THE IMPACT OF MACROECONOMIC VARIABLES ON THE STOCK MARKET PERFORMANCE IN JAPAN

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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.

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DEDICATION

We would like to dedicate this dissertation to our beloved parents who provide us the opportunity to pursue our studies in UTAR. Besides, they are the backbone for us to complete this dissertation by supporting us in terms of monetary and mentally.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
AIC	Akaike information criterion
APT	Arbitrage Pricing Theory
ARCH	Autoregressive Conditional Heteroscadasticity
AVM	Asset Valuation Model
BSE-Sensex	Bombay Stock Exchange Sensitive Index
CPI	Consumer price index
DDM	Dividend Discount Model
DEBT	Government debt
DJIA	Dow Jones Industrial Index
ECM	Error Correction Model
EGARCH	Exponential Generalized Autoregressive Conditional Heteroscadasticity
EMH	Efficient Market Hypothesis
EXG	Real exchange rate

FDI	Foreign Direct Investments
FPE	Final prediction error
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GDP	Gross domestic product
HQ	Hannan-Quinn information criterion
IIP	Index of industrial production
IMF	International Monetary Fund
INF	Inflation rate
INT	Real interest rate
JJ	Johansen and Juselius
KLSE	Kuala Lumpur Stock Exchange
KOSPI	Korean Composite Stock Price Indexes
KSE-100	Karachi Stock Exchange's 100 Index
MSCI	Morgan Stanley Composite Index
NASDAQ	National Association of Securities Dealers Automated Quotations
NIKKEI	*Nihon Keizai* (Japanese stock market index)

NSE-Nifty	National Stock Exchange's 50 Index
NYSE	New York Stock Exchange
OLS	Ordinary Least Square
OPEC	Organization of the Petroleum Exporting Countries
PP	Phillip Perron
S & P 500	Standard & Poor's 500 Index
SIC	Schwarz information criterion
TOPIX	Tokyo Stock Price Index
TSE	Tokyo Stock Exchange
VAR	Vector Autoregressive
VEC	Vector Error Correction
VECM	Vector Error Correction Model

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PREFACE

Japan is the country which its stock market trading volume is the third largest around the world. It is also plays an important role in leading the other countries in Asia. Most of the Asian countries have closely trading with Japan. Any movement or changes of its economy could bring large effect to its trading partners.

Japan stock market index, Nikkei 225 has played a pivotal role in supporting the growth of industries and commerce area in Japan which consists of 225 blue chips companies. It is also effectively diversified as it comprises of different industries in it. An outstanding performance of a country's stock market could influence several industries in a country even to global such as domestic production, balance of payment, real exchange rate and so on. The study of the stock market performance could provide the market participants a clear picture of the trend of different industries or areas.

The relationship between the macroeconomic variables and stock market performance will be discussed in the study to see whether there is long run effect from macroeconomic variables to the stock market performance. It is believed that real interest rate, inflation rate, real exchange rate, government debt as well as index of industrial production have significantly affected the Nikkei 225 in the long run.

ABSTRACT

There are many macroeconomic variables influencing the stock market index since stock market always been an important indicator of economic growth. In this study, the main focus would be in Japan. According to World Federation of Exchange, Japan is the highest trading volume and most active stock market in Asia. This leads us wants to examine the relationship between the macroeconomic variables as Officer (1973) stated that stock market performance will be volatile because of changes of macroeconomic variables. In this study, we examine the dynamic relationship between macroeconomic variables namely real interest rate, real exchange rate, industrial production index, inflation, government debt and stock market index in Japan, Nikkei 225. This study employs monthly time series data spanning the period January 2000 to January 2012 collected from DataStream. By applying Augmented Dickey Fuller test, unit root test, Philip Peron Test, Johansen cointegration test, Granger Causality Test and ECM (Error Correction Model), the result shows that all the variables are significantly impacted on Nikkei 225 in long run, during post Asian financial crisis.

CHAPTER ONE
RESEARCH OVERVIEW

1.1 Introduction

Stock market is a channel where the shares are issued by deficit spending units and traded with surplus spending units. There are two main sections in the stock market, primary market and secondary market. New securities will be issued to initial investors in the primary market. Investment bank who underwrites the offering will facilitate the primary market. In secondary market, stocks that previously issued are traded in organized exchange. The most well-known and leading stock market is New York Stock Exchange (NYSE). Meanwhile, over the counter market also provided stock trading as secondary market for investors. The trading in over counter market is done between two parties at different locations.

Typically, surplus spending units such as savers will utilize their additional income to invest in stock market in order to gain profit. Savers will earn dividend that promised to be paid by deficit spending units. Deficit spending units such as firms and government will issue shares to collect funds. Firms need funds for large project and expand their business development. Undoubtedly, stock market is very important to the global economic. According Alile (1984), it provides a channel that can move the funds from people who lack productive investment opportunities to people who have them. Therefore, stock market played a pivotal role in improving the economic growth (Demirguc-Kunt & Levine 1996, Singh 1997, and Levine & Zervos 1998).

Stock market index is used in measuring the value of stock market by computing the stock prices. There are two types of stock market index, market value weighted index and price weighted index. Market value index is a stock market index weighted according to the market capitalization. S&P 500 is one of the

popular market value indexes which based on 500 leading companies traded in United States market. For the price weighted index, it is a stock market index weighted according to the stock price. The Dow Jones Industrial Average (DJIA) is the most well-known price-weighted index. There are previous researches used S&P 100 index of call option as stock performance to test the stock market volatility (Theodore and Craig, 1992). In this paper, stock market index is chosen in examining the relationship between macroeconomics variables and stock market performance.

Besides that, some of the researchers also examined the relationship between macroeconomic variables and stock market performance in Western countries. According to Poon and Taylor (1991), they found that macroeconomic variables will affect the United States stock market return. There are some researchers examined on other Western countries as well such as France, Italy and United Kingdom (Mukherjee & Naka 1995, Cheung & Ng 1998, Nasseh & Strauss 2000, McMillan 2001 and Chaudhuri & Smiles 2004). Since there are different conclusions on this issue, investigation on the result of the relationship between macroeconomic variables and stock market performance should be further enhanced.

In addition, the stock performance is concerned by investors to make wise investment decisions. Due to macroeconomic factors, the performance of stock market is volatile (Officer, 1973). There are some past researches that examined macroeconomic variables such as interest rate, inflation rate, and industrial production, exchange rate affect stock market performance in Asia. Besides, previous research showed that macroeconomic variable such as inflation rate is positively affecting the stock return in Asia (Fama & Gibbons, 1982).

1.1.1 Japan

Japan, a well-developed country with its advance industrial technology and innovations has brought the entire nation towards a remarkable economic success.

In addition, Japan is the world's third largest economy and is main trading partners to all of large power nation such as China and United States (Forbes, 2013). The extraordinary expertise of adaption with technology in research and development strongly proven its achievements not only specifically in Asia continents but worked as the best in the world. Eventually, Japan has been evolving into an advance high tech nation after post war era. Therefore, it is encouraged to study the key of success how Japan able to outperform most of the Western rivals like United States.

Unfortunately, due to the major natural calamite incidents such as earthquake and tsunami in March 2011 had strained Japanese economy into a deep downturn with heavy destructions and massive losses incurred. Japan has been struggling and working all the way out in order to recover from slow growth and stagnation. Stock prices abruptly dropped, including a descent of more than 9% in Tokyo Price Stock Price Index (TOPIX) on March 15, 2011, the third top weakening in Japanese stock history. Investors begin to concern that Japan probably way back into a depression and remains unclear about how this disaster hurts the stock market. After the earthquake, a lot of buyer massive selling during that period, as result showed that the Japanese stock market hits record high of 5.7 billion shares of trading volume during that period. The President and Chief Executive Officer of Tokyo Stock Exchange (TSE), Mr. Atsushi Saito viewed the March 11 as an economic turning point for recovery of Japanese stock prices (Saito, 2012).

However, the independence of political interference is always an issue where everyone cares about. The lack of efficiency in the rule of governing can be due to often changes in level of government. Japan's main stock market is up to a surprising figure, 57 percent in year 2013, compared with the S&P 500 index 29 percent, thus become top market index of the year. All the credits should belong to Japan Prime Minister, Shinzo Abe in executing monetary policy to save Japan from economic recession. At the same time, the monetary stimulus package has activated the domestic and foreign investment. Furthermore, the Nikkei's drastic shift is reflecting the expectation of investors over the Japan stock market is remarkably uprising (Yglesias, 2013).

Next, other external factors such as financial crisis, global economy slump down and others would like to be investigated whether it will significantly impact on stock market performance. From the research conducted by Mitton (2001), Indonesia, Malaysia, Philippines, Korea and Thailand that involved in the East Asian financial crisis of 1997-1998, their stock market performance had suffered massive impact on economic position. Japan, as one of the Asian country, was also facing the Asian financial crisis as well that might have the similar negative impact on stock market performance compared with other Asian countries.

With years of expertise and innovations, Japan was the most active stock market in Asian region with a total of five (5) major stock exchanges in Japan whereby Tokyo Stock Exchange has the most trading volume among all.

Nihon Keizai, also known as **Nikkei 225** is a stock market index transacted under Tokyo Stock Exchange (TSE) since 1950 by using price-weighted basis which denominated in Yen (¥). Tokyo Stock Exchange is the third most active volume stock exchange in the world by comprehensive market capitalization of its listed companies of US$3.3 trillion as of December 2011 (Nikkei Inc., 2012). The stock exchange market is located in the capital city of Japan, Tokyo. Typically, Nikkei 225 was used as the main indices tracking towards national economy performance.

1.2 Problem Statement

Japan is a country with the largest and most active stock trading volume in Asia (World Federation of Exchanges). Therefore, all the time condition and performance of Japanese stock market are very important to the rest of the world or its trading partners. Japan stock market is exhibited strong linkage to rest of the Asian stock markets such as Malaysia, Indonesia, Philippines, Taiwan (Park, 2011). Its performance of the stock market indices is acting like a benchmark to the other countries.

According to Mukherjee and Naka (1995), the impact toward stock market performance from the macroeconomic variables was investigated mainly focuses on developed countries in the Western such as United States or European Union. According to Fama (1981), macroeconomic variable such as industrial production index is positively related with stock market performance. When industrial production index increase, the stock return will also increase. The industrial production and interest rate in Germany have a positive relationship with other European stock market returns as well such as United Kingdom, France and Italy (Cheung & Ng 1998, Nasseh & Strauss 2000, Mukherjee & Naka 1995, McMillan 2001 and Chaudhuri & Smiles 2004).

However, some research articles have done regarding on the impact of macroeconomic variables such as inflation rate , exchange rate , interest rate, towards the stock performances of the developing countries. According to Bing (2012), he tests the impact of the macroeconomic forces on Shanghai stock return performance. Adam and George (2008) also proved that there was long run relationship between macroeconomic variables and stock market in Ghana.

Maysami and Koh (2000) found that interest rate has a positively relationship with stock return in short run but negative relationship with stock return in long run with estimation test in Singapore stock market. They also found that exchange rate is another macroeconomic variable that is positively affecting stock market return. They found that Singapore with high import, export and domestic currency will increase the competitiveness of local producers in domestic market (Maysami & Koh, 2000).

Based on previous studies, it is found that Nigerian stock market has affected by inflation rate, broad money supply, real output growth and exchange rate (Olukayode and Akinwande, 2010).

There were several studies that had been carried out in Japanese stock market and very little attention has addressed the relationship between these macroeconomic variables and Japan's stock market performance. Therefore, we would like to further examine the effect impacted on Japan, a very crucial Asia stock market to

the rest of the world. Undoubtedly, Japan is one of the most innovated countries in the world which significant for further research (Louis, Yasushi and Josef, 2012). Besides, there is less contribution of the economic factors on the Japanese stock market performance.

1.3 Research Objective

1.3.1 General Objective

The objective of this paper is to examine the relationship between Japan stock market and five macroeconomic variables namely **index of industrial production, inflation rate, real exchange rate, real interest rate and government debt** in the long run during post crisis.

1.3.2 Specific Objective

1. To find out whether the inflation rate will negatively impact on stock market performance in long run during post crisis.

2. To find out whether the exchange rate will positively impact on stock market performance in long run during post crisis.

3. To find out whether the index of industrial production will positively impact on stock market performance in long run during post crisis.

4. To find out whether the interest rate will negatively impact on stock market performance in long run during post crisis.

5. To find out whether the government debt will negatively impact on stock market performance in long run during post crisis.

1.4 Research Question

1. Is inflation rate negatively impact on stock market indices in long run during post crisis?

2. Is exchange rate positively impact on stock market indices in long run during post crisis?

3. Is index of industrial production positively impact on stock market indices in long run during post crisis?

4. Is interest rate negatively impact on stock market indices in long run during post crisis?

5. Is government debt negatively impact on stock market indices in long run during post crisis?

1.5 Significance of the Study

This study examines on the relationship between macroeconomic variables and stock market performance in Japan regards the five factors which are inflation rate, real exchange rate, real interest rate, government debt and the index of industrial production. According to previous research, studies were more focused on United States markets due to highest trading volume in the world which has 12,693 billion dollar for New York Exchange and 8,914 billion dollar in NASDAQ. Japanese stock trading volume has 2,866 billion dollar in Tokyo Stock Exchange which is the third largest stock volume country in the world and the highest trading volume in Asia Pacific compared to Shanghai Stock Exchange which has 2,176 billon dollar of trade volume. Since Japan is playing an important role in capital market and important indicator of economy growth, therefore detail research on Japan stock market is essential.

Besides that, rarely studies have included government debt as the variables in explaining a country's stock performances. Other researches are mainly focus on interest rate, inflation rate or exchange rate impact on the stock performance. Government debt in Japan definitely plays a vital role in determining their fiscal policy due to the increment of interest cost of Japan at the recent year. Total government debt in Japan has passed one quadrillion Yen, around 10.5 trillion U.S. dollar; consist around 230% of Japan's GDP, which is highest debt to GDP ratio in the world. According to Kumar and Woo (2010), they showed that once a country reached status of high debt, their economic will experienced lower growth and will results in reduced in amount of investment and slower growth in capital stocks market.

However, Horioka, Nomoto, and Terada-Hagiwara (2013) examined the patterns over certain period in possessions of Japanese treasury bonds by sector and found that Japanese government treasury bonds were held mainly by local savers, which means that most of the government debt was absorbed by domestic savers which is distinct from other countries with mainly holding by the foreign. In addition, other countries such as Greece and Italy which having high debt had already facing the debt crisis. This makes foreign investor and policy maker curious about how the government debt in Japan significantly impacted the capital market growth and their stock market performance.

Although there are many literature reviews about the relationship between macroeconomic variables and stock index, however authors have been much concern during the financial crisis. There are only few researchers mentioned about the relationship between macroeconomic variables and stock index after crisis (Yusof & Majid, 2007 and Hsing, 2013). Therefore, this study would like to be re-examined the macroeconomic variables namely exchange rate, index of industrial production, government debt, real inflation rate, real interest rate and the stock index on the period of the after Asian financial crisis. Besides, it could help the policy makers conduct the fiscal or monetary macroeconomic policy with correct direction after the country is suffered from big economic recession.

1.6 Hypothesis Study

1. There is ***negative*** long run relationship between stock market indices and inflation rate.

2. There is ***positive*** long run relationship between stock market indices and exchange rate.

3. There is ***positive*** long run relationship between stock market indices and index of industrial production.

4. There is ***negative*** long run relationship between stock market indices and interest rate.

5. There is ***negative*** long run relationship between stock market indices and government debt.

1.7 Chapter Layout

The organization of the study is arranged as follows:

Chapter One: Introduction

This chapter consists of introduction or background of Japan stock market performance in respond to macroeconomic variable changes and reacts of stock market in the long run. A background research is done about Japan and Japan stock market. Moreover, problem statement, objective, research question and significant of study also clearly stated in this chapter.

Chapter Two: Literature Review

Literature reviews that include the discussion and comment from journal author from previous research. All the dependent and independent variable which include

in previous study will be included in this chapter. In addition, the theoretical framework which discusses the model will be included as well.

Chapter Three: Design and Methodology

This chapter is to identify the data collection method, definition of variables as well as method that we will carry out such as Unit Root test, Cointegration Test, Vector Error Correlation Model (VECM), and short term Granger Causality test.

Chapter Four: Findings and Analysis

The result of all empirical tests that carry out will be interpreted in this chapter. We will analysis as well as discuss the result that run by using E-views.

Chapter Five: Conclusion

Conclusion and hypothesis testing will be stated in this chapter. Besides, discussion of relationship between dependent and independent variables will be conducted. This chapter also consists of limitation of study as well as recommendation for future research.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter discusses literature review which covered various theories and approaches in evaluating the stock market return. This study is examined on the five independent variables which are: exchange rate, interest rate, government debt, inflation rate and index of industrial production with impact on stock market performance.

The discussion on the literature review was divided into few sections. Section 2.2 discussed on overall stock market performance attained by economic forces. Section 2.2.1 explained the relationship between exchange rate and stock market performance and its impact. Section 2.2.2 examined the significance of interest rate on stock market performance. Section 2.2.3 represented by the effect of government debt on stock market performance. Section 2.2.4 discussed the relationship between inflation rate and stock market performance. Section 2.2.5 reviewed on inflation rate in affecting the stock market performance. Section 2.3 conversed on proposed theoretical framework in our research. Section 2.4 referred to the conclusion of this chapter.

2.2 Stock Market Performance

Chen, Roll and Ross (1986) are among the authors who had studied on the relationship between economic forces and stock performance in the early era. They affirmed that the relationship between the inflation, industrial production and securities return provided the basis for the long term equilibrium through their

impact on current income and interest rates between stock prices and macroeconomic variables.

On the other hand, Cochrane (1991) found that the macroeconomic variables such as real output and interest rates could explain the stock market movement in the long run under the production based on asset pricing model which is used to explain the link between fluctuation in economic variables and stock return.

Positive correlation between real economic growth and stock prices was found and existed in both of their earlier studies conducted by Umstead (1977) and Fama (1981). Fama (1970) revealed that under the hypothesis of efficient market, stock prices should contain all the publicly available information particularly under semi strong form efficiency with important implication for the policy maker and capital market industry.

In addition, Nelson (1976) also studied on macroeconomic variables which is anticipated rates of inflation and unanticipated changes in the rate of inflation, results found that inflation do negatively influence the stock returns.

Moreover, Srinivasan *et al*. (2011) examined macroeconomic variables such as inflation, money supply and industrial production in India by using NSE-Nifty share price index as dependent variables. The study revealed that NSE-Nifty share price index has a significantly positive long-run relationship with the macroeconomic variables.

Meanwhile, Dadgostar and Moazzami (2003) have chosen the Toronto Stock Exchange Index to test the fluctuation in exchange rate, consumer price index (CPI) and industrial production index upon the stock price, by using the vector autoregressive model and error correction model, the result showed that the long run coefficients are significant and co-integrated with the macroeconomic variables selected above in Canada.

Kumar and Puja (2012) utilized the BSE-Sensex stock index to test the sensitivity of changes in macroeconomic variables namely, industrial production index, wholesale price index, money supply, treasury bills rates and exchange rates to the

stock prices. By using the vector correction model and Johansen's co-integrator, the authors have found that that there is existence of long term equilibrium relationship in money supply, industrial production index and wholesale price index and it is highly correlated with stock prices.

Rahman *et al.* (2009) conversed that the Malaysia stock market has significant relationship with gross domestic product (GDP), inflation, exchange rate, interest rates, and money supply in particular. The study on volatility in stock markets has measured empirically by Generalized Autoregressive Conditional Heteroscedasticity, GARCH.

Maysami *et al.* (2005) assessed long-run cointegrating relationship upon the stock prices with macroeconomic variables. Hence, the performance of the corporates should be used as proxy or indicators of economic activities. The dynamic relationship between macroeconomic variables and stock prices could be used to guide a nation's economic policies. Besides that, Chong and Koh (2003) mentioned that economic activities within an efficient market will ensure that all related information that presently in hand about changes in macroeconomic variables are fully reflected on latest stock price. According to the Efficient Market Hypothesis (EMH) which had defended by Fama (1970), in an efficient market, all the relevant information about the change in macroeconomic variable will directly affect the behavior of investor, thus will fully reflected in the current stock price. Investor will not able to earn an abnormally profit in efficient market. In another word, the change in macroeconomic variables will only have little or no effect on stock market return (Nail and Padhi, 2012).

On the other hand, Arbitrage Pricing Theory (APT) also provides high correlation among stock price and macroeconomic basics. This model was introduced by Ross (1976) and further developed by Benakovic and Posedel (2010). Investor believes that the stochastic elements of earning of capital assets are dependable with an issue arrangement (Huberman & Wanf, 2005 and Zhu, 2012). Ross (1976) argue that the predicted return on capital assets will roughly linearly associated to the return covariance of aspect if the equilibrium prices of assets does not offer an

arbitrage opportunity over static portfolio. The relationship between return on and asset and return on portfolio is foreseeable.

There is a hypothesis called Rational Expectations Hypothesis which is developed by Muth (1961) and applied by Nathan (2001) in his research. This theory presented a new idea on the formation of stock prices and the concept is very simple and understandable. Economists used past experiences with their expectations and forecast of the future to determine the value of an asset today. Sheffrin (1996) believed that people could conduct the actual values of variables that will equal to their expectation if an economic model is given because they have the belief that expectations are rational. This hypothesis also assumes that investors will consider all available information, both expectations variables and corresponding indicators will be combined into the model.

2.2.1 Relationship between Exchange Rate and Stock Market Performance

Most of the studies have figured out the relationship between exchange rate and stock market performance. By applying unit root test and co-integration test, Kasman (2003) found a long-run stable relationship between stock indices and exchange rate. Aurangzeb (2012) showed that exchange rate has positive impact on stock market performance in three South Asian countries - Pakistan, India and Sri-Lanka.

From the research of Beer and Hebein (2008), Exponential Generalized Autoregressive Conditional Heteroscadasticity (EGARCH) was utilized in estimating nine countries including U.S., Canada, UK, Japan, Hong Kong, Singapore, South-Korea, India and Philippines as sample. The results show that there is a trend in which the depreciation of currency has led to a decrease in stock price due to high inflation and subsequently affect investors' confidence. This effect occurs in developed countries such as Canada, Japan, South Korea and U.S. However, the author could not able to prove a negative relationship for the others

which similar to Canada, Japan, South Korea and U.S. while a positive relationship between exchange rate and stock market index in Hong Kong and Philippines.

Muktadir-al-Mukit (2012) tests the relationship of exchange rate and volatility of market index at Dhaka Stock Exchange. He used cointegration and error correction model and Granger causality test to test the long run and short run relationship between two variables. His observation is 1% increase in exchange rate; the market index will increase 1.04% in long run. From Muktadir's perspective, he comes out the statement that there is only unidirectional effect exists from market index to exchange rate. When foreign investors buy a country's stock, the capital inflow will results in appreciation of domestic currency while currency depreciation when capital outflow. However, there is a significant long run relationship exists between exchange rate and stock market return.

Tabak (2006) tested on the relationship between exchange rate and stock prices in Brazil by relating to two popular theories which are traditional approach and portfolio approach. Granger causality tests was used as the measurement and proved that traditional approach must be rejected whereby portfolio approach should be supported. However, Tabak (2006) stated that exchange rate does cause stock prices to move by using nonlinear causality tests.

Zhao (2009) also examined the cross-volatility effects between stock markets and foreign exchange in China by using likelihood ratio statistic. He concluded that there is a bi-directional volatility spillover effects between both variables. In other words, it indicated that changes in foreign exchange market have a significant impact on stock market vice versa.

Banerjee and Adhikary (2009) have used the cointegration test to test the relationship between exchange rate and stock market returns in Bangladesh. They used monthly data from year 1983 to 2006 and found long run bidirectional causal relationship between both dependent and independent variables. They explained that foreign investors always pay high attention to their investment and return.

They increase investment when they anticipate the exchange rate is moving optimistic and hence the stock price will increase. Conversely, when the foreigners feel that the exchange rate is not stable or even threaten their benefit, they will decrease their investment by selling the country's stock. Ultimately, it will cause a large amount of capital outflow and the stock price will decrease.

By using a multivariate simultaneous equation model, Dimitrova (2005) claimed that there is a jointly causality relationship between stock market and exchange rate during financial crises. If the exchange rate breakdown, the stock market performance will subsequently ruin down. After that, the collapse of stock market will cause the exchange rate to appreciate. Correspondingly, when the stock market falls down, the exchange rate will appreciate and the stock market will recover. As a result, both variables consist of self-recovery mechanism during financial crisis.

Yoon and Kang (2011) found significant linkage between exchange rate and stock market performance during post-crisis period. There is a strong causal relationship between foreign exchange in Korean Won and Korean Composite Stock Price Indexes (KOSPI) in Korea. The relationship was examined by illustrating two approaches which are flow-oriented model and stock-oriented models of exchange rate. Hence, negative relationship implied depreciation in currency values and unfavorable to stock market performance where strong bi-directional volatility spillover found between both variables in Korea as mentioned above.

On the other hand, Kurihara (2006) had done a research in Japan and indicated that the volatile of exchange rate does influence Japan's stock price in a negative relationship when Japan is implementing easing policy. The depreciation of domestic currency will stimulate the export of domestic products and ultimately lead to the increase of stock price. This result is being tested by using unit root test, co-integration test as well as Granger causality test.

Muhammad and Rasheed (2008) examined four South Asian countries, Pakistan, India, Bangladesh and Sri- Lanka by using monthly data from January 1994 to December 2000. They concluded that there is no long-run relationship between

stock price and exchange rate in Pakistan and India. However, a bi-directional causality relationship between both variables appears in Bangladesh and Sri-Lanka by applying Granger causality test.

Richard *et al.* (2009) examined the relationship between exchange rate and stock market performance in Australia from 2 January 2003 to 30 June 2006 by using Granger-Sim causality test, Ordinary Least Square (OLS) and Autoregressive Conditional Heteroscadasticity (ARCH) regressions as well as using three approaches: flow-oriented model, portfolio balance approach and co-integration and causality approach in explaining their research. They concluded that Australian stock prices and exchange rate interacts based on portfolio model whereby stock performance impacted by exchange rate via account transactions. The transformation from the traditional perspective of the Australia economy viewed as an export-dependent economy. Australian economy continuously leading and moving towards to flow oriented model. Exchange rate has caused the volatility in stock price with appreciation in the Australian dollar, hence negatively influence the domestic stock market with exchange rate.

There are two popular theories in academic studies used to explain the relationship of exchange rate and stock price which are 'flow oriented' and 'portfolio balance' models. Portfolio balance model also known as 'stock oriented' models. Dornbusch and Fisher (1980) was the first to introduce flow oriented model. The theory emphasizes that the movement of stock prices is caused by exchange rate movements and it is moving in a uni-directional causality way from exchange rate to stock prices. This approach is constructed based on the perspective that stock prices denote the discount present value of a firm's expected future cash flows. Conversely, portfolio balance model is the opposite side of flow oriented model and it is brought out by Branson (1977). The significance of this theory is the changes of stock prices have an effect on the changes of exchange rate through capital account transactions. Mostly the impact is come from the stock market liquidity and separation.

Bhargava and Konku (2010) found significant relationship between exchange rate and stock market. He claimed that through vector error correction model estimation, when the US dollar appreciates, the returns of the S&P 500 index will

go down. He also seconded that there is still impact of stock market returns on the changes of exchange rate although the chance is lesser than the impact when the exchange rate is independent variable. Thus, Bhargava and Konku (2010) stated the relationship between exchange rate and stock market is significant where increase volatility of exchange rate will cause the stock market go down.

Ooi *et al.* (2009) tested the long run relationship between exchange rate and stock price in Thailand and Malaysia. By applying Johansen-Juselius (1990), it showed that there is portfolio approach in which only unidirectional causal effect from stock prices to exchange rate during pre-crisis and post-crisis in Thailand where the effect appears in Malaysia only in post-crisis.

Obben *et al.* (2006) also analyzed the relationship between exchange rate and stock market performance. Their research was based on weekly data from January 1999 until June 2006 in New Zealand. The results show that there is bidirectional causality effect in stock market and exchange rate in both short run and long run by using cointegrating VAR and VECM approach. They further explained that the exchange rate and stock market index are supported by good market theories and portfolio balance. There are different descriptions between good market theories and portfolio balance. Portfolio balance claimed that the causality effect appears from stock market to exchange rate while the good market theories states that it appears in opposite way. However, both theories can be applied in long run and the result is strongly significant.

By employing a two-factor Arbitrage Pricing Theory (APT) model with the data from the period 1992 until 2001 in Philippines, Aquino (2002) comes out a strong statement that the stock return does not react considerably to exchange rate during pre-crisis period but it does react to the movement of exchange rate in post-crisis period. It is because the investors began to require a risk premium on their investment after the crisis in order to secure from the exchange rate risk.

Lean *et al.* (2003) also examine the effect of exchange rate to stock market performance in seven Asian countries during post-crisis period. The countries are Hong Kong, Indonesia, Singapore, Malaysia, Korea, Philippines and Thailand.

The overall results show that there is no Granger causality effect in most of the countries being analyzed except Malaysia and Philippines during pre-crisis period. However, the causality between exchange rate market and stock market shows a strong effect after Asian Financial Crisis. There are a few reasons such as tightening macroeconomic policies, investor tension and the unregulated of banking sectors. Other than that, the researchers also find that there is long term relationship between exchange rate and stock market performance after 2001 due to the 911-terrorist attack. This relationship can be treated as reciprocal effect in which the fluctuation of the exchange rate can affect the value of the firm and subsequently lead to the decrease of stock value.

Lee (2003) has examined the relationship between exchange rate movement and small size company's valuation. He concluded that the depreciation of currency will boost up the smallest 50 enterprises competitiveness in global financial market and thus rising up their stock earnings during pre-crisis period. While after the crisis, there is negative relationship between two variables due to declining economic conditions, short term foreign debt obligations and others.

2.2.2 Relationship between Interest Rate and Stock Market Performance

Tangjitprom (2011) had done a research in Thailand, the author analyzed that the stock market returns by including several lags of data accessibility. The author stated that it is important for the use of lead lag relationship to examine the macroeconomic variables and stock market performance. By using the decomposition of variance method, interest rate has been exposed as the most significant variable in clarify the stock market return variance. On the other hand, other macroeconomic variables such as money supply, industrial production and exchange rate attributed some of the effect on the variance of stock market return as well. Thus, the result of empirical test showed that, even by using short term or long term interest rate, nominal or real interest rate, the result would still be

similar and consistent. Therefore, there is no impact on the selection of interest rate utilization.

Another review regarding the relationship between United States stock market performance and macroeconomic variables has been conducted by Sirucek (2012). He measured the rate of change in interest rate with impact on stock market performance by included the change of interest rate in one month time deposit rate in their empirical test. In the end of research, he found that the change of interest rate is the most significant variable which impacted the stock market index (S&P 500). This study found to have negative relationship between interest rate and stock market index.

The systematic influences between the economic variables and stock market return and assets pricing had been explored by Chen, Roll and Ross (2012). The discount factor is one of the factors they included in analysis. They stated that the interest rate will be changed as the term structure spread change across different maturities. According to Rjoub, Tursoy and Gunsel (2009), interest rate is highly correlated with other macroeconomic variables and biased in model estimation. They recommended that, instead of using interest rate, one can use the term structure of interest rate. By using the term structure of interest rate theory, the value of stock is inverse relationship with interest rate. Therefore, the unanticipated change of interest rate will impact the future cash flow and thus the stock pricing. By using the one month treasury bill rate or risk free rate as a substitution variable of interest rate, they found a significant negative relationship in explain the stock market return in United States.

Bilson, Brailsford and Hooper (2000) conducted a study to identify the best macroeconomic factor in emerging stock market return. They reported that there are many macroeconomic factors are relevant in affecting the stock market return. One of the macroeconomic factors is interest rate. However, they further explain that not the interest rate itself is appropriate but the yield and evasion spread are more likely to explain the stock market return. On the other hand, they also found that short term interest rate is the principal variables which significant in explaining the emerging stock market return.

Some studies show that there are positive relationship between interest rate and stock market index instead of negative relationship. Srivastava (2010) had carry out a research in Indian which examines the relevance of macroeconomic factors and stock market in Indian. He predicts that the interest rate has a positive relationship on stock market performance. The interest rate will directly impact the discount rate in valuation model of stock price, in another word, future cash flow and current cash flow receive by the investor would be affected. Thus, there is a positive relationship between interest rate and stock market. Chen, Roll and Ross (2012) mentioned that the long-term interest rate has higher impact than short term interest rate, thus the result showed that interest rate does highly significant to impact the long term stock pricing of stock market in India.

By using Asset Valuation Model (AVM), Naka, Mukherjee and Tufte (1998) had stated that changes in required rate of return will inversely impact on the stock price. Before the authors run their test, they have predicted that there is a positive relationship between the nominal interest rate and risk free rate. Yet, the inflation might affect the real result of relation between interest rate and stock price. Thus, one must consider the inflation rate as well when study the interest rate in the research where stock market reflected on real time effect. The result they found is consistent with their prediction, which is a positive relationship between interest rate and stock price.

The causal relationship between five macroeconomic factors which are industrial production, inflation, money supply, exchange rate and gold price with BSE Sensitive Index in India had been study by Bhattacharya and Mukherjee (2002). Their main objective of the study is to test whether the macroeconomic factors granger causes the stock price in a single direction or two ways direction. The result showed that the interest rate does not granger causes stock price in India. Hence, there is no causal linkage between interest rate and stock market.

Bilal, Talib, Haq, Khan and Islam (2012) had conducted a study in Pakistan to study the relationship between the impacts of macroeconomic factors on stock market return after War on Terror. The equity market of Pakistan country had

highly affected by the War on Terror. By using the daily data, they conducted long run and short run test between several macroeconomic factors which are interest rate and inflation on Karachi Stock Exchange (KSE-100) from 1 July 2005 to 31 June 2010. The result showed that interest rate is significant affect the Karachi Stock Exchange Index at 1% level in long run and short run. Besides, causality relationship between interest rate and equity market is found in this study.

Another study on the long run macroeconomic variables and market performance in Nigeria had been conducted by Olukayode and Akinwande (2010). As mentioned by Olukayode and Akinwande (2010), Nigerian economy suffered from a global financial crisis since pre-1980 era. By choosing the period from 1984 to 2007, the authors excluded the financial crisis effects the reflected on poor stock market performance. Based on their research result, exchange rate, inflation, money supply and real output have showed significant in explaining the long run relationship with stock market performance but interest rate had showed insignificant. Therefore, they suggest that interest rate is less important to determine market return in long run.

On the other hand, another research on German stock return and interest rate also discussed by Czaja and Scholz (2006). By using term structure of interest rates, Czaja and Scholz found that it is important to explain the market return. Hess (2003) used vector error correction model and variance decomposition to take account of long run equilibrium, he has proved that interest rate is significant affecting market return in long run.

Adam and Tweneboah (2008) had investigated the relationship between various macroeconomic variables namely, inward foreign direct investments (FDI), treasury bill rate, consumer price index (CPI) and exchange rate on Ghana stock market from 1991 to 2007. Both long run and short run relationship is examined using cointegration test and VECM. The authors used treasury bill rate to represent interest rate, long run relationship is proven by using cointegration test and interest rate also showed a significant influence on stock market return using VECM analysis.

To determine long run relationship, VECM is conducted by Srivastava (2010) between selected macroeconomic variables namely, interest rate, inflation, exchange rate, index of industrial production, money supply, gold price, silver price and oil price on Indian stock market. By using ten year bond yield as interest rate, Srivastava (2010) had showed that all variables are significant to explain the stock market return in long run equilibrium which includes interest rate.

According to theory, Dividend Discount Model (DDM) is introduced by Miller and Modigliani (1988). This model states that the current market stock price of equity is equivalent to the present value future cash flow to the stock. Thus, any macroeconomic variables which affect the rate of return and expected future cash flow will then affect the share price. Based on DDM theory, the share price and interest rate are inversely correlated. When interest rate increases, the share price should be decrease. This is proved by French (1987) who illustrate that there is negative relationship between interest rate and stock prices in both long term and short term.

2.2.3 Relationship between Government Debt and Stock Market Performance

Pilinkus (2010) used vector auto regression to test the short term relationship between ten macroeconomic variables and stock indices in Baltics and Johansen co-integration was used to determine the long term relationships. The results revealed that the statistical significance of almost all macroeconomic variables in the long run which include state debt of the country but unemployment is not significant in both short run and long run relationship.

Campbell and Amme (1993) found a positive relationship between stock and bond returns but the correlation is weak. The authors use traditional approach to examine the relation between stock and bond by using monthly data from 1952 to 1987. An offsetting effect behind the correlation between stock and bond return

where increases in current account lead to decrease in government debt. Hence, it is beneficial to stock market return.

Besides, Evrim *et al*. (2011) used several co-integration methods such as Engle and Granger (1987), Gregory and Hansen (1987) and Hatemi-J (2008) and also long run elasticity of Stock and Watson (1993) and parameter stability tests, in particular they found that the government bond index is not significant to stock market indices. In contrast, by using Ordinary Least Square (OLS) and Dynamic OLS procedures, the government bond index has a significantly positive relationship with some stock index in Turkey where the data is obtained from May 2001 to August 2009 in the frequent of month.

Anderssona *et al*. (2008) suggested that stock and bond prices move in the similar direction during periods of high inflation expectation. The authors were using the method of simple rolling window sample correlation and dynamic conditional correlation model to test the correlation between stock and bonds market in U.S. and German using from January 1991 to April 2004 and January 1994 to April 2004 daily data.

In contrast, Baur and Lucey (2006) have some supportive results for "flight to quality" hypothesis. They using daily MSCI stocks and government bond return from selection of European countries and the U.S. from 1995 to 2005 with the method of dynamic conditional correlation and they found that there is negative correlation between the stock and bond market.

Besides, Connolly *et al*. (2005), the authors examined the daily stock and treasury bonds from 1986 to 2000, they concluded that negative relationship between the uncertainly measures and future correlation between stock and bond returns.
Shiller and Beltratti (1993) used time series econometric method to estimate a theoretical correlation level between stocks and bonds in the U.S. and the U.K. It is reported that the negative correlation is exist between stock and bond yield. John *et al*. (2013) examined an extensive study on the relationship between stock and bond markets changes considerably over time as well.

Johansson (2010) using a bivariate stochastic volatility model and showed there are significant volatility spillover effects between stock and bond markets in several Asian countries for instance, China, South Korea, Phillipines, Indonesia and Singapore. However, the author utilized local currency without considering the exchange rate in the study and found that correlation is varying when the economic crisis is approached.

Padota (2012) showed that there is a positive and significant correlation between bond and stock returns during economic richness. A significant positive correlation also observed during recession period, however it is negative and insignificant during recovery period. The author used different time phase horizon between stock and bond market indices from January 2005 to December 2010. The data is analyzed using correlation regression, T –test and Durbin Watson test to find the relationship between stock and bond market in India.

Lim *et al.* (2012) used Breitung rank test to test the theoretical hypothesis whether there is existences of correlation between stock market index and bond funds and score test proposed by Breitung to test the linearity of the relationship. They used the Malaysian stock market index and all the three series bond indices which are different term of maturities. The data they obtained is from January 1994 to September 2009.The results revealed that the stock index is non-linear cointegrating with different term of maturities of bond indices.

Solnik *et al*. (1996) revealed that there is no correlation between stock and bond markets of German, France, U.K., Switzerland and Japan with the U.S. markets. In their study, the volatility of foreign exchange rate between two countries is included to test the long term relationship. Results revealed that there is no similar direction movement of bond and stock markets and did not closely correlate.

2.2.4 Relationship between Inflation Rate and Stock Market Performance

Mukherjee and Naka (1995) had accomplished a study on the relationship between exchange rate, inflation, money supply, real economic activity, long-term Treasury bond rate, and call money rate with Japanese stock market. The authors found that there is a significant relationship between inflation rate and Japanese Stock Market by using Johansen's (1998) vector error correction model (VECM).

Besides that, Islam (2003) examined the relationship between the macroeconomic variables including interest rate, inflation rate, exchange rate and the index of industrial production with Kuala Lumpur Stock Exchange (KLSE). The result shows that inflation rate and others macroeconomic variables have a significant relationship with KLSE stock returns.

Early research done by Lintner (1975) and Body (1976) also concluded that there is significant negative relationship between inflation and stock price. Besides that, Nelson (1975) examined the relationship between stock return and inflation in the post war period from 1953 to 1957. Other than that, Jaffe and Mandelker (1976) also found that stock return is negatively related with inflation and it is consistent with the research done by Litner (1975) and Body (1976).

Furthermore, Fama and Schwert (1997) found a negative relationship between inflation rate and stock market return. The authors used data from Bureau of Labor Statistic Consumer Price Index (CPI) to estimate the inflation rate and used an equally weighted portfolio of New York Stock Exchange as stocks returns. From the result, they found that when the inflation is high, the stock market return will drop.

Apart from that, Geske and Roll (1983) found that inflation will cause the movement of the stock price. They found that inflation is a signal for stock market performance. When inflation occurs, the stock price will change. This can conclude that inflation will adversely affect the stock price.

Research done by Kessel and Alchian (1962) using the nominal contract hypothesis to examine the relationship between inflation and stock return found that, unexpected inflation benefit the debtor and harm the creditor in a nominal contract. The unexpected inflation is negatively related with the stock return of the creditor.

According to Huybens and Smith (1999), when the inflation rate increases, the stock performance will drop. They found that an increase in inflation rate will cause credit market friction. When there is credit market friction, the financial intermediaries such as banks will reduce their loan to the public. Public cannot have a loan to make investment in the stock market due to the increase of restriction and reduction on loan. It causes the resource allocation not efficient and directly affects the stock market performance.

According to Kullaporn and Lalita (2010), stock market performance is not influenced by inflation in Thailand. In their research, the authors used Thailand data start from 2000 to 2010 to examine relationship between inflation rate and stock market. By using Vector Autoregression (VAR), it concluded that stock price movement is irrelevant with inflation rate.

Yazdan and Soheila (2012) used panel data regression model during 2000 to 2010 based on Organization of the Petroleum Exporting Countries (OPEC) to examine relationship between inflation rate and stock market. OPEC is an organization which created to coordinate policies between oil producing countries. OPEC members include Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, United Arab Emirates and Venezuela. In the research, they found that inflation rate is insignificant with stock market performance in OPEC.

2.2.5 Relationship between Index of Industrial Production and Stock Market Performance

Index of industrial production (IIP) can be defined as a term of measurement which indicates the position of production in industrial field for a given duration compared with a reference period of time. The main purpose of IIP is to indicate the growth of various sectors statistically in an economy.

According to the study conducted by Rahman *et al.* (2009), the relationship between index of industrial production and stock market returns in Malaysia was investigated by using co-integration technique and vector error correction mechanism. IIP was found positively related to stock market returns and significant in the long run.

Another study done by Momani and Alsharari (2011) found that industrial production index was significantly related on financial market, however this effect differs in developed and developing countries respectively as in economic activities development. Emerging and developing countries would have higher industrial production due to exports. Annual industrial production index was positive statistically significant to the share price for the industrial sector index weighted by market value of capital.

The significance of industrial production on stock market performance had been examined extensively by Dimitrios *et al.* (2011) using panel data analyses in fixed effects and random effects model. Index of industrial production revealed as statistically significant in the empirical study. However, Chen *et al.* (1986) identify industrial production as a vital risk factor for the determination of stock returns, while Cutler et al. (1989) find that stock returns correlate significantly and positively with industrial production growth over the period 1926–1986 which in line with the empirical results found. The ambiguous conclusions provided with number of empirical studies do not definitively determine a significant and reliable statistical relationship with stock market performance in the past can be omitted (Gultekin, 1983, Fama, 1981, Homa and Jaffee, 1971).

On the other hand, Chakravarty and Mitra (2011) stated that stock prices were led by index of industrial production in contributing changes in the rate of inflation with two-way Granger causality. The study was based on Amman Stock Exchange, Jordan and estimated by using VAR framework (Bhattacharya and Mukherjee, 2002).

There is one of studies was done in investigating relationship between index of industrial production and stock market index at two different time interval which are pre financial crisis and post financial crisis in Thailand. Contrary to the study findings, index of industrial production has a strong and positive influence towards stock market returns in emerging markets by estimation methods such as unit root, co-integration and Granger causality tests (Brahmasrene and Jiranyakul, 2007).

Humpe and Macmillan (2007) applied the co-integration analysis to find out the relationship between macroeconomic determinants and stock market returns in the U.S. and explored that there is positive relationship between industrial production and stock prices by applying the data for the period of 1971 to 1990.

Liu and Shrestha (2008) investigated the long run relationship between macroeconomics variables which include industrial production and Chinese stock market. Findings of the study found to be positive relationship with the impact on stock prices. Heteroscedastic co-integration test was applied in estimating the model used using secondary data from January 1992 to December 2001.

On the other hand, long run relationship was detected between index of industrial production and stock price in Lahore Stock Exchange, Pakistan in a positive manner (Sohail and Hussain, 2009). The study was carried out with stationary check at first difference then proceeds to vector error correction model for estimation. However, short run relationship was not significant.

Maysami, Howe and Hamzah (2004) examined index of industrial production with stock market indices in Singapore. Long run cointegrating relationship was found to be significant by tested using vector error correction model. The study

were extended to Hong Kong and Singapore (Maysami and Sims, 2002), Malaysia and Thailand (Maysami and Sims, 2001), Japan and Korea (Maysami and Sims 2001b), as well as Islam (2003) on Kuala Lumpur Stock Exchange (KLSE) Composite Index.

Brahmasrene and Jiranyakul (2007) studied the cointegration and causality between macroeconomic variables namely, industrial production index, money supply, exchange rate, and world oil prices on stock index in an emerging market. Relationship was examined in post-financial liberalization and post-financial crisis in Thailand. Industrial production index had negative impact on cointegrating long run relationship in post-financial crisis at different order.

2.3 Proposed Theoretical/Conceptual Framework

Specifically, previous researcher had included many macroeconomic variables in their different researches. There are some common macroeconomic variables which are frequently being use in their study. Islam (2003) had included interest rate, inflation rate, exchange rate and index of industrial production as independent variables to explain stock market performance in Malaysia. On the other hand, Olukayode and Akinwande (2010) had included the similar macroeconomic variables as Islam included but with one additional independent variable, which is the money supply to explain the stock market performance in Nigeria. Their research focused in post crisis due to Nigerian economy suffered global economy downturn since pre-1980. Mosley and Singer (2008) has conducted a study of market performance by using government debt, gross domestic production (GDP), income per capita, interest rate, inflation and other nine variables in 37 developed and developing countries. Campbell and Amme (1993) also include government debt in their research of stock market performance. Bhattacharya and Mukherjee (2002) had studied industrial production, inflation and exchange rate, money supply and gold price in testing the BSE Sensitive Index in India. Bilal, Talib, Haq, Khan and Islam (2012) had conducted a study in Pakistan by determining the long run relationship between

the impact of macroeconomic variables such as interest rate and inflation with stock market return. Rahman *et al.* (2009) also study the long run relationship between index of industrial production with stock market returns in Malaysia.

Therefore, in this study, it is proposed by including interest rate, exchange rate, inflation rate, index of industrial production and government debt as independent variable and Nikkei 225 index to represent stock market performance as dependent variable. It is an extensive study by Islam (2003), Olukayode and Akinwande (2010) and Campbell and Amme (1993) by testing the relationship between macroeconomic factors on stock market performance in Asian developed country, Japan during post crisis. Meanwhile, most studies that have done by Islam (2003), Olukayode and Akinwande (2010) and Campbell and Amme (1993) focused in Asian developing or emerging countries such as Malaysia and Nigeria. According to Olukayode and Akinwande (2010), the impact on post crisis affected the significance of independent variables in determining stock market performance. Thus, effect on post crisis has been accountable in our extensive study as well.

2.4 Conclusion

In the field of study, it is pivotal to have a comprehensive and excel study in order to create awareness and enhancement. This research focus on the selected macroeconomic variables: exchange rate, interest rate, government debt, inflation rate and index of industrial production on the examination of the relationship between macroeconomic variables with stock market performance. This study creates greater contribution for better dissemination of information to the people. More importantly, specialization and focus on the scope of study in Japan provides a clearer view of the overall innovations in stock market especially in Asia.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter discusses methodology which includes method of data collection, variable measurement unit, hypothesis development and data processing in order to conduct in this research. The objective of this study is to investigate the relationship between five selected macroeconomic variables such as real exchange rate, inflation rate, real interest rate, government debt, index of industrial production and stock market index (NIKKEI 225) in post crisis. The research conducted with secondary data and focused in quantitative approach.

Before running any analysis, unit root test (ADF, PP) was used to check the stationarity of data which had collected for this research. Vector Error Correction Model (VECM) will be used to determine the dynamic relationship between the variables and stock index in post crisis. Other than that, a causal relationship between the five variables and stock index in post crisis are affirmed by granger causality test. In checking the fitness of data with the research purpose, diagnostic testing has been evaluated in diagnosing the collected data. The discussion on the research methodology was divided into few sections. Section 3.2 discussed on how data was collected and the availability the data. Section 3.3 explained the collected data and how the specific data was presented. Section 3.4 listed out all the methodologies being used in our study. Section 3.5 represented the hypotheses being carried out. Section 3.6 referred to the conclusion of this chapter.

3.2 Data Collection

In order to find out the relationship between Japan stock market performance with the selected macroeconomic variables in post crisis, research data and information were collected. All of the research data and information were secondary data. It was collected from DataStream which covered between the duration of January 2000 to December 2012. Nikkei 225, stock market index will be the dependent variable and exchange rate, interest rate, national government debt, inflation rate and index of industrial production would be the independent variables.

3.2.1 Research Model

$$SMI = \beta_0 + \beta_1 EXG + \beta_2 INT + \beta_3 INF + \beta_4 DEBT + \beta_5 IIP$$

SMI = Stock market index (NIKKEI 225)

EXG = Real exchange rate

INF = Inflation rate

INT = Real interest rate

DEBT = Government debt

IIP = Index of industrial production

3.2.2 Dependent Variable

Nikkei 225 is a stock market index in Tokyo Stock Exchange. It is a price weighted index which unit denominated in Yen. Previously, Lee (2004) had examined the relationship between Singapore stock market index with interest rate, inflation rate, exchange rate, industrial production index and money supply. Through the research conducted, Singapore stock market index was represented as

the stock market performance of Singapore. In this study, Japan stock market index, Nikkei 225 is selected as dependent variable to examine long run relationship with five macroeconomic variables, real exchange rate, inflation rate, real interest rate, government debt and index of industrial production. Nikkei 225 has been chosen as dependent variable because the movement of Japan stock market can be understand through Nikkei 225. Nikkei 225 also can be a good economy indicator because it consists of 225 blue chip companies in Japan. Therefore, it is very sensitive with the effect of macroeconomic variables.

3.2.3 Independent Variables

3.2.3.1 Real Exchange Rate

Real exchange rate has considered about the effect of inflation. It directly reflects the purchasing power because when inflation happens purchasing power will drop. Real exchange rate can capture the effect of purchasing power which caused by inflation after crisis but nominal exchange rate could only show the exchange rate of currency. Therefore, real exchange rate has been selected in this study. The unit measurement of exchange rate is from one hundred thousand Yen in exchange with one US dollar after inflation taken into account. According to Caporale and Pittis (1997), real exchange rate has long run relationship and causal influence between real exchange rate and stock market index.

3.2.3.2 Real Interest Rate

To capture the effect of inflation after crisis, real interest rate has been selected as independent variable. It is measured in percentage in this study. However, nominal interest rate does not consider the effect of inflation. Therefore, real interest rate has been selected as independent variables in this study. Previous research done by Chong and Koh (2003) concluded that there is long run relationship between real interest rate and stock market return.

3.2.3.3 Government debt

National government debt consists of internal government debt and external government debt. Government can borrow money within the country by selling securities and government bond or can make borrowing from other countries or International Monetary Fund (IMF). Japan government debt is always a concern in Japan economy. Japan is a developed country which economy is focus on export. Although Japan is one of the largest exporter in the world but it still has a huge amount of government debt. In 2009, Japan faced a sharp drop in export and caused government debt continuously increasing. It directly slows down Japan economy. Therefore, Japan government debt is included in this research as independent variable and measured in billion.

3.2.3.1 Inflation Rate

Inflation rate is a rate to measure for the reduction value of money. When inflation happens, the price level of goods and services will significantly increase. Thus, purchasing power will be reduced. Japan is always negative inflation but on 2008 is facing about 1.4% inflation. It is cause by the financial crisis from 2007 to 2008. In this study, inflation rate which measured in percent is used to examine long run relationship between inflation and stock market in post crisis. Previous research done by Huybens (1998) and Smith (1999) shown that there is negative long run relationship between stock market performance and inflation rate.

3.2.3.1 Index of Industrial Production

Index of industrial production is an index which is use as the economic indicator. It can reflect the growth of each sector in Japan economy such as manufacturing, mining, electricity and others. This index was computed each month. This research has included Japan industrial production as independent variable because it is very sensitive to the business cycle and economy. Apart from that, Industrial production can be considered as a reliable leading indicator which shows all information in Japan economy. Previous research had been done in India, one of the country that using indexes of industrial production as an economic indicator.

India used index of industrial production base year weight in some sector such as manufacturing, mining, electricity and conclude that changes in index of industrial production will affect the India economy (Singhi, n.d.).

3.3 Sampling

This study has selected secondary monthly average data to perform regression analysis presented from January 2000 to December 2012. The data has been obtained from DataStream which is reliable in consisting of huge financial and economic database with time series and static data especially on economics, bonds, equities and others.

During the crisis period, most of the macroeconomic variables movement will be controlled by the local government especially interest rate and inflation rate in order to avoid economic continuously downturn such as inflation, decrease or increase in money supply and so on, hence the result will be mistrusted as it does not follow the real trend.

Lean *et al.* (2003) examine the effect of exchange rate to stock market performance in seven Asian countries during post-crisis period. The countries are Hong Kong, Indonesia, Singapore, Malaysia, Korea, Philippines and Thailand. The overall results show that there is no Granger causality effect in most of the countries being analyzed except Malaysia and Philippines during crisis period. However, the causality between exchange rate market and stock market shows a strong effect after Asian Financial Crisis. It shows that data will be affected by tightening macroeconomic policies, investor tension and the unregulated of banking sectors during crisis.

To avoid the data manipulated by crisis effect, this study used data starts from 2000 which is post crisis period to examine the relationship between macroeconomic variables such as real exchange rate, inflation rate, real interest

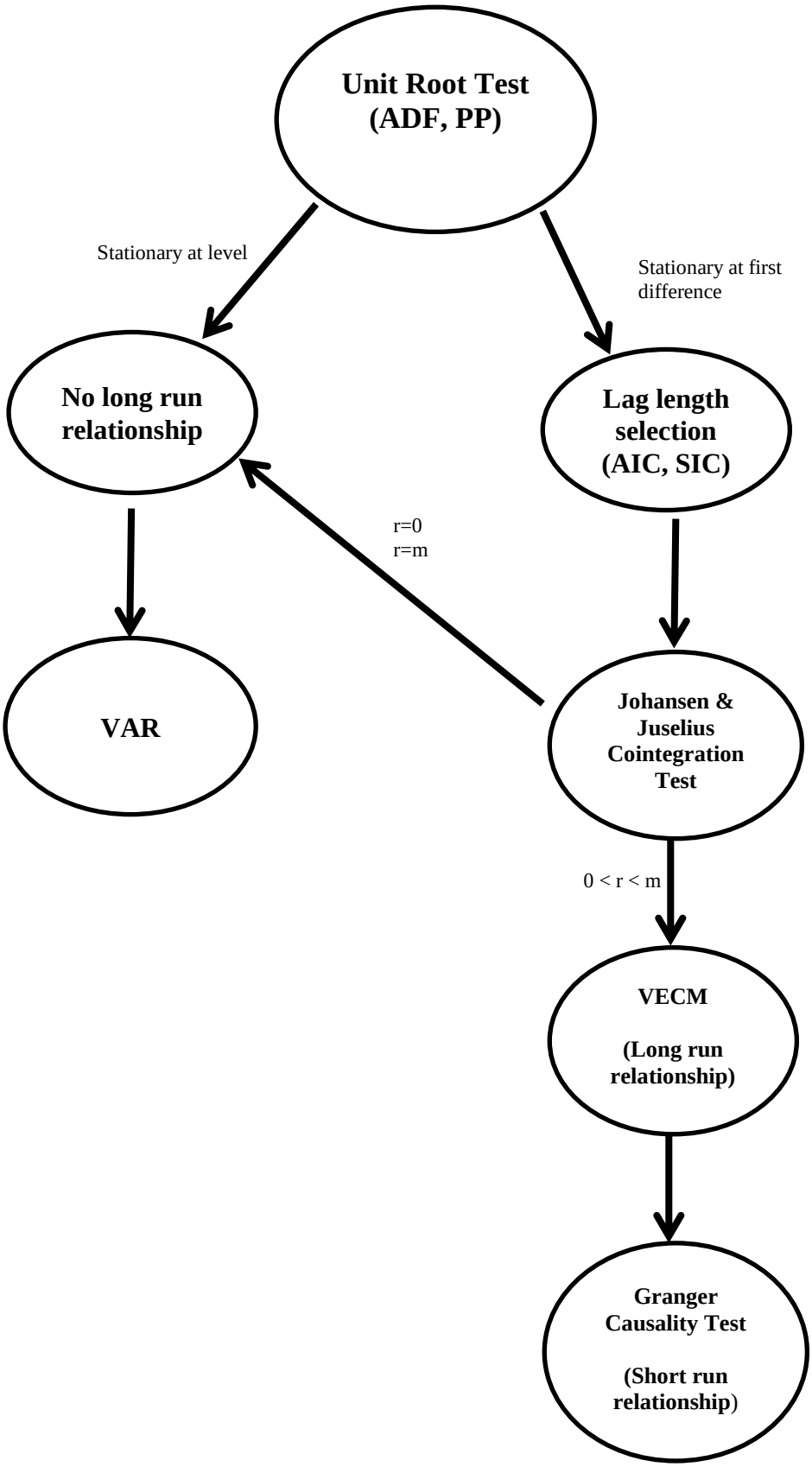
rate, government debt, index of industrial production and Japan stock market, Nikkei 225.

Besides that, the range of 2000 to 2012 secondary monthly average data was selected due to recovery from the impact of financial crisis. Global stock markets were very active during this period whereby Japan had been gone through a rapid development among other Asian countries. Any sound of its stock market activity will bring a great implication to other trading countries even to the worldwide.

The purpose of collecting these data is to determine whether real exchange rate, inflation rate, real interest rate, government debt, index of industrial production would be significantly affected the Nikkei 225 performance.

3.4 Flow Chart of Methodology

First, the study runs the unit root test using ADF and PP approach. When it is stationary at level, it could be illustrated that there is no long run relationship exist and researchers should proceed in running VAR approach. When it is stationary at first level, researchers will move to lag length selection which is choosing the minimum AIC and SIC. After selection of the lag length, researchers could test the Johansen and Juselius cointegration Test whereby when *r* equals to the number co-relationship and equals to the number of variables, it is prove that there is no long run relationship exist. Conversely, when *r* is larger than zero and smaller than the number of variables, researchers could proceed to run the VECM test to see whether there is long run relationship occur between dependent variables and independent variables. If the researchers want to test the short run relationship, they could proceed to test the Granger Causality Test.


Unit Root Test
(ADF, PP)
Stationary at level
Stationary at first difference
No long run relationship
Lag length selection
(AIC, SIC)
r=0
r=m
VAR
Johansen & Juselius Cointegration Test
0 < r < m
VECM
(Long run relationship)
Granger Causality Test
(Short run relationship)

3.5 Methodology

3.5.1 Descriptive Statistics

Descriptive statistics show the summary of the sample and measure. The main purpose of the descriptive statistic was used to summarize the data which include mean, median, maximum, minimum, standard deviation, skewness and kurtosis for analysis.

3.5.2 Unit Root Test

Unit Root test is use to test whether the data are stationary in level, first differences or second differences. When the data is difference one time to be converted into stationary, we can said that the series is integrated in order 1. The times to convert into stationary are larger, the higher the integration order. The followings are the explanation of integration order for unit root test.

I (0) series is a stationary series

I (1) series is stationary at first difference

I (2) series is stationary at second difference

Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test are commonly used to test for stationary of data.

Augmented Dickey-Fuller test

$$\Delta Y_t = \alpha + \phi Y_{t-1} + \delta T + \sum_{i=2}^{p} \beta_i \Delta y_{t-i-1} + \varepsilon_i$$

$$\Delta Y_t = \alpha + \phi Y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta y_{t-i-1} + \varepsilon_i$$

By introducing lag time into Dickey-Fuller test, The Augmented Dickey-Fuller test tests the null hypothesis that a time series yt is I (1) against the alternative that it is I(0). ADF can use to counter for a logger and complex time series model sets.

The Phillips-Perron test

$$\frac{1}{N}\sum_{t=1}^{N}\varepsilon_t^2 + \frac{2}{N}\sum_{t=1}^{N}\omega(s,l)\sum_{t=s+1}^{N}\varepsilon_t\varepsilon_{t-s}$$

The function of Phillips-Perron test is same as Augmented Dickey-Fuller test, which it take into account of an automatic correction to the Dickey Fuller procedure to allow for auto-correlated residuals. Phillips-Perron test statistics will provide a calculation which is much difficult compare to Augmented Dickey-Fuller test. However, the test statistics normally provides same result as Augmented Dickey-Fuller test.

By using unit root test, stationary test of Nikkei market against the five variables would be tested, which is unemployment rate, national debt, exchange rate, index of industrial production and interest rate. By understanding the stationary status of data, we can estimate whether there are long run relationship between dependent and independent variables since Vector Error Correction Model require data to be stationary at first difference or above.

3.5.3 Cointegration test

The concept of cointegration exists and shared stochastic drift when two or more individual series were integrated with set of orders. Cointegration was usually detected in time series variables in statistical manner. Integrated orders tested would be able to establish models for stationarity testing among variables in this study which are between stock market index and the selected macroeconomic variables where standard inference is possible. Testing for cointegration could be essential to ensure the significance or equilibrium of model in our research. Cointegration test carried out were Johansen test, Phillips–Ouliaris cointegration

test and Engle–Granger method with two individual time series x_t and y_t are cointegrated.

The Johansen test estimated H_0 with cointegration rank less than or equal to *r* among the time series data in our study between stock market index and the selected macroeconomic variables. As a result, maximum likelihood estimates of the parameters in a vector error-correction (VEC) model of the cointegrated series could be obtained. (Johansen, 1991). General formula for Johansen tests would be as below:

$$\Delta \mathbf{y}_t = C\mathbf{y}_{t-1} + B_1 \Delta \mathbf{y}_{t-1} + \ldots + B_q \Delta \mathbf{y}_{t-q} + DX + \varepsilon_t$$

According to Carol (1999), Johansen test would be preferable in testing cointegration due to sample size and multivariate tests with more than two independent variables used in our study. This enables to provide us a sound methodology for our research model in the dynamic relationship. Engle-Granger method would be advantage for bivariate testing. In order to fulfill Johansen test, x_t and y_t must be in random walk for testing in order to avoid spurious regression that can be due to limiting distribution. (Phillips, 1986)

On the other hand, cointegration test estimated would be proceed in Vector Autoregressive Model (VAR) to determine the significance of short run relationship where Vector Error Correction Model (VECM) in investigating for long run relationship between stock market index and selected macroeconomic variables in our research.

3.5.4 Error Correction Model (ECM)

Vector Error Correction Model (VECM) can be classified as the estimation on dependent variable, Y returns to equilibrium after a change in an independent variable, X by using multiple time series model (Johansen, 1991). Error Correction Model (ECM) describes how variables y and x behave in the short run consistent with a long-run cointegrating relationship. According to SAS Institute

Inc., Cary, NC, USA, Vector error correction model serve greater knowledge on the nature of any non-stationarity among the several element series and also enhance longer term estimation over an unconstrained model. Theoretically, it is essential for Vector Error Correction Model (VECM) in estimating long run relationship on one another due to its cointegration vector. Eventually, estimation test can be done with integrated data as well as stationary data.

$$\Delta Yt = \alpha + \beta \Delta Xt\text{-}1 - \beta ECt\text{-}1 + \varepsilon$$

In this study, the purpose for application of Vector Error Correction Model (VECM) is to determine the significance of selected macroeconomic variables which are exchange rate, interest rate, government debt, inflation rate and index of industrial production (IIP) on dependent variable, stock market index (Nikkei 225). As per Andreas and Peter (2007) past account, results were found to be co-integrated and significant in long run relationship between macroeconomic variables and stock price by applying Vector Error Correction Model (VECM). Other than that, the degree of equilibrium between stock market index, Nikkei 225 and selected macroeconomic variables was to be estimated as well by using the application above.

Through interpretation β, decision rule will be imposed with comparison of test statistics and critical value obtained where long run relationship exists in the model between exchange rate and stock market index with the condition that H_0 is rejected.

3.5.5 Vector Autoregressive Model (VAR)

The empirical method employed in this paper is Vector Autoregressive Model (VAR). It has become increasingly demanding and popular in recent decades due to it requires less restriction and giving a consistent and accurate result.

Thus, it is useful in dynamic econometrics and attract a number of attentions of the specialist econometrician. It has been employed in a wide range of economic

problem where the dynamic impact needs to be estimated. Besides that, it is also used to apply the estimation of economic relationship as well as modify fluctuation in economic activities. Sims (1980) mentioned that VAR is giving the consistent and logical results to data description, forecasting and policy analysis. He also argued that VAR approach provide more systematic approach to imposing restriction and could lead one to capture empirical regularities which remains hidden to standard procedures.

In order to run the VAR analysis, we have to make sure that the Yt and Xt have to be stationary along the multiple time series. According to Granger and Newbold (1974), Yt and Xt will cause the estimated regression results to be spurious if Yt and Xt have non stationary form in the level form. We could test the stationarity by applying the unit root test.

Precisely, VAR is frequent use in solving macroeconomic problems. For example in Campbell, Lo & Mackinlay (1997) and Cuthbertson (1996), they providing the way of application of VAR model in financial data. According to Garratt, Lee, Pesaran and Shin (1999), Vector Autoregressive Model is used to examine the short run dynamic between the independent variable and dependent variable in time series data.

Therefore, we use the VAR model in this paper to investigate the short run relationship between index of industrial production, inflation rate, real exchange rate, real interest rate, government debt with Nikkei 225 precisely.

3.5.6 Granger Causality Test

In this study, granger causality test is used to determine the direction of causation among the variables. The test is following two regression equations.

$$Yt = \Sigma \alpha i \, Xt\text{-}i + \Sigma \beta j \, Yt\text{-}j + u1t \qquad (I)$$

$$Xt = \Sigma \lambda i \, Xt\text{-}i + \Sigma \delta j \, Yt\text{-}j + u2t \qquad (II)$$

Through granger causality test, there are four different possible results.

1) Unidirectional causality from dependent variable to independent variables occurs if the estimated coefficients on lagged X in equation (I) are not equal to zero and estimated coefficients on lagged Y in equation (I) are not equal to zero.

2) Unidirectional causality from independent variables to dependent variable occurs if the estimated coefficients on lagged X in equation (II) are not equal to zero and estimated coefficients on lagged Y in equation (II) are not equal to zero.

3) Bidirectional causality between dependent variable and independent variables occurs if the sets of X and Y coefficients are significant and not equal to zero in both equation.

4) No causality between dependent variable and independent variables occurs if the sets of X and Y coefficients are not significant in both equation.

There are a few researchers using granger causality test to examine the causal relationship between macroeconomic variables and stock price or stock index. Norma (n.d.) finds that stock index does granger cause macroeconomic variables in Mexico. Through granger causality test, he finds that Mexican Stock Index can used to predict industrial production. Therefore, he determines that Mexican Stock Index is an indicator for macroeconomic variables in Mexico.

3.6 Hypothesis

The hypotheses developed in this research are to examine the whether there are relationship between inflation rate, exchange rate, index of industrial production, interest rate, government debt and stock market performance of Japan.

Hypothesis 1

H_0: There is no long run relationship between stock market indices and inflation rate.

H_1: There is a long run relationship between stock market indices and inflation rate.

Hypothesis 2

H_0: There is no long run relationship between stock market indices and exchange rate.

H_1: There is a long run relationship between stock market indices and exchange rate.

Hypothesis 3

H_0: There is no long run relationship between stock market indices and index and industrial production.

H_1: There is long run relationship between stock market indices and index and industrial production.

Hypothesis 4

H_0: There is no long run relationship between stock market indices and interest rate.

H_1: There is a long run relationship between stock market indices and interest rate.

Hypothesis 5

H_0 : There is no long run relationship between stock market indices and government debt.

H_1: There is a long run relationship between stock market indices and government debt.

3.7 Conclusion

The data sources and research methodologies have already been described above. The research methodologies were used to test the variables whether the five macroeconomic variables will have negative or positive relationship with the Japan stock market performance and also to know whether there is granger causality between the five macroeconomic variables and Japan market performance.

CHAPTER FOUR
EMPIRICAL RESULT

4.1 Introduction

This chapter showed our methodology test result. It consists the result of descriptive statistics, unit root test, Johansen and Juselius Cointegration test, Vector Error Correction Model (VECM) and Granger Causality test.

4.2 Descriptive Statistics

Descriptive statistics provide summary of data set for explanation of basic features, general pattern and trend. It consists of mean, median, maximum, minimum, standard deviation, skewness and kurtosis. The details of descriptive statistics are showed in Table 4.1. It showed descriptive statistic of dependent variable and independent variables in Japan from January 2000 to December 2012.

Table 4.1 Descriptive Statistic

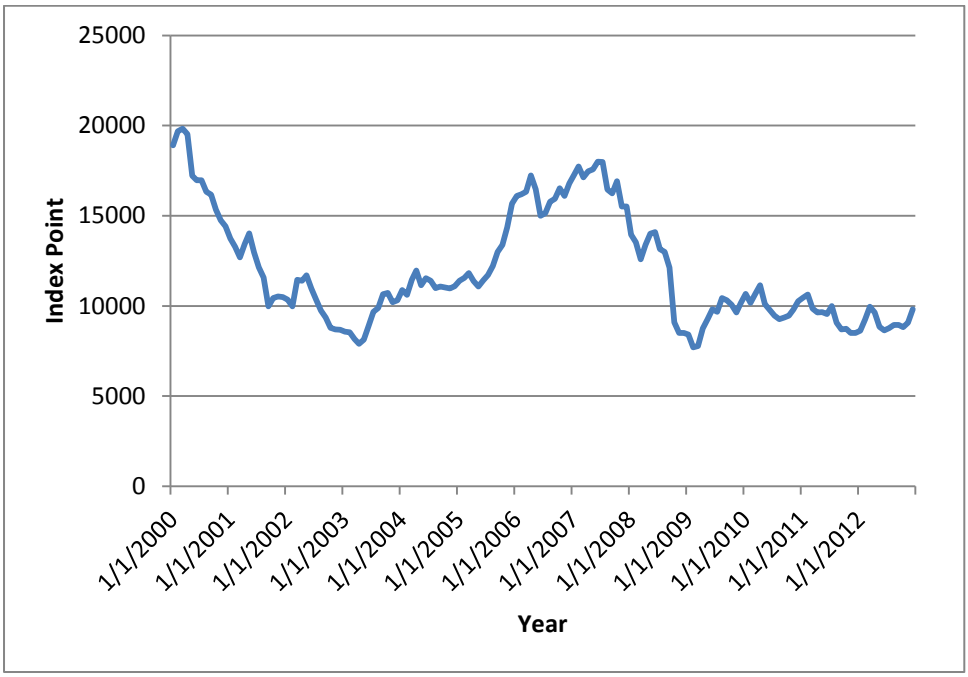
Dep. variable	Mean	Median	Maximum	Minimum	Std. Deviation	Skewness	Kurtosis
SMI	11957.25	10977.61	19823.05	7707.34	3085.60	0.7707	2.4417

Ind. Variables	Mean	Median	Maximum	Minimum	Std. Deviation	Skewness	Kurtosis
INT	1.0900	1.1400	1.8000	0.4300	0.3448	0.0008	1.9464
INF	-0.2761	-0.3000	2.2900	-2.5200	0.7644	0.4087	5.0974
IIP	96.1654	96.0500	116.9000	68.1000	8.8497	-0.2439	3.4411
EXC	100.7005	101.4850	125.3600	79.0000	10.3295	0.1514	3.1828
DEBT	775014.6	832024.1	999612.5	482808.0	145105.0	-0.4648	2.0468

From Table 4.1, it showed that the highest mean is government debt and the lowest is inflation rate which is in negative (-0.2761). This result indicated that Japan government debt is at very high level. Besides that, inflation rate in Japan is negative due to deflation in their economy. For the median, government debt has the highest median (832024.1) while inflation rate has the lowest mean (-0.3000). Regarding to maximum point, government debt has the highest maximum point (999612.5) while interest rate has the lowest maximum point (1.8000). Due to high level in Japan's government debt, government debt has the highest minimum point (482808.0) while deflation in Japan cause inflation rate has the lowest minimum point (-2.5200). For standard deviation, government debt has the highest standard deviation (145105.01) while interest rate has the lowest standard deviation (0.3448). Among all variables, all show positive skewness except for index of industrial production and government debt is negative. Inflation has the highest kurtosis (5.0974) while interest rate has the lowest kurtosis (1.9464) according to Table 4.1.

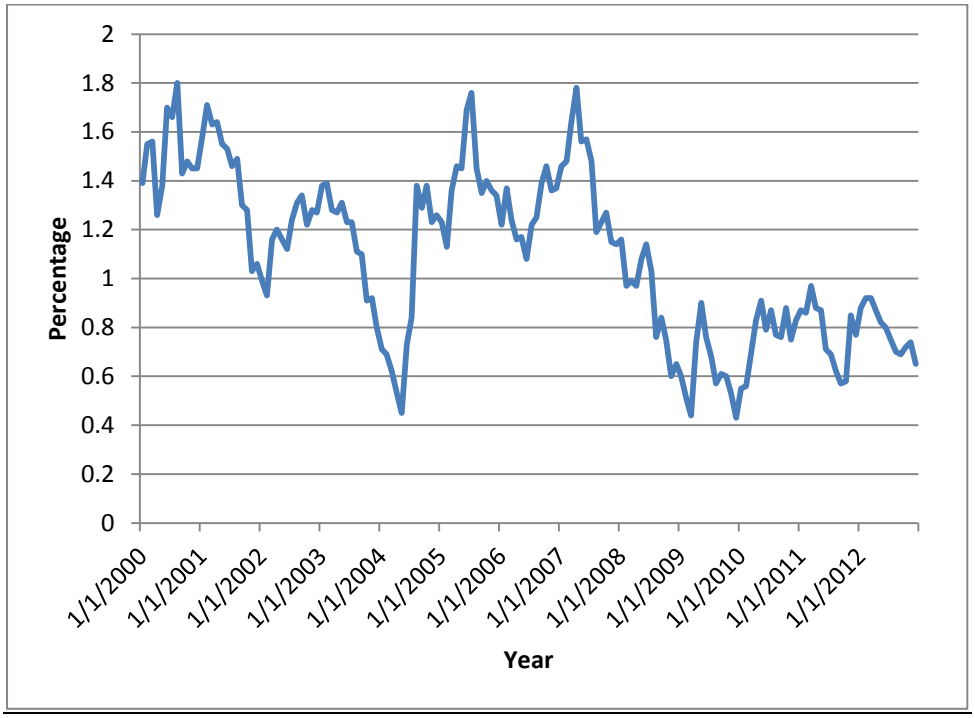
4.3 Graph line

Figure 4.1: Graph Line of Nikkei 225 Index



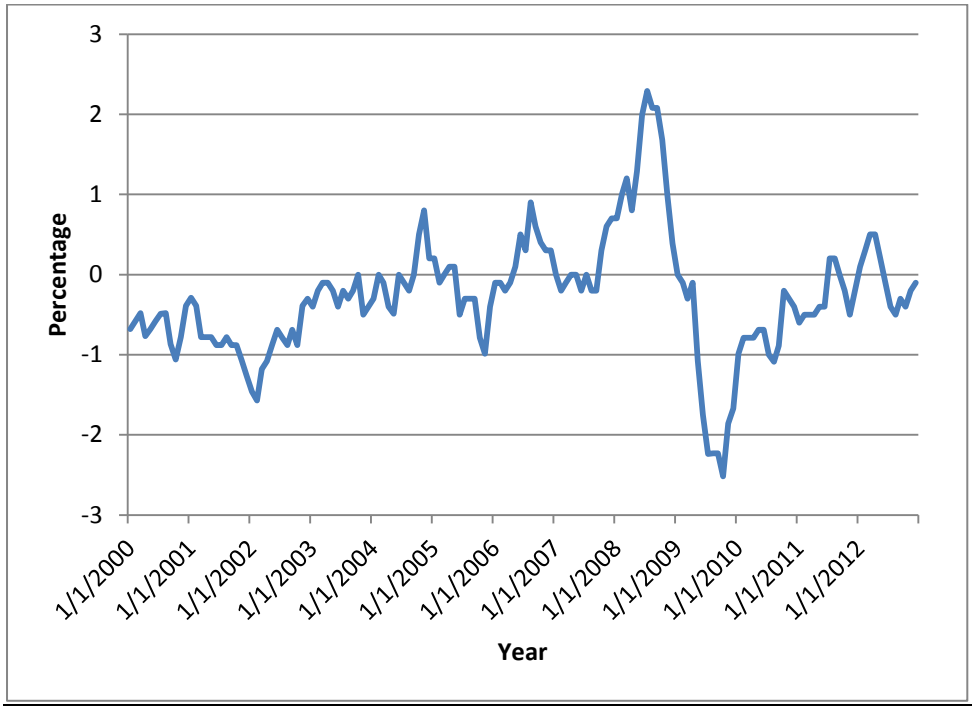
From Figure 4.1, Nikkei 225 is significantly dropped during period 2000 to 2003. After the Asian financial crisis happened in 1997, Japan faced early recession happened in 2000. Japan had facing Lost Decade when the collapse of Japan asset pricing bubble problem from 1991 to 2000. The following years 2000 to 2003 also affected by the recession happened in 2000 and caused Nikkei 225 dropped significantly. After that, Japan recovery from recession. Therefore, Nikkei 225 increases in year 2003 to 2007 year and decreases significantly in 2008.

Figure 4.2: Graph line of Interest Rate



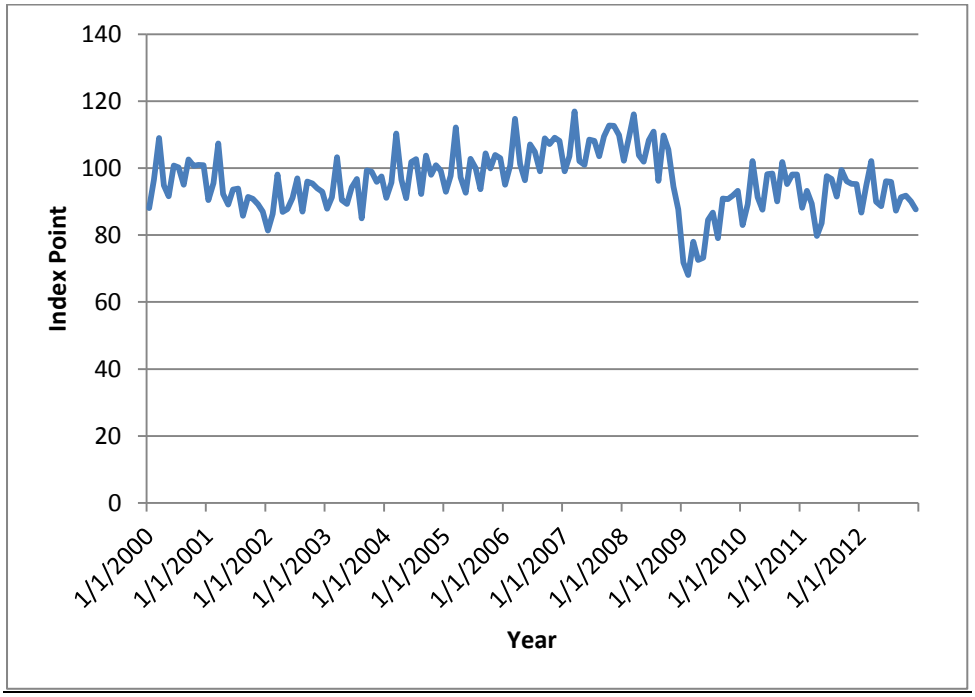
Real interest rate in Japan is fluctuating because of the financial crisis. During the early recession which happened in 2000, Japan interest rate has a dramatic drop in 2003. After recovery from the recession, real interest rate has been adjusted into normal trend. However, a sharp decline of interest rate in 2008. During financial crisis, Japan will lower down their interest rate to attract investors to make investment which can boost economy growth.

Figure 4.3: Graph line of Inflation Rate



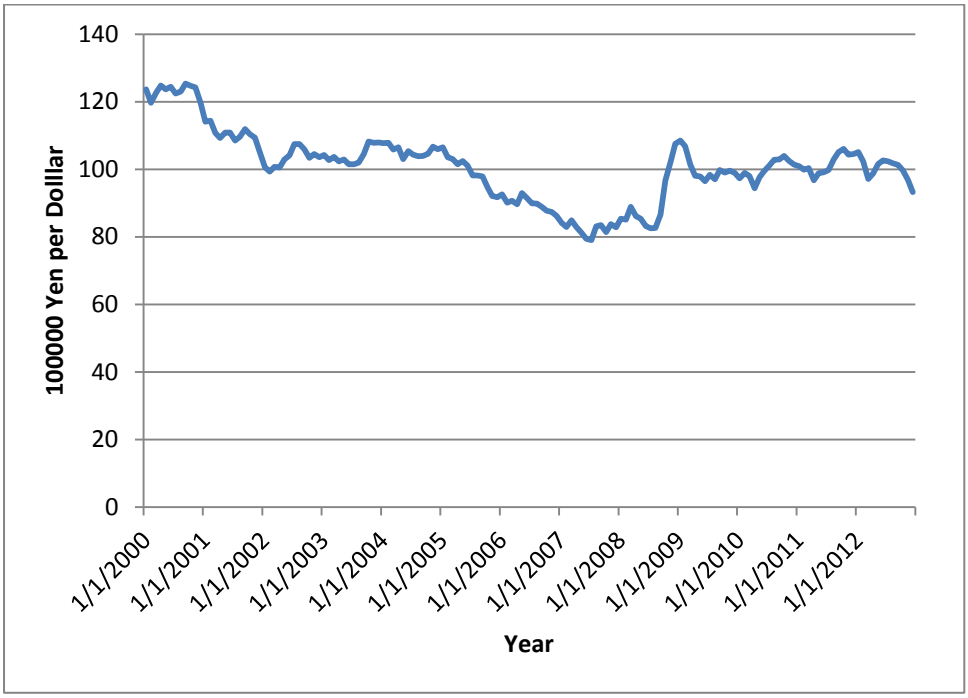
Inflation rate that lower than zero is known as deflation. Japan usually has deflation problem from 2000 to 2012 except 2008 has inflation. Deflation started from 1990, Japan government tried to solve deflation problem by reducing interest rate but failed. Deflation happened in Japan related with Japan asset price fall. Although good deflation makes the price of product cheaper but bad deflation will cause financial crisis, recession and unemployment. During period from 2000 to 2012, Japan only has inflation on 2008. Inflation in 2008 contributed the price of goods and service to increase. However, in the following year (2009), Japan continues with the deflation problem after recovery.

Figure 4.4: Graph line of Index of Industrial Production



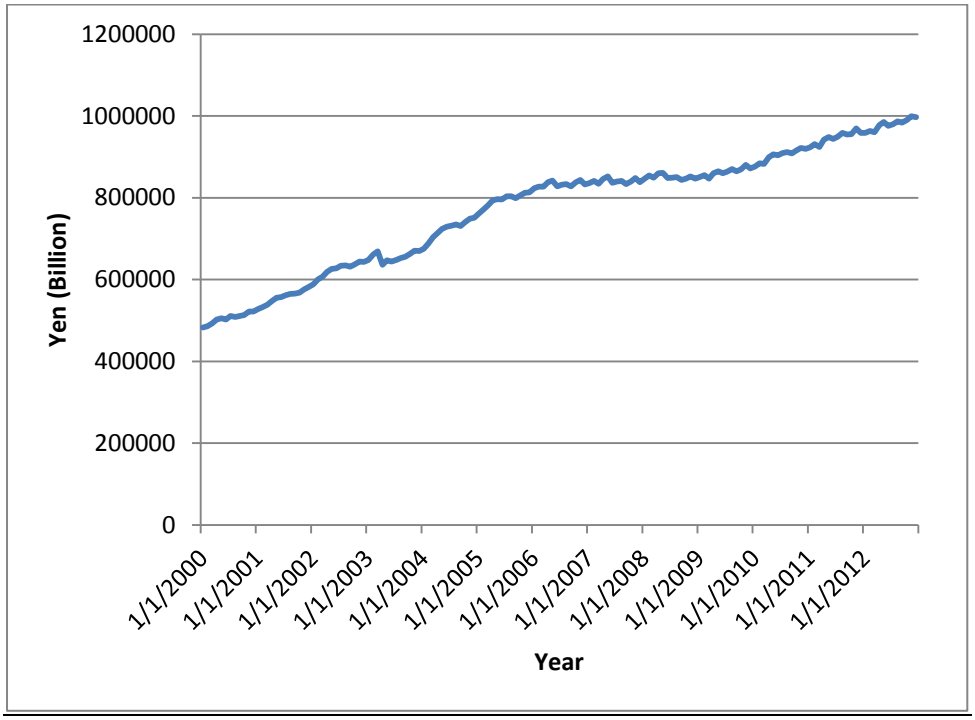
Index of industrial production used to measure the growth of various industries in Japanese economy. From Figure 4.4, index of industrial production dropped significantly in 2008. Every industry in Japan economy had been affected. It cause index of industrial production has a sharp decline because Japan economy become unstable. However, index of industrial production is slightly increased after 2008 because Japan is going to recovery from the crisis.

Figure 4.5: Graph line of Exchange Rate



Real exchange rate is decreasing started from 2000 which affect by the recession happened in 2000. However, real exchange rate has a dramatic rise after 2008. Japan's government lowers down their interest rate in 2008 and by attracting more foreign investors. Since Japan lower their interest rate, many foreign investors make investment in Japan. As the demand of Japan currency increase, exchange rate will increase as well. Therefore, Japan real exchange rate has significantly increased after 2008.

Figure 4.6: Graph line of Government Debt



From International Monetary Fund, it shows that Japan is the country which has the highest government debt in the world. Japan's government debt is always part of major concern in Japanese economy. However, Japan's government debt never decreases. From Figure 4.6, Japan's government debt has increase almost 50% from about 500,000 thousand million yen to almost 1,000,000 thousand million yen during 2000 to 2012. The Japan government debt is increasing because it uses to invest in research and development in high technology product.

4.4 Unit Root Test

For unit root test, ADF and PP test will be carried out to test on the stationary of dependent and independent variables. The results of ADF and PP were compared and shown in the table below. The hypothesis for ADF and PP are:

H_0: Series is non-stationary

H_1: Series is stationary

The null hypothesis will be rejected if p-value is lesser than α, otherwise we do not reject null hypothesis. Table 4.2 will summarizes the result of ADF test and PP test on level for each series.

Table 4.2: ADF and PP stationary test on dependent variable and independent variable at level

Series	Intercept		Trend and Intercept	
	ADF	PP	ADF	PP
SMI	-2.6896*	-2.3396	-2.4540	-2.1717
ECG	-2.1190	-2.3247	-2.1857	-2.2206
IIP	-3.0239**	-6.8623***	-3.0473	-6.9153***
INF	-2.9894**	-2.7609*	-3.0280	-2.7868
INT	-2.1984	-2.2177	-3.0935	-3.0935
DEBT	-1.4401	-1.7619	-1.6672	-1.5432

*Note: *, **, *** denotes rejection of the hypothesis at 10%, 5% and 1% significance level.*

The above tables show the result of two different stationary tests. To determine whether the data are stationary, one must stationary in three conditions, which is intercept, trend and intercept and none. For ADF test, the result indicates that the test-statistics of Nikkei are significant at 10% of significance level while inflation rate and index of industrial production are significant at 5% significance level when include intercept in test equation. If we include none in test equation,

inflation rate is stationary at 10% significance level. Condition required data significant at intercept, trend and intercept and none before rejecting the null hypothesis. Therefore, the null hypothesis for Nikkei 225 index and other independent variables cannot be rejected. Therefore, all the six variables are concluded to be non-stationary in level under the two sets of exogenous assumption. In the other words, the six variables series are integrated at zero order, which can be denoted as I (0) series in our research study.

On the other hand, the PP test also shows the same result as ADF test. Even though index of industrial production show statistically significant at intercept and trend and intercept, yet it shows insignificant in none. There is no conflict in result between two tests. The null hypothesis cannot be rejected for both two exogenous assumptions. Therefore, all the six variables are concluded to be non-stationary at level. Unit root test is extended for all the six variables at first difference and second difference until the appropriate integration order to be found. Table 4.3 will summarizes the result of ADF test and PP test on first differences for all the six variables.

Table 4.3: ADF and PP stationary test on dependent variable and independent variable at first difference

Series	Intercept		Trend and Intercept	
	ADF	PP	ADF	PP
SMI	-9.8280***	-9.9048***	-9.8836***	-9.9134***
ECG	-9.5029***	-9.5748***	-9.4767***	-9.5423***
IIP	-2.8306*	-20.8861***	-2.8278	-20.8134***
INF	-9.9720***	-9.9719***	-9.9388***	-9.9386***
INT	-12.9143***	-13.0221***	-12.8715***	-12.9752***
DEBT	-5.2998***	-14.4178***	-5.4056***	-14.6645***

*Note: *, **, *** denotes rejection of the hypothesis at 10%, 5% and 1% significance level.*

From the table above, Nikkei 225, exchange rate, inflation rate and interest rate showed consistent results for ADF test and PP test, which is significant at 1% significance level when testing at first differences level. The null hypothesis is rejected. Therefore, this can be concluded that Nikkei 225, exchange rate, inflation rate and interest rate is stationary at first differences. On the other word, the two series can be denoted as I (1) series in our research study.

However, looking into the result for index of industrial production and government debt, ADF test and PP test showed conflict in result between them. From Table 4.3, index of industrial production and government debt is non-stationary at first difference in ADF test. However, it showed that the two variables are significant even at 1% significant level in PP test. This result conflicted whether index of industrial production and government debt are stationary at first difference or second difference. However, PP test's result provides better result than ADF test's result. According to Schwert (1989), he suggests that if we are using large sample size, PP test will provide more accurate result than ADF test. By using only the PP test result for index of industrial production and government debt, both can be concluded that the series is stationary at first difference.

In conclusion, the null hypothesis rejected for both two exogenous assumptions, all the six variables are stationary at first difference, which are denote as I (1) series. By obtaining the result, estimation by using Vector Error Correction Model could be proceed.

4.5 Cointegration Test Lag Length Determination

Table 4.4: VAR Lag Order Selection Criteria

Lag Length	FPE	AIC	SIC	HQ
0	4.62e+18	60.00488	60.12638	60.05424
1	3.38e+12	45.87687	46.72743*	46.22245*
2	2.87e+12	45.70941	47.28902	26.35120
3	2.62e+12	45.61191	47.92057	46.54991
4	2.22e+12*	45.43433*	48.47204	46.66854
5	2.50e+12	45.53623	49.30299	47.06666
6	3.09e+12	45.72075	50.21657	47.54739
7	3.04e+12	45.66809	50.89296	47.79094
8	3.93e+12	45.87218	51.82611	48.29125

** shows minimum number in each criterion*

FPE: Final prediction error

AIC: Akaike information criterion

SIC: Schwarz infromation criterion

HQ: Hannan-Quinn information criterion

Table 4.4 showed the result of lag length determination by using different criteria. Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) is the most common use by researchers to find the true lag length for cointegration test. The wrong selection of lag length will affect the true result of cointegration test as the lag length determination is very sensitive to the result. The rule of thumb in selecting the best lag length is to observe the lowest AIC and SIC result. However, the result of AIC and SIC do not provide the same result of lag length determination. AIC showed the lowest result at lag length=4 whereas SIC showed the lowest at lag length=1. Specifically, lag length=4 has been selected in our cointegration test because Ozicck and McMillin (1999) mentioned that in a frequency distribution test, AIC provide the best lag length selection more frequently compare to other criteria.

4.6 Johansen and Juselius Cointegration Test

The existence and the amount of co-integrating relationships among the macroeconomic variables are going through Vector Error Correction Model (VECM) test by applying the Johansen procedure (Johansen and Juselius, 1990 & Johansen, 1991). Typically, we will look at the trace statistic and the maximum eigenvalue. These two tests are used to examine the number of cointegrating vectors. The trace statistic identify there is three co-integrating vector and the results are presented in the table below:

Table 4.5: Multivariate (Johansen) Cointegration Test results

Hypothesized No. of CE(s)	Trace Statistics	Critical Value (0.05)	Probability	Max-Eigen Statistics	Critical Value (0.05)	Probability
None	121.1546*	95.75366	0.0003	46.61854*	40.07757	0.0080
At most 1	74.53610*	69.81889	0.0200	25.35198*	33.87687	0.0316
At most 2	49.18412*	47.85613	0.0373	20.01217	27.58434	0.3403
At most 3	29.17195	29.79707	0.0589	15.74105	21.13162	0.2403
At most 4	15.43090	15.49471	0.0999	10.52789	14.26460	0.1795
At most 5	2.903017	3.841466	0.0884	2.903017	3.841466	0.0884

** denotes rejection of the hypothesis at the 0.05 level*

r =Number of cointegration relationship

m=Number of variables

Table 4.5 had showed Trace Statistics and Max-Eigen Statistics indicated different result of co-integration relationship in our model. Trace Statistics showed that there was evidence that three co-integrating vector while Max-Eigen Statistics showed only two co-integrating relationship in our model. However, Trace Statistics is more powerful than Max-Eigen Statistics because it takes into consideration of all the smallest value of Max-Eigen Statistics (Kasa, 1992). Therefore, we can conclude that there are three co-integrating relationship, which is the short run and long run interaction of the underlying variables existed by using VECM based on the Johansen cointegration methodology. The null

hypothesis of no cointegration vector hypothesis (r=0) is rejected at 5 percent level of significant. When *r* is greater than zero and smaller than *m*, it shows that a long-run equilibrium relationship exists between Nikkei 225 index and the selected macroeconomic variables.

4.7 Vector Error Correction Model

Vector Error Correction Model is proposed by Johansen (1991). It is used to examine the long run co-integrating relationship between dependent variable and independent variables. The equation of our model is as follow:

$$\boldsymbol{SMI_{t-1} = 92324.29 - 7168.011INT_{t-1} - 7200.815INF_{t-1} + 1139.377IIP_{t-1} +}$$

(-1.68103) ** (-1.44949) * (-4.70471) *** (2.04936) **

$$\boldsymbol{57.82173EXG_{t-1} - 0.006992DEBT_{t-1}}$$

(2.42999) ** (-1.46872)*

*Note: *, **, *** denotes rejection of the hypothesis at 10%, 5% and 1% significance level*

( ) is t-statistics of each variable

From the result, the expected signs for all independent variables are in line with common theoretical theories and all the independent variables are significantly affect the stock market index, Nikkei 225 at different significance level of 10%, 5% and 1%.

The t-statistic of interest rate is -1.44949, which significant at 10% level, shows that there are long run relationship between stock market performance and interest rate. The co-integration results reveal that stock returns are negatively impact by interest rate. The coefficient can be interpreted as when interest rate increase by 1%, Nikkei 225 index will decrease by 7168.011 points, holding other variables constant.

For the inflation rate, the t-statistic test show that it is also significant at 1% level. The coefficient of inflation rate is -7200.815 and this indicates that when the

inflation rate increase by 1%, the Nikkei 225 index will decrease by 7200.815 points by holding other variables constant.

Meanwhile for the industrial index of production, the coefficient result is 1139.377 and significant at 5% level of significance, meaning to say that when there is 1 point increase in industrial index of production, Nikkei 225 index will increase by 1139.377 points, holding other variables constant.

Exchange rate shows a positive sign and significant at 5% level of significance which can be illustrated as when there is 100000 yen per US Dollar increase in exchange rate, the Nikkei 225 index will increase by 57.82173 points, holding other variables constant.

For the government debt, the coefficient value is -0.006992 and it is significant at 10% level of significance. This result shows that when government debt increases by 1 billion, Nikkei 225 index will decrease by 0.006992 points by holding other variables constant.

4.8 Granger Causality Test

Granger causality was used to examine whether there is short run relationship existed between each of the variables. It was significant to note that the null hypothesis of Granger Causality indicated there was no granger causality while rejection of null hypothesis indicated that there was a relationship existed between the variables.

There has hypothesis testing in the Granger Causality Test to examine the causality relationship between dependent variable and independent variable.

H_0: Independent variable does not granger cause dependent variable

H_1: Independent variable does granger cause dependent variable.

Reject the null hypothesis when Wald F test is greater than the critical value, otherwise do not reject the null hypothesis. There is unidirectional relationship occur in the independent variable and dependent variable.

H_0: Dependent variable does not granger cause independent variable

H_1: Dependent variable does granger cause independent variable

Reject the null hypothesis when Wald F test is greater than the critical value, otherwise do not reject the null hypothesis. There is unidirectional relationship occur in the dependent variable and independent variable.

When these two situations occur in the model, it will have a bidirectional relationship between dependent variable and independent variable.

Table 4.6: Short Run Granger Causality test

	Short run lagged differences						Coint Eq1 ECT_{t-1}
	ΔSMI	ΔINT	ΔINF	ΔIIP	ΔEXG	ΔDEBT	
Dep.Var	Chi-square (χ^2) statistic						
ΔSMI	-	1.6085	11.5468**	1.4145	4.4949	1.6510	-0.022951**
ΔINT	13.519***	-	2.3434	7.8438*	19.819***	3.8748	-3.72E-06*
ΔINF	1.9661	3.0247	-	13.674***	16.560***	2.9643	-2.70E-05***
ΔIIP	4.5913	1.5569	1.6372	-	6.3824	26.508***	0.000246**
ΔEXG	1.3804	2.9867	12.8015**	9.0850*	-	2.4102	0.000112**
ΔDEBT	2.9762	4.1818	1.5809	18.836***	2.5510	-	-1.89365*

*Note: *, **, *** denotes rejection of the hypothesis at 10%, 5% and 1% significance level*

By the perception of short run dynamics that reflect by Granger causalities, there is no rejection of null hypothesis in the variables of Nikkei 225 index except inflation. All the other lagged coefficients of interest rate, index of industrial production, government debt and exchange rate are not significantly different from zero, hence the four variables are not granger causal for Nikkei 225 index. Therefore, there is no short run dynamics from any of the four series to Nikkei.

Inflation rate showed that there is a short run dynamic relationship to Nikkei 225 index at 5% significant level.

The second column shows that χ^2 statistics of 13.5189 for Nikkei 225 index with reference to interest represent that lagged coefficients of Nikkei 225 index in the regression equation of *INT* are significantly different from zero, meaning to say that Nikkei 225 index Granger causes interest rate at 1% level of significance. Meanwhile, for the lagged coefficients of index of industrial production and exchange rate are significantly different from zero, χ^2 statistics of both are 7.8438 and 19.8185 respectively, which mean both Grangers causes interest rate at 10% and 1% level of significance. For the government debt and inflation rate, the lagged coefficients do not reject the null hypothesis even at 10% level of significance, represents that government debt and inflation rate are not Granger causes interest rate.

On the other hand, in the equation of *INF*, χ^2 statistics of 13.7637 and 16.5602 for index of industrial production and exchange indicate that the rejection of null hypothesis at 1% level of significance, so index of industrial production and exchange rate is Granger causal for inflation rate. Besides, the χ^2 statistics of Nikkei 225 index, interest rate and government debt are 1.9666, 3.0247 and 2.9643 respectively. As we observe the p-value, none of these lagged coefficients of variable is Granger causes inflation rate at any level of significance. Thus, there is no short run dynamics from the three series to inflation rate.

For the equation of *IIP*, there is only one rejection of null hypothesis which debt Granger causes index of industrial production at 1% level of significance with χ^2 statistics of 26.5082, but the rest of the series is failed to reject the null hypothesis even at 10% level of significance. This showed that only debt has short run dynamics towards index of industrial production.

For the equation of *EXG*, there is no rejection of null hypothesis except inflation and IIP. The χ^2 statistics of inflation and index of industrial production is 12.8015 and 2.4102, showed that they are Granger causes exchange rate at 5% and 10% significant level respectively. On the other hand, the lagged coefficients of Nikkei

225 index, interest, and government debt is not significantly from zero, hence they are not Granger causes for exchange rate.

Furthermore, for the equation of *DEBT*, there is only one rejection of null hypothesis, which is index of industrial production. With the χ^2 statistics of 18.8357, the lagged coefficient of index of industrial production is Granger causes debt at 1% significant level. While the other variables which is Nikkei 225 index, interest, inflation and exchange rate are not significant at any significant level. This indicates that there is no short run dynamics from the four series to government debt.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Our study focused on the investigation of long run relationship between the macroeconomic variables which are interest rate, exchange rate, index of industrial production, government debt and inflation rate and stock market performance, Nikkei 225 in Japan from year 2000 to 2012. Despite of this, Granger causality relationship between macroeconomic variables has also been part of our investigation. It is important to make available the latest information to the community who has intention to manage their investment in stock market.

This chapter summarized and discussed the result of our finding on the long run relationship between macroeconomic variables and stock market performance based on monthly basis from January 2000 to December 2012. In addition, it also includes the limitation as well as the recommendation for future study on this topic.

5.2 Summary and Discussions

This session is to discuss about the relationship between the five independent variables and the dependent variable, Nikkei 225. The overall result has shown that every single independent variable is significantly influenced Nikkei 225.

The result showed that there is significant negative relationship between interest rate and Nikkei 225 in the long run. It is in line with the study of previous researchers Eita (2011); Goswami and Jung (1997); Ozbay (2009); and Alshogeathri (2011) who suggest that interest rate has significant negative

relationship with stock market performance in the long run. Ozbay (2009) proposed that discount rate will influence the riskiness of the stock price as well as the time value of money in the case of Turkey. When the interest rate increases, market rate will also increase. The stock price will decrease due to higher required rate of return. According to Stowe (2007), the discount rate can be also perceived as a required rate of return. This is also matched with the study of Chen, Roll and Ross (2012) and Naka, Mukherjee and Tufte (1998) which have already stated in our literature review. Furthermore, the increase of interest rate will also increase a company's cost of capital. If the company wants to sustain its status in the market, it has to be generated more profit in order to cover the implication brought by high inflated interest rate. If company facing losses, its company stock would not be attractive in previous and therefore, it has to offer high risk premium for the investors to buy its share. The inverse relationship between stock price and interest rate has been proven in this statement. Wong and Fung (2002) also have an outcome that there is negative relationship between interest rate and stock market liquidity after Asian financial crisis. Conversely, there are still have researchers such as Oyama (1997); Garg (2008); Stein *et al.* (2012) implied that a positive relationship does exist between interest rate and stock market performance.

Next, the result showed that inflation rate is negatively and significantly influenced Nikkei 225 in the long run. It is contended in literature review and match with the study of Lintner (1975), Body (1976), Fama and Schwert (1997) and Huybens and Smith (1999). The rise of inflation rate will lead to lower earnings and cause the investors or customers lose their purchasing power (Ozbay, 2009). This phenomenon will bring certain effects to investors or firms that invest in stock market. Firms enrolled in long term investment with specific amount or value will be easily affected by the fluctuation of inflation rate. It is because the value of the investment will decrease when the inflation rate increase, firms will face with inflation risk and could not get back the same return from stock investment as initially planned.

Besides, increase in inflation rate may cause government to implement monetary or fiscal policy to control it. The implementation may distort the optimal original

investment plan and therefore, the value of the firms will decrease (Schwert, 1981). Besides, Omran and John (2001); Ioannides *et al.* (2005); and Alshogeathri (2011) have also pointed out that there is significant negative relationship between inflation rate and stock market performance in Nigeria, Eygpt, Greek and Saudi Arabia. Meanwhile, Onran and Jogn (2011) indicate that when the inflation rate decreases, the interest rate will decrease as well. It may give the investors a good sign to invest in stock market and grant an opportunity to expand their business. Omotor (2011), Ibrahim and Agbaje (2013) have different outcome. They implied that there is a positive relationship between inflation rate and stock market performance as the outcome seems suggest the theory of Fisher (1930) that equities are a good hedge against inflation which against Fama's proxy hypothesis.

The index of industrial production has positively affected Nikkei 225 in the long run and it is in line with theoretical prediction. When the index of industrial production increases, it indicates that the country has an optimistic perspective in its growth of production as well as positive impact to its economy. Therefore, the stock market will reflect the current market condition (Rahman *et al.*, 2009; Ghazi, 2011; Culter *et al.*, 1989). Previous studies show that there is strongly positive relationship between index of industrial production and stock market index in long run (Jay *et al.*, 1999; Patel, 2012; Srinivasan, 2011). They stated that compared with recession and growth period, the average stock return has significant improved in growth period in G-7 countries such as Canada, France, Germany, Italy, Japan, UK and US. Indian stock market also performs a similar trend.

The result showed that there is significant positive relationship between exchange rate and Nikkei 225 in the long run. When the exchange rate increases, the domestic currency will depreciate in value. Thus, the local products or stocks will be cheaper than foreign product. Foreign investors will come and invest their capital in domestic country's stock market and consequently boost up its stock market performance. This statement is similar to Ozbay (2009) who applied good market model and states that changes in exchange rates will affect its countries' trade balance and international competitiveness. This will influence the countries' real income and output. Therefore, the stock price will present a desirable outlook.

Kasman (2003) also stated that changes in exchange rate does make changes in stock indices. In addition, it is performing a positive relationship. By analyzing Singapore stock market, Maysami *et al.* (2004) found a positive relationship between exchange rate and stock index in long run. They implied that if Singapore dollar depreciate, it will increase the demand of its domestic goods and thereby increasing cash inflows to Singapore. This will also increase its stock market investment. Hence, the increase in demand will boost up the stock market performance.

Furthermore, Muradoglu and Metin (1996) have revealed the result by examining Turkey's stock market and indicates that when exchange rate increase, stock return will increase as well in long run. Kasman (2003) have proved that the exchange rate and stock price have moved together stably in the long run by investigating in Turkey stock market as well. Moreover, Lean (2003) has found out that there is significant long run relationship after 2001 and 911-terrorist attack. It is perfectly match with our research objectives. There were also some previous researchers have different view on this issue. Yoon and Kang (2011); Kurihara (2006); Bhargava and Konku (2010); and Banerjee and Adhikary (2009) stated that there is negative relationship between exchange rate and stock price.

On the other hand, the result showed that there is significant negative relationship between government debt and Nikkei 225 in the long run. According to Ureche-Rangau and Burietz (2013), the reason which the stock market performance will drop is due to the association with high government debt. Hence, increase its risk premium. Previous researchers Altayligil and Akkay (2013) also claim that by applying approaches "safe assets" and "lazy bank" view, the result will show positive and negative relationship between domestic public debt and financial development respectively.

Different countries will have different outcome of changing of public indebtedness. Baur and Lucey (2006); Connolly *et al.* (2005); Shiller and Beltratti (1993); Nguyen and Schüßler (2013) also found a negative relationship between stock and debt market. The empirical findings of Apergis and Sorros (2011) from 1999 until 2009 show that long-term leverage obligations have negatively and

significant impact on the value of firms because it will simultaneously impairing firm's stock price. The level of impact is differentiated according to the amount of the long-term debt. Inversely, Rajan (1992) claimed that government debt should be positive impact on stock market performance. He argued that firms can benefit from diversification of debt borrowing when there is introduction of public debt. Hence, they can reduce the cost of borrowing from the bank and would be have a positive stock price movement.

From the result, there is a great disparity between the figure of government debt and Nikkei 225. It is due to the difference in unit measurement. The unit measurement for government debt is 1000 million in Japanese Yen and the Nikkei 225 index is presented in points. Therefore, the comparison between government debt and Nikkei will be exaggerated. However, the final result has shown that there is still have a significant relationship exists.

5.3 Implications of study

In our research study, Japan was proven to have significant relationship between the selected macroeconomic variables and stock market performance, Nikkei 225 regards the five factors which are inflation rate, real exchange rate, real interest rate, government debt and the index of industrial production.

Firstly, this study implies that inflation rate is one of the pivotal factors by influencing stock market performance as inflation rate in Japan has significant long run relationship to stock market index. Typically for developing and emerging countries, controlling inflation rate has been on high priority due to economic reform. Omran and Pointon (2001) had analysed statistically that the impact on returns is not sensible for such a short period of time as well. Thus, high in inflation rate reduces market activity and liquidity which provides an indicator of market attraction. Nevertheless, appropriate monetary measures can be proposed and adopted in controlling inflation in order to minimize the volatility of stock market performance.

Other than that, the changes in real exchange rate significantly affecting stock market index in long run, implying that it is another important variable that cannot be neglected. Ajayi and Mougoue (1996) mentioned that an appreciation of the yen increases Japanese stock prices. Eventually, this determines the decisions on expansionary monetary or contractionary fiscal policies implementation in order to boost up stock market performance such as the increase and decrease of money supply can influence the exchange rate and subsequently bring some certain effects to the stock market (Dimitrova, 2005).

Real interest rate is a crucial factor of economic growth of Japan. In our study, real interest rate was found to have significant relationship in long run with stock market index. In fact, the interest rate has been considerably controlled by Central Bank, however it will be benefit greatly by manipulate supply and demand of investors in share market (Alam, 2009).

On the other hand, in our study also implies that government debt has significant relationship affecting stock market index in long run. According to Lim *et al.* (2012), as correlation between government debt and stock market can be vary due to economic condition; this provides an indicator of volatility with different term of maturities. Typically, developing and emerging countries would be focus in financing through debt market; however excessive high in debt will lead to changes in inflation and interest rate in financial market. The significance in studying government debt allows government ease in controlling and monitoring inflow and outflow of capital. Thus, suitable monetary and fiscal policies can be used in management. By pursuing economic growth, reduction in government debt would be able to promote positive GDP.

Lastly, the index of industrial production has been implied and proven to have significant relationship in long run. Specifically, increase in index of industrial production would be able to enhance development of capital markets in Japan. It is because when the economic growth improved, investors' confidence has been gain and eventually it is able to attract more investment to domestic market. From the past research, Chen *et al.* (1986) identified industrial production as a vital risk

factor for the determination of stock returns. Thus, appropriate policies such as set up subsidiary in different countries, encourage domestic production, and tax cutting can be taken in order to control stock market performance by diversifying systematic risk.

In fact, Fama (1970) stated that the Efficient Market Hypothesis (EMH) in especially semi-strong form efficiency stock prices must consist of all relevant information including publicly attainable information and has vital effect for authorities who make the economic policy. The cointegrating relationship between macroeconomic variables and stock market index concluded with inefficient market hypothesis. On contrary, it is pivotal for policy-makers like government needed to evaluate whether the undergoing economic policies are appropriate.

During post crisis starting in 2000, Japan's economy was recovering by strengthening monitor and control. Manipulating macroeconomic variables through policies implementation for policy-makers is important with better understanding in our research study. According to Hsing (2013), adjusting in interest rate able to attract investments and source funds into financial market, however excessive in money supply relative to GDP would lead to increase inflation expectations and harm the stock market as well as social activities due to decrease in purchasing power. Therefore, in order to source fund, the investors are suggested to create alternatives which provide lower risk such as obtain funds through debt market. Other than that, investors can also try to reduce inflation risk by entering into hedging market to keep the value of their portfolio. Next, Central Bank can also play a vital role to implement suitable monetary policy in order to minimize the inflation risk.

As Japan remained as one of the most active leading stock market in Asia, exposure and economic integration would be affecting neighbouring countries as well. Innovation and development progress in Japan could be viewed as an indicator which represents the current trend in Asian stock market. After the incident of financial crisis in 1997, capital controls changes in respective countries like Malaysia, Phillipines, Thailand, Korea and Singapore. Therefore, physical

implementations will be exerted pressure significantly to other countries' stock market performance in the region (Chancharat *et al.*, 2007).

Our present study confirmed that the selected macroeconomic factors continue to affect the stock market performance in Japan. However, logical extension of the study could be done in order to enhance the comprehensiveness of our research study.

5.4 Limitations

In our research, the relationship between macroeconomic variables and stock index is examined in post crisis based on data from 2000 to 2012. The data are being obtained from DataStream. However, DataStream could only provide the data until year 2012 where the complete data for year 2013 have yet to be updated. It is a constraint for us to effectively examine the relationship between Nikkei 225 and five macroeconomic variables which are interest rate, inflation rate, exchange rate, index of industrial production and government debt. Other than that, inability in making prediction and forecasting for 2014 as we are not accessible to the latest data. For the methodology, vector error correction model (VECM) is used to test the long run relationship between macroeconomic variables and stock index. Through VECM, major focus has been put on studying the long run relationship in our research as long run captured real effect. Minor concern is given on the short run relationship between macroeconomic variables and stock index by using VECM. Besides, some variables are volatile in short run such as Nikkei 225 because it is calculated daily.

Typically, vector error correction model is sensitive to the choice of lag length. Any changes in lag length will influence our research result. Besides that, Augmented Dickey-Fuller (ADF) test also sensitive with lag length. We need to concern lag length when we run through ADF test. The wrong choice of lag length may mislead the true result of our model.

5.5 Recommendations for Future Research

The future research could have been enriched with additional test on different time frequencies other than monthly data such as daily, weekly or quarterly. Besides, this research only focuses on five independent variables which are interest rate, inflation rate, index of industrial production, exchange rate and government debt. Future research could include other variables such as consumer price index, trade balance and so on in order to obtain more accurate result or to explore the model to see the different relationship between stock market performance and macroeconomic variables.

Besides, the period of our study is from beginning of year 2000 to end of year 2012, which we could not take in the newest information of variables in year 2013 into consideration. A longer period of data could have been produced a more refined result.

5.6 Conclusion

In a nutshell, our study has shown a significant relationship between Nikkei 225 and five variables in long run which are interest rate, inflation rate, exchange rate, index of industrial production and government debt. Econometrics approaches such as unit root test, Vector Autoregression (VAR), vector error correction model (VECM) and Granger causality test enable us to test the relationship. The relationship between Nikkei 225 and the five macroeconomic variables that we examined also show significant result during post crisis period. Japan is one of the most developed countries in the world and it has traded with many countries, therefore the study of its stock market can predominantly provide an explicit picture for the investors to make a good investment decision.

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APPENDIXES

Appendix 4.1: Descriptive Statistic of Common Sample

	NIKKEI	INTEREST	INFLATION	IIP	EXCHANGE	DEBT
Mean	11957.25	1.090064	-0.276090	96.16538	100.7005	775014.6
Median	10977.61	1.140000	-0.300000	96.05000	101.4850	832024.1
Maximum	19823.05	1.800000	2.290000	116.9000	125.3600	999612.5
Minimum	7707.341	0.430000	-2.520000	68.10000	79.00000	482808.0
Std. Dev.	3085.596	0.344763	0.764365	8.849710	10.32953	145105.1
Skewness	0.770770	0.000823	0.408719	-0.243852	0.151392	-0.464767
Kurtosis	2.441749	1.946440	5.097389	3.441056	3.182781	2.046827
Jarque-Bera	17.47193	7.214937	32.93710	2.810508	0.813063	11.52173
Probability	0.000161	0.027120	0.000000	0.245305	0.665956	0.003148
Sum	1865331.	170.0500	-43.07000	15001.80	15709.28	1.21E+08
Sum Sq. Dev.	1.48E+09	18.42350	90.55931	12139.19	16538.37	3.26E+12
Observations	156	156	156	156	156	156

Appendix 4.2: ADF Test for SMI include intercept in level

Null Hypothesis: NIKKEI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.689630	0.0781
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.3: ADF Test for SMI include trend and intercept in level

Null Hypothesis: NIKKEI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.453993	0.3506
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.4: ADF Test for SMI include none in level

Null Hypothesis: NIKKEI has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.607643	0.1015
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.5: PP Test for SMI include intercept in level

Null Hypothesis: NIKKEI has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.339567	0.1610
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Appendix 4.6: PP Test for SMI include trend and intercept in level

Null Hypothesis: NIKKEI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.171679	0.5015
Test critical values:	1% level	-4.018349	
	5% level	-3.439075	
	10% level	-3.143887	

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

Appendix 4.7: PP Test for SMI include none in level

Null Hypothesis: NIKKEI has a unit root
Exogenous: None
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.471683	0.1316
Test critical values:	1% level	-2.579967	
	5% level	-1.942896	
	10% level	-1.615342	

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

Appendix 4.8: ADF Test for EXG include intercept in level

Null Hypothesis: EXCHANGE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.119026	0.2376
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.9: ADF Test for EXG include trend and intercept in level

Null Hypothesis: EXCHANGE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.185739	0.4937
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.10: ADF Test for EXG include none in level

Null Hypothesis: EXCHANGE has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.929236	0.3126
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.11: PP Test for EXG include intercept in level

Null Hypothesis: EXCHANGE has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.324700	0.1656
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Appendix 4.12: PP Test for EXG include trend and intercept in level

Null Hypothesis: EXCHANGE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.220572	0.4745
Test critical values:	1% level	-4.018349	
	5% level	-3.439075	
	10% level	-3.143887	

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

Appendix 4.13: PP Test for EXG include none in level

Null Hypothesis: EXCHANGE has a unit root
Exogenous: None
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.134782	0.2327
Test critical values:	1% level	-2.579967	
	5% level	-1.942896	
	10% level	-1.615342	

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

Appendix 4.14: ADF Test for IIP include intercept in level

Null Hypothesis: IIP has a unit root
Exogenous: Constant
Lag Length: 12 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.023940	0.0351
Test critical values:	1% level	-3.476472	
	5% level	-2.881685	
	10% level	-2.577591	

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

Appendix 4.15: ADF Test for IIP include trend and intercept in level

Null Hypothesis: IIP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 12 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.047296	0.1233
Test critical values:	1% level	-4.023506	
	5% level	-3.441552	
	10% level	-3.145341	

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

Appendix 4.16: ADF Test for IIP include none in level

Null Hypothesis: IIP has a unit root
Exogenous: None
Lag Length: 12 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.485668	0.5040
Test critical values:	1% level	-2.581233	
	5% level	-1.943074	
	10% level	-1.615231	

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

Appendix 4.17: PP Test for IIP include intercept in level

Null Hypothesis: IIP has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.862301	0.0000
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Appendix 4.18: PP Test for IIP include trend and intercept in level

Null Hypothesis: IIP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.915263	0.0000
Test critical values:	1% level	-4.018349	
	5% level	-3.439075	
	10% level	-3.143887	

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

Appendix 4.19: PP Test for IIP include none in level

Null Hypothesis: IIP has a unit root
Exogenous: None
Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.272034	0.5866
Test critical values:	1% level	-2.579967	
	5% level	-1.942896	
	10% level	-1.615342	

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

Appendix 4.20: ADF Test for INF include intercept in level

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.989357	0.0381
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.21: ADF Test for INF include trend and intercept in level

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.027995	0.1281
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.22: ADF Test for INF include none in level

Null Hypothesis: INFLATION has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.846063	0.0046
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.23: PP Test for INF include intercept in level

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.760948	0.0664
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Appendix 4.24: PP Test for INF include trend and intercept in level

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.786816	0.2045
Test critical values:	1% level	-4.018349	
	5% level	-3.439075	
	10% level	-3.143887	

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

Appendix 4.25: PP Test for INF include none in level

Null Hypothesis: INFLATION has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.641117	0.0084
Test critical values:	1% level	-2.579967	
	5% level	-1.942896	
	10% level	-1.615342	

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

Appendix 4.26: ADF Test for INT include intercept in level

Null Hypothesis: INTEREST has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.198358	0.2078
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Appendix 4.27: ADF Test for INT include trend and intercept in level

Null Hypothesis: INTEREST has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.093546	0.1115
Test critical values:	1% level	-4.018349	
	5% level	-3.439075	
	10% level	-3.143887	

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

Appendix 4.28: ADF Test for INT include none in level

Null Hypothesis: INTEREST has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.104513	0.2437
Test critical values:	1% level	-2.579967	
	5% level	-1.942896	
	10% level	-1.615342	

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

Appendix 4.29: PP Test for INT include intercept in level

Null Hypothesis: INTEREST has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.217722	0.2009
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Appendix 4.30: PP Test for INT include trend and intercept in level

Null Hypothesis: INTEREST has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.093546	0.1115
Test critical values:	1% level	-4.018349	
	5% level	-3.439075	
	10% level	-3.143887	

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

Appendix 4.31: PP Test for INT include none in level

Null Hypothesis: INTEREST has a unit root
Exogenous: None
Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.085571	0.2507
Test critical values:	1% level	-2.579967	
	5% level	-1.942896	
	10% level	-1.615342	

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

Appendix 4.32: ADF Test for DEBT include intercept in level

Null Hypothesis: DEBT has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.440072	0.5612
Test critical values:	1% level	-3.473672	
	5% level	-2.880463	
	10% level	-2.576939	

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

Appendix 4.33: ADF Test for DEBT include trend and intercept in level

Null Hypothesis: DEBT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.667206	0.7611
Test critical values:	1% level	-4.019561	
	5% level	-3.439658	
	10% level	-3.144229	

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

Appendix 4.34: ADF Test for DEBT include none in level

Null Hypothesis: DEBT has a unit root
Exogenous: None
Lag Length: 3 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		3.228822	0.9997
Test critical values:	1% level	-2.580264	
	5% level	-1.942938	
	10% level	-1.615316	

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

Appendix 4.35: PP Test for DEBT include intercept in level

Null Hypothesis: DEBT has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.761855	0.3983
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Appendix 4.36: PP Test for DEBT include trend and intercept in level

Null Hypothesis: DEBT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.543185	0.8104
Test critical values:	1% level	-4.018349	
	5% level	-3.439075	
	10% level	-3.143887	

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

Appendix 4.37: PP Test for DEBT include none in level

Null Hypothesis: DEBT has a unit root
Exogenous: None
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		5.623711	1.0000
Test critical values:	1% level	-2.579967	
	5% level	-1.942896	
	10% level	-1.615342	

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

Appendix 4.38: ADF Test for SMI include intercept in 1st difference

Null Hypothesis: D(NIKKEI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.827999	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.39: ADF Test for SMI include trend and intercept in 1st difference

Null Hypothesis: D(NIKKEI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.883581	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.40: ADF Test for SMI include none in 1st difference

Null Hypothesis: D(NIKKEI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.780834	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.41: PP Test for SMI include intercept in 1st difference

Null Hypothesis: D(NIKKEI) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.904784	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.42: PP Test for SMI include trend and intercept in 1st difference

Null Hypothesis: D(NIKKEI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.913417	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.43: PP Test for SMI include none in 1st difference

Null Hypothesis: D(NIKKEI) has a unit root
Exogenous: None
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.869582	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.44: ADF Test for EXG include intercept in 1st difference

Null Hypothesis: D(EXCHANGE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.502876	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.45: ADF Test for EXG include trend and intercept in 1st difference

Null Hypothesis: D(EXCHANGE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.476745	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.46: ADF Test for EXG include none in 1st difference

Null Hypothesis: D(EXCHANGE) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.490456	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.47: PP Test for EXG include intercept in 1st difference

Null Hypothesis: D(EXCHANGE) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.574775	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.48: PP Test for EXG include trend and intercept in 1st difference

Null Hypothesis: D(EXCHANGE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.542284	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.49: PP Test for EXG include none in 1st difference

Null Hypothesis: D(EXCHANGE) has a unit root
Exogenous: None
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.569063	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.50: ADF Test for IIP include intercept in 1st difference

Null Hypothesis: D(IIP) has a unit root
Exogenous: Constant
Lag Length: 11 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.830570	0.0565
Test critical values:	1% level	-3.476472	
	5% level	-2.881685	
	10% level	-2.577591	

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

Appendix 4.51: ADF Test for IIP include trend and intercept in 1st difference

Null Hypothesis: D(IIP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 11 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.827845	0.1899
Test critical values:	1% level	-4.023506	
	5% level	-3.441552	
	10% level	-3.145341	

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

Appendix 4.52: ADF Test for IIP include none in 1st difference

Null Hypothesis: D(IIP) has a unit root
Exogenous: None
Lag Length: 11 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.828821	0.0049
Test critical values:	1% level	-2.581233	
	5% level	-1.943074	
	10% level	-1.615231	

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

Appendix 4.53: PP Test for IIP include intercept in 1st difference

Null Hypothesis: D(IIP) has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-20.88613	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.54: PP Test for IIP include trend and intercept in 1st difference

Null Hypothesis: D(IIP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-20.81343	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.55: PP Test for IIP include none in 1st difference

Null Hypothesis: D(IIP) has a unit root
Exogenous: None
Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-20.96526	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.56: ADF Test for INF include intercept in 1st difference

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.971978	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.57: ADF Test for INF include trend and intercept in 1st difference

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.938750	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.58: ADF Test for INF include none in 1st difference

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.00375	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.59: PP Test for INF include intercept in 1st difference

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.971872	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.60: PP Test for INF include trend and intercept in 1st difference

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.938641	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.61: PP Test for INF include none in 1st difference

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: None
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.00363	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.62: ADF Test for INT include intercept in 1st difference

Null Hypothesis: D(INTEREST) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.91434	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.63: ADF Test for INT include trend and intercept in 1st difference

Null Hypothesis: D(INTEREST) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.87153	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.64: ADF Test for INT include none in 1st difference

Null Hypothesis: D(INTEREST) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.92906	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.65: PP Test for INT include intercept in 1st difference

Null Hypothesis: D(INTEREST) has a unit root
Exogenous: Constant
Bandwidth: 7 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.02209	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.66: PP Test for INT include trend and intercept in 1st difference

Null Hypothesis: D(INTEREST) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.97522	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.67: PP Test for INT include none in 1st difference

Null Hypothesis: D(INTEREST) has a unit root
Exogenous: None
Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.99532	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.68: ADF Test for DEBT include intercept in 1st difference

Null Hypothesis: D(DEBT) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.299803	0.0000
Test critical values:	1% level	-3.473672	
	5% level	-2.880463	
	10% level	-2.576939	

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

Appendix 4.69: ADF Test for DEBT include trend and intercept in 1st difference

Null Hypothesis: D(DEBT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.405634	0.0001
Test critical values:	1% level	-4.019561	
	5% level	-3.439658	
	10% level	-3.144229	

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

Appendix 4.70: ADF Test for DEBT include none in 1st difference

Null Hypothesis: D(DEBT) has a unit root
Exogenous: None
Lag Length: 11 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.061899	0.2595
Test critical values:	1% level	-2.581233	
	5% level	-1.943074	
	10% level	-1.615231	

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

Appendix 4.71: PP Test for DEBT include intercept in 1st difference

Null Hypothesis: D(DEBT) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.41779	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Appendix 4.72: PP Test for DEBT include trend and intercept in 1st difference

Null Hypothesis: D(DEBT) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.66449	0.0000
Test critical values:	1% level	-4.018748	
	5% level	-3.439267	
	10% level	-3.143999	

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

Appendix 4.73: PP Test for DEBT include none in 1st difference

Null Hypothesis: D(DEBT) has a unit root
Exogenous: None
Bandwidth: 8 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.72062	0.0000
Test critical values:	1% level	-2.580065	
	5% level	-1.942910	
	10% level	-1.615334	

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

Appendix 4.74: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: NIKKEI INTEREST INFLATION IIP EXCHANGE DEBT
Exogenous variables: C
Date: 03/19/14 Time: 16:59
Sample: 2000M01 2012M12
Included observations: 146

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4354.508	NA	3.52e+18	59.73298	59.85559	59.78280
1	-3302.447	2003.239	3.18e+12	45.81434	46.67264*	46.16309*
2	-3251.404	92.99645	2.59e+12	45.60827	47.20225	46.25594
3	-3207.464	76.44258	2.34e+12	45.49951	47.82918	46.44611
4	-3162.239	74.96282	2.09e+12*	45.37313*	48.43848	46.61866
5	-3134.729	43.33763	2.39e+12	45.48944	49.29047	47.03388
6	-3111.223	35.09731	2.92e+12	45.66059	50.19731	47.50397
7	-3069.911	58.28933*	2.82e+12	45.58783	50.86023	47.73013
8	-3046.469	31.14908	3.54e+12	45.75985	51.76794	48.20108
9	-3025.299	26.39101	4.66e+12	45.96299	52.70676	48.70314
10	-2989.747	41.39536	5.14e+12	45.96914	53.44859	49.00821

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix 4.75: Johansen Cointegration Test

Date: 03/19/14 Time: 17:28
Sample (adjusted): 2000M06 2012M12
Included observations: 151 after adjustments
Trend assumption: Linear deterministic trend
Series: NIKKEI INTEREST INFLATION IIP EXCHANGE DEBT
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.265622	121.1546	95.75366	0.0003
At most 1 *	0.154556	74.53610	69.81889	0.0200
At most 2 *	0.124124	49.18412	47.85613	0.0373
At most 3	0.098996	29.17195	29.79707	0.0589
At most 4	0.067346	13.43090	15.49471	0.0999
At most 5	0.019042	2.903017	3.841466	0.0884

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.265622	46.61854	40.07757	0.0080
At most 1	0.154556	25.35198	33.87687	0.3616
At most 2	0.124124	20.01217	27.58434	0.3403
At most 3	0.098996	15.74105	21.13162	0.2403
At most 4	0.067346	10.52789	14.26460	0.1795
At most 5	0.019042	2.903017	3.841466	0.0884

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix 4.76: Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 03/19/14 Time: 17:01
Sample (adjusted): 2000M06 2012M12
Included observations: 151 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
NIKKEI(-1)	1.000000
INTEREST(-1)	7168.011 (3289.53) [2.17904]
INFLATION(-1)	7200.815 (1226.58) [5.87066]
IIP(-1)	-1139.377 (151.915) [-7.50009]
EXCHANGE(-1)	-57.82173 (94.5354) [-0.61164]
DEBT(-1)	0.006992 (0.00740) [0.94519]
C	92324.29

Error Correction:	D(NIKKEI)	D(INTEREST)	D(INFLATION)	D(IIP)	D(EXCHANGE)	D(DEBT)
CointEq1	-0.022951 (0.01365) [-1.68103]	-3.72E-06 (2.6E-06) [-1.44949]	-2.70E-05 (5.7E-06) [-4.70471]	0.000246 (0.00012) [2.04936]	0.000112 (4.6E-05) [2.42999]	-0.189365 (0.12893) [-1.46872]
D(NIKKEI(-1))	0.184048 (0.09225) [1.99504]	-8.84E-06 (1.7E-05) [-0.50985]	-5.21E-07 (3.9E-05) [-0.01345]	-0.000625 (0.00081) [-0.77056]	-7.89E-05 (0.00031) [-0.25379]	1.428882 (0.87121) [1.64012]
D(NIKKEI(-2))	-0.017750 (0.09229) [-0.19233]	-1.22E-06 (1.7E-05) [-0.07029]	1.23E-05 (3.9E-05) [0.31760]	0.000959 (0.00081) [1.18269]	-0.000313 (0.00031) [-1.00567]	0.234483 (0.87155) [0.26904]
D(NIKKEI(-3))	0.083523 (0.09179) [0.90991]	-3.92E-05 (1.7E-05) [-2.26927]	4.24E-05 (3.9E-05) [1.10069]	0.001144 (0.00081) [1.41776]	0.000148 (0.00031) [0.47882]	0.022408 (0.86687) [0.02585]
D(NIKKEI(-4))	0.039474 (0.09069) [0.43527]	5.40E-05 (1.7E-05) [3.16841]	1.95E-05 (3.8E-05) [0.51232]	-1.90E-05 (0.00080) [-0.02383]	7.09E-05 (0.00031) [0.23225]	-0.105769 (0.85644) [-0.12350]
D(INTEREST(-1))	-7.123696 (456.034)	0.073853 (0.08575)	0.209112 (0.19148)	1.839557 (4.00711)	-1.279139 (1.53593)	3843.003 (4306.66)

	[-0.01562]	[0.86122]	[1.09210]	[0.45907]	[-0.83281]	[0.89234]
D(INTEREST(-2))	385.9962	0.009695	0.000638	-3.816981	-0.947116	-5390.147
	(438.241)	(0.08241)	(0.18401)	(3.85076)	(1.47600)	(4138.62)
	[0.88079]	[0.11765]	[0.00347]	[-0.99123]	[-0.64168]	[-1.30240]
D(INTEREST(-3))	396.6330	-0.010659	0.232050	-2.125722	0.972907	-5037.966
	(423.195)	(0.07958)	(0.17769)	(3.71856)	(1.42533)	(3996.53)
	[0.93724]	[-0.13395]	[1.30594]	[-0.57165]	[0.68259]	[-1.26058]
D(INTEREST(-4))	6.321771	-0.047689	-0.038036	0.843980	-1.649469	1359.931
	(423.013)	(0.07954)	(0.17761)	(3.71695)	(1.42471)	(3994.81)
	[0.01494]	[-0.59952]	[-0.21415]	[0.22706]	[-1.15775]	[0.34042]
D(INFLATION(-1))	-512.5097	-0.011162	0.231818	1.473395	0.798669	-864.8525
	(188.652)	(0.03547)	(0.07921)	(1.65766)	(0.63538)	(1781.58)
	[-2.71669]	[-0.31466]	[2.92662]	[0.88884]	[1.25698]	[-0.48544]
D(INFLATION(-2))	255.2451	0.045375	0.000166	-0.016241	-1.164084	505.7141
	(198.129)	(0.03726)	(0.08319)	(1.74094)	(0.66730)	(1871.08)
	[1.28827]	[1.21790]	[0.00200]	[-0.00933]	[-1.74446]	[0.27028]
D(INFLATION(-3))	-302.9461	-0.010136	-0.099061	0.664726	0.387705	873.9848
	(199.351)	(0.03749)	(0.08370)	(1.75167)	(0.67142)	(1882.61)
	[-1.51967]	[-0.27040]	[-1.18349]	[0.37948]	[0.57744]	[0.46424]
D(INFLATION(-4))	-233.5826	-0.030019	0.105778	1.304974	1.839512	1483.610
	(192.359)	(0.03617)	(0.08077)	(1.69023)	(0.64787)	(1816.58)
	[-1.21431]	[-0.82991]	[1.30968]	[0.77207]	[2.83934]	[0.81670]
D(IIP(-1))	-12.41130	-0.002629	-0.021991	-0.212815	0.094298	-206.0540
	(17.0287)	(0.00320)	(0.00715)	(0.14963)	(0.05735)	(160.814)
	[-0.72885]	[-0.82103]	[-3.07575]	[-1.42229]	[1.64417]	[-1.28132]
D(IIP(-2))	-17.46986	-0.005765	-0.016781	-0.368145	0.138783	-15.14240
	(15.9503)	(0.00300)	(0.00670)	(0.14015)	(0.05372)	(150.631)
	[-1.09526]	[-1.92220]	[-2.50576]	[-2.62673]	[2.58340]	[-0.10053]
D(IIP(-3))	-10.55297	-0.000719	-0.007218	0.055461	0.112349	-351.9236
	(13.1131)	(0.00247)	(0.00551)	(0.11522)	(0.04417)	(123.837)
	[-0.80476]	[-0.29150]	[-1.31089]	[0.48134]	[2.54383]	[-2.84183]
D(IIP(-4))	-11.81018	-0.001626	-0.001821	0.146578	0.058936	-32.87155
	(11.1932)	(0.00210)	(0.00470)	(0.09835)	(0.03770)	(105.705)
	[-1.05512]	[-0.77257]	[-0.38755]	[1.49033]	[1.56333]	[-0.31097]
D(EXCHANGE(-1))	-37.78147	-0.012321	-0.040449	-0.213202	0.209885	-144.8647
	(26.8660)	(0.00505)	(0.01128)	(0.23607)	(0.09049)	(253.715)
	[-1.40629]	[-2.43887]	[-3.58580]	[-0.90314]	[2.31955]	[-0.57097]
D(EXCHANGE(-2))	-30.62609	0.009388	0.006258	0.120964	0.224534	-135.6819
	(28.8074)	(0.00542)	(0.01210)	(0.25313)	(0.09702)	(272.049)
	[-1.06313]	[1.73297]	[0.51735]	[0.47788]	[2.31422]	[-0.49874]
D(EXCHANGE(-3))	30.07810	-0.015671	-0.003215	-0.541102	-0.146776	-309.2365
	(29.0638)	(0.00547)	(0.01220)	(0.25538)	(0.09789)	(274.470)
	[1.03490]	[-2.86739]	[-0.26349]	[-2.11882]	[-1.49944]	[-1.12667]
D(EXCHANGE(-4))	-22.31145	0.012182	0.018818	-0.083218	-0.034204	64.24754
	(29.5109)	(0.00555)	(0.01239)	(0.25931)	(0.09939)	(278.693)

	[-0.75604]	[2.19527]	[1.51873]	[-0.32092]	[-0.34413]	[0.23053]
D(DEBT(-1))	-0.005279	-8.07E-07	-1.68E-06	7.33E-05	2.76E-05	-0.021155
	(0.00941)	(1.8E-06)	(4.0E-06)	(8.3E-05)	(3.2E-05)	(0.08888)
	[-0.56089]	[-0.45617]	[-0.42441]	[0.88630]	[0.87096]	[-0.23802]
D(DEBT(-2))	-0.000328	2.55E-06	-3.80E-06	-3.19E-05	-3.47E-05	-0.067571
	(0.00843)	(1.6E-06)	(3.5E-06)	(7.4E-05)	(2.8E-05)	(0.07961)
	[-0.03889]	[1.60955]	[-1.07395]	[-0.43031]	[-1.22360]	[-0.84880]
D(DEBT(-3))	-0.009566	1.87E-06	-3.80E-06	-0.000175	-1.99E-06	0.284773
	(0.00839)	(1.6E-06)	(3.5E-06)	(7.4E-05)	(2.8E-05)	(0.07920)
	[-1.14067]	[1.18288]	[-1.07786]	[-2.38149]	[-0.07038]	[3.59561]
D(DEBT(-4))	-0.002522	6.47E-07	2.72E-06	0.000264	-6.03E-06	-0.093131
	(0.00877)	(1.6E-06)	(3.7E-06)	(7.7E-05)	(3.0E-05)	(0.08283)
	[-0.28758]	[0.39218]	[0.73858]	[3.42608]	[-0.20417]	[-1.12433]
C	22.36424	-0.020467	0.024442	-0.535697	-0.108311	2893.984
	(80.1027)	(0.01506)	(0.03363)	(0.70385)	(0.26979)	(756.467)
	[0.27919]	[-1.35876]	[0.72671]	[-0.76109]	[-0.40147]	[3.82566]
R-squared	0.198689	0.282578	0.345402	0.585131	0.297938	0.438086
Adj. R-squared	0.038427	0.139094	0.214482	0.502157	0.157525	0.325703
Sum sq. resids	46802126	1.654927	8.250930	3613.546	530.9019	4.17E+09
S.E. equation	611.8962	0.115063	0.256919	5.376650	2.060877	5778.576
F-statistic	1.239778	1.969402	2.638274	7.051998	2.121873	3.898151
Log likelihood	-1168.894	126.5112	5.215302	-453.9847	-309.1857	-1507.942
Akaike AIC	15.82641	-1.331275	0.275294	6.357413	4.439545	20.31711
Schwarz SC	16.34594	-0.811743	0.794826	6.876945	4.959077	20.83664
Mean dependent	-49.06042	-0.004834	0.003841	-0.025828	-0.201589	3254.809
S.D. dependent	624.0031	0.124010	0.289880	7.620188	2.245296	7037.123

Determinant resid covariance (dof adj.)	1.03E+12
Determinant resid covariance	3.31E+11
Log likelihood	-3288.239
Akaike information criterion	45.69854
Schwarz criterion	48.93562

Appendix 4.77: VEC Granger Causality/ Block Exogeneity Wald Tests

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 03/19/14 Time: 17:02
Sample: 2000M01 2012M12
Included observations: 151

Dependent variable: D(NIKKEI)

Excluded	Chi-sq	df	Prob.
D(INTEREST)	1.608536	4	0.8073
D(INFLATION)	11.54680	4	0.0211
D(IIP)	1.414453	4	0.8417
D(EXCHANGE)	4.493899	4	0.3433
D(DEBT)	1.650978	4	0.7996
All	20.34029	20	0.4368

Dependent variable: D(INTEREST)

Excluded	Chi-sq	df	Prob.
D(NIKKEI)	13.51893	4	0.0090
D(INFLATION)	2.343427	4	0.6729
D(IIP)	7.843823	4	0.0975
D(EXCHANGE)	19.81852	4	0.0005
D(DEBT)	3.874809	4	0.4232
All	45.69280	20	0.0009

Dependent variable: D(INFLATION)

Excluded	Chi-sq	df	Prob.
D(NIKKEI)	1.966611	4	0.7419
D(INTEREST)	3.024706	4	0.5537
D(IIP)	13.67374	4	0.0084
D(EXCHANGE)	16.56024	4	0.0024
D(DEBT)	2.964287	4	0.5638
All	43.72744	20	0.0016

Dependent variable: D(IIP)

Excluded	Chi-sq	df	Prob.
D(NIKKEI)	4.591331	4	0.3319
D(INTEREST)	1.556855	4	0.8165
D(INFLATION)	1.637197	4	0.8021
D(EXCHANGE)	6.382381	4	0.1724
D(DEBT)	26.50821	4	0.0000
All	45.29876	20	0.0010

Dependent variable: D(EXCHANGE)

Excluded	Chi-sq	df	Prob.
D(NIKKEI)	1.380373	4	0.8476
D(INTEREST)	2.986722	4	0.5600
D(INFLATION)	12.80146	4	0.0123
D(IIP)	9.085011	4	0.0590
D(DEBT)	2.410221	4	0.6608
All	30.07993	20	0.0686

Dependent variable: D(DEBT)

Excluded	Chi-sq	df	Prob.
D(NIKKEI)	2.976155	4	0.5618
D(INTEREST)	4.181768	4	0.3820
D(INFLATION)	1.580931	4	0.8122
D(IIP)	18.83573	4	0.0008
D(EXCHANGE)	2.551039	4	0.6355
All	35.50196	20	0.0176