationship with stock price. However, most of the result of previous researchers showed that there is negative relationship between Treasury bill rate and stock price. In our research, the coefficient of Treasury bill rate is near to zero. This means that the factor of Treasury bill rate does not have much effect on stock price. Thus, the movement of stock price does not depend on Treasury bill rate. Therefore, government does not need to adjust the Treasury bill rate for rising stock price.

5.3 Limitations and Recommendations of the Study

It is common that every research has its own limitations. Therefore our study is not an exception. First of the limitation that we encountered in our research is that our model does not allow us to conduct Ordinary Least Square (OLS) method together with the Vector Error Correction Model (VECM) because there is some conflict between the level of integration. In order to run the VECM, all the variable in the model should be in I(1) process, while for OLS, all the variable in the model should be in I(0) process. Since the variables in our model contain both I(0) and I(1) process, thus we can only choose either one method to perform in our research. We choose to perform OLS instead of VECM.

The second limitation that we found in our research is the insufficient of independent variables as there are just four independent variables in our model. Even though our variables are significant but the R^2 that we obtained is low. Another limitation is that, the independent variable of inflation in our model is insignificantly affects the stock price movement. This may because investors have take into account the expected inflation instead of inflation and thus any changes to the stock price movement will only depend on expected inflation. Any inflation that comes in later does not affect the stock price movement.

Regarding the first limitation, we suggest that the future researcher can conduct VECM to indicate the exogeneity or endogeneity of a variable in a system and the direction of Granger Causality within the same sample period. Besides that, due to the insufficient independent variable in our model, we suggest that future researchers should focus on more other variables that can affect stock prices movements because the more independent variables are being used, the higher will be the R^2 and the model is said to be best fitted. For the last limitation, we suggest that future researchers may choose not to include both inflation and expected inflation as their independent variables in the model because the model might exist serious multicollinearity problem.

5.4 Conclusion

We obtained data from data stream and conduct several test to identify whether inflation, money supply, expected inflation and Treasury bill rate affect the stock price movement. Results show that all the independent variables in our chosen model are significantly affects the stock price movement. Expected inflation and money supply have a negative relationship while Treasury bill rate has a positive relationship with the stock price movement. We faced three limitations during our research and we had purposed some recommendation so that future researcher can obtain a better result in their future research.

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APPENDIX 1: EVIEW RESULTS

Ordinary Least Square of Equation 1

Dependent Variable: S_P_500
Method: Least Squares
Date: 07/16/12 Time: 18:18
Sample (adjusted): 1991Q1 2011Q3
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TB	93.27453	17.67025	5.278619	
M2	-0.101324	0.088476	-1.145213	
CPI	19.52658	3.989177	4.894888	
EXPEC_INF	-56.31181	37.78164	-1.490454	
C	-2209.296	335.7984	-6.579234	

R-squared	0.767999	Mean dependent var	975.4861
Adjusted R-squared	0.756102	S.D. dependent var	354.0191
S.E. of regression	174.8361	Akaike info criterion	13.22392
Sum squared resid	2384277.	Schwarz criterion	13.36964
Log likelihood	-543.7929	Hannan-Quinn criter.	13.28246
F-statistic	64.55144	Durbin-Watson stat	0.262226
Prob(F-statistic)	0.000000		

Muliticollinerity test of Equation 1

	S_P_500	CPI	EXPEC_INF	M2	TB
S_P_500	1.000000	0.749696	-0.422348	0.641250	-0.154864
CPI	0.749696	1.000000	-0.526149	0.969475	-0.647829
EXPEC_INF	-0.422348	-0.526149	1.000000	-0.469320	0.462025
M2	0.641250	0.969475	-0.469320	1.000000	-0.742962
TB	-0.154864	-0.647829	0.462025	-0.742962	1.000000

Ordinary Least Square of CPI & Money Supply of Equation 1

Dependent Variable: CPI
Method: Least Squares
Date: 07/16/12 Time: 18:14
Sample (adjusted): 1991Q1 2011Q3
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	0.019599	0.000551	35.58573	0.0000
C	72.23067	3.243546	22.26904	0.0000

R-squared	0.939882	Mean dependent var	185.1303
Adjusted R-squared	0.939140	S.D. dependent var	24.91398

S.E. of regression	6.146258	Akaike info criterion	6.493365
Sum squared resid	3059.896	Schwarz criterion	6.551651
Log likelihood	-267.4747	Hannan-Quinn criter.	6.516781
F-statistic	1266.344	Durbin-Watson stat	0.063800
Prob(F-statistic)	0.000000		

Breusch-Godfrey Serial Correlation LM Test of Equation 1

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	243.2868	Prob. F(1,77)	0.0000
Obs*R-squared	63.04601	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 07/16/12 Time: 17:51
Sample: 1991Q1 2011Q3
Included observations: 83
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	-0.004165	0.043663	-0.095379	0.9243
EXPEC_INF	-20.52319	18.69121	-1.098013	0.2756
CPI	-0.068583	1.968621	-0.034838	0.9723
TB	1.772576	8.720821	0.203258	0.8395
C	85.91839	165.8044	0.518191	0.6058
RESID(-1)	0.875811	0.056150	15.59765	0.0000

R-squared	0.759590	Mean dependent var	1.03E-12
Adjusted R-squared	0.743979	S.D. dependent var	170.5185
S.E. of regression	86.27974	Akaike info criterion	11.82261
Sum squared resid	573202.9	Schwarz criterion	11.99747
Log likelihood	-484.6383	Hannan-Quinn criter.	11.89286
F-statistic	48.65736	Durbin-Watson stat	1.740372
Prob(F-statistic)	0.000000		

Heteroskedasticity Test: ARCH of Equation 1

Heteroskedasticity Test: ARCH

F-statistic	78.91965	Prob. F(1,80)	0.0000
Obs*R-squared	40.72128	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2

Method: Least Squares
Date: 07/16/12 Time: 17:47
Sample (adjusted): 1991Q2 2011Q3
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8684.970	3682.130	2.358681	0.0208
RESID^2(-1)	0.703482	0.079188	8.883673	0.0000

R-squared	0.496601	Mean dependent var	29075.56
Adjusted R-squared	0.490308	S.D. dependent var	36519.39
S.E. of regression	26072.17	Akaike info criterion	23.19921
Sum squared resid	5.44E+10	Schwarz criterion	23.25791
Log likelihood	-949.1677	Hannan-Quinn criter.	23.22278
F-statistic	78.91965	Durbin-Watson stat	1.751753
Prob(F-statistic)	0.000000		

Ramsey RESET Test of Equation 1

Ramsey RESET Test
Equation: UNTITLED
Specification: S_P_500 M2 EXPEC_INF CPI TB C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.061342	77	0.9512
F-statistic	0.003763	(1, 77)	0.9512
Likelihood ratio	0.004056	1	0.9492

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	116.5086	1	116.5086
Restricted SSR	2384277.	78	30567.65
Unrestricted SSR	2384160.	77	30963.12
Unrestricted SSR	2384160.	77	30963.12

LR test summary:

	Value	df
Restricted LogL	-543.7929	78
Unrestricted LogL	-543.7909	77

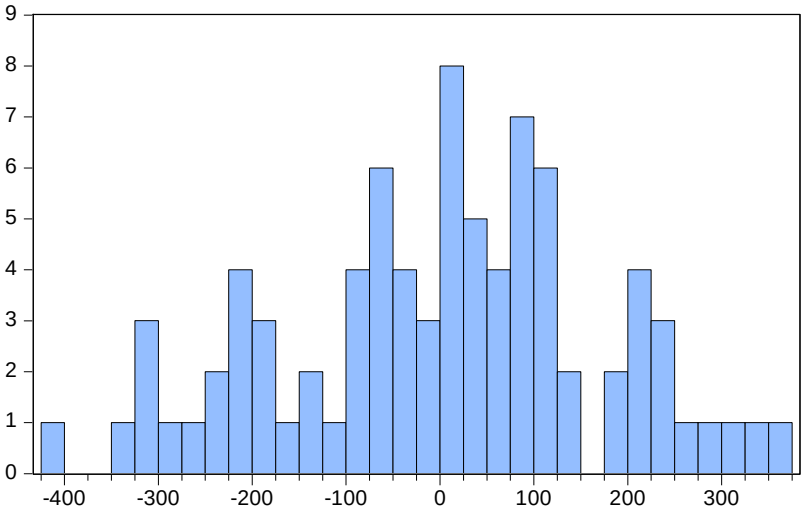
Unrestricted Test Equation:
Dependent Variable: S_P_500
Method: Least Squares
Date: 07/16/12 Time: 17:54
Sample: 1991Q1 2011Q3
Included observations: 83

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	-0.099500	0.093880	-1.059857	0.2925

EXPEC_INF	-57.37734	41.80488	-1.372503	0.1739
CPI	19.90634	7.378812	2.697770	0.0086
TB	96.64429	57.74117	1.673750	0.0982
C	-2281.156	1219.237	-1.870969	0.0651
FITTED^2	-1.64E-05	0.000267	-0.061342	0.9512

R-squared	0.768011	Mean dependent var	975.4861
Adjusted R-squared	0.752946	S.D. dependent var	354.0191
S.E. of regression	175.9634	Akaike info criterion	13.24797
Sum squared resid	2384160.	Schwarz criterion	13.42283
Log likelihood	-543.7909	Hannan-Quinn criter.	13.31822
F-statistic	50.98233	Durbin-Watson stat	0.262709
Prob(F-statistic)	0.000000		

Normality Test of Equation 1



Series: Residuals
Sample 1991Q1 2011Q3
Observations 83

Mean	1.03e-12
Median	21.76523
Maximum	360.1750
Minimum	-416.8811
Std. Dev.	170.5185
Skewness	-0.203339
Kurtosis	2.589363
Jarque-Bera	1.155117
Probability	0.561267

Ordinary Least Square for Equation 2

Dependent Variable: S_P_500
Method: Least Squares
Date: 07/16/12 Time: 17:34
Sample: 1991Q1 2011Q3
Included observations: 83

	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-0.000230	0.000245	-0.938623	0.3508
EXPEC_INF	-0.034859	0.008036	-4.337763	0.0000
MS	-1.421290	0.856680	-1.659068	0.1011
TB	0.006134	0.002949	2.080013	0.0408
C	0.126114	0.060424	2.087157	0.0401

R-squared	0.213189	Mean dependent var	0.005033
Adjusted R-squared	0.172840	S.D. dependent var	0.043414
S.E. of regression	0.039484	Akaike info criterion	-3.567469

Sum squared resid	0.121604	Schwarz criterion	-3.421755
Log likelihood	153.0500	Hannan-Quinn criter.	-3.508929
F-statistic	5.283590	Durbin-Watson stat	1.810443
Prob(F-statistic)	0.000809		

Multicollinearity Result of Equation 2

	S_P_500	TB	CPI	EXPEC_INF	MS
S_P_500	1.000000	0.134026	-0.063983	-0.287942	-0.073426
TB	0.134026	1.000000	-0.647829	0.462025	-0.092858
CPI	-0.063983	-0.647829	1.000000	-0.526149	0.187737
EXPEC_INF	-0.287942	0.462025	-0.526149	1.000000	-0.283274
MS	-0.073426	-0.092858	0.187737	-0.283274	1.000000

Ordinary Least Square of CPI and Treasury Bills of Equation 2

Dependent Variable: TB
Method: Least Squares
Date: 07/16/12 Time: 21:08
Sample: 1991Q1 2011Q3
Included observations: 83

	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-0.051556	0.006736	-7.653684	0.0000
C	12.83683	1.258159	10.20287	0.0000

R-squared	0.419683	Mean dependent var	3.292289
Adjusted R-squared	0.412519	S.D. dependent var	1.982713
S.E. of regression	1.519697	Akaike info criterion	3.698700
Sum squared resid	187.0678	Schwarz criterion	3.756986
Log likelihood	-151.4961	Hannan-Quinn criter.	3.722116
F-statistic	58.57888	Durbin-Watson stat	0.109363
Prob(F-statistic)	0.000000		

Breusch-Godfrey Serial Correlation LM Test for Equation 2

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.375215	Prob. F(1,77)	0.5420
Obs*R-squared	0.402491	Prob. Chi-Square(1)	0.5258

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 07/16/12 Time: 17:38
Sample: 1991Q1 2011Q3
Included observations: 83
Presample missing value lagged residuals set to zero.

	Coefficient	Std. Error	t-Statistic	Prob.
TB	-0.000112	0.002967	-0.037854	0.9699
CPI	-1.50E-05	0.000247	-0.060681	0.9518
EXPEC_INF	-0.000189	0.008074	-0.023450	0.9814
MS	0.082238	0.870547	0.094467	0.9250
C	0.003405	0.060921	0.055893	0.9556
RESID(-1)	0.071642	0.116958	0.612548	0.5420

R-squared	0.004849	Mean dependent var	-5.52E-18
Adjusted R-squared	-0.059771	S.D. dependent var	0.038509
S.E. of regression	0.039644	Akaike info criterion	-3.548233
Sum squared resid	0.121014	Schwarz criterion	-3.373377
Log likelihood	153.2517	Hannan-Quinn criter.	-3.477986
F-statistic	0.075043	Durbin-Watson stat	1.935634
Prob(F-statistic)	0.995823		

Heteroskedasticity Test: ARCH for Equation 2

Heteroskedasticity Test: ARCH

F-statistic	4.433193	Prob. F(1,80)	0.0384
Obs*R-squared	4.305437	Prob. Chi-Square(1)	0.0380

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/16/12 Time: 17:42
Sample (adjusted): 1991Q2 2011Q3
Included observations: 82 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001104	0.000320	3.444504	0.0009
RESID^2(-1)	0.228095	0.108332	2.105515	0.0384

R-squared	0.052505	Mean dependent var	0.001435
Adjusted R-squared	0.040662	S.D. dependent var	0.002581
S.E. of regression	0.002528	Akaike info criterion	-9.098402

Sum squared resid	0.000511	Schwarz criterion	-9.039701
Log likelihood	375.0345	Hannan-Quinn criter.	-9.074835
F-statistic	4.433193	Durbin-Watson stat	1.962346
Prob(F-statistic)	0.038383		

Ramsey RESET Test for Equation 2

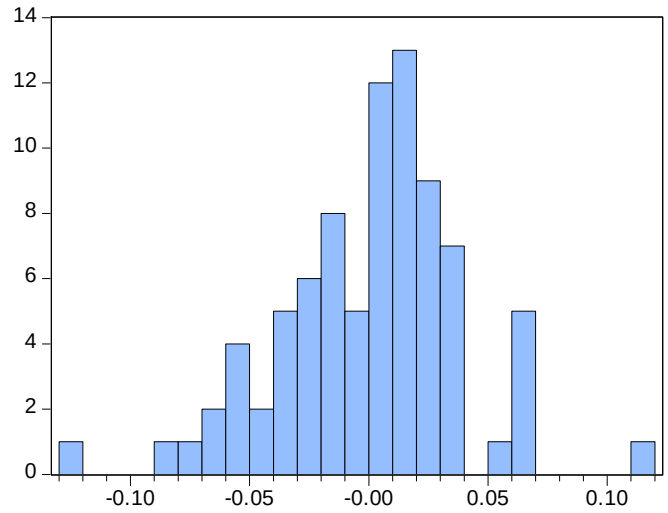
Ramsey RESET Test:			
F-statistic	0.015208	Prob. F(1,77)	0.9022
Log likelihood ratio	0.016392	Prob. Chi-Square(1)	0.8981

Test Equation:
Dependent Variable: S_P_500
Method: Least Squares
Date: 07/16/12 Time: 17:44
Sample: 1991Q1 2011Q3
Included observations: 83

	Coefficient	Std. Error	t-Statistic	Prob.
TB	0.006156	0.002973	2.070515	0.0418
MS	-1.393724	0.890646	-1.564846	0.1217
CPI	-0.000225	0.000249	-0.903759	0.3689
EXPEC_INF	-0.034715	0.008171	-4.248542	0.0001
C	0.125082	0.061382	2.037771	0.0450
FITTED^2	-0.840232	6.813323	-0.123322	0.9022

R-squared	0.213344	Mean dependent var	0.005033
Adjusted R-squared	0.162263	S.D. dependent var	0.043414
S.E. of regression	0.039736	Akaike info criterion	-3.543570
Sum squared resid	0.121580	Schwarz criterion	-3.368714
Log likelihood	153.0581	Hannan-Quinn criter.	-3.473322
F-statistic	4.176547	Durbin-Watson stat	1.808770
Prob(F-statistic)	0.002070		

Normality Test for Equation 2



Series: Residuals	
Sample 1991Q1 2011Q3	
Observations 83	
Mean	-5.52e-18
Median	0.007375
Maximum	0.118393
Minimum	-0.121760
Std. Dev.	0.038509
Skewness	-0.262395
Kurtosis	4.065013
Jarque-Bera	4.875061
Probability	0.087376

Ordinary Least Square for Equation 3

Dependent Variable: S_P_500
Method: Least Squares
Date: 06/09/12 Time: 15:26
Sample (adjusted): 1 83
Included observations: 83 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
CPI	9.48E-05	0.000258	0.367579	0.7142
MS	-0.557894	0.922420	-0.604816	0.5470
TB	0.003567	0.003198	1.115428	0.2680
C	-0.022835	0.055040	-0.414886	0.6794

R-squared	0.023384	Mean dependent var	0.005033
Adjusted R-squared	-0.013703	S.D. dependent var	0.043414
S.E. of regression	0.043711	Akaike info criterion	-3.375460
Sum squared resid	0.150939	Schwarz criterion	-3.258889
Log likelihood	144.0816	Hannan-Quinn criter.	-3.328628
F-statistic	0.630526	Durbin-Watson stat	1.551372
Prob(F-statistic)	0.597462		

Multicollinearity Result of Equation 3

	CPI	MS	TB	C
CPI	6.66E-08	-4.00E-05	5.32E-07	-1.40E-05
MS	-4.00E-05	0.850859	-0.000113	0.005596

TB	5.32E-07	-0.000113	1.02E-05	-0.000132
C	-1.40E-05	0.005596	-0.000132	0.003029

Ordinary Least Square of CPI and Treasury Bills of Equation 3

Dependent Variable: TB
Method: Least Squares
Date: 07/16/12 Time: 18:27
Sample (adjusted): 1 83
Included observations: 83 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-0.051556	0.006736	-7.653684	0.0000
C	12.83683	1.258159	10.20287	0.0000

R-squared	0.419683	Mean dependent var	3.292289
Adjusted R-squared	0.412519	S.D. dependent var	1.982713
S.E. of regression	1.519697	Akaike info criterion	3.698700
Sum squared resid	187.0678	Schwarz criterion	3.756986
Log likelihood	-151.4961	Hannan-Quinn criter.	3.722116
F-statistic	58.57888	Durbin-Watson stat	0.109363
Prob(F-statistic)	0.000000		

Breusch-Godfrey Serial Correlation LM Test for Equation 3

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.855610	Prob. F(1,78)	0.0531
Obs*R-squared	3.909514	Prob. Chi-Square(1)	0.0480

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 06/09/12 Time: 20:31
Sample: 1 83
Included observations: 83
Presample missing value lagged residuals set to zero.

	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-5.74E-05	0.000255	-0.225145	0.8225
MS	0.402639	0.929098	0.433365	0.6659
TB	-0.000544	0.003154	-0.172537	0.8635

C	0.011199	0.054371	0.205979	0.8373
RESID(-1)	0.227100	0.115657	1.963571	0.0531

R-squared	0.047103	Mean dependent var	-3.34E-18
Adjusted R-squared	-0.001764	S.D. dependent var	0.042904
S.E. of regression	0.042941	Akaike info criterion	-3.399611
Sum squared resid	0.143829	Schwarz criterion	-3.253898
Log likelihood	146.0839	Hannan-Quinn criter.	-3.341072
F-statistic	0.963903	Durbin-Watson stat	1.952805
Prob(F-statistic)	0.432175		

Heteroskedasticity Test: ARCH for Equation 3

Heteroskedasticity Test: ARCH			
F-statistic	1.573469	Prob. F(1,80)	0.2134
Obs*R-squared	1.581696	Prob. Chi-Square(1)	0.2085

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 06/09/12 Time: 20:55
Sample (adjusted): 2 83
Included observations: 82 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001590	0.000353	4.503579	0.0000
RESID^2(-1)	0.139750	0.111410	1.254380	0.2134

R-squared	0.019289	Mean dependent var	0.001839
Adjusted R-squared	0.007030	S.D. dependent var	0.002653
S.E. of regression	0.002644	Akaike info criterion	-9.009106
Sum squared resid	0.000559	Schwarz criterion	-8.950406
Log likelihood	371.3734	Hannan-Quinn criter.	-8.985539
F-statistic	1.573469	Durbin-Watson stat	1.999688
Prob(F-statistic)	0.213357		

Ramsey RESET Test for Equation 3

Ramsey RESET Test:			
F-statistic	0.000607	Prob. F(1,78)	0.9804
Log likelihood ratio	0.000646	Prob. Chi-Square(1)	0.9797

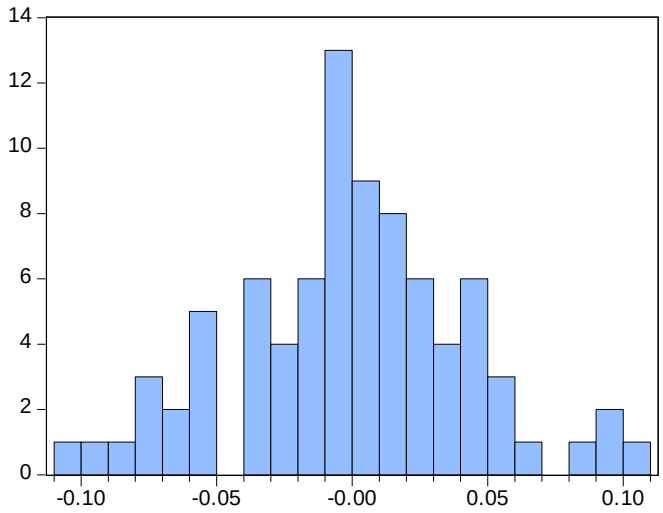
Test Equation:
Dependent Variable: S_P_500

Method: Least Squares
Date: 06/09/12 Time: 20:37
Sample: 1 83
Included observations: 83

	Coefficient	Std. Error	t-Statistic	Prob.
CPI	9.15E-05	0.000293	0.312825	0.7552
MS	-0.564074	0.961601	-0.586599	0.5592
TB	0.003483	0.004697	0.741524	0.4606
C	-0.022105	0.062831	-0.351814	0.7259
FITTED^2	2.577546	104.6169	0.024638	0.9804

R-squared	0.023392	Mean dependent var	0.005033
Adjusted R-squared	-0.026691	S.D. dependent var	0.043414
S.E. of regression	0.043990	Akaike info criterion	-3.351371
Sum squared resid	0.150937	Schwarz criterion	-3.205658
Log likelihood	144.0819	Hannan-Quinn criter.	-3.292832
F-statistic	0.467064	Durbin-Watson stat	1.551590
Prob(F-statistic)	0.759708		

Normality Test for Equation 3



Series: Residuals
Sample 1 83
Observations 83

Mean	-3.34e-18
Median	-0.000526
Maximum	0.105984
Minimum	-0.109644
Std. Dev.	0.042904
Skewness	-0.101656
Kurtosis	3.087145
Jarque-Bera	0.169215
Probability	0.918873

Ordinary Least Square for Equation 4

Dependent Variable: S_P_500
Method: Least Squares
Date: 06/09/12 Time: 20:45
Sample: 1991Q1 2011Q3
Included observations: 83

	Coefficient	Std. Error	t-Statistic	Prob.
TB	0.007628	0.002480	3.075557	0.0029
MS	-1.489430	0.852956	-1.746199	0.0847
EXPEC_INF	-0.032553	0.007646	-4.257707	0.0001
C	0.072543	0.019826	3.658985	0.0005

R-squared	0.204302	Mean dependent var	0.005033
Adjusted R-squared	0.174086	S.D. dependent var	0.043414
S.E. of regression	0.039455	Akaike info criterion	-3.580333
Sum squared resid	0.122977	Schwarz criterion	-3.463763
Log likelihood	152.5838	Hannan-Quinn criter.	-3.533502
F-statistic	6.761299	Durbin-Watson stat	1.807730
Prob(F-statistic)	0.000407		

Multicollinearity Result of Equation 4

	EXPEC_INF	MS	TB	C
EXPEC_INF	5.85E-05	0.001775	-8.65E-06	-0.000136
MS	0.001775	0.727533	-9.46E-05	-0.006402
TB	-8.65E-06	-9.46E-05	6.15E-06	3.59E-06
C	-0.000136	-0.006402	3.59E-06	0.000393

Ordinary Least Square of Expected Inflation and Treasury Bills of Equation 4

Dependent Variable: TB
Method: Least Squares
Date: 07/16/12 Time: 18:29
Sample: 1991Q1 2011Q3
Included observations: 83

	Coefficient	Std. Error	t-Statistic	Prob.
EXPEC_INF	1.371804	0.292579	4.688668	0.0000
C	-0.449594	0.821357	-0.547380	0.5856

R-squared	0.213467	Mean dependent var	3.292289
Adjusted R-squared	0.203757	S.D. dependent var	1.982713
S.E. of regression	1.769224	Akaike info criterion	4.002760
Sum squared resid	253.5424	Schwarz criterion	4.061046
Log likelihood	-164.1146	Hannan-Quinn criter.	4.026176
F-statistic	21.98360	Durbin-Watson stat	0.145273

Prob(F-statistic)	0.000011

Breusch-Godfrey Serial Correlation LM Test for Equation 4

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.366106	Prob. F(1,78)	0.5469
Obs*R-squared	0.387754	Prob. Chi-Square(1)	0.5335

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 06/09/12 Time: 20:46
Sample: 1991Q1 2011Q3
Included observations: 83
Presample missing value lagged residuals set to zero.

	Coefficient	Std. Error	t-Statistic	Prob.
TB	-1.74E-05	0.002490	-0.006993	0.9944
EXPEC_INF	-1.28E-05	0.007677	-0.001662	0.9987
MS	0.091261	0.869579	0.104949	0.9167
C	-0.000190	0.019909	-0.009539	0.9924
RESID(-1)	0.070439	0.116415	0.605067	0.5469

R-squared	0.004672	Mean dependent var	-8.19E-18
Adjusted R-squared	-0.046371	S.D. dependent var	0.038726
S.E. of regression	0.039614	Akaike info criterion	-3.560920
Sum squared resid	0.122403	Schwarz criterion	-3.415206
Log likelihood	152.7782	Hannan-Quinn criter.	-3.502380
F-statistic	0.091526	Durbin-Watson stat	1.928955
Prob(F-statistic)	0.984866		

Heteroskedasticity Test: ARCH for Equation 4

Heteroskedasticity Test: ARCH			
F-statistic	2.498207	Prob. F(1,80)	0.1179
Obs*R-squared	2.483120	Prob. Chi-Square(1)	0.1151

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 06/09/12 Time: 21:02
Sample (adjusted): 1991Q2 2011Q3

Included observations: 82 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001195	0.000330	3.621188	0.0005
RESID^2(-1)	0.173273	0.109627	1.580572	0.1179

R-squared	0.030282	Mean dependent var	0.001448
Adjusted R-squared	0.018160	S.D. dependent var	0.002637
S.E. of regression	0.002613	Akaike info criterion	-9.032912
Sum squared resid	0.000546	Schwarz criterion	-8.974211
Log likelihood	372.3494	Hannan-Quinn criter.	-9.009345
F-statistic	2.498207	Durbin-Watson stat	1.965539
Prob(F-statistic)	0.117922		

Ramsey RESET Test for Equation 4

Ramsey RESET Test:

F-statistic	0.001449	Prob. F(1,78)	0.9697
Log likelihood ratio	0.001542	Prob. Chi-Square(1)	0.9687

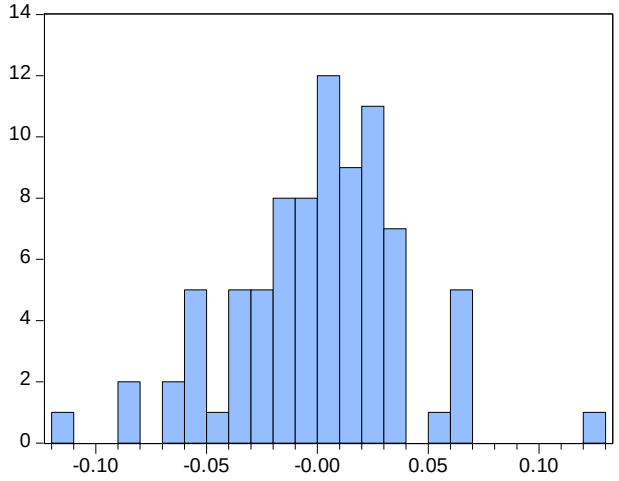
Test Equation:
Dependent Variable: S_P_500
Method: Least Squares
Date: 06/09/12 Time: 20:48
Sample: 1991Q1 2011Q3
Included observations: 83

	Coefficient	Std. Error	t-Statistic	Prob.
TB	0.007633	0.002499	3.054170	0.0031
EXPEC_INF	-0.032532	0.007715	-4.216859	0.0001
MS	-1.480172	0.892183	-1.659045	0.1011
C	0.072565	0.019961	3.635402	0.0005
FITTED^2	-0.293148	7.700018	-0.038071	0.9697

R-squared	0.204317	Mean dependent var	0.005033
Adjusted R-squared	0.163513	S.D. dependent var	0.043414
S.E. of regression	0.039706	Akaike info criterion	-3.556256
Sum squared resid	0.122975	Schwarz criterion	-3.410542
Log likelihood	152.5846	Hannan-Quinn criter.	-3.497716
F-statistic	5.007240	Durbin-Watson stat	1.806912

Prob(F-statistic)	0.001207

Normality Test for Equation 4



Series: Residuals	
Sample 1991Q1 2011Q3	
Observations 83	
Mean	-8.19e-18
Median	0.005054
Maximum	0.124436
Minimum	-0.119437
Std. Dev.	0.038726
Skewness	-0.198949
Kurtosis	4.131722
Jarque-Bera	4.976949
Probability	0.083037

APPENDIX 2: GRANGER CAUSALITY RESULT

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/09/12 Time: 21:43
Sample: 1991Q1 2011Q3
Included observations: 81

Dependent variable: S_P_500

Excluded	Chi-sq	df	Prob.
LCPI	0.973656	2	0.6146
MS	0.738546	2	0.6912
EXPEC_INF	10.43653	2	0.0054
TB	2.970343	2	0.2265
All	17.50881	8	0.0252

Dependent variable: LCPI

Excluded	Chi-sq	df	Prob.
S_P_500	5.602171	2	0.0607
MS	0.409301	2	0.8149
EXPEC_INF	12.58915	2	0.0018
TB	0.469493	2	0.7908
All	16.75747	8	0.0327

Dependent variable: MS

Excluded	Chi-sq	df	Prob.
S_P_500	4.189877	2	0.1231
LCPI	5.135920	2	0.0767
EXPEC_INF	0.494456	2	0.7810
TB	4.737733	2	0.0936
All	12.85237	8	0.1170

Dependent variable: EXPEC_INF

Excluded	Chi-sq	df	Prob.
S_P_500	1.366544	2	0.5050
LCPI	2.376438	2	0.3048
MS	3.396193	2	0.1830
TB	0.243774	2	0.8852

All	11.05248	8	0.1987

Dependent variable: TB

Excluded	Chi-sq	df	Prob.
S_P_500	6.228584	2	0.0444
LCPI	4.741633	2	0.0934
MS	2.670566	2	0.2631
EXPEC_INF	1.087156	2	0.5807
All	13.82708	8	0.0864