FACTORS AFFECTING THE LONG RUN STOCK MARKET PERFORMANCE IN MALAYSIA: AN ARDL ANALYSIS

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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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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
APT	Arbitrage Pricing Theory
AR(1)	First-order Autoregression
ARCH	Autoregressive Conditional Heteroscedastic
ARDL	Autoregressive Distributed Lag
ASI	All Share Index
BLUE	Best Linear Unbiased Estimator
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares
CAPM	Capital Asset Pricing Model
CPI	Consumer Price Index
CRU	Crude Oil
DF	Dickey-Fuller
EMH	Efficient Market Hypothesis
EU-12	European Union of 12 Member States

FBMEMAS	FTSE Bursa Malaysia EMAS
FTSE	Financial Times Stock Exchange
GARCH	Generalized AutoRegressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
IFS	International Financial Statistics
IPI	Industrial Production Index
KLCI	Kuala Lumpur Composite Index
KLSE	Kuala Lumpur Stock Exchange
KLSI	Kuala Lumpur Syariah Index
LM	Lagrange Multiplier
LNCPI	Natural Logarithm of Consumer Price Index
LNCRU	Natural Logarithm of Crude Oil Prices
LNIPI	Natural Logarithm of Industrial Production Index
LNKLCI	Natural Logarithm of Kuala Lumpur Composite Index
LNREER	Natural Logarithm of Real Effective Exchange Rate
LOP	Law of One Price
MESDAQ	Malaysian Exchange of Securities Dealing and Automated Quotation
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
OPEC	Organisation of the Petroleum Exporting Countries

PP	Phillips-Perron
PPP	Purchasing Power Parity
Q	Quarter
REER	Real Effective Exchange Rate
RESET	Regression Specification Error Test
SETI	Thai Stock Exchange Index
TOL	Tolerance value
UK	United Kingdom
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
VIF	Variance Inflation Factor
WTI	West Texas Intermediate

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PREFACE

Stock price index is indicative of stock market performance of a nation at large. Market participants are often concerned with how stock price index can be affected by economy indicators at macroeconomic level. Although many studies had been conducted on this topic; however, studies in the case of Malaysia are still lacking and results are somewhat inconclusive.

By employing autoregressive distributed lag model (ARDL) bounds testing approach, this research intends to discover how Malaysian stock market performance as measured by Kuala Lumpur Composite Index (KLCI) is influenced by macroeconomic variables in the long run. This research could provide useful information or guidelines to several parties such as policymakers, firms, investors, and researchers who want to gain more understanding and knowledge about Malaysian stock market performance.

ABSTRACT

Malaysian economy had undergone massive growth in 1990 as a result of the successful industrial transformation. Thereafter, due to many liberal financial policies that targeted to draw foreign capital, Malaysian stock market is growing enormously. This study aims to examine the factors that influence the long run stock market performance in Malaysia over the period from year Quarter 1 1998 to Quarter 4 2016. The selected macroeconomic variables include inflation rate, exchange rate, crude oil price and industrial production index. This study applied autoregressive distributed lag model (ARDL) bounds testing approach to determine the effect of the selected variables on long run stock market performance by using 76 quarterly data. The findings of this study suggest that inflation rate, crude oil price and industrial production index have statistically significant positive effect on Malaysia stock market performance as indicated by Kuala Lumpur Composite Index (KLCI) in the long run. Whereas, exchange rate is found to have insignificant negative long run relationship towards Malaysia stock market performance. Governments, policymakers, researchers, academicians and investors are able to determine the latest macroeconomic variables that are significantly impacting the stock price based on this study. It is recommended to take the three significant variables into account as a reference or guideline while imposing or adjusting existing policy to maintain a healthy and stable stock market in Malaysia. Lastly, the limitations and also recommendations of the study are provided for future researchers to conduct more comprehensive research.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This chapter gives a general overview of this study. Specifically, Chapter 1 covers research background (background of both Malaysian economy and stock market) and the statement of research problem. Also, research questions, research objectives, hypotheses and significance of the study are included in this chapter. The last part of this chapter presents the chapter layout and a short conclusion.

1.1 Research Background

1.1.1 Background of Malaysian Economy

Malaysia is considered as one of the most successful countries among non-western countries. At the end of 20^{th} century, it has successfully accomplished a relatively smooth transition to modern economic growth (Drabble, n.d.). According to Datuk Seri Abdul Rahman Dahlan, the Minister in the Prime Minister's Department, during the third quarter of year 2017, economic growth of Malaysia is among the fastest in the Asian region. He further added that this puts Malaysia ahead of countries like Singapore, Indonesia, South Korea and Taiwan in terms of Gross Domestic Product (GDP) growth. Also, it is faster than developed economies such as the United States, the European Union and the United Kingdom (Abas, 2017). Malaysia is now targeted to become a fully developed country; hence Malaysia is looking forward to draw further investments in high technology value-added production, knowledge-based goods and services. In order to be more competitive in the global market, government of Malaysia has liberalised several services subsections and applied fiscal reforms in order to attain a balanced budget before 2020 through reforming tax along with reducing the endowments (“Malaysia”, n.d.).

Unfortunately, Malaysia encountered financial crisis in 1997 which shrank down the economy of Malaysia. The 1997 crisis was caused by Bangkok unpegged the Thai baht from the US dollar which in turn giving rise to devalue of a series currency (Ba, n.d.). After the financial crisis, Malaysia carried on to post continuous growth rates, with average of 5.5 percent every year beginning year 2000 until year 2008. However, in year 2009, the Global Financial Crisis crashed Malaysian economy badly, fortunately Malaysia was able to recover from the financial crisis rapidly. Since then, the posting growth rates of Malaysia stayed at 5.7 percent on average (“Overview”, 2017).

Malaysia's economic development is mainly driven by its wealth of natural resources in agriculture and forestry. Malaysia mainly produces palm oil, cocoa and rubber. Furthermore, Malaysia also exports the raw materials including the rubber tin, petroleum and palm oil to develop its economy. In recent years, Malaysia successfully became one of the sizeable exporters among those countries which also produce semi-conductor devices, as well as electrical goods and appliances. This is due to the Malaysian government is planning to transform Malaysia to a major producer and developer of products that are of high technology like nano solar panels and electric cars. After China and India, Malaysia is also ranked as a main outsourcing destination for components production (“Malaysia: Economic and political outline”, n.d.).

1.1.2 Background of Malaysian Stock Market

Malaysian stock market which is also known as Bursa Malaysia, plays an important role in the global stock market today. In Southeast Asia, Malaysian stock market is considered as one of the biggest stock markets. Before 1990, Malaysian stock market has small capitalization, and then because of the successful industrial transformation, Malaysian economy had undergone massive growth in 1990. Thereafter, due to many liberal financial policies that targeted to draw foreign capital, Malaysian stock market is growing enormously (Yeoh, Hooy & Arsad, 2010).

Malaysian equity market was started in 1930. Bursa Malaysia, also known as the Kuala Lumpur Stock Exchange (KLSE), is Malaysian stock exchange that established in 1973. FTSE Bursa Malaysia KLCI has a market capitalization of MYR 555,631 and it comprises of 30 constituents ("FTSE Bursa Malaysia KLCI", 2018). Bursa Malaysia CEO, Datuk Seri Tajuddin Attan said that 2017 was one of the strongest years for the local equity market. The FBMKLCI saw growth of 9.4% and market capitalisation grew by 14.4% year-on-year ("Bursa Malaysia gets earnings boost on equity market participation", 2018).

Lastly, there are three sections in the market operation of Bursa Malaysia, namely Securities Exchange, Derivative Exchange as well as Offshore Exchange. Bursa Malaysia Securities Main Board listed the stock of bigger corporations while the medium-sized corporations will be listed on the Second Board, however, companies like high development and technology companies will be listed in the MESDAQ market. In addition, Derivatives Exchange provides trading services for futures and options contracts, which is operated by Bursa Derivatives (Mantraa, 2017). To make the market competitive and to ensure companies have easy access to capital in Malaysia, by the year end of 2008, the main and second board companies on Bursa Malaysia was merged with a set of unified listing requirements ("Bursa Malaysia merges main and second boards, revamps Mesdaq", 2008).

1.2 Problem Statement

According to Chen, Cheng and Demirer (2017), inefficient in dissemination of information in the market place will be reflected in asset price through investor trading. Stock market provides access to capital for listed companies in exchange with the ownership. This is the reason why it is an important component of a free-market economy (Kaufmann & Panni, 2017).

From the past until today, the performance of stock market is a concern for researchers. Up to today, it is still a famous topic for the researchers to study. There are a lot of studies related to the performance of stock market but a consensus still cannot be reached. Every researcher has their own opinion on different determinants that will affect the stock market performance.

When the prices of goods and services change too much and too fast, it will surely shock the market even though prices are fluctuating over time. Consumer Price Index (CPI) is a commonly used indicator to determine the change in price in a basket of goods and services. It helps to indicate whether the recent economy is undergoing either inflation, deflation or stagflation. Theoretically, no relationship is found between the inflation and stock prices because companies can increase their prices to make up for the increased cost. But in reality, companies are competing strongly which make them unable to raise their prices easily because they are afraid of losing business, so the competing companies are negatively affected by inflation. Johnson (2017) found out that inflation may stimulate economic performance in term of short run.

When the real effective exchange rate (REER) increases, it implies that the Ringgit Malaysia has appreciated against other currencies. Conversely, when it decreases, it implies that the Ringgit Malaysia has depreciated. There is always a strong belief by the policymakers that when an exchange rate appreciates, it will provoke imports and cut down exports. Thereby, Malaysia as an export-oriented country, can always promote exports by changing the exchange rate. It might also have significant impact on investors in the market. When Ringgit Malaysia is expected to appreciate, it implies that the market is doing well, and it will give investors confidence to invest in this country. While the Ringgit Malaysia is depreciating, as an export-oriented country, the goods become cheaper and more attractive for importers from other countries. This can also help the country to produce more goods and increase the exports.

Malaysia is one of the oil production countries in this world. Due to the heavily reliance of oil export to support the country's expenses and growth, crude oil price and Malaysian stock market performance are expected to closely linked with each other. The effect of oil price on the performance of stock market in Malaysia can be positive due to Malaysia is an oil exporter. When the oil price increases, the country's revenue will also increase. According to Say (2017), the ringgit has obediently tracked oil price movements. Oil prices had been on a slow but steady increase prior to mid-2014.

Industrial production index (IPI) allows the market and investors to become optimistic because it shows the real production output of manufacturing, mining, and utilities in the market. The optimism amongst the stock markets and investors can bring the markets up. This is due to the markets expect that the companies' performance to increase. At the end, it will help the growth in a country's GDP and imply improvement in its economy. Increase of a country's GDP makes it an attractive investment to foreign investors because they will assume that increase in GDP is due to the improvement of the economy of the country. And thus investors have confidence that they can gain from the investment in this country through capital gain and also dividend distribution. However, there is a major problem of using IPI as a determinant of stock market performance. For the products manufactured by small and medium-sized enterprises, there is not much representation can be found. Therefore, the IPI numbers are unable to capture the real trends in the small and medium-sized enterprises sector (Victor, 2011).

However, it is important to note that there is not much research done on stock market performance in Malaysia with the above mentioned determinants because Malaysia is a developing country. Most of the research is focusing on examining the developed countries. Also, most of the results obtained have passed through a long period of time and there are limited recent studies on this subject. Therefore, this research, by using ARDL analysis, aims to investigate the impact of inflation, exchange rate, price of crude oil as well as index of industrial production on the stock market performance in Malaysia.

1.3 Research Questions

1. Is the relationship between Malaysian stock market performance and inflation rate significant in the long run?
2. Is the relationship between Malaysian stock market performance and exchange rate significant in the long run?
3. Is the relationship between Malaysian stock market performance and crude oil price significant in the long run?
4. Is the relationship between Malaysian stock market performance and industrial production index significant in the long run?

1.4 Research Objectives

1.4.1 General Objective

Generally, this research attempts to determine how the four selected macroeconomics variables related to the performance of stock market in the long run in Malaysia. The period covered in this research is from Q1 1998 to Q4 2016.

1.4.2 Specific Objectives

1. To study the long run relationship between the performance of Malaysian stock market and inflation rate.
2. To study the long run relationship between the performance of Malaysian stock market and exchange rate.
3. To study the long run relationship between the performance of Malaysian stock market and crude oil price.
4. To study the long run relationship between the performance of Malaysian stock market and industrial production index.

1.5 Hypotheses of the Study

H_1: Inflation rate and Malaysian stock market performance are significantly related in the long run.

H_1: Exchange rate and Malaysian stock market performance are significantly related in the long run.

H_1: Crude oil price and Malaysian stock market performance are significantly related in the long run.

H_1: Industrial production index and Malaysian stock market performance are significantly related in the long run.

1.6 Significance of Study

This research aims to examine the factors that will alter the long-run stock market performance in Malaysia from Q1 1998 to Q4 2016. The factors are inflation rate, exchange rate, crude oil price and industrial production index. Different factors will have different impacts towards the stock market performance.

This study focuses on the findings from previous research within the latest 8 years which is from year 2010 to year 2017. Focusing on the latest research enables the readers to have a better understanding in the latest trend of the current stock market and the stock market performance. As a result, policymakers can compare the result of this study with other research to have a clearer picture of the impact on the stock market performance.

Besides, this study can benefit investors too. Before investors make any decision, they have to understand the current stock market condition ("Investing your money", n.d.). Therefore, investors can forecast the movement of the stock price by referring to their understanding of the current market condition. For instance, any changes in market factors may generate either good or bad effect on the stock market performance which will directly influence the investors' profitability. Thus, it is vital for the investors to understand the market condition before making any investment decisions.

In conclusion, this study not only can help researchers, but also policymakers and investors who want to investigate the factors that will influence the long-run stock market performance in Malaysia. They can also find out more information about the Malaysian stock market performance and the four variables through this study.

1.7 Chapter Layout

The organization of this study is as follows:

Chapter 1: Research Overview
This chapter comprises of the background of this research, problem statement, research questions and objectives, as well as hypotheses and significance of this study.

Chapter 2: Literature Review
This chapter reviews past literature and also studies the theoretical frameworks that support this study.

Chapter 3: Methodology

Research design, methods used for data collection are part of this chapter. This chapter also covers the flow of data processing, econometric regression model and analysis of the data obtained.

Chapter 4: Data Analysis
Chapter 4 illustrates and explains the result obtained from each of the econometric tests introduced in chapter 3 in a detailed manner.

Chapter 5: Discussion, Conclusion and Implication
This chapter summarizes the result found in the previous chapter and discusses the major findings, policy implications, limitations and recommendations of this study.

1.8 Conclusion

This chapter provides a general picture of the Malaysian economy including stock market as well as this study's direction and purpose. After understanding the overview of this research, chapter 2 will review the past literature and the relevant theoretical models to give an in-depth understanding about this study.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this chapter, the results from the prior studies about the relationship among the independent variables and the dependent variable will be reviewed. This study's dependent variable is Kuala Lumpur Composite Index (KLCI). The independent variables of this study include inflation rate, exchange rate, crude oil price and industrial production index in Malaysia. Relevant theories and their respective linkages with the independent variables will be explained.

2.1 Review of the Literature

2.1.1 Stock Market Performance (KLCI)

Stock market is a platform where issuing and trading of equities take place. Besides, stock market acts as a free-market economy, as it gives listed companies access to capital for expanding their businesses, also providing investors the ownership of the company either through formal exchanges or over-the-counter markets.

Kuala Lumpur Composite Index (KLCI) is the most commonly used indicator for the Malaysian stock market performance. It is made up of 30 top companies in Malaysia. The performance of the top 30 companies is believed to have a significant effect on the Malaysia's economic growth.

According to Milani (2017), the stock market acts a crucial role for macro-economic variables. Besides, stock market also acts a major role through its impact on expectations to the real activity in the future. Policymakers will consider the stock index as one of the indicators when implementing policies such as fiscal policies or monetary policies to stabilize the country's economy.

According to Chulia, Guillen and Uribe (2017), the uncertainty in the financial markets are affected by financial prices, like the stock market index. According to Olufisayo (2013), a positive and significant output-return relation may imply hedging opportunities for investors and also suggest that change in real economic activity may be a priced factor. Nasser and Hajilee (2016) stated in their research that short-run integration exists among the stock markets in emerging countries and developed markets.

2.1.2 Inflation Rate (CPI)

Inflation rate is found to be positively-related, negatively-related and not-related to the stock market performance from past empirical research.

According to Tiwari, Dar, Bhanja, Arouri and Teulon (2015), stock market and inflation show a positive relationship and therefore stock market in Pakistan could serve as a hedge against inflation at least in the long run. Bekaert and Engstrom (2010) also stated that equity and bond yields and inflation are positively correlated. They posit in their study that during recession, unpredictability and risk aversion may increase and cause higher equity premiums, and thus increase stock yield. In addition, Kolluri, Wahab and Wahab (2015) also found that the inflation rate is positively related to the stock return.

Eksi and Tas (2017) also proved that inflation rate has a positive relationship with the performance of stock market through Federal Reserve's policy actions. Fed purchases longer-term assets from investors when there is high inflation and this induces those investors to buy equities. When there is high inflation rate, there is an increase in demand for stocks and the stock prices will increase. However, Oxman (2012) mentioned that the inflation rate has positively affected the stock market performance during year 1966–1983 but it shows insignificant relationship during 1984–2009 period.

Besides, from the study of Dimic, Kiviaho, Piljak and Aijo (2016), the long run analysis demonstrates that the relationship between inflation and the stock is positive in emerging markets. According to Samadi, Bayani and Ghalandar (2012), inflation rate is positively related with the stock return index but the growth in the stock return index is to compensate the decrease in real profit.

Lee (2010) observed a negative stock return–inflation relation for all ten nations in his study. Similarly, the negative relationship is proven by Olufisayo (2013) in Nigeria for the period of year 1986 to 2010 and Mahmood, Nazir and Junid (2015) in Pakistan by using VAR model. In addition, Ahmadi (2016) also asserts that the stock prices of listed companies on Tehran's stock exchange have a negative relationship with the inflation rate by using GARCH models. Chia and Lim (2015) stated that the long-run coefficients indicate that Malaysia's share prices can be affected positively by the interest rate in addition to money supply and negatively by inflation.

Antonakakis, Gupta and Tiwari (2017) carried out a research in the United States about correlations between the inflation and stock market returns from year 1791 to 2015. The result of the research was that there is a significant positive correlations in the 1840s, 1860s, 1930s, and 2011, and significant negative correlations otherwise. These results indicate that, though in general real stock returns and inflation are negatively related, there is no guarantee that lower inflation rates could boost the health of the stock market.

According to the analysis of Li, Narayan and Zheng (2010), the UK's inflation has a negative relationship with the UK's stock returns in short term, but could be either positive or negative relationship in the medium-term study. They found that there is a mixed results on the relationship. There is a positive significant relationship for the expected inflation while unexpected inflation shows a negative significant relationship in the medium term.

Lastly, the research of Pradhan, Arvin, and Bahmani (2015) which covers year 1960 to 2012, studies a group of 34 OECD countries. The researchers found unidirectional causality to run from both the growth in economy and the development in stock market to inflation in the short run and also in the long run.

2.1.3 Exchange Rate (REER)

Changing in exchange rate plays a key role among multiple factors which can significantly affect the firm's stock prices and market value. However, there is still no concurrence conclusion on the relationship among the real effective exchange rate and the stock market although many researchers had done this topic of research, for example, Suriani, Kumar, Jamil and Muneer (2015). Some studies found the real effective exchange rate to be significantly related to the stock price. Referring to Bahmani-Oskooee and Saha (2016), there is a significant short-run effects on the stock prices from the fluctuations of exchange rate in the linear model in Canada, Brazil, Chile, Korea, Japan, Malaysia, Mexico, Indonesia and the United Kingdom by applying nonlinearity into adjustment process and using Non-linear ARDL approach to cointegration and error-correction model. The appreciation of currency has significant long-run effects whereas there is no effect for currency depreciations for Malaysia and Mexico. However, Wong (2017) found that the exchange rate has negatively affected the stock market although they are significantly correlated.

From the research of Ho and Huang (2015), they used the Lagrange multiplier (LM) to examine the causality in the variance and the relationship between the exchanges rates and Brazil's stock indexes, Russia, India, and China between February 2002 and December 2013 using weekly closing prices. Ho and Huang (2015) divided the study period in two sub-periods and found that in first sub-period, the exchange rate has causality relationship with the stock but the causality relationship does not exist in second sub-period for Brazil. However, for Russia and India, causality relationship exits in both sub-period. For China, in the first sub-period, there is no relationship, but there is a causality relationship in second sub-period.

Tudor and Popescu-Dutaa (2012) applied VAR model to examine the causality relationship between the stock index and the exchange rate in Brazil and Russia by applying the monthly statistics starting from January 1997 until March 2013, determined that the exchange rate is not related with the stock index in China. Such result is consistent with Suriani, Kumar, Jamil and Muneer (2015), which shows that when both of the variables are independent with each other, the exchange rate does not have relationship with the stock price by applying Granger Causality test. Furthermore, the researchers also applied Regression Analysis test to examine authenticity of the Granger Causality test to reinforce that the exchange rate does not have relationship with the stock price.

2.1.4 Crude Oil Price (CRU)

Crude oil has been regarded as one of the precious and highly demanded commodities in the entire world (Ekmekcioglu, 2012). Therefore, this will influence the performance of the related country. Fluctuations of the crude oil prices are often considered as a vital element to understand the changes in the stock market performance (Chittedi, 2012).

When oil is considered as the most important factor for a country’s income source, the fluctuations of the oil prices can affect the real sector and the capital market (Nejada, Jahantigh, & Rahbari, 2016). Narayan and Narayan (2010) found that increases in the crude oil prices have statistically, significantly and positively influence the stock market performance.

Mohanty, Nandha, Turkistani and Alaitani (2011) and Fayyad and Daly (2011) also found that the crude oil price has a positive relationship with the stock market. Increase in the oil prices can lead to an increase in the government revenues and an increase in monetary base in the oil exporting countries as those countries will have the higher income and wealth effects (Nejada, Jahantigh, & Rahbari, 2016). Thus, increasing in oil prices will have a good impact on the oil exporting countries' stock prices as measured by Tehran stock exchange (Nejada, Jahantigh & Rahbari, 2016).

On the other hand, Alhayki (2014) found that the crude oil price has a negative effect on the performance of the stock market. Basher, Haug and Sadorsky (2012) also found that the oil price has negatively affected the performance of stock market. This is because when there is an increase in the oil price, it will influence the cash flow because it is a vital input that used to produce many goods and services (Kapusuzoglu, 2011). Thus, rising the oil price will lead to an increase in the production costs under the situations when no substitute is possible in the factors of production (Kapusuzoglu, 2011). When the production cost becomes higher, the cash flow will be influenced and therefore, there is a decrease in the stock prices.

However, there were some studies which showed that the oil price does not have significant relationship with the stock markets (Kang & Yoon, 2013; Unal & Korman, 2012). Furthermore, Al-Janabi, Hatemi-J and Irandoust (2010) also found that the oil price does not give any effect towards the stock market. In fact, Sehgal and Kapur (2012) found that the high-growth economies will tend to have positive market returns no matter how the oil price fluctuates. In other words, there will surely be positive market returns in the stock market for a country that has strong economy because the stock market performance is not relying on the fluctuations of the oil price.

2.1.5 Industrial Production Index (IPI)

Several previous studies were carried out by using different techniques, countries and also periods of study to inspect the connection between IPI and the performance of stock market. Sohail and Hussain (2012) found that IPI is positively related with the stock prices in all three Pakistan stock exchanges, namely Karachi, Islamabad and Lahore stock exchanges in the long run. In the meantime, Hussin, Muhammad, Abu and Awang (2012) studied the impact of IPI on the development of Kuala Lumpur Syariah Index (KLSI), which represents the Islamic stock market in Malaysia. Their findings indicated that the stock prices on KLSI are cointegrated with IPI and the IPI has a significant positive relationship with KLSI by using the Vector Auto Regression (VAR) method. Similarly, the IPI was proved to be having a positive and significant effect on Nigeria Stock Exchange's All Share Index (ASI) for the period 1994 to 2012 (Aromolaran, Taiwo, Adekoya & Malomo, 2016).

Subeniotis, Papadopoulos, Tampakoudis and Tampakoudi (2011) mapped the nexus between the IPI and the EU-12 stock market price indices by using panel data analysis in twelve European countries. The criterion on choosing the countries of study was a shared currency (Euro), implying that there were similar macroeconomic characteristics and policies applied. A negative and statistically significant relationship was proven by the authors between IPI and the EU-12 stock market price indices. However, this was still in accordance with previous literature (Errunza & Hogan, 1998) though the effect of IPI on stock market movements was considered to be ambiguous.

Ibrahim and Musah (2014) employed the vector error correction model (VECM) and Johansen multivariate cointegration approach, also revealed a significant negative nexus between stock returns and IPI at 5% level in Ghana, in which a 1% increase in IPI would result in a 12% decrease in stock returns. Forson and Janrattanagul (2014) studied the long-run equilibrium relationship of certain macro-economic variables on Thai stock Exchange

Index (SETI) by employing 20-year monthly time series data. The results stated that a long-term negative and significant relationship exists between IPI and SETI. One possible reason behind the inconsistency with the research hypothesis was said that the Thai IPI was already modified for higher price levels that caused by inflation. For that reason, it was concluded that IPI might not be a good measure of Thailand's aggregate economic activities.

However, Filis (2010) found that the IPI does not have causal relationship with the Greek stock market during the time period ranging from January of 1996 to June of 2008 by using the multivariate VAR model.

2.2 Review of Relevant Theoretical Models

2.2.1 Present Value Model Framework

According to the Present Value Model, stock price is linked with future discount rate of the cash flows and future expected cash flows (Humpe & Macmillan, 2009). It postulates that stock price is influenced by any macroeconomic variables that will influence the expected future cash flows or the discount rate. Therefore, the long-run relationship between the macroeconomic variables and the stock market is often being examined by using the present value model (Chia & Lim, 2015).

Rahman, Sidek and Tafri (2009) and Chen, Roll and Ross (1986) stated that the stock price may be influenced by new information of the macroeconomic variables such as interest rate, inflation rate, money supply and others via the effect of changes in expected dividends, discount rate or both. A simple Present Value Model illustrated an idea that a corporate stock's value is equivalent to the present value of expected future dividends and the real economic activity is reflected by these future dividends. The expected future economic activity will have a close relationship with the stock price if all presently available information that is taken into account. This close relationship can be viewed in two different perspectives, which are (1) the stock market is a leading indicator of economic activity; in addition to (2) the possible effect that the stock market has on the aggregate demand via the aggregate consumption and investment suggesting that stock market lags economic activity (Ahmed, 2008).

2.2.2 Efficient Market Hypothesis (EMH)

EMH introduced by Fama (1970) assumed that investors will not earn abnormal profits in an efficient market as the current stock price is already adjusted based on all the available information. Under the EMH, macroeconomic factors should not bring any changes that would affect the stock price much. Indeed, it is very unlikely and difficult to be profiting from predicted price movements because the hypothesis suggests that the arrival of new information is the main factor behind the price changes.

There are three types of information that would influence the value of securities and hence the EMH is categorised into three forms depending on the availability of information, which are weak form hypothesis, semi strong form hypothesis and strong form hypothesis (Fama, 1970). The weak form hypothesis states that the prices of asset reflect all relevant past information, the semi strong form hypothesis stresses that the prices of asset reflect all past information and the available public information, and finally the strong form hypothesis indicates that the prices of asset reflect all relevant past information, public information and also private information that is specifically associated with the company. This study will focus on the weak form EMH that is only related to past or historical information because it would be easier to measure and obtain data.

2.2.3 Random Walk Hypothesis

Random Walk Hypothesis states that the history of the price series could not be adopted to forecast the future (Fama, 1965). In reality, when the 'random-walk theory of stock prices' is stated, it is referring to the Efficient Market Hypothesis. Mishkin and Eakins (2012) claimed that given today value, the term, random walk is used to describe the movements of a security's price whose changes in future cannot be forecasted, the security's price is having the same probability to fall as to rise.

According to Seelenfreund, Parker and Horne (1968), there were two types of empirical testing of Random Walk Hypothesis. In the predominant and first method, statistical tests of the series of prices over time were involved, which included serial correlation coefficient and run test. While in the second method, direct testing on whether the mechanical trading rules could beat a naive buy and hold strategy was involved. Mechanical trading rules should not show a profit if the stock price changes were independent.

Fama (1965) and Samuelson (1965) did not deny the Random Walk Hypothesis. As indicated by Shiller (1989), there was lot of evidence suggested that the stock price did follow a random walk and the random-walk behaviour of stock price should hold. However, studies by Lo and MacKinlay (1988) and Niederhoffer and Osborne (1966) declined the Random Walk Hypothesis. All of these studies claimed that "stock price follow a random walk" was not support by ample of theoretical basis. They declared that the stock price in emerging markets violated weak form Efficient Market Hypothesis.

2.2.4 Fisher Effect/ Hypothesis (Inflation)

Fisher (1930) explained the relationship between the interest rates and the inflation. It also can be defined as the nominal interest rate has a positive relationship with the inflation rate without any effect upon the real interest rates of savings and investments of a holder (Incekara, Demez & Ustaoglu, 2012). According to Tsong and Lee (2013), the nominal interest rate and inflation move in the same direction in the long run, both variables cointegrating coefficients are displayed in an asymmetric pattern subject to the shock's sign and size, in contrast with counterparts of the conventional cointegration methods. The researchers such as Koustas and Serletis (1999) did not find any prove that inflation has any effect on short-term interest rates. Fahmy and Kandil (2003) found consistent results and demonstrated that there is a weak impact of inflation on the short term interest rates while inflation tend to correspond with interest rates.

Fisher Effect is based on this equation:

$(i+1) = (1+r)(1+\pi^e)$

$i+1 = 1 + r\pi^e + r + \pi^e$

$i = r + \pi^e$

Where, i is the nominal interest rate

r equals the real interest rate

π^e is the expected inflation rate

2.2.5 Purchasing Power Parity (Exchange Rate)

A Swedish economist, Gustav Cassel formulated the Purchasing Power Parity (PPP) theory to be applied to a flexible exchange rate standard and to the gold standard in the year 1918 (Cassel, 1918). The 'law of one price' (LOP) is the essential element of PPP. PPP hypothesis suggests that the exchange rates has an impulse-response link with the price of securities, and that exchange rate should converge to its equilibrium rate that matches the prices of identical basket of goods in different nations in the long run (Shim, Kim, Kim & Ryu, 2015).

There are two versions for this theory, including the absolute Purchasing Power Parity and the relative Purchasing Power Parity. The absolute PPP asserts that the exchange rate between the 2 countries' currencies equalizes to the ratio of the price levels in the 2 countries and its formula is shown below:

$$Et = \frac{P_t}{P*_t}$$

Where, E_t = Exchange rate in period t

P_t = Domestic price level in period t

$P*_t$ = Foreign price level in period t

However, according to Shim et al. (2015), the absolute PPP does not hold in reality due to various reasons, so the relative PPP is being used more commonly in empirical studies rather than the absolute version. As stated in Al-Zyoud (2015), the relative PPP states that decrease or increase in the exchange rates compensate for the inflation differentials in different nations and it is expressed in:

$$\frac{E_t - E_{t-1}}{E_{t-1}} = \frac{P_t - P_{t-1}}{P_{t-1}} - \frac{P*_t - P*_{t-1}}{P*_{t-1}}$$

Where, E_t = Exchange rate in period t

E_{t-1} = Exchange rate in period t-1

P_t = Domestic price level in period t

P_{t-1} = Domestic price level in period t-1

$P*_t$ = Foreign price level in period t

$P*_{t-1}$ = Foreign price level in period t-1

Thus, the two countries' exchange rates equal to the ratio of the price levels in the two countries. The domestic currency's purchasing power is represented by the overall price level of a given basket of goods and services of one's country. Hence, PPP theory states that a decrease in the domestic purchasing power of a country will cause its own currency to depreciate proportionately on the foreign exchange market. On the other hand, there is a proportionate appreciation in the currency when there is an increase in the domestic purchasing power of the currency.

2.2.6 Hotelling's Model (Crude Oil Price)

The Hotelling's Model was first developed in 1931 by Harold Hotelling, this theory states that the efficient path of the oil price will be such that depletion of the oil stock will occur exactly at a certain choke price (Hotelling, 1931). Assuming that the nonrenewable resources' owners are motivated by profit and also the markets are efficient, Hotelling (1931) proposed that a limited supply of their product will be produced only if it yields more than the bonds or interest-bearing instruments. This theory also says that long-term prices should be rising every year at the prevailing interest rate, and if the future oil prices are believed to be not increasing faster than the interest rates, the owners of the resources would be at an advantage by trading their products for cash as much as possible to buy bonds or other interest-bearing instruments.

According to Minnitt (2007), 'Hotelling r-per cent rule' which specifically states that the price of a nonrenewable resource must grow at the market interest rate, and is given by the equation:

$$P_t = P_0 e^{rt}$$

Where, P_t = Price in period t

P_0 = Price in the initial period

r = Market interest rate

2.2.7 Arbitrage Pricing Theory (Industrial Production Index)

According to Wilkinson (2013), arbitrage pricing theory (APT) explains the association between the expected return and risk of the securities. The expected return of security is derived from the security's sensitivity to the fluctuation in macroeconomic factors. APT proposed by Ross (1976), managed to overwhelm CAPM's (capital asset pricing model) inadequacy to illustrate the phenomena observed in capital market for risk assets because it demands less and more realistic assumptions (Jecheche, 2012).

The most well-known multifactor security return model is developed by Chen, Ross and Roll (1986). The Chen-Ross-Roll model is as shown below:

$$\mathbf{R = \alpha + \beta_{MP}MP + \beta_{DEI}DEI + \beta_{UI}UI + \beta_{UPR}UPR + \beta_{UTS}UTS + e}$$

Where,

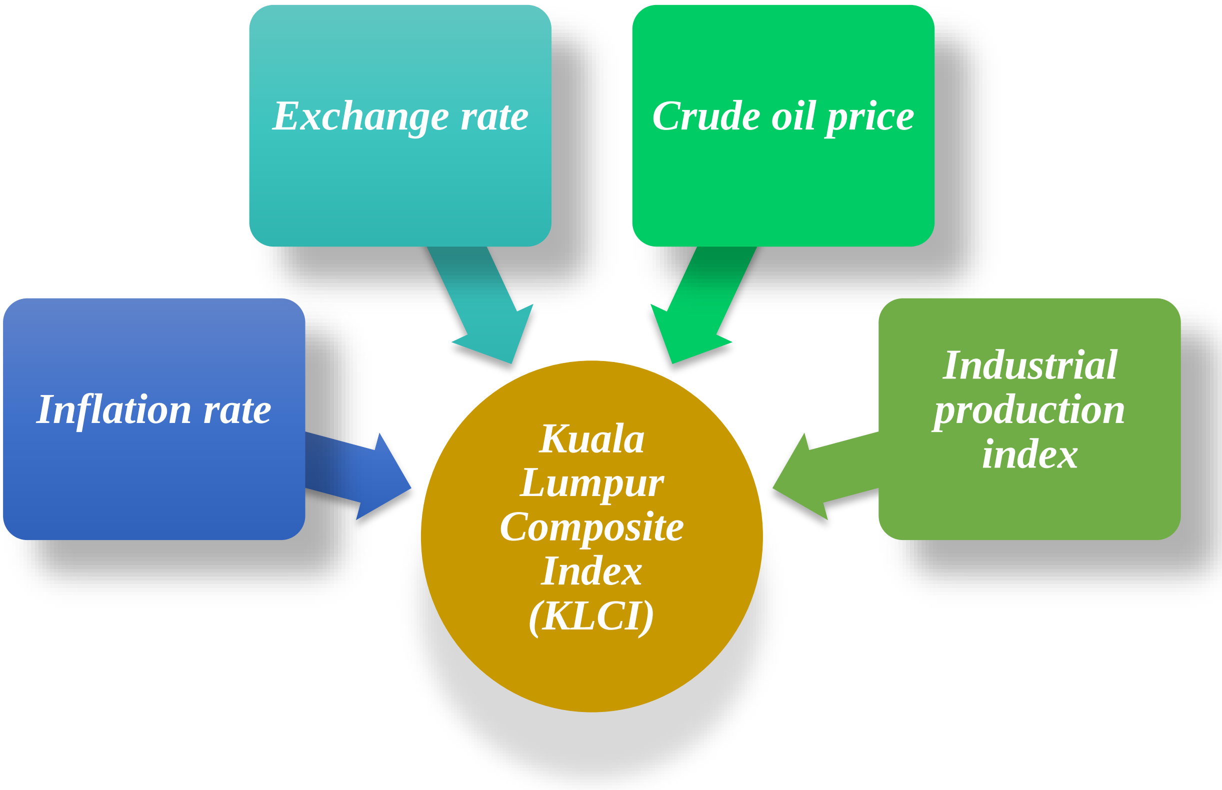
MP = monthly growth rate of the industrial production
DEI = the change in expected inflation
UI = the unexpected inflation
UPR = the risk premium
UTS = the term structure of interest rates
e = the error term

Chen, Ross and Roll (1986) claimed that variations in the real production's expected level would bring impact to the cash flows' current real value. As far as the measure of risk premium does not capture the uncertainty of the industrial production, innovations in the productive activity rate should affect the stock returns through their effect towards the cash flows (Chen, Ross & Roll, 1986). In addition, Azeez and Yonezawa (2006) stated that stock price movements will be affected by any economic announcements as new information is revealed and consequently, influencing either the expectations of future dividends or the discount rates or both. The change in expected dividends will then influence cash flows. Hence, the increase or decrease in industrial production would affect profits and therefore dividends of stocks. The studies of both Chen, Ross and Roll (1986) as well as Azeez and Yonezawa (2006) found industrial production to be a significant determinant of stock price movements for the APT model.

2.3 Proposed Theoretical/ Conceptual Framework

The Figure 2.3 shows that Kuala Lumpur Composite Index (KLCI) is affected by the macroeconomic variables which include exchange rate, inflation rate, crude oil price and industrial production index.

Figure 2.3: Proposed Theoretical Framework



2.4 Conclusion

Previous studies about whether the dependent variable has positive relationship, negative relationship or no relationship with the independent variables have been reviewed in this chapter. The highlight in this chapter is that all journals that used for the review of the literature are from the most recent eight years (2010 to 2017) to have a better capture of the recent events that will influence the stock market performance in the recent years. In details, some of the researchers have found that the dependent variable has positive relationship, negative relationship or no relationship with the independent variables. In order to examine the outcomes from the previous studies, there are some tests to be carried out in the following chapters.

CHAPTER 3: METHODOLOGY

3.0 Introduction

Chapter 3 exhibits and explains the methodologies applied in this study in an organized manner. Generally, this chapter consists of research design, data collection methods, data processing procedures, econometric regression model and data analysis. The econometric tests are carried out to ensure that the model is valid.

3.1 Research Design

The research design is referring to the overall tactics that researchers decide on to affiliate the different constituents of the research in a rational and sound way. As a result, research design makes sure that the researchers will effectively deal with the research problems. Research design also comprises of the framework for the collection, measurement, and analysis of data. Therefore, research needs a design before data collection.

Besides, research design needs a work plan. There is a list on what to be done during this project in the work plan, and it will flow from the research design. To make sure that the proof obtained allows researchers to answer the initial question as clear as possible, it is necessary to have a research design.

This research project is based on quantitative data, whereby the data are in numerical form, for example, index, percentage, and descriptive statistics. In addition, the data collected are based on the existing theories. The dependent variable in this study is stock market performance in Malaysia and four macroeconomic variables are also included in this study, which are inflation rate, exchange rate, crude oil price and industrial production index.

3.2 Data Collection Methods

The data collected for this study are time series data from Quarter 1 1998 to Quarter 4 2016.

3.2.1 Secondary Data

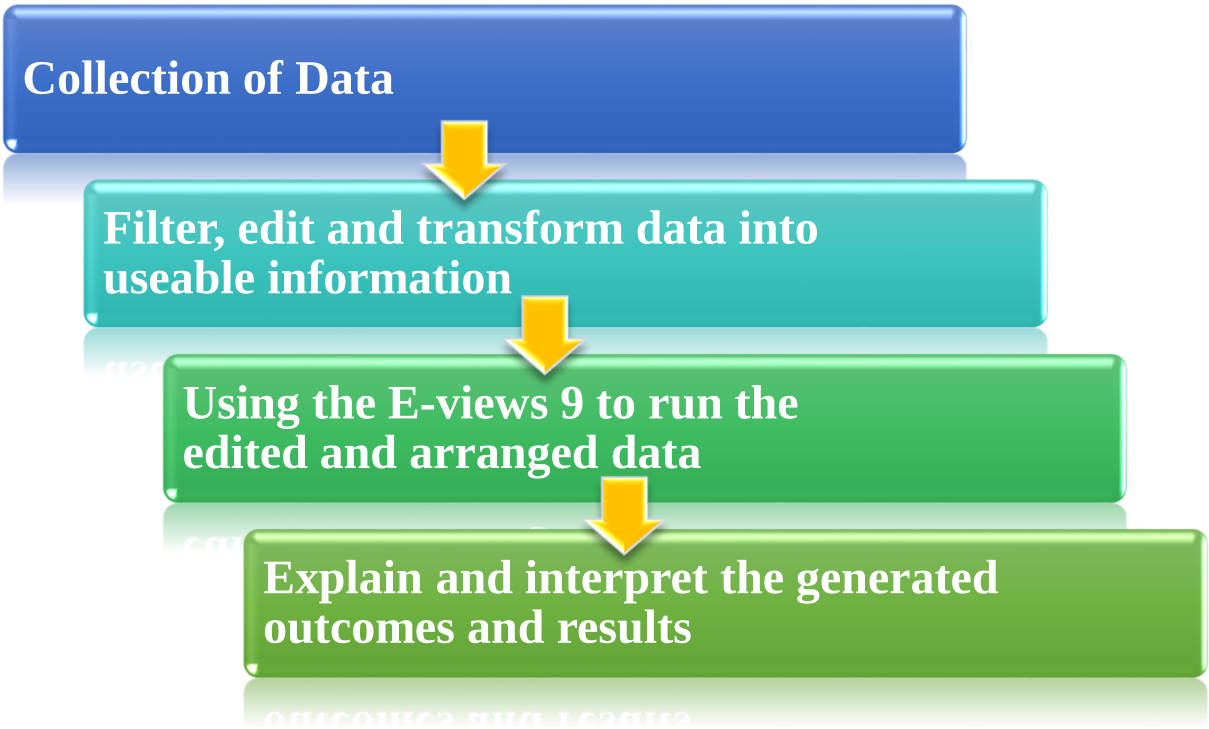
This study uses secondary data where they are collected and readily available from other sources. This form of data is more time saving and inexpensive as a source of data collection. Further information of this research is obtained from journals, news, textbooks, and articles for more precise and consistent result with the theories applied. The table below shows the various sources that accessed for data collection:

Table 3.2.1 Sources of Data

Variables	**Proxy**	**Units**	**Description**	**Source**
Stock Market Performance in Malaysia	KLCI	Index	Kuala Lumpur Composite Index (quarterly closing price) in Bursa Malaysia	Bloomberg
Inflation rate	CPI	Index	Consumer price index (base year = 2010)	International Financial Statistics (IFS)
Exchange rate	Real effective exchange rate	Index	The weighted average of the individual exchange rates of Malaysia with its main trading partners. It is adjusted for inflation.	Bloomberg
Crude oil price		$ per barrel	Global price of crude oil per barrel in US dollar	Federal Reserve Bank of St. Louis
Industrial production index	Bursa Malaysia Industrial production index	Index	Capitalization-weighted index of all stocks in the EMAS Index involved in the industrial production sector	Bloomberg

3.3 Data Processing

Figure 3.3: Diagram of Data Processing



Most of the data in this research are collected from Bloomberg Terminal which is available in UTAR library. Some data that cannot be collected from Bloomberg Terminal are obtained from Federal Reserve Bank of St. Louis and International Financial Statistics (IFS). After collecting all the data, the data are being edited and arranged sequentially by using Microsoft Excel in order to be used for running the data by using E-views 9. Subsequently, the generated outcomes and results are being analysed, explained and presented in details.

3.4 Econometric Regression Model

3.4.1 Econometric Function

The relationship between stock price, inflation rate, exchange rate, crude oil price and industrial production index can be specified as follows:

$KLCI_t = f\ (CPI_t, REER_t, CRU_t, IPI_t)$

Where,
KLCI= FBMKLCI Index
CPI= Consumer Prices Index
REER= Malaysia Real Effective Exchange Rate
CRU= Global price of WTI Crude
IPI= Bursa Malaysia Industrial Production Index
t= 1998Q1, 1998Q2, … , 2016Q4

3.4.2 Econometric Model

$KLCI_t = \alpha + \beta 1\ CPI_t + \beta 2\ REER_t + \beta 3\ CRU_t + \beta 4\ IPI_t + \varepsilon_t$

To make the variance–covariance matrix stationary, natural logs are added to the model. Therefore, the above model is remodelled as follows:

Equation 1:
$LNKLCI_t = \alpha + \beta 1\ LNCPI_t + \beta 2\ LNREER_t + \beta 3\ LNCRU_t + \beta 4\ LNIPI_t + \varepsilon_t$

Where, ε_t is the regression error term.

Equation (1) can be framed into a normal ARDL bound test setting as follows:

Equation 2:

$$\Delta LNKLCI_t = \beta_0 + \beta_1 LNKLCI_{t-1} + \beta_2 LNCPI_{t-1} + \beta_3 LNREER_{t-1} + \beta_4 LNCRU_{t-1} + \beta_5 LNIPI_{t-1} + \sum_{p=1}^{n1} \theta_1 \Delta LNKLCI_{t-p} + \sum_{p=0}^{n2} \theta_2 \Delta LNCPI_{t-p} + \sum_{p=0}^{n3} \theta_3 \Delta LNREER_{t-p} + \sum_{p=0}^{n4} \theta_4 \Delta LNCRU_{t-p} + \sum_{p=0}^{n5} \theta_5 \Delta LNIPI_{t-p} + \mu_t$$

3.4.3 Dynamic Regression Model

In time series models, a change in a policy and an economic decision-making may pass through a significant period of time. In other words, the changes of dependent variable (y) to the adjustment in independent variable or explanatory variable (x) is usually distributed through time (Karanasos, n.d.). Therefore, Karanasos (n.d.) stated that the lagged independent variables should be explicitly incorporated in the time series regression model if the proper decision and response period is sufficiently long. The time adjustment process can be measured by the series of lagged independent variables.

In addition, an economic variable's current value that depends on its own past values can reveal the dynamic behaviour of an economy. Precisely, according to the result in the value of Yt depending on lagged Y's, the model may reflect the formation of the expectations of decision makers and their reaction to the economy changes (Karanasos, n.d.). Hence, to take into consideration the dynamic element of economic behaviour, the lagged values of the explanatory variable should be included together with the independent variable.

3.5 Data Analysis

3.5.1 Unit Root Test

Unit root is applied to test that whether a time series variable is non-stationary by applying the autoregressive model (Bierens, 2003). Applying unit root test in a parametric time series models have drawn interest in statistical theory and application. The unit root hypothesis has become significant implication in the economics field, as a result of unit root is frequently a theoretical implication of models to predicate the details for economic agents to access. For instance, futures contracts, stock prices, dividends, spot and forward exchange rates, and also real consumption (Phillips & Perron, 1988). Hence unit root test is significant in examining the validity of financial theories including models (Li & Zheng, 2017).

To test for non-stationarity and stationarity, consider the stylised trend-cycle decomposition of a time series Yt:

$$Y_t = TD_t + Z_t$$
$$TD_t = \kappa + \delta_t$$
$$z_t = \emptyset z_{t-1} + \varepsilon_t, \varepsilon_t \sim WN(0, \sigma^2)$$

Where,

TD_t is the deterministic linear trend
z_t is an AR(1) process

However, if $|\emptyset| < 1$ then Y_t is I(0) about the deterministic trend TD_t. If $\emptyset = 1$, then $z_t = z_{t-1} + \varepsilon_t = z_0 + \sum_{j=1}^{t} \varepsilon_j$, a stochastic trend and Y_t is I(1) with drift.

Autoregressive unit root tests are derived from testing the H_0 that $\emptyset = 1$ opposed to the alternative hypothesis that $\emptyset < 1$. It also named as unit root tests as a result of under the H_0 the autoregressive polynomial of z_t, $\emptyset(z) = (1 - \emptyset z) = 0$, has a root equivalent to integration ("Unit root tests", n.d.).

3.5.1.1 Augmented Dickey-Fuller (ADF) Test

The Augmented Dickey-Fuller (ADF) Test, developed by Dickey and Fuller in 1981, is used to detect the stationarity of time series data (Dickey & Fuller, 1981). The ADF is extended from the simple Dickey-Fuller (DF) that created for unit root test and it is the most favoured stationary test practiced by researchers such as Oskooe (2010), Hosseini, Ahmad and Lai (2011), Ozcan (2012) and Singh (2014) in studying the effects of macroeconomic variables on the stock market. In order to get rid of autocorrelation problem, the ADF includes extra lagged terms of the dependent variable. Besides, ADF Test also can be used to determine the outliers in the data to detect any nonstationary movement in the data. If the mean, variance and covariance are not constant over the time window of the data, this indicates there is a nonstationary movement in the data and the unit root test will become not reliable.

According to Brooks (2008), referring to the data frequency or basing on the minimum value of information criterion can help to determine the optimal lag length. There is a limitation on the number of lags for ADF test. This is because the test statistic value will become lower if the number of lags increases which will then result in decrease in degree of freedom and also the standard error (Hosseini et al., 2011). The optimal lag length on the extra terms in this study is determined by the AIC (Akaike Information Criterion).

The three possible forms of the ADF test are expressed as follows:

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \mu_t$$

$$\Delta Y_t = \alpha_0 + \delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \mu_t$$

$$\Delta Y_t = \alpha_0 + \delta Y_{t-1} + \alpha_2 t + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \mu_t$$

3.5.1.2 Phillips-Perron (PP) Test

The Phillips-Perron (PP) test developed by Phillips and Perron (1988) as an alternative unit root test for ADF test, modifies the ADF test by taking into consideration the less restrictive nature of error process. The PP test modifies the test statistic by employing the nonparametric statistical method and hence it does not require lagged dependent variables to be included if there is autocorrelation problem in error terms (Brooks, 2008). The PP test is robust to general forms of heteroscedasticity in the error term and it can be employed without having to determine a lag length (Lee, Kok, Kogid, Mulok, Mansur & Loganathan, 2011).

The test regression for the PP test is the AR(1) process which is expressed as follows:

$$\Delta Y_{t-1} = \alpha_0 + \delta Y_{t-1} + \varepsilon_t$$

By using unit root tests, the stationary test of the stock market performance in Malaysia against the four variables would be tested, which are inflation rate, exchange rate, crude oil price, and industrial production index. The ADF and PP tests are used to test whether the data are stationary in level, first difference or second difference. Holding other variables constant, it is not necessary to proceed with first difference or second difference when the series are stationary at I(0) (Gujarati, 2009). As the bounds test of cointegration assumes that all variables must be I(0) or I(1), it is rational to perform the unit root tests to make sure the variables are not I(2) or beyond.

3.5.2 ARDL Bounds Test

This paper applies the autoregressive distributed lag model (ARDL) bounds testing approach introduced in Pesaran, Shin and Smith (2001). It is a cointegration test applied to identify the long-run nexus between underlying set of variables. Some popular cointegration approaches include Engle and Granger (1987) two-step cointegration procedure and Johansen and Juselius (1990) multivariate cointegration approach (Belloumi, 2014). Some cointegration methods necessitate that all variables to have same order of integration because long–run relationship cannot be established when the order of integration among variables is different. The ARDL model can overcome this problem by using bounds testing procedure to establish long-run relationship among variables without requiring that all variables must have the same integration order. However, this test demands that the explained variable must be of I(1) in levels and the explanatory variables must not be I(2) or higher. Besides, ARDL bounds testing approach is believed to be more robust and appropriate in the case of small and finite sample data size (Haug, 2002). Appropriate modification of the lag order of ARDL is enough to rectify the problems of serial correlation and endogeneity simultaneously (Pesaran & Shin, 1995). Thus, this approach also makes it possible to address the possible endogeneity problem that exists in empirical studies.

The ARDL model proposed for this study is as follows:

$$\Delta LNKLCI_t = \beta_0 + \beta_1 LNKLCI_{t-1} + \beta_2 LNCPI_{t-1} + \beta_3 LNREER_{t-1} + \beta_4 LNCRU_{t-1} + \beta_5 LNIPI_{t-1} + \sum_{p=1}^{n1} \theta_1 \Delta LNKLCI_{t-p} + \sum_{p=0}^{n2} \theta_2 \Delta LNCPI_{t-p} + \sum_{p=0}^{n3} \theta_3 \Delta LNREER_{t-p} + \sum_{p=0}^{n4} \theta_4 \Delta LNCRU_{t-p} + \sum_{p=0}^{n5} \theta_5 \Delta LNIPI_{t-p} + \mu_t$$

3.5.3 Diagnostic Checking

3.5.3.1 Multicollinearity

One of the most common problems that will be found in the regression analysis is multicollinearity problem. Multicollinearity problem occurs when there is a very high inter-associations or inter-correlations among the independent variables in a multiple regression equation ("Multicollinearity", n.d.). In other words, multicollinearity problem exists when there is an explanatory variable highly correlated with any one of the other explanatory variables in the same regression model, such as disposal income and expenses (Allen, 1997).

There are some reasons that will cause multicollinearity problem. One of the reasons is that the multicollinearity can be caused by inaccurate use of dummy variables such as a researcher might add a dummy variable for every classification ("Multicollinearity", n.d.). According to Andale (2017), there are some cases when including insufficient data or data collection methods can cause multicollinearity problem too. In addition, when there are same or almost same class of variables included in a regression model, meaning that there is a repetition of same type of variables like savings income and investment income, this might cause multicollinearity problem.

Furthermore, the regression estimates will become unstable and unreliable when the multicollinearity problem is present. Thus, the multicollinearity can cause several problems. For instance, the partial regression coefficient may not be calculated accurately due to multicollinearity problem, the t-statistic probably will be very small and the standard errors tend to be high (Andale, 2017). In addition, it may cause the partial regression coefficients to have a change in the sign or magnitude from one sample to another and the confidence intervals of the coefficients generally will become wider (“Multicollinearity”, n.d.). Hence, it is difficult to evaluate the effect of the explanatory variables towards the explained variable. The null hypothesis of the study also will be very tough to reject when the multicollinearity problem exists in the study (“Multicollinearity”, n.d.).

Fortunately, there are some signals or ways to detect the multicollinearity problem that exists in a regression model. One of the signals is the overall result of the statistic is significant when the individual result of a statistic is insignificant (“Multicollinearity”, n.d.). Thus, the researcher would get a combine result of insignificant and significant that would probably signal the multicollinearity problem. In addition, the variance inflation factor (VIF) can also detect whether the multicollinearity problem is existing in the regression analysis (“Multicollinearity statistics”, n.d.). For instance, when the value of VIF is 10 or more than 10, this indicates that there is a serious multicollinearity problem.

3.5.3.2 Normality

The normality test is a vital assumption for many statistical processes as it is prerequisite to make the assessment on the normality of the data. The normality test is a statistical process that used to identify whether a sample or any set of data is well-defined by a standard normal distribution (“Normality Test”, n.d.). In addition, the normality test also can be used to measure how likely a group of data to be normally distributed for a random variable (“Normality Test”, n.d.). There are two ways to present the normality test either in graphically or in mathematically.

There are many types of normality test that are used to determine the normality of a sample or any set of data. For instance, the general normality test is Jarque-Bera Test which is used to compute the skewness and kurtosis of the data (Glen, 2017). The larger the Jarque-Bera statistics, the more the data diverges from normal. There are other normality tests such as Kolmogorov-Smirnov Goodness of Fit Test, Chi-square normality test, Shapiro-Wilk Test, D’Agostino-Pearson Test, Lilliefors Test and others (Glen, 2017). Most of the normality tests can be conducted in the SPSS Explore procedure (Ghasemi & Zahediasl, 2012).

According to Ghasemi and Zahediasl (2012), the sampling distribution tends to be normal in three situation according to the central limit theorem. First situation is when the sample data are normal, the sampling distribution will be normal too. Second situation is the sampling distribution will be normal no matter what is the shape of the data when there is a large sample size (more than 30). Third situation is any distribution of the random samples will have their normal distribution.

On the other hand, it is also essential to check the normality assumption when dealing with very small sample size (“Normality”, n.d.). This process can be fulfilled by an inspection of the residuals from the regression analysis. However, the statistics that used to evaluate will be unstable in small sample size. For instance, the p value is a good solution to be used when the distribution of the disturbance term is not normal (“Normality”, n.d.). Furthermore, the p value can be used in the confidence intervals and the significance tests.

3.5.3.3 Autocorrelation

Autocorrelation also called as serial correlation, is used to describe the correlation or similarity between the values of the same variables at different points of time in statistics (“Autocorrelation”, n.d.). The autocorrelation is where the error terms in a time series transfer from one time period to another time period (Glen, 2017). The autocorrelation does not follow the assumption of instance independence that underlies most of the conventional models (“Autocorrelation”, n.d.). However, the autocorrelation problem that exists in the regression analysis normally is unpredicted by the researchers as the presence of the autocorrelation problem is mostly caused by the dependencies within the data. Furthermore, the autocorrelation can be ranging from positive value of one (perfect positive correlation) to negative value of one (perfect negative correlation) (“Autocorrelation”, n.d.).

There are some reasons that will cause the autocorrelation problem to exist in a regression model. One of the reasons is omitted important variable or relevant independent variable in a regression model (“Forecast Friday topic: Detecting autocorrelation”, 2010). When the regression model has omitted an important independent variable, this will cause the error term to be positively correlated if the omitted independent variable is positively correlated with the dependent variable. Another reason is the explanatory variables and explained variable are in the wrong functional form (“Forecast Friday topic:

Detecting autocorrelation", 2010). Measurement error is also one of the reason that may cause the autocorrelation problem exists in the regression model.

In addition, the presence of the autocorrelation problem may result in some consequences or problems. One of the consequences is the ordinary least squares (OLS) estimators are still linear and unbiased but the OLS estimators are no longer BLUE due to the inefficiency and no longer have the minimum variance property ("Autocorrelation", n.d.). Besides, according to Glen (2017), the significant regression coefficients will have false positives, meaning that the regression coefficient becomes significant when it should not be significant for the regression model.

There are a few methods used to detect the autocorrelation problem. The Durbin Watson test is a very popular test that can identify the autocorrelation problem in a regression model ("Autocorrelation", n.d.). The graphical method also can be employed to test for the autocorrelation problem by using graph error against time ("Autocorrelation", n.d.). According to Glen (2017), there are other methods to tests the presence of the autocorrelation problem such as the Lagrange Multiplier test and the Moran's I statistics that are similar to a correlation coefficient.

3.5.3.4 Heteroscedasticity

Heteroscedasticity exists when the variance of the error term is inconstant. In other meaning, heteroscedasticity occurs when the data are unequally spread. Several reasons can cause the heteroscedasticity to occur. Firstly, heteroscedasticity may occur when the value of an independent variable increases, the error also may increase. Taking into an example, the error terms identified in large firms will likely have larger variances comparing to the error terms identified in smaller firms.

And the revenue of larger firms will be more volatile than the smaller firm's revenue. Secondly is when the values of independent variables become more extreme, the errors also will become greater. In addition, subpopulation differences and model misspecifications are also the reasons that could cause the heteroscedasticity problem to arise (Williams, 2015).

Fail to detect heteroscedasticity may lead to several consequences, hence diverse tests need to be carried out to detect the presence of the problem. Breusch Pagan Godfrey test is one of the popular test of heteroscedasticity proposed by Breusch and Pagan (1979). Test statistic of Breusch Pagan test is referring to the chi-square distribution where the error variances are all equivalent for the null hypothesis and error variance are unequal for the alternate hypothesis. If the chi-square value is small, then it means that the null hypothesis is correct (Stephanie, 2016).

Another test that is used to examine for the heteroscedastic errors in regression analysis is White's test. White's test is actually the Breusch-Pagan test's special case. White's test is applicable when there is a lot of explanatory variables in the statistics set. Nonetheless, there is a problem with White's test in which the model will obtain a significant result despite that the variances of the errors are equivalent (Williams, 2015).

Autoregressive conditional heteroscedastic (ARCH) developed by Engle (1982), is also considered as a test to determine the heteroscedasticity problem. Lagrange multiplier procedure is used in evaluating whether the disturbances follow an ARCH process. ARCH process can be explained in a diversity of contexts. Bera and Higgins (1993) described it with the terms of errors distribution of a dynamic linear regression model. Y_t is presumed to be generated by

$Y_t = X_t^1 \xi + \varepsilon_t$, t =1,…,T

Where,
X_t is k x 1 vector of exogenous variables (may take in DV lagged values)
ξ is a k x 1 vector of regression parameters

Original ARCH model which is proposed by Engle (1982) assumed as

$$\varepsilon_t | \psi_{t-1} \sim \mathrm{N}(0, \mathrm{h_t})$$

Where, $\mathrm{h_t} = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots + \alpha_q \varepsilon_{t-q}^2$, with $\alpha_0 > 0$ and $\alpha_i \geq 0$, I =1, . . , q, to make sure the positivity of the conditional variance.

3.5.3.5 Model Specification

Model specification can be explained as whether the independent variables must be eliminated from a regression equation or taken into account. In other words, it must be primarily referred on theoretical considerations other than methodological or empirical ("Model specification in regression analysis," 1997). Econometrics must be managed in the context of a particular research purpose. Furthermore there is no globally correct empirical model. Instead, a model must be specified and the results must be determined relatively to its intended application (Tomek, n.d.). Determining for specification errors is considered as the significant part for the building of econometric model. Model specification errors can be defined in several means. Two main errors are inaccurate functional form and invalid assumptions on the distribution of disturbance term (Bera & Jarque, 1982).

Several studies have been carried out to test for the specification errors. One of the tests is Ramsey Reset Test suggested by Ramsey (1969). This is a “one-directional test”, it is designed to test for “single” specification only. Reset test evaluates on the significance of residuals regression on a linear function of vectors q_j, j=1,2,… . The original model of regression specification error test (RESET):

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + \mu$$

In the equation above, the linear functions of the independent variables is significant.

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_i x_i + \delta_1 \hat{y}^2 + \delta_2 \hat{y}^3 + error$$

For the expanded equation, RESET test adds polynomials in the OLS fitted values in order to identify general types of fictional form of misspecification. Fitted values in the functions from the initial estimation become an explanatory variables. This equation is to be used to review that the original equation has missed out any significant nonlinearities. However, if the result obtained is the rejection of null hypothesis, meaning that the equation is mis-specified in some terms (Wooldridge, 2012).

3.5.4 CUSUM Test and CUSUMSQ Test

CUSUM Test and CUSUMSQ (CUSUM of Squares) Test are proposed by Brown, Durbin and Evans (1975) based on the recursive residuals to test a structural stability of the model. Based on the cumulated sum of the recursive residuals, the CUSUM test provides solutions for the alternative hypotheses containing the unknown breakpoint from the plot of the quantity: $W_t = \sum_{t=k+1}^{m} \frac{w_t}{\hat{\sigma}_w}$

Where, $\hat{\sigma}_w^2 = \frac{\sum_{t=K+1}^{m}(w_t - \bar{w})^2}{T-K-1}$, $\bar{w} = \frac{\sum_{t=K+1}^{m} W_t}{T-k}$ and m=K+1,…, T.

Under the null hypothesis, H_0, W_m must be inside the critical bound [$-L_m$, L_m]. Where, $L_m = \frac{a(2m+T-3K)}{\sqrt{T-K}}$, with "$a$" is equal to 1.143, 0.948 and 0.850

at 1%, 5% and 10% levels respectively. H_0 will be rejected if the quantity, W_m cut - L_m or L_m. If W_m exits out the critical bound, it can be concluded that there was a structural break at the point where the sum started its movement toward the bound. We will then reject the specification chosen throughout the period if a breakpoint is found. Basically, CUSUM test aimed at detecting any systematic eventual movements of the coefficients values (Dufour, 1982).

Besides, the CUSUMSQ Test is also proposed by the same authors, Brown, Durbin and Evans (1975) to detect the haphazard or random movements. A haphazard movements are those movements that are not necessarily the result from a structural change in coefficients (Farhani, 2012). CUSUMSQ Test is based on the squared recursive residuals $w_t^2$and is constructed on the quantities' plot:

$$S_m = \frac{\sum_{t=K+1}^{m} W_t^2}{\sum_{t=K+1}^{T} W_t^2} = \frac{S_m}{S_T}$$

Under the H_0, the quantities, $S_m$follows a Beta distribution with a mean equals to $E(S_m) = \frac{m-K}{T-K}$. It is framed by the critical bound, $\pm\mathrm{C} + \frac{\mathrm{m-K}}{\mathrm{T-K}}$ .Where, C is the Kolmogorov-Smirnov statistic. Similar to CUSUM test, at the date t = m, if S_m crosses the boundary, then we can conclude that there exists a random break, reflecting the instability of the coefficients (Farhani, 2012).

Caporale and Pittis (2004) concluded that the CUSUMSQ test is recommended to use in a generalised dynamic ADL model. The performance of the CUSUMSQ test in both cointegration and stationary environments is satisfactory. Most notably, if the test is conducted within a dynamic ADL model, it correctly interprets the change in the marginal process. The rejections of the null hypothesis have the high probability in reflecting the actual parameter instability.

3.6 Conclusion

In short, this chapter provides a clear explanation on the research design, data collection and processing methods. This chapter also states the econometric model applied in this study. In addition, the explanation for all econometric methods and statistical tests is included in this section.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter mainly focuses on analysing the empirical results obtained from the methodologies proposed in the previous chapter. This chapter starts with interpreting the descriptive statistics, Unit Root Test, Bounds Test, Pair-wise Cointegration Test and ends with performing Diagnostic tests (multicollinearity, normality, autocorrelation, heteroscedasticity and model specification). All the results attained from EViews 9 will be presented with its respective explanations and interpretations.

4.1 Descriptive Analysis

Table 4.1.1 Descriptive Statistics

	LNKLCI	LNCPI	LNREER	LNCRU	LNIPI
Mean	6.971550	4.538431	4.574443	3.895360	4.534354
Median	6.953281	4.527677	4.580314	4.013770	4.495180
Maximum	7.540468	4.757891	4.672174	4.820066	5.047546
Minimum	5.922972	4.330227	4.434738	2.556969	3.891412
Std. Dev.	0.406755	0.127182	0.046093	0.603091	0.294742
Skewness	-0.291112	0.104032	-0.978363	-0.473838	-0.016401
Kurtosis	2.067426	1.662839	4.428146	2.231847	1.912625
Jarque-Bera	3.827481	5.799089	18.58320	4.712470	3.747627
Probability	0.147528	0.055048	0.000092	0.094776	0.153537
Sum	529.8378	344.9207	347.6577	296.0474	344.6109
Sum Sq. Dev.	12.40869	1.213148	0.159341	27.27893	6.515466
Observations	76	76	76	76	76

Table 4.1.1 demonstrates the descriptive statistics of the variables used for estimation of this study, namely, natural logarithm (log) of KLCI (LNKLCI), log of Consumer Price Index (LNCPI), log of Real Effective Exchange Rate (LNREER), log of Crude Oil Prices (LNCRU) and log of Industrial Production Index (LNIPI). The mean LNKLCI for the period 1998Q1 to 2016Q4 is recorded as 6.971550. Also, it is reported that the mean values of LNCPI, LNREER LNCRU, and LNIPI for the same period are 4.538431, 4.574443, 3.895360 and 4.534354 respectively. LNKLCI has a median of 6.953281, while LNCPI, LNREER, LNCRU and LNIPI have respective median values of 4.527677, 4.580314, 4.013770, and 4.495180. The maximum LNKLCI is 7.540468 recorded in 2014Q2 and the minimum value is 5.922972 reported in 1998Q3. 2016Q4 has the maximum LNCPI (4.757891) and the minimum LNCPI is recorded in 1998Q1 with the value of 4.330227. The period that has maximum LNREER (4.672174) is 2002Q1 while the period with minimum LNREER (4.434738) is 2015Q3. The maximum and minimum LNCRU are 4.820066 and 2.556969 which occurred in 2008Q2 and 1998Q4 respectively. For LNIPI, the maximum value of 5.047546 occurred in 2015Q4, while 1998Q3 has the minimum LNIPI value of 3.891412. The negative values for the skewness of LNKLCI, LNREER, LNCRU and LNIPI indicate that the data are left-skewed. By looking at the skewness, it appears that only one variable, LNCPI is right-skewed. Furthermore, the positive kurtosis means a heavy-tailed distribution for all of the variables.

4.2 Unit Root Test

As this study adopts time series data, it is necessary for all the variables to test for stationarity before performing the causality test. To check the stationarity, this research uses Augmented Dickey-Fuller (ADF) Test and Phillips-Perron (PP) Test. This research is using both tests to determine the order of integration of dependent and independent variables before applying ARDL bounds test since all the variables are I(0) or I(1) is the underlying assumption of ARDL bounds test. Running unit root tests aims at avoiding spurious results by making sure that no variables are I(2).

H_0: The variable is not stationary. Where, the variables include LNKLCI, LNCPI, LNREER, LNCRU and LNIPI.

H_1: The variable is stationary. Where, the variables include LNKLCI, LNCPI, LNREER, LNCRU and LNIPI.

α=0.05

Decision Rule: If p-value is smaller than significance level, α, reject H_0. Otherwise, do not reject H_0.

4.2.1 Augmented Dickey-Fuller (ADF) Test

Table 4.2.1: Unit Root Test (Augmented Dickey-Fuller)

Variables	Augmented Dickey-Fuller (ADF)			
	Level		1st different	
	Intercept	Trend and intercept	Intercept	Trend and intercept
LNKLCI	0.3905	0.0695	0.0001*	0.0000*
LNCPI	0.9777	0.1605	0.0000*	0.0000*
LNREER	0.6198	0.7415	0.0000*	0.0000*
LNCRU	0.1862	0.6094	0.0000*	0.0003*
LNIPI	0.5149	0.0013*	0.0000*	0.0000*

Notes: * represents stationarity at 5% significance level. Figures in Table 4.2.1 are the p-values of ADF test. The optimal lag length is chosen based on the Akaike Information Criterion (AIC).

Level Phases:

Intercept:

Do not reject H_0 for all variables at 5% significance level. At level phases, there is adequate evidence to conclude the non-stationarity of all variables.

Trend and Intercept:

Do not reject H_0 for LNKLCI, LNCPI, LNREER and LNCRU at 5% significance level; reject H_0 for LNIPI. There is sufficient evidence to conclude that all variables (LNKLCI, LNCPI, LNREER and LNCRU) are not stationary at level phases except LNIPI. It is concluded that LNIPI is stationary at level phases.

First Difference:

Intercept:

At 5% significant level, reject H_0 for every variables. There is enough evidence to reach a conclusion that at first difference, all variables are stationary.

Trend and Intercept:

Reject H_0 for all variables (LNKLCI, LNCPI, LNREER, LNCRU and LNIPI) at 5% significance level. There is enough evidence to conclude that at first difference, all variables are stationary.

4.2.2 Phillips-Perron (PP) Test

Table 4.2.2: Unit Root Test (Phillips-Perron)

Variables	Phillips-Perron (PP)			
	Level		1st different	
	Intercept	Trend and intercept	Intercept	Trend and intercept
LNKLCI	0.6508	0.0034*	0.0001*	0.0000*
LNCPI	0.9739	0.3668	0.0000*	0.0000*
LNREER	0.5587	0.6921	0.0000*	0.0000*
LNCRU	0.3038	0.8455	0.0000*	0.0000*
LNIPI	0.5242	0.0034*	0.0000*	0.0000*

Notes: * indicates stationarity at 5% significance level. Figures in Table 4.2.2 are the p-values of PP test. The bandwidth is chosen on the basis of Newey-West Bandwidth Criterion.

Level Phases:

Intercept:

At 5% significance level, do not reject H_0 for all variables. There is adequate evidence to conclude the non-stationarity of all variables at level phases.

Trend and Intercept:

Do not reject H_0 for LNCPI, LNREER and LNCRU at 5% significance level. There is sufficient evidence to conclude that LNCPI, LNREER and LNCRU are not stationary and have a unit root at level phases. Reject H_0 for LNKLCI and LNIPI at 5% significance level. It is concluded that LNKLCI and LNIPI are stationary at level phases.

First Difference:

Intercept:

At 5% significance level, reject H_0 for all variables. There is adequate evidence to conclude the stationarity of all variables at first difference.

Trend and Intercept:

Reject H_0 for every variables at 5% significance level. There is enough evidence to conclude that at first difference, all variables are stationary.

Based on the results obtained, it is clear that both unit root tests concluded that there is no I(2) variable, this fulfils the requirement to proceed to the bounds testing procedure.

4.3 Bounds test

Table 4.3.1: ARDL Bounds Test

ARDL Bounds Test		
Test Statistic	Value	k
F-statistic	6.808699	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

H_0: No cointegration and no long-run relationships exist.

H_1: Cointegration and long-run relationships exist.

Decision Rule: Reject H_0 if test statistic is greater than the upper critical bounds value. Do not reject H_0 if test statistic is smaller than the lower bounds value. Otherwise, inconclusive.

Test Statistic: 6.808699

Decision Making: Since test statistic (6.808699) exceeds the upper-bound critical value (4.01), reject H_0 at 5% significance level.

Conclusion: There is adequate evidence to conclude that cointegration exists. There is an existence of long run relationship between the variables, which are LNCPI, LNREER, LNCRU and LNIPI when the dependent variable is LNKLCI.

4.4 Pair-wise cointegration

Table 4.4.1: Pair-wise Cointegration

Pair-wise cointegration		
Variable	Coefficient	Prob.
Cointegrating Form		
CointEq(-1)	-0.552184	0.0000
Long Run Coefficients		
LNCPI	0.459330	0.0428
LNREER	-0.011436	0.9565
LNCRU	0.203816	0.0000
LNIPI	0.828599	0.0000
C	0.429061	0.7691

CointEq(-1) is one period lag error correction term. It symbolises the speed of adjustment, the value of coefficient expresses the percent of correction happening in first to going. It guides the variables (LNKLCI, LNCPI, LNREER, LNCRU and LNIPI) of the system to restore back to equilibrium. Therefore, the coefficient should be negative and significant but not smaller than -1. The negative and significant coefficient shows the adjustment rate of the previous period system disequilibrium. The coefficient of -0.552184 is between 0 and -1, also, it is significant at 5% level as it has a p-value (0.0000) less than α=0.05. This indicates that the system corrects its previous period disequilibrium at a speed of adjustment of 55.22% yearly to reach long run equilibrium steady state position.

Equation (The long-run elasticity estimates):

$$\mathbf{LNKLCI_t = 0.429061 + 0.459330\ LNCPI_t - 0.011436\ LNREER_t + 0.203816\ LNCRU_t + 0.828599\ LNIPI_t}$$

H_0: No existence of significant long run relationship between the independent variables and LNKLCI. Where, the independent variables include LNCPI, LNREER, LNCRU and LNIPI.

H_1: Existence of significant long run relationship between the independent variables and LNKLCI. Where, the independent variables include LNCPI, LNREER, LNCRU and LNIPI.

$\alpha=0.05$

Decision Rule: If p-value is smaller than $\alpha=0.05$, reject H_0. Otherwise, do not reject H_0.

In conclusion, the estimated coefficients are significant for LNCPI, LNCRU and LNIPI but not significant for LNREER in indicating the long-run relationship. LNCPI, LNCRU and also LNIPI are positively and significantly affect LNKLCI at 5% significance level. LNREER has negative insignificant impact on LNKLCI at 5% significance level. In the long run, when CPI increases by 1%, on average, KLCI will also increase by 0.4593%, ceteris paribus. Holding other variables constant, in the long run, 1% rise in CRU will rise KLCI by 0.2038% on average. Averagely, when IPI increases by 1%, KLCI will rise by 0.8286% as a result, ceteris paribus.

4.5 Diagnostic Checking

4.5.1 Multicollinearity

Table 4.5.1.1: Correlation Coefficient Matrix

	LNCPI	LNREER	LNCRU	LNIPI
LNCPI	1			
LNREER	-0.334873	1		
LNCRU	0.737171	0.012895	1	
LNIPI	0.857477	-0.345154	0.645929	1

Table 4.5.1.1 above shows the correlation between LNCPI, LNREER, LNCRU and LNIPI. Except LNCPI and LNREER, LNREER and LNIPI show a negative relationship, there is a positive relationship among all other combinations. The highest value in the table is 0.857477, from the combination of LNIPI and LNCPI, therefore, it is suspected that this two variables may suffer from a serious multicollinearity problem. So, VIF and TOL is calculated to clarify the prediction.

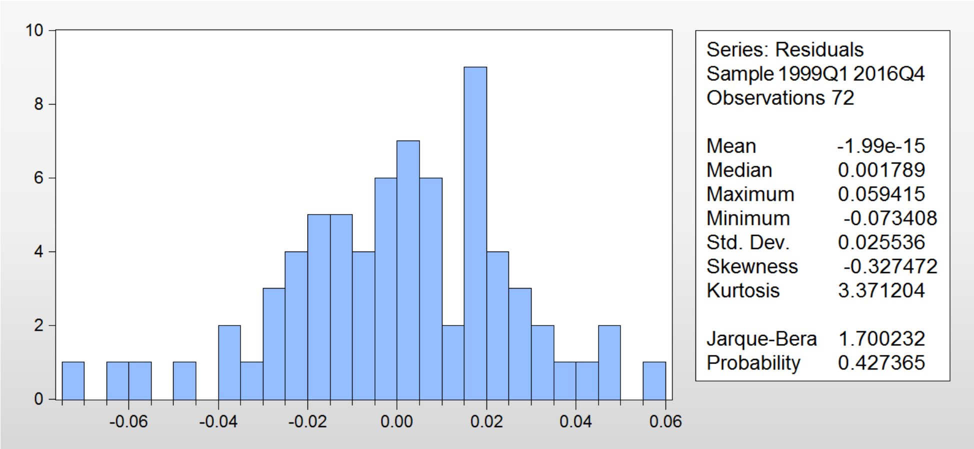
Table 4.5.1.2: Results of Variance Inflation Factor (VIF) and Tolerance value (TOL)

Dependent Variable	R^2	$VIF = \frac{1}{1 - R^2}$	$TOL = \frac{1}{VIF}$
LNCPI	0.809204	5.2412	0.1908
LNREER	0.276333	1.3819	0.7236
LNCRU	0.623048	2.6529	0.3769
LNIPI	0.741548	3.8692	0.2585

The VIFs are all less than 10, also, all of the TOLs are not close to 0 as shown in Table 4.5.1.2. Therefore, it can be concluded that serious multicollinearity problem does not take place between LNCPI and other variables, LNREER and other variables, LNCRU and other variables and also LNIPI and other variables.

4.5.2 Normality

Figure 4.5.2.1: Jarque-Bera Normality Test



H_0: The error term is normally distributed.

H_1: The error term is not normally distributed.

α=0.05

Decision Rule: If p-value is smaller than α=0.05, reject H_0. Otherwise, do not reject H_0.

Decision Making: Since p-value (0.427365) is greater than α= 0.05, do not reject H_0.

Conclusion: There is enough evidence to conclude that the error term is normally distributed.

4.5.3 Autocorrelation

Table 4.5.3.1: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.111970	Prob. F(1,53)	0.7392
Obs*R-squared	0.151789	Prob. Chi-Square(1)	0.6968

H_0: There is no autocorrelation problem.

H_1: There is autocorrelation problem.

α=0.05

Decision Rule: if p-value is less than α=0.05, reject H_0. Otherwise, do not reject H_0.

Decision Making: Since p-value (0.6968) is more than α= 0.05, do not reject H_0.

Conclusion: There is sufficient evidence to conclude that autocorrelation problem does not exist.

4.5.4 Heteroscedasticity

Table 4.5.4.1: ARCH Test

ARCH Test			
F-statistic	0.841774	Prob. F(1,69)	0.3621
Obs*R-squared	0.855734	Prob. Chi-Square(1)	0.3549

H_0: There is no heteroscedasticity problem.

H_1: There is heteroscedasticity problem.

α=0.05

Decision Rule: Reject H_0 if p-value is smaller than α=0.05. Otherwise, do not reject H_0.

Decision Making: Do not reject H_0 since p-value (0.3549) is more than α= 0.05.

Conclusion: There is sufficient evidence to conclude that heteroscedasticity problem does not exist.

4.5.5 Model Specification

Table 4.5.5.1: Ramsey RESET Test

Ramsey RESET Test			
	Value	df	Probability
t-statistic	1.173122	53	0.2460
F-statistic	1.376215	(1, 53)	0.2460

H_0: There is no model specification error.

H_1: There is model specification error.

α=0.05

Decision Rule: If p-value is smaller than α=0.05, reject H_0. Otherwise, do not reject H_0.

Decision Making: since p-value (0.2460) is larger than α= 0.05, do not reject H_0.

Conclusion: There is sufficient evidence to conclude that there is no model specification error.

In short, since the model passes all the diagnostic tests, the model is specified appropriately and adequately. No econometric problem contains in the model. The statistical validity of the long-run model is generally supported by the diagnostic tests.

4.6 CUSUM Test and CUSUMSQ Test

Figure 4.6.1: CUSUM Test

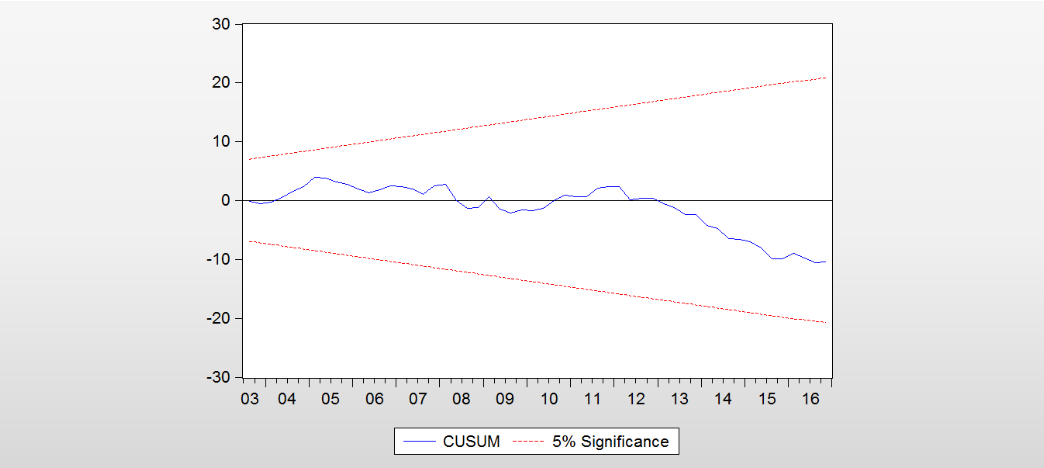
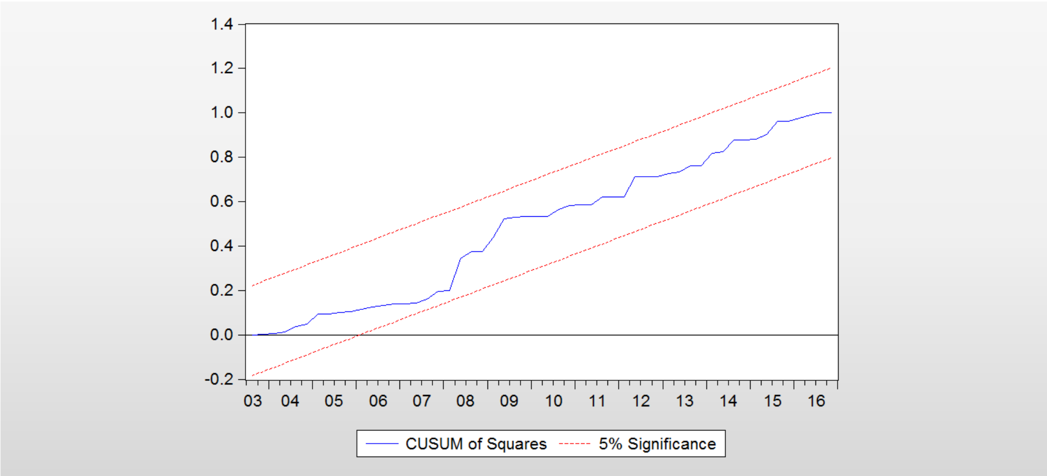


Figure 4.6.2: CUSUMSQ Test



CUSUM test and CUSUM of Squares (CUSUMSQ) test are used to measure the parameter stability. The figures above plot the results for CUSUM test and CUSUMSQ test respectively. The outcomes specify that the instability of the coefficients is absent. The plot of both the CUSUM and the CUSUMSQ statistic fall within the critical bands of the 5% confidence interval of the stability of the parameter. The results in Figure 4.6.1 and Figure 4.6.2 suggest the stability of all coefficients over the sample period in the estimated output regression.

4.7 Conclusion

This chapter carries out and interprets the empirical results from the methodologies included Unit Root Test, Bounds Test, Pair-wise Cointegration Test and diagnostic checking tests for the purpose of this research. Moreover, the long run relationships between LNKLCI and LNCPI, LNREER, LNCRU and LNIPI are examined. The following chapter will discuss the summary of this study.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

Chapter 5 provides a synopsis of the results obtained from Chapter 4. This chapter then continues with discussing the major findings and follows by the implications of this research. Several limitations of this study and also the recommendations for future research will be discussed in this chapter. This chapter ends with a conclusion.

5.1 Summary of Statistical Analyses

Table 5.1.1 Summary of Unit Root Tests

Variables	Results			
	Augmented Dickey-Fuller (ADF)		Phillips-Perron (PP)	
	Stationary at		Stationary at	
	Level	First difference	Level	First difference
KLCI		✓	✓	✓
Inflation rate		✓		✓
Exchange rate		✓		✓
Crude oil price		✓		✓
Industrial Production Index	✓	✓	✓	✓

The ADF and PP tests performed have proven that none of the variables are having higher order of integration, I(2) or beyond. This has fulfilled the assumption to proceed to the bounds test, that is all of the variables included in the model are I(0) or I(1).

Table 5.1.2 Summary of Major Findings

Variables	**P-value**	**Relationship**	**Results (long run relationship)**
Inflation rate	0.0428	Positive	Significant
Exchange rate	0.9565	Negative	Insignificant
Crude oil price	0.0000	Positive	Significant
Industrial Production Index	0.0000	Positive	Significant

There are three variables (inflation rate, crude oil price and industrial production index) among the four variables included in this study found significantly affect the Malaysian stock market performance in the long run. The only insignificant variable found is exchange rate.

Table 5.1.3 Summary of the Diagnostic Checking Results

Diagnostic Checking	**P-value**	**Results**
Multicollinearity:		
Variance Inflation Factor (VIF)	Highest VIF = 5.2412	No serious multicollinearity problem
Tolerance value (TOL)	Lowest TOL = 0.1908	No serious multicollinearity problem
Normality : Jarque-Bera Test	0.427365	The error term is normally distributed
Autocorrelation : Breusch-Godfrey Serial Correlation LM Test	0.6968	No autocorrelation problem

Heteroscedasticity: ARCH Test	0.3549	No heteroscedasticity problem
Model Specification: Ramsey RESET Test	0.2460	No model specification error

Referring to the table above, the model used in this study is free from multicollinearity, normality, autocorrelation, heteroscedasticity and model specification problems at 5% significance level. Therefore, it can be concluded that the results obtained in this study are statistically valid.

Table 5.1.4 Summary of CUSUM Test and CUSUMSQ Test

Tests on Parameter Stability	**Results**
CUSUM Test	The plot of the CUSUM statistic fall within the 5% confidence interval critical bands
CUSUMSQ Test	The plot of the CUSUMSQ statistic fall within the 5% confidence interval critical bands

Both CUSUM Test and CUSUMSQ Test suggested that all of the coefficients in the estimated output regression are not unstable during the research period, Q1 1998 to Q4 2016.

5.2 Discussion of Major Findings

The results shown that inflation rate, crude oil price in addition to industrial production index are significant in explaining the long run stock market performance in Malaysia. In contrast, exchange rate shows insignificant relationship with the performance of Malaysian stock market in the long run. Inflation rate, crude oil price and industrial production index exhibit positive sign with the dependent variable while exchange rate shows the opposite sign (negative).

5.2.1 Significant Variables

5.2.1.1 Inflation Rate (CPI)

Based on this study, in the long run, inflation rate is positively and significantly affecting the stock market performance in Malaysia as measured by KLCI.

This finding is consistent with the research by Tiwari, Dar, Bhanja, Arouri and Teulon (2015), Bekaert and Engstrom (2010), Kolluri, Wahab and Wahab (2015), Eksi and Tas (2017), Oxman (2012) and Dimic, Kiviaho, Piljak and Aijo (2016).

However, Lee (2010), Olufisayo (2013), Mahmood, Nazir and Junid (2015), Ahmadi (2016) as well as Chia and Lim (2015) found conflicting results with this study.

According to Ng, So, Tan, Teo and Yu (2015), economy policy will be restricted with the rise in inflation as the discount rate will increase simultaneously which eventually results in the increment in the stock price. Bekaert and Engstrom (2010) also stated that there is positive correlation emerging between equity yields and inflation. The authors suggested that stock yield increases in recession due to the high unpredictability and risk aversion which causes higher equity premiums.

Fisher effect theory explains that the movement in interest rate is closely related to the movement in inflation to compensate the lender for deviations in the real value of nominal interest rate payments (Geetha, Mohidin, Chandran & Chong, 2011). Also, the study in the Spanish market observes stock returns and inflation to have a significant positive relationship. The researchers clarified based on the "flow-through" theory indicating that most of the companies in several sectors are having a high capability to transfer the inflation to the prices of products or services (Geetha, Mohidin, Chandran & Chong, 2011).

5.2.1.2 Crude Oil Price (CRU)

This study shows that the crude oil price and Malaysian stock market performance are positively and significantly related in the long run.

The result is in line with the study by Narayan and Narayan (2010), Mohanty, Nandha, Turkistani and Alaitani (2011), Fayyad and Daly (2011) and Nejada, Jahantigh and Rahbari (2016).

In contrast, Alhayki (2014) and Basher, Haug and Sadorsky (2012) found out that there is an adverse movement between crude oil price and the stock market. Their findings are contrary with this study.

The positive significant long run relationship is found between crude oil price with the stock market performance mainly because Malaysia is a crude oil exporter. Abeysinghe (2001) explained that the increment in oil prices rises the revenue of net oil exporters like Malaysia. Increased oil price will positively affect oil and gas companies return like Petronas Gas Bhd, Petronas Chemicals Group Bhd and Petronas Dagangan Bhd. To illustrate, following the announcement of OPEC (Organisation of the Petroleum Exporting Countries) to reduce oil production, the crude oil prices have advanced by 10% immediately (Isa, 2016). Based on The Star newspaper, as at 5pm on 1 December 2016, the price of West Texas Intermediate rose to US$49.93 per barrel. Oil and gas stocks dominated the market in both gains and trading volume.

5.2.1.3 Industrial Production Index (IPI)

Significant positive long run relationship is found between IPI and stock market performance in this study.

Similar results also found by Aromolaran et al. (2016), Sohail and Hussain (2012) and Hussin et al. (2012).

On the other hand, the two variables are found to have negative significant relationship by a number of studies like Subeniotis et al. (2011), Ibrahim and Musah (2014) and Forson and Janrattanagul (2014).

According to Fama and French (1989), the stock returns are commonly known to be related to the output variables. Hence, the industrial production that represents a country's output is expected to positively associate with the stock price as direct relationship exists between industrial production and expected cash flow of the firms. An increase in industrial production increases the real economic activity of the country, therefore, there will be potential higher earnings and causing a better stock market performance. Additionally, Rasiah (2010) stated that the changes in the firms' expectation of the future cash flows will bring innovations on industrial production and consequently bring a positive impact on the stock returns. Cash flows increase with the boost in industrial production, thus rising the profitability of the companies and eventually bringing up the stock returns.

5.2.2 Insignificant Variable

5.2.2.1 Exchange Rate

Exchange rate and KLCI in this study are shown to have insignificant negative relationship in the long run.

Similarly, Wong (2017) found that there is negative relationship between exchange rate market and stock market. However, the adverse significant relationship is only found in the short run. And for the long run, it was found that there is no relationship among the two markets. Likewise, Bahmani-Oskooee and Saha (2016) stated that the changes of exchange rate significantly affects the stock prices only in the short-run. Tudor and Popescu-Dutaa (2012), Abidin, Walters, Lim and Azilawati (2013) and Suriani, Kumar, Jamil and Muneer (2015) also stated that stock price and exchange rate have no relationship between each other.

The purchasing power parity theory suggests that when domestic currency depreciates, domestic purchasing power will also decline and vice versa. When domestic currency depreciates, it generally means that domestic country has a lower exchange rate, more domestic currency is needed to buy the similar amount of foreign currency. Therefore, domestic investors will demand for more local stocks and the increasing demand will boost up the stock prices.

Moreover, Kibria et al. (2014) claimed that exchange rate is associated with the stock returns as foreign investors may change their profits on stocks to their own countries' currency. The researchers stated that exchange rate and stock returns show a negative relationship. They imply that currency depreciation will boost stock prices in the long run. According to Foo (2009), Malaysia as an export-oriented country will be more competitive in the world market when its currency depreciates because the products are relatively cheaper, therefore the countries will gain in terms of increasing exports. Income of the country rises as exports increase, ultimately, more foreign investors will be attracted to invest in the nation and consequently stimulating the stock market performance (Foo, 2009).

The exchange rate and also the stock market performance are found to have insignificant long-run relationship and it can be clarified using purchasing power parity theory. Shim, Kim, Kim and Ryu (2015) stated that the exchange rate should converge to its equilibrium rate in the long run so that the prices of identical basket of goods are almost the same in different nations.

5.3 Implications of the Study

This study concentrates on investigating the impact of macroeconomic variables on the stock price in Malaysia, such as inflation, exchange rate, crude oil price and industrial production index, which based on quarterly data from 1998 to 2016. Results obtained show that the macroeconomic variables that significantly affect the Malaysian stock price are inflation, crude oil price and industrial production index, while the exchange rate is found to have no significant effect on the stock price. Based on this study, governments, policymakers, researchers, academicians and investors are able to determine the latest macroeconomic variables that are significantly impacting the stock price. It is recommended to take the three significant variables into account as a reference or guideline while imposing or adjusting existing policy to maintain a healthy and stable stock market in Malaysia.

Inflation is significantly affecting stock market performance in long run. This indicates that it is also an important variable that should not be disregarded. Thaker, Hassama and Amin (2010) mentioned that in order to stabilize the stock market, the government needs to emphasise on the inflation variable as a financial policy instrument. In addition, the stock market is affected by inflation. This is due to the inflationary pressures can intimidate the future profits of corporate, increase the nominal discount rates, lower the current value of future profits and finally affect the stock returns as well (Geetha, Mohidin, Chandran & Chong, 2011). Hence, Malaysia should review and enhance monetary policy in line with the country's inflation.

Real effective exchange rate has also a crucial implication for the competitiveness of exports and domestic price inflation. According to the study of Ma and Kao (1990), the depreciation of the exchange rates causes the domestic products to be more appealing and it also raises the demand of export for these goods in the global market. This indicates that the stock market is affected by the revenue earned. The drastic volatility of exchange rate may cause the policymakers to distort their decision-making in international transactions, specifically in the foreign investment and trading (Loh, 2013). Nordin, Nordin and Ismail (2014) also mentioned that in order to achieve low inflation rate or full employment, policymakers must not neglect the effect of rules or polices of the exchange rates variable. To maintain the stability of exchange rate, the implementation of the related policies must be proceeded carefully because it may causes negative effect on the stock market performance.

In general, it is helpful for investors to identify on the effects of oil price shocks to the financial market. Investors will be better in risk management and constructions of portfolio in the stock market. For example, if investors are well-informed about the possible movement between crude oil price and stock price, they can determine how and when to take a short or long position in the stock market effectively. Besides, the consideration of stock market response to positive or negative changes in crude oil price is very important for hedging strategies because upward and downward movements in crude oil price by the same magnitude are not likely to have the same effect on the stock market. Hence, in order to have better forecast results, financial market analysts may have to fit in this information while formulating their predictive model for stock prices. Policymakers in oil exporting countries should also constantly monitor the crude oil price movement so that the stock market performance can be maximized to achieve sustainable economic development.

In long run, industrial production index has been proven to have significant and positive relationship with stock price. Increases in the industrial production can cause a growth in economic activities, which means there will be potential higher earnings and then causing an increase in stock valuations resulting in stock gains. Hence, increase in index of industrial production can enhance the development of stock market in Malaysia. According to Chen, Roll and Ross (1986), industrial production index is identified as one of the vital economic forces for the determination of stock returns. Appropriate policies that can be taken include encouraging domestic production, setting up subsidiary in foreign countries and tax cutting in order to control Malaysian stock market performance by diversifying systematic risk.

This study provides valuable information to domestic investors and also investors from other countries that are interested to invest in Malaysia. This is because that they are more able to predict long run stock prices. With more information on the relevant macroeconomic variables that might bring certain impact to the stock market, investors can make their investment decision more precisely by being able to weight the expected risk and return more accurately. Information from this study may also help investors to be more familiar with the Malaysian stock market environment and thus, stimulating the investing environment of stock market in Malaysia.

This present study confirms that the selected macroeconomic variables continuously affect the performance of stock market in Malaysia. However, to make this study more comprehensive, logical extension of the study is necessary.

5.4 Limitation

There are some limitations found during this research. Readers of this research are advised to refer to these limitations as it might affect the accuracy of the research. Besides, for future researchers who plan to study similar topic, they are suggested to solve these limitations to increase the accuracy of the study.

5.4.1 Restriction of Kuala Lumpur Composite Index (KLCI)

In this research, to measure the stock market performance in Malaysia, the Kuala Lumpur Composite Index (KLCI) is chosen as a tool. During this research, it was found that many of the researchers who are studying the topic regarding stock market performance in Malaysia are also using KLCI as an indicator. However, KLCI is found to be not the best indicator to study the performance of stock market in Malaysia because KLCI only comprises of the largest 30 companies, which is not sufficient to study for a total of 805 listed companies in Bursa Malaysia.

Especially, there are many different industries in the market such as technology, manufacturing and plantation, and different market is sensitive to different factors. KLCI which comprises of 30 companies, is not sufficient enough to study the market well. Therefore, the result from this research may not be fully suitable to apply to the overall stock market condition in Malaysia. The readers of this research are recommended to be aware of this limitation and make further study on it.

5.4.2 Limitation of Data Used

During this research, data collected are in quarterly basis. The variables such as exchange rate and stock market performance are fluctuating every day. It will be better if the result is carried out by using daily data. Although daily data is believed to be more accurate because it captures daily changes. But during the research being conducted, daily data are not available for all the selected independent variables. Besides, results generated using daily, monthly, quarterly and yearly data will give different results. Some of the variables do not have daily data but mostly quarterly and yearly data. As a result, the findings of this research might be less accurate than using daily or monthly data.

5.5 Recommendations for Future Research

5.5.1 Other Indexes in Malaysia

The dependent variable of this study is Kuala Lumpur Composite Index (KLCI). However, KLCI is not always the best indicator that can be adopted to display the stock market performance of Malaysia. As the KLCI only consists of the 30 largest listed companies on the Bursa Malaysia Main Market based on the market capitalization ("FTSE Bursa Malaysia KLCI", 2018). Therefore, there are other indexes that include in the FTSE Bursa Malaysia Index Series such as Hijrah Shariah Index, Top 100 Index, Palm Oil Plantation Index, EMAS Index, ACE index and others ("FTSE Bursa Malaysia Index Series", 2017). These series can be separated into the size segments, Shariah-compliant indices and the palm oil plantation sector. So, future researchers can use different types of Malaysia's indexes to meet their objectives perfectly.

5.5.2 Qualitative Variables

The qualitative variables act a vital role in affecting the stock market performance too. The qualitative variables comprise of investors' preference, risk factors, political factors, government regulation and others that many of these factors are not measurable and cannot be calculated (Lan, 2013). For instance, when an investor is interested to invest in the stock index, he or she would like to know whether any political issues are happening nowadays as these issues will influence the stock market performance. According to Fitzsimons and Sun (2012), they found that the political risk will influence the stock market performance of developing countries more as the developing countries have to face more number of challenges. Thus, the qualitative variables should not be neglected to be included in a regression model because this can allow the study to have a better capture of the current stock market performance.

5.5.3 Behavioural Finance

Behavioural finance can be known as using the science of finance and the science of psychology in the analysis of the decision-making process to make an investment (Prawirasasra, 2016). Most of the financial theories assume that those investors take their stock investment decisions when they are well-informed, consistent and cautious. However, investors are not entirely rational because they will be influenced by their own behavioural factors while making investment decisions. For example, some investors are overconfidence in making investment decisions (Kannadhasan Phil & Trichy, 2015). According to the Kannadhasan, Phil and Trichy (2015), they found that the investors who are overconfidence will think that they have enough knowledge but in reality they have overestimated their predictive skill in making investment decisions. Thus, this will affect those investors in making the right decision in investment. So, it is important for the future researchers to include the behavioural finance as a variable in a regression model as it is a vital factor that will affect the investment decisions of investors.

5.5.4 Panel Data

In order to make the study becomes more comparable, panel data can be used in the research as this study only includes the time-series data. Panel data comprise of the time-series data and also the cross-sectional data which include a number of observations (cross-sectional units) over a specific period of time (Moffatt, 2017). Thus, the investors can compare the stock market performance among the countries and can choose the best stock market to invest. Furthermore, using the panel data brings some advantages such as panel data comprise of more information, more efficiency, more degrees of freedom and less collinearity among the variables ("Research methodology & panel data analysis", n.d.). So, future researchers can consider using the panel data to have a better understanding of the stock market performance among different countries at different period of time.

5.6 Conclusion

In conclusion, the factors affecting the long run stock market performance in Malaysia are being analysed by using ARDL approach in this study. The findings of this study suggest that inflation rate, crude oil price and industrial production index have significant and also positive relationship with the long run stock price in Malaysia, but exchange rate has insignificant and negative effect in this study referring to observations ranging from Q1 1998 to Q4 2016. All the results in this study could be useful to provide information to various parties such as government, policymakers, researchers, academicians and investors to perform their tasks. At the end of this chapter, the limitations and also recommendations of the study are provided for future researchers to conduct more comprehensive research.

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APPENDICES

Appendix 4.2.1: Augmented Dickey-Fuller (ADF) Test

Variable: LNKLCI

Level without trend

Null Hypothesis: LNKLCI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.773860	0.3905
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNKLCI)
Method: Least Squares
Date: 08/16/17 Time: 22:54
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKLCI(-1)	-0.058814	0.033156	-1.773860	0.0804
D(LNKLCI(-1))	-0.089677	0.105313	-0.851524	0.3973
C	0.428320	0.231316	1.851668	0.0682

R-squared	0.059436	Mean dependent var	0.017322
Adjusted R-squared	0.032941	S.D. dependent var	0.115543
S.E. of regression	0.113624	Akaike info criterion	-1.472157
Sum squared resid	0.916631	Schwarz criterion	-1.378749
Log likelihood	57.46980	Hannan-Quinn criter.	-1.434895
F-statistic	2.243318	Durbin-Watson stat	2.210694
Prob(F-statistic)	0.113575		

Level with trend

Null Hypothesis: LNKLCI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.329297	0.0695
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNKLCI)
Method: Least Squares
Date: 08/16/17 Time: 23:01
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKLCI(-1)	-0.314501	0.094465	-3.329297	0.0014
D(LNKLCI(-1))	0.034253	0.109204	0.313657	0.7547
C	2.014512	0.594632	3.387827	0.0012
@TREND("1998Q1")	0.005060	0.001762	2.871967	0.0054

R-squared	0.158582	Mean dependent var	0.017322
Adjusted R-squared	0.122521	S.D. dependent var	0.115543
S.E. of regression	0.108233	Akaike info criterion	-1.556520
Sum squared resid	0.820009	Schwarz criterion	-1.431976
Log likelihood	61.59125	Hannan-Quinn criter.	-1.506838
F-statistic	4.397619	Durbin-Watson stat	2.196953
Prob(F-statistic)	0.006819		

1st different without trend

Null Hypothesis: D(LNKLCI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.62576	0.0001
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNKLCI,2)
Method: Least Squares

Date: 08/16/17 Time: 23:02
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNKLCI(-1))	-1.120266	0.105429	-10.62576	0.0000
C	0.018673	0.013456	1.387692	0.1695

R-squared	0.610614	Mean dependent var	0.006085
Adjusted R-squared	0.605206	S.D. dependent var	0.183511
S.E. of regression	0.115305	Akaike info criterion	-1.455820
Sum squared resid	0.957255	Schwarz criterion	-1.393548
Log likelihood	55.86533	Hannan-Quinn criter.	-1.430979
F-statistic	112.9067	Durbin-Watson stat	2.174252
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNKLCI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.58421	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNKLCI,2)
Method: Least Squares
Date: 08/16/17 Time: 23:04
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNKLCI(-1))	-1.119428	0.105764	-10.58421	0.0000
C	0.036690	0.027731	1.323090	0.1901
@TREND("1998Q1")	-0.000468	0.000630	-0.743778	0.4595

R-squared	0.613625	Mean dependent var	0.006085
Adjusted R-squared	0.602741	S.D. dependent var	0.183511
S.E. of regression	0.115664	Akaike info criterion	-1.436554
Sum squared resid	0.949854	Schwarz criterion	-1.343146
Log likelihood	56.15250	Hannan-Quinn criter.	-1.399293
F-statistic	56.37962	Durbin-Watson stat	2.193491
Prob(F-statistic)	0.000000		

Variable: LNCPI

Level without trend

Null Hypothesis: LNCPI has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.317455	0.9777
Test critical values:	1% level	-3.522887	
	5% level	-2.901779	
	10% level	-2.588280	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 08/16/17 Time: 23:06
Sample (adjusted): 1998Q4 2016Q4
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)	0.002119	0.006675	0.317455	0.7519
D(LNCPI(-1))	0.144520	0.117968	1.225084	0.2247
D(LNCPI(-2))	-0.217305	0.116265	-1.869052	0.0659
C	-0.003600	0.030254	-0.118985	0.9056

R-squared	0.063032	Mean dependent var	0.005596
Adjusted R-squared	0.022294	S.D. dependent var	0.006996
S.E. of regression	0.006918	Akaike info criterion	-7.056176
Sum squared resid	0.003302	Schwarz criterion	-6.930671
Log likelihood	261.5504	Hannan-Quinn criter.	-7.006160
F-statistic	1.547259	Durbin-Watson stat	2.021659
Prob(F-statistic)	0.210116		

Level with trend

Null Hypothesis: LNCPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.926211	0.1605
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 08/16/17 Time: 23:09
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)	-0.180835	0.061798	-2.926211	0.0046
D(LNCPI(-1))	0.202719	0.114852	1.765045	0.0819
C	0.784375	0.266663	2.941451	0.0044
@TREND("1998Q1")	0.001058	0.000356	2.973524	0.0040

R-squared	0.125231	Mean dependent var	0.005575
Adjusted R-squared	0.087741	S.D. dependent var	0.006951
S.E. of regression	0.006639	Akaike info criterion	-7.139262
Sum squared resid	0.003085	Schwarz criterion	-7.014718
Log likelihood	268.1527	Hannan-Quinn criter.	-7.089580
F-statistic	3.340384	Durbin-Watson stat	1.944239
Prob(F-statistic)	0.024072		

1st different without trend

Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.914830	0.0000
Test critical values:	1% level	-3.522887	
	5% level	-2.901779	
	10% level	-2.588280	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI,2)
Method: Least Squares
Date: 08/16/17 Time: 23:09
Sample (adjusted): 1998Q4 2016Q4
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPI(-1))	-1.068159	0.154474	-6.914830	0.0000
D(LNCPI(-1),2)	0.215584	0.115390	1.868311	0.0659
C	0.005997	0.001178	5.090832	0.0000

R-squared	0.464300	Mean dependent var	8.27E-05
Adjusted R-squared	0.448994	S.D. dependent var	0.009260
S.E. of regression	0.006873	Akaike info criterion	-7.082113
Sum squared resid	0.003307	Schwarz criterion	-6.987985
Log likelihood	261.4971	Hannan-Quinn criter.	-7.044602
F-statistic	30.33507	Durbin-Watson stat	2.019932
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.899590	0.0000
Test critical values:	1% level	-4.088713	
	5% level	-3.472558	
	10% level	-3.163450	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI,2)
Method: Least Squares
Date: 08/16/17 Time: 23:11
Sample (adjusted): 1998Q4 2016Q4
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPI(-1))	-1.072663	0.155468	-6.899590	0.0000
D(LNCPI(-1),2)	0.216503	0.115982	1.866684	0.0662
C	0.005200	0.001875	2.773491	0.0071
@TREND("1998Q1")	2.11E-05	3.84E-05	0.548620	0.5850

R-squared	0.466627	Mean dependent var	8.27E-05
Adjusted R-squared	0.443436	S.D. dependent var	0.009260
S.E. of regression	0.006908	Akaike info criterion	-7.059069
Sum squared resid	0.003293	Schwarz criterion	-6.933564
Log likelihood	261.6560	Hannan-Quinn criter.	-7.009053
F-statistic	20.12176	Durbin-Watson stat	2.021846
Prob(F-statistic)	0.000000		

Variable: LNREER

Level without trend

Null Hypothesis: LNREER has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.312723	0.6198
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNREER)
Method: Least Squares
Date: 08/16/17 Time: 23:12
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNREER(-1)	-0.081500	0.062085	-1.312723	0.1934
C	0.370898	0.284126	1.305402	0.1959

R-squared	0.023062	Mean dependent var	-0.002063
Adjusted R-squared	0.009679	S.D. dependent var	0.023446
S.E. of regression	0.023332	Akaike info criterion	-4.651673
Sum squared resid	0.039740	Schwarz criterion	-4.589873
Log likelihood	176.4377	Hannan-Quinn criter.	-4.626997
F-statistic	1.723242	Durbin-Watson stat	1.988765
Prob(F-statistic)	0.193388		

Level with trend

Null Hypothesis: LNREER has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.700493	0.7415
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNREER)
Method: Least Squares

Date: 08/16/17 Time: 23:13
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNREER(-1)	-0.109929	0.064645	-1.700493	0.0934
C	0.508153	0.297369	1.708828	0.0918
@TREND("1998Q1")	-0.000188	0.000130	-1.453766	0.1504

R-squared	0.050920	Mean dependent var	-0.002063
Adjusted R-squared	0.024557	S.D. dependent var	0.023446
S.E. of regression	0.023156	Akaike info criterion	-4.653937
Sum squared resid	0.038607	Schwarz criterion	-4.561237
Log likelihood	177.5226	Hannan-Quinn criter.	-4.616923
F-statistic	1.931480	Durbin-Watson stat	1.989457
Prob(F-statistic)	0.152369		

1st different without trend

Null Hypothesis: D(LNREER) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.138855	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNREER,2)
Method: Least Squares
Date: 08/16/17 Time: 23:14
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNREER(-1))	-1.071072	0.117200	-9.138855	0.0000
C	-0.001817	0.002738	-0.663784	0.5089

R-squared	0.537033	Mean dependent var	6.37E-05
Adjusted R-squared	0.530603	S.D. dependent var	0.034279
S.E. of regression	0.023485	Akaike info criterion	-4.638240
Sum squared resid	0.039712	Schwarz criterion	-4.575968
Log likelihood	173.6149	Hannan-Quinn criter.	-4.613399
F-statistic	83.51867	Durbin-Watson stat	1.925109
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNREER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.263199	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNREER,2)
Method: Least Squares
Date: 08/16/17 Time: 23:15
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNREER(-1))	-1.085224	0.117154	-9.263199	0.0000
C	0.004543	0.005606	0.810385	0.4204
@TREND("1998Q1")	-0.000166	0.000128	-1.298176	0.1984

R-squared	0.547767	Mean dependent var	6.37E-05
Adjusted R-squared	0.535028	S.D. dependent var	0.034279
S.E. of regression	0.023374	Akaike info criterion	-4.634671
Sum squared resid	0.038791	Schwarz criterion	-4.541263
Log likelihood	174.4828	Hannan-Quinn criter.	-4.597410
F-statistic	42.99941	Durbin-Watson stat	1.942528
Prob(F-statistic)	0.000000		

Variable: LNCRU

Level without trend

Null Hypothesis: LNCRU has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.264265	0.1862
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCRU)
Method: Least Squares
Date: 08/16/17 Time: 23:16
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCRU(-1)	-0.069772	0.030814	-2.264265	0.0266
D(LNCRU(-1))	0.215520	0.112210	1.920695	0.0588
C	0.286201	0.121810	2.349573	0.0216

R-squared	0.105998	Mean dependent var	0.016370
Adjusted R-squared	0.080815	S.D. dependent var	0.163680
S.E. of regression	0.156927	Akaike info criterion	-0.826380
Sum squared resid	1.748445	Schwarz criterion	-0.732972
Log likelihood	33.57607	Hannan-Quinn criter.	-0.789119
F-statistic	4.209082	Durbin-Watson stat	1.951987
Prob(F-statistic)	0.018729		

Level with trend

Null Hypothesis: LNCRU has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.966793	0.6094
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCRU)

Method: Least Squares
Date: 08/16/17 Time: 23:17
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCRU(-1)	-0.096468	0.049049	-1.966793	0.0532
D(LNCRU(-1))	0.242707	0.119100	2.037839	0.0453
C	0.352929	0.154918	2.278168	0.0258
@TREND("1998Q1")	0.000969	0.001381	0.701238	0.4855

R-squared	0.112234	Mean dependent var	0.016370
Adjusted R-squared	0.074187	S.D. dependent var	0.163680
S.E. of regression	0.157491	Akaike info criterion	-0.806353
Sum squared resid	1.736248	Schwarz criterion	-0.681809
Log likelihood	33.83508	Hannan-Quinn criter.	-0.756671
F-statistic	2.949878	Durbin-Watson stat	1.959559
Prob(F-statistic)	0.038570		

1st different without trend

Null Hypothesis: D(LNCRU) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.198852	0.0000
Test critical values:	1% level	-3.522887	
	5% level	-2.901779	
	10% level	-2.588280	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCRU,2)
Method: Least Squares
Date: 08/16/17 Time: 23:19
Sample (adjusted): 1998Q4 2016Q4
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCRU(-1))	-0.922930	0.148887	-6.198852	0.0000
D(LNCRU(-1),2)	0.157002	0.117928	1.331339	0.1874
C	0.015707	0.019041	0.824908	0.4122

R-squared	0.413550	Mean dependent var	0.001688
Adjusted R-squared	0.396795	S.D. dependent var	0.208043
S.E. of regression	0.161580	Akaike info criterion	-0.767410
Sum squared resid	1.827558	Schwarz criterion	-0.673281
Log likelihood	31.01046	Hannan-Quinn criter.	-0.729898
F-statistic	24.68116	Durbin-Watson stat	2.008058
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNCRU) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.218062	0.0003
Test critical values:	1% level	-4.094550	
	5% level	-3.475305	
	10% level	-3.165046	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCRU,2)
Method: Least Squares
Date: 08/16/17 Time: 23:19
Sample (adjusted): 1999Q3 2016Q4
Included observations: 70 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCRU(-1))	-1.428870	0.273832	-5.218062	0.0000
D(LNCRU(-1),2)	0.592781	0.235728	2.514677	0.0145
D(LNCRU(-2),2)	0.412978	0.197329	2.092843	0.0404
D(LNCRU(-3),2)	0.220313	0.156573	1.407100	0.1643
D(LNCRU(-4),2)	0.308567	0.124474	2.478973	0.0159
C	0.111130	0.048277	2.301915	0.0247
@TREND("1998Q1")	-0.002231	0.001046	-2.132785	0.0368

R-squared	0.498172	Mean dependent var	-0.003127
Adjusted R-squared	0.450379	S.D. dependent var	0.208786
S.E. of regression	0.154786	Akaike info criterion	-0.798905
Sum squared resid	1.509401	Schwarz criterion	-0.574056
Log likelihood	34.96168	Hannan-Quinn criter.	-0.709592
F-statistic	10.42352	Durbin-Watson stat	1.994651
Prob(F-statistic)	0.000000		

Variable: LNIPI

Level without trend

Null Hypothesis: LNIPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.526474	0.5149
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIPI)
Method: Least Squares
Date: 08/16/17 Time: 23:21
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIPI(-1)	-0.073443	0.048113	-1.526474	0.1312
C	0.340314	0.218328	1.558726	0.1234

R-squared	0.030932	Mean dependent var	0.007724
Adjusted R-squared	0.017657	S.D. dependent var	0.122050
S.E. of regression	0.120967	Akaike info criterion	-1.360289
Sum squared resid	1.068215	Schwarz criterion	-1.298489
Log likelihood	53.01084	Hannan-Quinn criter.	-1.335613
F-statistic	2.330124	Durbin-Watson stat	1.959052
Prob(F-statistic)	0.131213		

Level with trend

Null Hypothesis: LNIPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.769868	0.0013
Test critical values:	1% level	-4.090602	
	5% level	-3.473447	
	10% level	-3.163967	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIPI)
Method: Least Squares

Date: 08/16/17 Time: 23:22
Sample (adjusted): 1999Q1 2016Q4
Included observations: 72 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIPI(-1)	-0.469743	0.098481	-4.769868	0.0000
D(LNIPI(-1))	0.162060	0.113448	1.428491	0.1579
D(LNIPI(-2))	0.352690	0.109519	3.220360	0.0020
D(LNIPI(-3))	0.237551	0.101819	2.333069	0.0227
C	1.922124	0.402128	4.779886	0.0000
@TREND("1998Q1")	0.005448	0.001256	4.338155	0.0001

R-squared	0.281447	Mean dependent var	0.010655
Adjusted R-squared	0.227011	S.D. dependent var	0.109726
S.E. of regression	0.096471	Akaike info criterion	-1.759488
Sum squared resid	0.614243	Schwarz criterion	-1.569766
Log likelihood	69.34156	Hannan-Quinn criter.	-1.683959
F-statistic	5.170240	Durbin-Watson stat	1.849826
Prob(F-statistic)	0.000461		

1st different without trend

Null Hypothesis: D(LNIPI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.834537	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIPI,2)
Method: Least Squares
Date: 08/16/17 Time: 23:23
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNIPI(-1))	-1.084196	0.110244	-9.834537	0.0000
C	0.013223	0.013482	0.980759	0.3300

R-squared	0.573253	Mean dependent var	0.004727
Adjusted R-squared	0.567326	S.D. dependent var	0.175959
S.E. of regression	0.115742	Akaike info criterion	-1.448245
Sum squared resid	0.964533	Schwarz criterion	-1.385973
Log likelihood	55.58506	Hannan-Quinn criter.	-1.423404
F-statistic	96.71813	Durbin-Watson stat	2.102500
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNIPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.745292	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIPI,2)
Method: Least Squares
Date: 08/16/17 Time: 23:24
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNIPI(-1))	-1.083820	0.111215	-9.745292	0.0000
C	0.014600	0.027934	0.522651	0.6028
@TREND("1998Q1")	-3.58E-05	0.000635	-0.056392	0.9552

R-squared	0.573272	Mean dependent var	0.004727
Adjusted R-squared	0.561251	S.D. dependent var	0.175959
S.E. of regression	0.116552	Akaike info criterion	-1.421263
Sum squared resid	0.964490	Schwarz criterion	-1.327854
Log likelihood	55.58671	Hannan-Quinn criter.	-1.384001
F-statistic	47.69114	Durbin-Watson stat	2.103432
Prob(F-statistic)	0.000000		

Appendix 4.2.2: Phillips-Perron (PP) Test

Variable: LNKLCI

Level without trend

Null Hypothesis: LNKLCI has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.245023	0.6508
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

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

Residual variance (no correction)	0.015583
HAC corrected variance (Bartlett kernel)	0.014011

Phillips-Perron Test Equation
Dependent Variable: D(LNKLCI)
Method: Least Squares
Date: 08/16/17 Time: 23:57
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKLCI(-1)	-0.047621	0.036196	-1.315647	0.1924
C	0.342720	0.252559	1.356993	0.1790

R-squared	0.023162	Mean dependent var	0.010999
Adjusted R-squared	0.009781	S.D. dependent var	0.127153
S.E. of regression	0.126530	Akaike info criterion	-1.270374
Sum squared resid	1.168714	Schwarz criterion	-1.208574
Log likelihood	49.63902	Hannan-Quinn criter.	-1.245698
F-statistic	1.730926	Durbin-Watson stat	1.999382
Prob(F-statistic)	0.192410		

Level with trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.444845	0.0034
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

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

Residual variance (no correction)	0.012998
HAC corrected variance (Bartlett kernel)	0.017174

Phillips-Perron Test Equation
Dependent Variable: D(LNKLCI)
Method: Least Squares
Date: 08/16/17 Time: 23:58
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKLCI(-1)	-0.364623	0.090139	-4.045110	0.0001
C	2.309202	0.569187	4.057017	0.0001
@TREND("1998Q1")	0.006360	0.001681	3.784276	0.0003

R-squared	0.185221	Mean dependent var	0.010999
Adjusted R-squared	0.162588	S.D. dependent var	0.127153
S.E. of regression	0.116358	Akaike info criterion	-1.425111
Sum squared resid	0.974822	Schwarz criterion	-1.332412
Log likelihood	56.44167	Hannan-Quinn criter.	-1.388097
F-statistic	8.183762	Durbin-Watson stat	1.683705
Prob(F-statistic)	0.000627		

1st different without trend

Null Hypothesis: D(LNKLCI) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.84774	0.0001
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Residual variance (no correction)	0.012936
HAC corrected variance (Bartlett kernel)	0.011303

Phillips-Perron Test Equation
Dependent Variable: D(LNKLCI,2)
Method: Least Squares
Date: 08/16/17 Time: 23:59
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNKLCI(-1))	-1.120266	0.105429	-10.62576	0.0000
C	0.018673	0.013456	1.387692	0.1695

R-squared	0.610614	Mean dependent var	0.006085
Adjusted R-squared	0.605206	S.D. dependent var	0.183511
S.E. of regression	0.115305	Akaike info criterion	-1.455820
Sum squared resid	0.957255	Schwarz criterion	-1.393548
Log likelihood	55.86533	Hannan-Quinn criter.	-1.430979
F-statistic	112.9067	Durbin-Watson stat	2.174252
Prob(F-statistic)	0.000000		

1st different with trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.60406	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Residual variance (no correction)	0.012836
HAC corrected variance (Bartlett kernel)	0.012665

Phillips-Perron Test Equation
Dependent Variable: D(LNKLCI,2)
Method: Least Squares
Date: 08/17/17 Time: 00:01
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNKLCI(-1))	-1.119428	0.105764	-10.58421	0.0000
C	0.036690	0.027731	1.323090	0.1901
@TREND("1998Q1")	-0.000468	0.000630	-0.743778	0.4595

R-squared	0.613625	Mean dependent var	0.006085
Adjusted R-squared	0.602741	S.D. dependent var	0.183511
S.E. of regression	0.115664	Akaike info criterion	-1.436554
Sum squared resid	0.949854	Schwarz criterion	-1.343146
Log likelihood	56.15250	Hannan-Quinn criter.	-1.399293
F-statistic	56.37962	Durbin-Watson stat	2.193491
Prob(F-statistic)	0.000000		

Variable: LNCPI

Level without trend

Null Hypothesis: LNCPI has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.247451	0.9739
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

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

Residual variance (no correction)	4.82E-05
HAC corrected variance (Bartlett kernel)	2.75E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 08/17/17 Time: 00:10
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)	0.000542	0.006522	0.083104	0.9340
C	0.003244	0.029593	0.109612	0.9130

R-squared	0.000095	Mean dependent var	0.005702
Adjusted R-squared	-0.013603	S.D. dependent var	0.006991
S.E. of regression	0.007038	Akaike info criterion	-7.048700
Sum squared resid	0.003616	Schwarz criterion	-6.986900
Log likelihood	266.3262	Hannan-Quinn criter.	-7.024024
F-statistic	0.006906	Durbin-Watson stat	1.742251
Prob(F-statistic)	0.933996		

Level with trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.419378	0.3668
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

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

Residual variance (no correction)	4.46E-05
HAC corrected variance (Bartlett kernel)	4.59E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 08/17/17 Time: 00:11
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)	-0.145861	0.061066	-2.388569	0.0195
C	0.635062	0.263686	2.408397	0.0186
@TREND("1998Q1")	0.000847	0.000351	2.410379	0.0185

R-squared	0.074756	Mean dependent var	0.005702
Adjusted R-squared	0.049055	S.D. dependent var	0.006991
S.E. of regression	0.006817	Akaike info criterion	-7.099636
Sum squared resid	0.003346	Schwarz criterion	-7.006936
Log likelihood	269.2363	Hannan-Quinn criter.	-7.062622
F-statistic	2.908644	Durbin-Watson stat	1.627229
Prob(F-statistic)	0.060986		

1st different without trend

Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.904805	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Residual variance (no correction)	4.70E-05
HAC corrected variance (Bartlett kernel)	2.13E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNCPI,2)
Method: Least Squares
Date: 08/17/17 Time: 00:12
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(LNCPI(-1))	-0.884942	0.115905	-7.635067	0.0000
C	0.004926	0.001040	4.738188	0.0000

R-squared	0.447405	Mean dependent var	-6.80E-05
Adjusted R-squared	0.439730	S.D. dependent var	0.009287
S.E. of regression	0.006951	Akaike info criterion	-7.073115
Sum squared resid	0.003479	Schwarz criterion	-7.010842
Log likelihood	263.7052	Hannan-Quinn criter.	-7.048273
F-statistic	58.29425	Durbin-Watson stat	1.927672
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 13 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.017141	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Residual variance (no correction)	4.68E-05
HAC corrected variance (Bartlett kernel)	1.89E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNCPI,2)
Method: Least Squares
Date: 08/17/17 Time: 00:13
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPI(-1))	-0.886573	0.116472	-7.611905	0.0000
C	0.004080	0.001785	2.285206	0.0253
@TREND("1998Q1")	2.22E-05	3.80E-05	0.584474	0.5608

R-squared	0.450051	Mean dependent var	-6.80E-05
Adjusted R-squared	0.434559	S.D. dependent var	0.009287
S.E. of regression	0.006983	Akaike info criterion	-7.050887
Sum squared resid	0.003462	Schwarz criterion	-6.957479
Log likelihood	263.8828	Hannan-Quinn criter.	-7.013626
F-statistic	29.05140	Durbin-Watson stat	1.934349
Prob(F-statistic)	0.000000		

Variable: LNREER

Level without trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.439063	0.5587
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

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

Residual variance (no correction)	0.000530
HAC corrected variance (Bartlett kernel)	0.000572

Phillips-Perron Test Equation
Dependent Variable: D(LNREER)
Method: Least Squares
Date: 08/17/17 Time: 00:14
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNREER(-1)	-0.081500	0.062085	-1.312723	0.1934
C	0.370898	0.284126	1.305402	0.1959

R-squared	0.023062	Mean dependent var	-0.002063
Adjusted R-squared	0.009679	S.D. dependent var	0.023446
S.E. of regression	0.023332	Akaike info criterion	-4.651673
Sum squared resid	0.039740	Schwarz criterion	-4.589873
Log likelihood	176.4377	Hannan-Quinn criter.	-4.626997
F-statistic	1.723242	Durbin-Watson stat	1.988765
Prob(F-statistic)	0.193388		

Level with trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.806008	0.6921
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

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

Residual variance (no correction)	0.000515
HAC corrected variance (Bartlett kernel)	0.000551

Phillips-Perron Test Equation
Dependent Variable: D(LNREER)
Method: Least Squares
Date: 08/17/17 Time: 00:15
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNREER(-1)	-0.109929	0.064645	-1.700493	0.0934
C	0.508153	0.297369	1.708828	0.0918
@TREND("1998Q1")	-0.000188	0.000130	-1.453766	0.1504

R-squared	0.050920	Mean dependent var	-0.002063
Adjusted R-squared	0.024557	S.D. dependent var	0.023446
S.E. of regression	0.023156	Akaike info criterion	-4.653937
Sum squared resid	0.038607	Schwarz criterion	-4.561237
Log likelihood	177.5226	Hannan-Quinn criter.	-4.616923
F-statistic	1.931480	Durbin-Watson stat	1.989457
Prob(F-statistic)	0.152369		

1st different without trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.134520	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Residual variance (no correction)	0.000537
HAC corrected variance (Bartlett kernel)	0.000545

Phillips-Perron Test Equation
Dependent Variable: D(LNREER,2)
Method: Least Squares
Date: 08/17/17 Time: 00:16
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(LNREER(-1))	-1.071072	0.117200	-9.138855	0.0000
C	-0.001817	0.002738	-0.663784	0.5089

R-squared	0.537033	Mean dependent var	6.37E-05
Adjusted R-squared	0.530603	S.D. dependent var	0.034279
S.E. of regression	0.023485	Akaike info criterion	-4.638240
Sum squared resid	0.039712	Schwarz criterion	-4.575968
Log likelihood	173.6149	Hannan-Quinn criter.	-4.613399
F-statistic	83.51867	Durbin-Watson stat	1.925109
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNREER) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.256511	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Residual variance (no correction)	0.000524
HAC corrected variance (Bartlett kernel)	0.000534

Phillips-Perron Test Equation
Dependent Variable: D(LNREER,2)
Method: Least Squares
Date: 08/17/17 Time: 00:18
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNREER(-1))	-1.085224	0.117154	-9.263199	0.0000
C	0.004543	0.005606	0.810385	0.4204
@TREND("1998Q1")	-0.000166	0.000128	-1.298176	0.1984

R-squared	0.547767	Mean dependent var	6.37E-05
Adjusted R-squared	0.535028	S.D. dependent var	0.034279
S.E. of regression	0.023374	Akaike info criterion	-4.634671
Sum squared resid	0.038791	Schwarz criterion	-4.541263
Log likelihood	174.4828	Hannan-Quinn criter.	-4.597410
F-statistic	42.99941	Durbin-Watson stat	1.942528
Prob(F-statistic)	0.000000		

Variable: LNCRU

Level without trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.959711	0.3038
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

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

Residual variance (no correction)	0.024924
HAC corrected variance (Bartlett kernel)	0.027152

Phillips-Perron Test Equation
Dependent Variable: D(LNCRU)
Method: Least Squares
Date: 08/17/17 Time: 00:19
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCRU(-1)	-0.059564	0.030638	-1.944103	0.0557
C	0.247029	0.120769	2.045472	0.0444

R-squared	0.049226	Mean dependent var	0.015007
Adjusted R-squared	0.036202	S.D. dependent var	0.162998
S.E. of regression	0.160021	Akaike info criterion	-0.800721
Sum squared resid	1.869287	Schwarz criterion	-0.738921
Log likelihood	32.02702	Hannan-Quinn criter.	-0.776045
F-statistic	3.779535	Durbin-Watson stat	1.573090
Prob(F-statistic)	0.055737		

Level with trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.425635	0.8455
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

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

Residual variance (no correction)	0.024921
HAC corrected variance (Bartlett kernel)	0.027480

Phillips-Perron Test Equation
Dependent Variable: D(LNCRU)
Method: Least Squares
Date: 08/17/17 Time: 00:19
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCRU(-1)	-0.063047	0.047897	-1.316309	0.1922
C	0.255777	0.152492	1.677313	0.0978
@TREND("1998Q1")	0.000127	0.001334	0.095070	0.9245

R-squared	0.049345	Mean dependent var	0.015007
Adjusted R-squared	0.022938	S.D. dependent var	0.162998
S.E. of regression	0.161118	Akaike info criterion	-0.774179
Sum squared resid	1.869052	Schwarz criterion	-0.681480
Log likelihood	32.03173	Hannan-Quinn criter.	-0.737166
F-statistic	1.868634	Durbin-Watson stat	1.567895
Prob(F-statistic)	0.161742		

1st different without trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.748584	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Residual variance (no correction)	0.025334
HAC corrected variance (Bartlett kernel)	0.016740

Phillips-Perron Test Equation
Dependent Variable: D(LNCRU,2)
Method: Least Squares
Date: 08/17/17 Time: 00:20
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(LNCRU(-1))	-0.796665	0.115248	-6.912625	0.0000
C	0.013525	0.018827	0.718384	0.4748

R-squared	0.398920	Mean dependent var	0.002379
Adjusted R-squared	0.390572	S.D. dependent var	0.206699
S.E. of regression	0.161361	Akaike info criterion	-0.783685
Sum squared resid	1.874700	Schwarz criterion	-0.721413
Log likelihood	30.99636	Hannan-Quinn criter.	-0.758844
F-statistic	47.78438	Durbin-Watson stat	1.935313
Prob(F-statistic)	0.000000		

1st different with trend

Null Hypothesis: D(LNCRU) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.311249	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Residual variance (no correction)	0.024759
HAC corrected variance (Bartlett kernel)	0.008534

Phillips-Perron Test Equation
Dependent Variable: D(LNCRU,2)
Method: Least Squares
Date: 08/17/17 Time: 00:21
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCRU(-1))	-0.823176	0.116578	-7.061154	0.0000
C	0.057788	0.039253	1.472202	0.1454
@TREND("1998Q1")	-0.001140	0.000888	-1.283399	0.2035

R-squared	0.412548	Mean dependent var	0.002379
Adjusted R-squared	0.396000	S.D. dependent var	0.206699
S.E. of regression	0.160641	Akaike info criterion	-0.779592
Sum squared resid	1.832195	Schwarz criterion	-0.686184
Log likelihood	31.84491	Hannan-Quinn criter.	-0.742331
F-statistic	24.93048	Durbin-Watson stat	1.936039
Prob(F-statistic)	0.000000		

Variable: LNIPI

Level without trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.508123	0.5242
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

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

Residual variance (no correction)	0.014243
HAC corrected variance (Bartlett kernel)	0.013987

Phillips-Perron Test Equation
Dependent Variable: D(LNIPI)
Method: Least Squares
Date: 08/17/17 Time: 00:22
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIPI(-1)	-0.073443	0.048113	-1.526474	0.1312
C	0.340314	0.218328	1.558726	0.1234

R-squared	0.030932	Mean dependent var	0.007724
Adjusted R-squared	0.017657	S.D. dependent var	0.122050
S.E. of regression	0.120967	Akaike info criterion	-1.360289
Sum squared resid	1.068215	Schwarz criterion	-1.298489
Log likelihood	53.01084	Hannan-Quinn criter.	-1.335613
F-statistic	2.330124	Durbin-Watson stat	1.959052
Prob(F-statistic)	0.131213		

Level with trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.443908	0.0034
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

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

Residual variance (no correction)	0.011868
HAC corrected variance (Bartlett kernel)	0.015585

Phillips-Perron Test Equation
Dependent Variable: D(LNIPI)
Method: Least Squares
Date: 08/17/17 Time: 00:23
Sample (adjusted): 1998Q2 2016Q4
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIPI(-1)	-0.351526	0.085576	-4.107749	0.0001
C	1.434091	0.351158	4.083891	0.0001
@TREND("1998Q1")	0.004356	0.001148	3.795625	0.0003

R-squared	0.192507	Mean dependent var	0.007724
Adjusted R-squared	0.170076	S.D. dependent var	0.122050
S.E. of regression	0.111187	Akaike info criterion	-1.516022
Sum squared resid	0.890109	Schwarz criterion	-1.423323
Log likelihood	59.85084	Hannan-Quinn criter.	-1.479008
F-statistic	8.582417	Durbin-Watson stat	1.749164
Prob(F-statistic)	0.000454		

1st different without trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.834537	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

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

Residual variance (no correction)	0.013034
HAC corrected variance (Bartlett kernel)	0.013034

Phillips-Perron Test Equation
Dependent Variable: D(LNIPI,2)
Method: Least Squares
Date: 08/17/17 Time: 00:25
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(LNIPI(-1))	-1.084196	0.110244	-9.834537	0.0000
C	0.013223	0.013482	0.980759	0.3300

R-squared	0.573253	Mean dependent var	0.004727
Adjusted R-squared	0.567326	S.D. dependent var	0.175959
S.E. of regression	0.115742	Akaike info criterion	-1.448245
Sum squared resid	0.964533	Schwarz criterion	-1.385973
Log likelihood	55.58506	Hannan-Quinn criter.	-1.423404
F-statistic	96.71813	Durbin-Watson stat	2.102500
Prob(F-statistic)	0.000000		

1st different with trend

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.745292	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

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

Residual variance (no correction)	0.013034
HAC corrected variance (Bartlett kernel)	0.013034

Phillips-Perron Test Equation
Dependent Variable: D(LNIPI,2)
Method: Least Squares
Date: 08/17/17 Time: 00:26
Sample (adjusted): 1998Q3 2016Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNIPI(-1))	-1.083820	0.111215	-9.745292	0.0000
C	0.014600	0.027934	0.522651	0.6028
@TREND("1998Q1")	-3.58E-05	0.000635	-0.056392	0.9552

R-squared	0.573272	Mean dependent var	0.004727
Adjusted R-squared	0.561251	S.D. dependent var	0.175959
S.E. of regression	0.116552	Akaike info criterion	-1.421263
Sum squared resid	0.964490	Schwarz criterion	-1.327854
Log likelihood	55.58671	Hannan-Quinn criter.	-1.384001
F-statistic	47.69114	Durbin-Watson stat	2.103432
Prob(F-statistic)	0.000000		

Appendix 4.3: Bounds test

ARDL Bounds Test
Date: 08/17/17 Time: 00:36
Sample: 1999Q1 2016Q4
Included observations: 72
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	6.808699	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Test Equation:
Dependent Variable: D(LNKLCI)
Method: Least Squares
Date: 08/17/17 Time: 00:36
Sample: 1999Q1 2016Q4
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNKLCI(-1))	0.040596	0.043732	0.928272	0.3574
D(LNKLCI(-2))	0.143463	0.041196	3.482465	0.0010
D(LNCPI)	-0.605599	0.618864	-0.978566	0.3322
D(LNCPI(-1))	-0.833940	0.651530	-1.279971	0.2060
D(LNCPI(-2))	-1.168817	0.678037	-1.723824	0.0905
D(LNREER)	0.341080	0.179886	1.896087	0.0633
D(LNREER(-1))	0.647046	0.184531	3.506426	0.0009
D(LNCRU)	-0.025261	0.034452	-0.733213	0.4666
D(LNCRU(-1))	-0.069653	0.033545	-2.076410	0.0426
D(LNCRU(-2))	-0.032486	0.028891	-1.124446	0.2658
D(LNCRU(-3))	-0.056666	0.031382	-1.805677	0.0765
D(LNIPI)	0.854436	0.042534	20.08845	0.0000
C	0.236920	0.778872	0.304184	0.7622
LNCPI(-1)	0.253634	0.148663	1.706102	0.0937
LNREER(-1)	-0.006315	0.114689	-0.055060	0.9563
LNCRU(-1)	0.112544	0.022949	4.903973	0.0000
LNIPI(-1)	0.457539	0.097777	4.679423	0.0000
LNKLCI(-1)	-0.552184	0.113484	-4.865734	0.0000

R-squared	0.937395	Mean dependent var	0.014305
Adjusted R-squared	0.917686	S.D. dependent var	0.102057
S.E. of regression	0.029281	Akaike info criterion	-4.011461
Sum squared resid	0.046297	Schwarz criterion	-3.442295
Log likelihood	162.4126	Hannan-Quinn criter.	-3.784874
F-statistic	47.56202	Durbin-Watson stat	2.061005
Prob(F-statistic)	0.000000		

Appendix 4.4: Cointegration and Long Run Form

ARDL Cointegrating And Long Run Form
Dependent Variable: LNKLCI
Selected Model: ARDL(3, 3, 2, 4, 1)
Date: 08/17/17 Time: 00:44
Sample: 1998Q1 2016Q4
Included observations: 72

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNKLCI(-1))	0.040596	0.043732	0.928272	0.3574
D(LNKLCI(-2))	0.143463	0.041196	3.482465	0.0010
D(LNCPI)	-0.605599	0.618864	-0.978566	0.3322
D(LNCPI(-1))	0.334877	0.969839	0.345292	0.7312
D(LNCPI(-2))	-1.168817	0.678037	-1.723824	0.0905
D(LNREER)	0.341080	0.179886	1.896087	0.0633
D(LNREER(-1))	0.647046	0.184531	3.506426	0.0009
D(LNCRU)	-0.025261	0.034452	-0.733213	0.4666
D(LNCRU(-1))	-0.037167	0.045054	-0.824931	0.4130
D(LNCRU(-2))	0.024180	0.040930	0.590757	0.5571
D(LNCRU(-3))	-0.056666	0.031382	-1.805677	0.0765
D(LNIPI)	0.854436	0.042534	20.088451	0.0000
CointEq(-1)	-0.552184	0.113484	-4.865734	0.0000

Cointeq = LNKLCI - (0.4593*LNCPI -0.0114*LNREER + 0.2038*LNCRU + 0.8286*LNIPI + 0.4291)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI	0.459330	0.221416	2.074508	0.0428
LNREER	-0.011436	0.208795	-0.054772	0.9565
LNCRU	0.203816	0.024174	8.431192	0.0000
LNIPI	0.828599	0.066276	12.502290	0.0000
C	0.429061	1.453980	0.295094	0.7691

Appendix 4.5.1.1: Correlation

	LNCPI	LNREER	LNCRU	LNIPI
LNCPI	1.000000	-0.334873	0.737171	0.857477
LNREER	-0.334873	1.000000	0.012895	-0.345154
LNCRU	0.737171	0.012895	1.000000	0.645929
LNIPI	0.857477	-0.345154	0.645929	1.000000

Appendix 4.5.1.2: Variance Inflation Factor (VIF) and Tolerance value (TOL)

Let LNCPI be the dependent variable:

Dependent Variable: LNCPI
Method: Least Squares
Date: 08/17/17 Time: 03:10
Sample: 1998Q1 2016Q4
Included observations: 76

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNREER	-0.397294	0.160272	-2.478871	0.0155
LNCRU	0.078618	0.015060	5.220435	0.0000
LNIPI	0.244652	0.032829	7.452245	0.0000
C	4.940243	0.789823	6.254873	0.0000

R-squared	0.809204	Mean dependent var	4.538431
Adjusted R-squared	0.801254	S.D. dependent var	0.127182
S.E. of regression	0.056699	Akaike info criterion	-2.850925
Sum squared resid	0.231464	Schwarz criterion	-2.728255
Log likelihood	112.3352	Hannan-Quinn criter.	-2.801900
F-statistic	101.7889	Durbin-Watson stat	0.437701
Prob(F-statistic)	0.000000		

Let LNREER be the dependent variable:

Dependent Variable: LNREER
Method: Least Squares
Date: 08/17/17 Time: 03:11
Sample: 1998Q1 2016Q4
Included observations: 76

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCRU	0.044057	0.011349	3.882201	0.0002
LNIPI	-0.038974	0.030495	-1.278019	0.2053
LNCPI	-0.197923	0.079844	-2.478871	0.0155
C	5.477804	0.250773	21.84363	0.0000

R-squared	0.276333	Mean dependent var	4.574443
Adjusted R-squared	0.246180	S.D. dependent var	0.046093
S.E. of regression	0.040019	Akaike info criterion	-3.547723
Sum squared resid	0.115310	Schwarz criterion	-3.425053

Log likelihood	138.8135	Hannan-Quinn criter.	-3.498698
F-statistic	9.164425	Durbin-Watson stat	0.364226
Prob(F-statistic)	0.000033		

Let LNCRU be the dependent variable:

Dependent Variable: LNCRU
Method: Least Squares
Date: 08/17/17 Time: 03:13
Sample: 1998Q1 2016Q4
Included observations: 76

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIPI	0.241462	0.289831	0.833115	0.4075
LNCPI	3.492610	0.669027	5.220435	0.0000
LNREER	3.928826	1.012010	3.882201	0.0002
C	-31.02267	5.422690	-5.720901	0.0000

R-squared	0.623048	Mean dependent var	3.895360
Adjusted R-squared	0.607342	S.D. dependent var	0.603091
S.E. of regression	0.377912	Akaike info criterion	0.942883
Sum squared resid	10.28284	Schwarz criterion	1.065553
Log likelihood	-31.82956	Hannan-Quinn criter.	0.991908
F-statistic	39.66864	Durbin-Watson stat	0.203558
Prob(F-statistic)	0.000000		

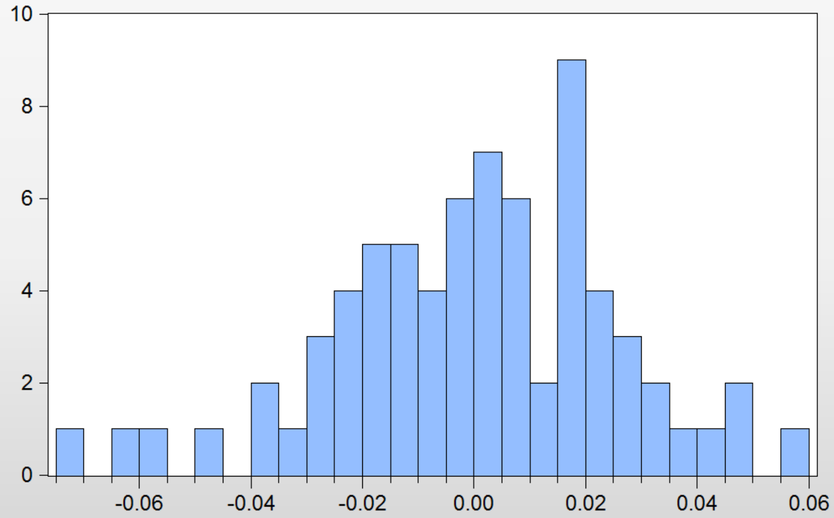
Let LNIPI be the dependent variable:

Dependent Variable: LNIPI
Method: Least Squares
Date: 08/17/17 Time: 03:15
Sample: 1998Q1 2016Q4
Included observations: 76

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI	1.779885	0.238839	7.452245	0.0000
LNREER	-0.569153	0.445340	-1.278019	0.2053
LNCRU	0.039542	0.047463	0.833115	0.4075
C	-1.094005	2.643453	-0.413854	0.6802

R-squared	0.741548	Mean dependent var	4.534354
Adjusted R-squared	0.730779	S.D. dependent var	0.294742
S.E. of regression	0.152931	Akaike info criterion	-0.866460
Sum squared resid	1.683935	Schwarz criterion	-0.743790
Log likelihood	36.92548	Hannan-Quinn criter.	-0.817435
F-statistic	68.86059	Durbin-Watson stat	0.667150
Prob(F-statistic)	0.000000		

Appendix 4.5.2: Jarque-Bera Normality Test



Series: Residuals	
Sample 1999Q1 2016Q4	
Observations 72	
Mean	-1.99e-15
Median	0.001789
Maximum	0.059415
Minimum	-0.073408
Std. Dev.	0.025536
Skewness	-0.327472
Kurtosis	3.371204
Jarque-Bera	1.700232
Probability	0.427365

Appendix 4.5.3: Autocorrelation - Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.111970	Prob. F(1,53)	0.7392
Obs*R-squared	0.151789	Prob. Chi-Square(1)	0.6968

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 08/17/17 Time: 00:58
Sample: 1999Q1 2016Q4
Included observations: 72
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKLCI(-1)	0.031137	0.140990	0.220843	0.8261
LNKLCI(-2)	-0.000953	0.043689	-0.021824	0.9827
LNKLCI(-3)	0.001245	0.041705	0.029849	0.9763
LNCPI	-0.041712	0.636345	-0.065549	0.9480
LNCPI(-1)	0.086577	1.015520	0.085254	0.9324
LNCPI(-2)	-0.047930	0.988347	-0.048495	0.9615
LNCPI(-3)	-0.017395	0.685656	-0.025370	0.9799
LNREER	-0.002467	0.181534	-0.013590	0.9892
LNREER(-1)	-0.009565	0.244459	-0.039127	0.9689
LNREER(-2)	-0.000390	0.186071	-0.002097	0.9983
LNCRU	-5.92E-05	0.034739	-0.001703	0.9986
LNCRU(-1)	-0.002695	0.045978	-0.058620	0.9535
LNCRU(-2)	-0.001109	0.045550	-0.024346	0.9807
LNCRU(-3)	0.000707	0.041324	0.017107	0.9864
LNCRU(-4)	-0.002062	0.032238	-0.063973	0.9492
LNIPI	-0.000259	0.042895	-0.006037	0.9952
LNIPI(-1)	-0.026639	0.127506	-0.208919	0.8353
C	0.072474	0.814674	0.088961	0.9294

RESID(-1)	-0.064456	0.192625	-0.334619	0.7392

R-squared	0.002108	Mean dependent var	-1.99E-15
Adjusted R-squared	-0.336798	S.D. dependent var	0.025536
S.E. of regression	0.029524	Akaike info criterion	-3.985794
Sum squared resid	0.046200	Schwarz criterion	-3.385007
Log likelihood	162.4886	Hannan-Quinn criter.	-3.746619
F-statistic	0.006221	Durbin-Watson stat	2.028235
Prob(F-statistic)	1.000000		

Appendix 4.5.4: Heteroscedasticity – ARCH

Heteroskedasticity Test: ARCH

F-statistic	0.841774	Prob. F(1,69)	0.3621
Obs*R-squared	0.855734	Prob. Chi-Square(1)	0.3549

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/17/17 Time: 01:03
Sample (adjusted): 1999Q2 2016Q4
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000721	0.000142	5.060230	0.0000
RESID^2(-1)	-0.109949	0.119838	-0.917482	0.3621

R-squared	0.012053	Mean dependent var	0.000649
Adjusted R-squared	-0.002265	S.D. dependent var	0.001003
S.E. of regression	0.001004	Akaike info criterion	-10.94205
Sum squared resid	6.95E-05	Schwarz criterion	-10.87831
Log likelihood	390.4428	Hannan-Quinn criter.	-10.91670
F-statistic	0.841774	Durbin-Watson stat	1.918059
Prob(F-statistic)	0.362086		

Appendix 4.5.5 Model Specification - Ramsey RESET Test

Ramsey RESET Test
Equation: UNTITLED
Specification: LNKLCI LNKLCI(-1) LNKLCI(-2) LNKLCI(-3) LNCPI LNCPI(-1) LNCPI(-2) LNCPI(-3) LNREER LNREER(-1) LNREER(-2) LNCRU LNCRU(-1) LNCRU(-2) LNCRU(-3) LNCRU(-4) LNIPI LNIPI(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.173122	53	0.2460
F-statistic	1.376215	(1, 53)	0.2460

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.001172	1	0.001172
Restricted SSR	0.046297	54	0.000857
Unrestricted SSR	0.045126	53	0.000851

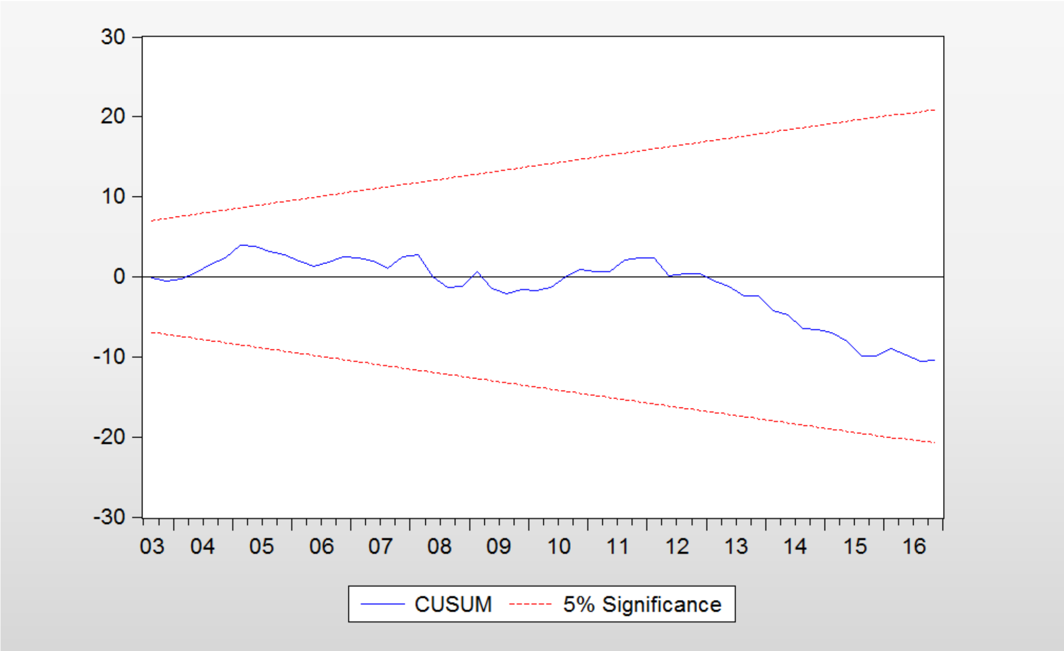
Unrestricted Test Equation:
Dependent Variable: LNKLCI
Method: ARDL
Date: 08/17/17 Time: 01:07
Sample: 1999Q1 2016Q4
Included observations: 72
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic):
Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNKLCI(-1)	0.863306	0.336279	2.567231	0.0131
LNKLCI(-2)	0.175993	0.075776	2.322549	0.0241
LNKLCI(-3)	-0.247682	0.097866	-2.530837	0.0144
LNCPI	-1.092421	0.743338	-1.469616	0.1476
LNCPI(-1)	0.143297	0.975723	0.146862	0.8838
LNCPI(-2)	-0.683267	1.011076	-0.675782	0.5021
LNCPI(-3)	2.163699	1.084327	1.995430	0.0511
LNREER	0.704149	0.357658	1.968778	0.0542
LNREER(-1)	0.517698	0.303513	1.705688	0.0939
LNREER(-2)	-1.118348	0.441837	-2.531132	0.0144
LNCRU	-0.045898	0.038577	-1.189773	0.2394
LNCRU(-1)	0.117975	0.061686	1.912494	0.0612
LNCRU(-2)	0.066078	0.051217	1.290154	0.2026
LNCRU(-3)	-0.046757	0.045100	-1.036728	0.3046
LNCRU(-4)	0.104510	0.051394	2.033510	0.0470
LNIPI	1.549028	0.593604	2.609532	0.0118
LNIPI(-1)	-0.686986	0.266152	-2.581179	0.0126
C	-3.187615	3.020590	-1.055295	0.2961
FITTED^2	-0.058977	0.050274	-1.173122	0.2460

R-squared	0.995469	Mean dependent var	7.011681
Adjusted R-squared	0.993930	S.D. dependent var	0.374522
S.E. of regression	0.029179	Akaike info criterion	-4.009318
Sum squared resid	0.045126	Schwarz criterion	-3.408531
Log likelihood	163.3355	Hannan-Quinn criter.	-3.770143
F-statistic	646.8776	Durbin-Watson stat	2.036131
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Appendix 4.5.6.1: CUSUM Test



Appendix 4.5.6.2: CUSUMSQ Test