CAN COMMON STOCKS HEDGE AGAINST INFLATION? EVIDENCE FROM BRIC (BRAZIL, RUSSIA, INDIA AND CHINA)

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DECLARATION

We hereby declare that:

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

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

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

（4） The word count of this research report is 15,211

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LIST OF ABBREVIATIONS

BRIC	Brazil, Russia, India, China
CPI	Consumer Price Index
GDP	Gross Domestic Product
G7	United States, Japan, Germany, France, Italy, United Kingdom and Canada
IBOVESPA	Bolsa de Valores do Estado de São Paulo Index
N11	Republic Korea, Iran, Mexico, Philippines, Turkey, Indonesia, Egypt, Nigeria, Pakistan, Vietnam and Bangladesh
PPP	Purchasing Power Parity
RTSI	RTS Index
SSE Composite	Shanghai Stock Exchange Composite
S&P BSE SENSEX	S&P Bombay Stock Exchange Sensitive Index

ABSTRACT

This study aims to analyse relationship between stock and consumer prices in Brazil, Russia, India and China (BRIC) in order to determine the validity of Fisher hypothesis. This study employs monthly data that cover the period from November 2001 to December 2013. Phillips-Perron (PP) unit root test and the test of cointegration developed by Engle-Granger (EG) and Johansen-Jusellius (JJ) are employed. The result indicates that there is no long-run equilibrium relationship between the stock and consumer prices. Hence, this finding rejects the Fisher hypothesis in BRIC countries. Then, the findings from Granger causality, impulse response functions and variance decomposition indicate that stock return and inflation possess insignificant short-run nexus during both pre- and post-crisis periods. Some policy implications are suggested for policymakers and investors based on our findings.

CHAPTER 1: INTRODUCTION

1.0 Overview

This chapter provides general background on incentive that inspired the carried out of this study. The vital role that a stock market plays in the economic growth of a country and the consequences of high inflation to the country will be presented. After that, several current issues about the inflation and stock return surrounding the Brazil, Russia, India and China which motivates us to conduct this study will be highlighted. Next, research questions are laid down. Meanwhile, to answer the research questions, several research objectives will be formed. Finally, the contribution of this study is explained and followed by outline of study.

1.1 Research Background

Stock market has been recognized to have a prominent role in the macroeconomic development of a nation because it contributes to the financial liberalization and increases the foreign portfolio flows from industrialized countries. According to Caporale, A Howells and Soliman (2004), economic growth of a country can be fostered by a well-developed stock market through a faster accumulation of capital and an efficient allocation of resources in the long-run. This is because a well-functioning stock market helps to channel the public and private savings into various investment vehicles (Schumpeter, 1934). Stock market helps to direct resources into productive investments because it closely links to the economy of a nation.

Yet, according to Fisher (1993), a high inflation rate in a country will lead to a reduction in terms of growth in investment and productivity. Whenever

inflation is expected to happen in the future, holding cash in hand today is worth more than holding cash in hand in the future. As a result, individuals will reduce their savings which are essential to finance investments which boost economic growth. Besides that, higher inflation rate in a country will lead to difficulty for the businesses to plan for production which will then deteriorate the economic growth of a nation. Barro (1995) indicates that the continuous increase in the inflation rate will reduce the per capita GDP growth rate and erode the purchasing power of individuals with fixed income. Therefore, the inflation can also be served as a leading indicator of a country's economic activity.

Hence, in the present, issue on whether the common stock returns are being able to provide an effective hedge against the inflation has prompted tremendous empirical studies to be carried out. The reason behind is that the common stock offers the investors with limited liability and the potential for the delivery of very large gains as compared to bonds. As a result, the investors nowadays would like to invest in the stock market rather than the bond market in order to deal with the high inflation. Other than that, by investing in common stock, it can also provide liquidity to the investors since it can be converted into cash easily without any loss in value. In addition, it is also possible for the investors to earn from capital gains with an increase in the value of stock and dividend will also be paid out to investors whenever the company earns profits.

Fisher hypothesis was firstly proposed by Irving Fisher (1930) to explain the positive one-for-one relationship between the stock return and expected inflation. He argued that if the nominal interest rates rise proportionately with the expected inflation, then the real interest rate must remain constant. As a result, the investors are being protected from the reduction in their purchasing power whereby the real value of their money has been eroded due to the high inflation.

However, there are some of the previous researchers who have not agreed with the statement as explained by the Fisher hypothesis. As a consequence, they have proposed several hypotheses in order to explain the negative relationship found between the stock returns and inflation. For instance, Fama (1981) comes out with the Fama's or Proxy hypothesis which stated that the stock returns do not

provide a good shelter against the inflation due to the negative relationship found between the inflation and real activity of a nation. Besides that, Inflation illusion hypothesis (Modigliani and Cohn, 1979), Tax effect hypothesis (Feldstein, 1980), Reverse causality hypothesis (Geske and Roll, 1983) and 2-Regime hypothesis (Hess and Lee, 1999) have also been used to describe the negative correlation found between the stock returns and inflation.

1.2 Problem Statement

From the economic perspective, issue on whether the common stock return able to hedge against the inflation has gained vast interest from various parties such as the policymakers as well as the investors. This is because Fisher hypothesis suggested that equity should hedge against the inflation since it serves as a claim on the real assets. Yet, most of the previous empirical studies on developed and industrialized economies have come out with the results that are contradicted with the theory (Berument and Jelassi, 2002; Wong and Wu, 2003). Hence, the final discussion concerning this issue remains inconclusive as previous empirical evidences on this matter remain ambiguous.

In addition, majority of the previous empirical research has been carried out in developed countries such as North America and Europe but empirical evidence on whether the Fisher hypothesis is applicable to the stock market of emerging countries such as Brazil, Russia, India and China (BRIC) is still uncertain. This is due to the reason that until now there is no study that has been carried out in investigating the relationship between stock return and inflation in BRIC countries.

According to Neill (2001), who emphasized on the relationship between the G7 (United States, Japan, Germany, France, Italy, United Kingdom and Canada) and some of the emerging market economies has found that the GDP in US$ on a Purchasing Power Parity (PPP) basis in Brazil, Russia, India and China holds about 23.3 percentage of world GDP at the end of year 2000. As a result,

Neill suggested that these countries will hold a larger percentage in world GDP over the next 10 years and hence grouped these countries into BRIC term. Subsequently, BRIC was first prominently used in the thesis of Goldman investment bank (Wilson and Purushothaman, 2003). Goldman Sachs has forecasted that the economic growth of this particular group of countries plays an important role on the stock market in the near future. The total economic size of the BRIC is forecasted to be exceeded the total size of the economy of the G7 countries given that the BRIC countries possess considerable amount of resources.

From Figure 1.1, it is observed that the BRIC have outperformed the G7. The reason is China has shown a larger percentage in terms of growth rate as measured by the GDP on a PPP in billions US$ from 2001 to 2012, implying that the economy of China is booming. Besides that, the Brazil, Russia and India are performing much better than other G7 countries since these three countries experienced a rapid growth in its economic development from 2001 to 2012.

Furthermore, Figure 1.2 shows that the BRIC have outperformed than the N11 countries (Republic Korea, Iran, Mexico, Philippines, Turkey, Indonesia, Egypt, Nigeria, Pakistan, Vietnam and Bangladesh) which were considered as the competitive emerging markets. This is because the BRIC have occupied the first four places in terms of GDP, PPP measured in billions US$ in 2012 as compared to N11 countries. In addition, these four countries also demonstrate a high growth rate in GDP from 2001 to 2012 as compared to N11 countries.

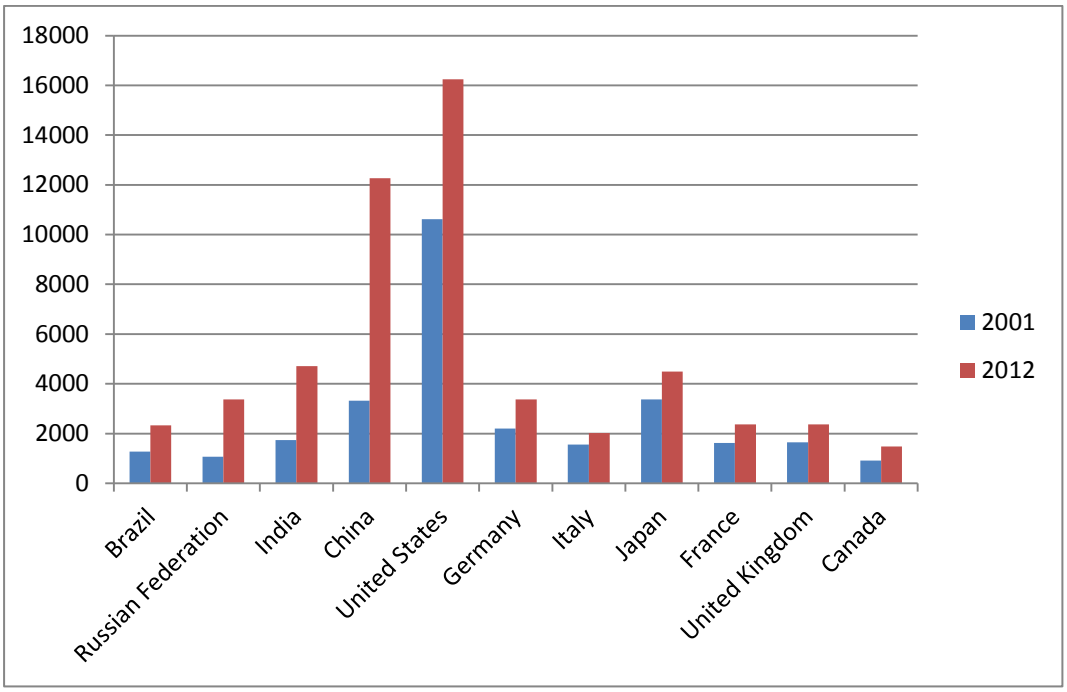


Figure 1.1: GDP, PPP of BRIC and G7 in Billions of US$ in 2001 and 2012

Source: World Bank

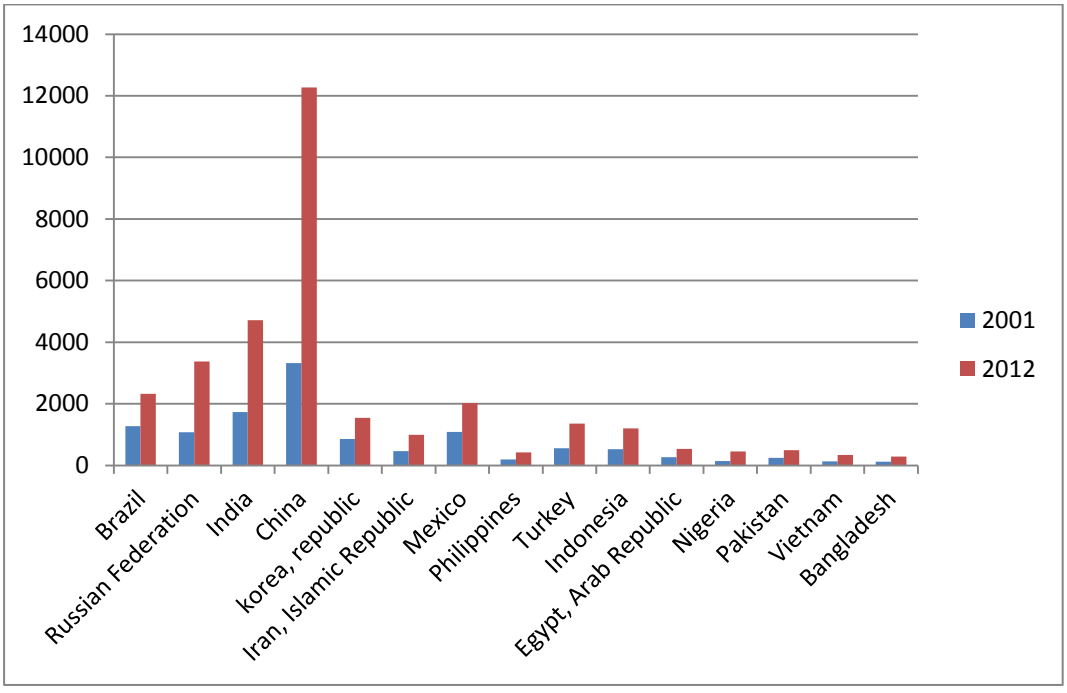


Figure 1.2: GDP, PPP of BRIC and N11 in Billions of US$ in 2001 and 2012

Source: World Bank

As resource-rich economies, the BRIC have adopted a development paradigm which is based on the intensive extraction of natural resources such as fossil and bio-fuels which drive most of the countries' exports. The Brazil and Russia have experienced a strong economic growth due to the economic liberalization and structural reform such as privatization in those countries (OECD, 2011 and Vasiliev, 2000). Moreover, Brazil and India also share the similar characteristics of abundant of natural resources especially the agricultural commodities which may contribute to the countries' comparative advantage. For example, Jain (2011) in her study has mentioned that both Brazil and India enjoyed from trade as a result from the huge exports of agricultural products such as coffee and sugar to other countries.

Besides that, these countries also have comparative advantage in terms of cheap labour, especially in China and India. Wang (1978) in her study stated that China has very cheap labour which gave it the comparative advantage in the production of labour-intensive goods. Batra and Khan (2005) in their study verified that both China and India have enjoyed in the global market due to their comparative advantage in labour-intensive goods whereby these two countries can produce more of a commodity with cheap labour. Moreover, Burange and Chaddha (2008) also suggested that comparative advantage in terms of cheap labour in India has enable the country to enjoy in international trade since it could export the labour-intensive goods to foreign countries after satisfying the domestic demand.

Furthermore, according to the monthly report of World Federation of Exchanges as at December 31, 2012 as illustrated by Figure 1.3, the major stock indexes in the BRIC countries are listed in the top 20 stock exchanges in the world, which are measured by the market capitalization in billions US$. This indicates that the stock markets of BRIC countries are performing well.

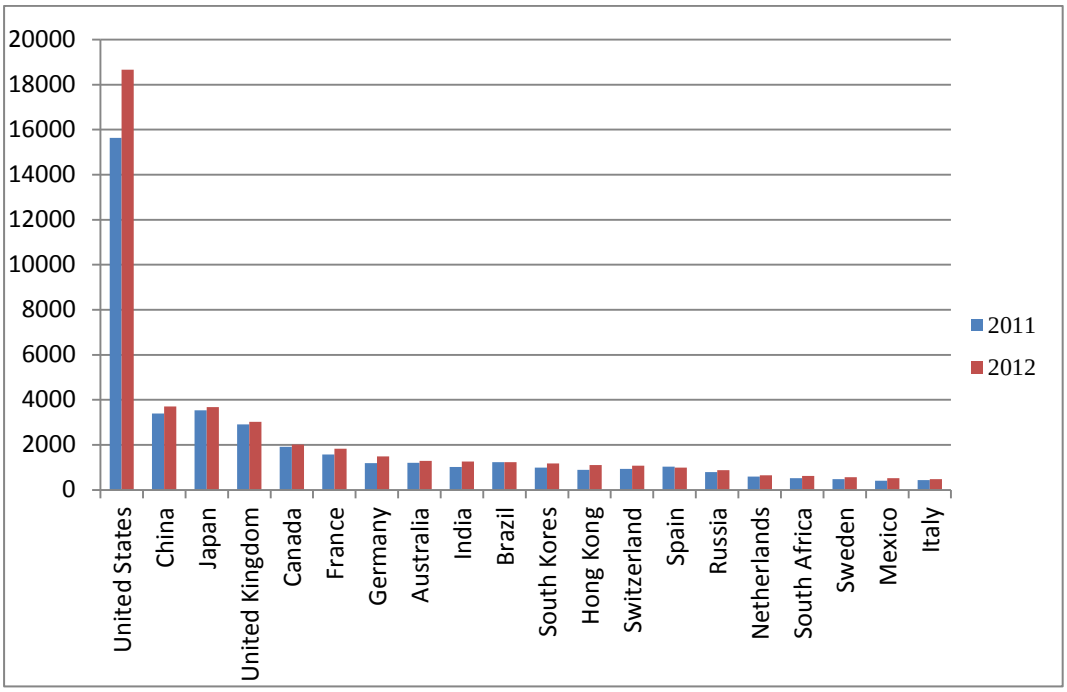


Figure 1.3: Top 20 Major Stock Exchanges in the World (Market Capitalization in Billions US$) as at 31st December 2011 and 2012

Source: Monthly Report, World Federation of Exchange

The high economic growth and extraordinary economy characteristics displayed by the BRIC have promoted them to become strong economy countries like the G7. For the sake of goodness, these conditions have also led the BRIC to become one of the popular stock market in the world. However, similar to other emerging countries, inflation has been surging in BRIC countries over the past years. Based on the World Bank, the inflation rate in Brazil, Russia, India and China are higher than all of the G7 members in 2010 and 2011. During the year of 2012, Brazil, Russia and India have possessed higher inflation rate than other G7 countries which are 5.4 per cent, 5.1 per cent and 9.3 per cent respectively. The inflation rate of China, however, is lower than Italy in 2012.

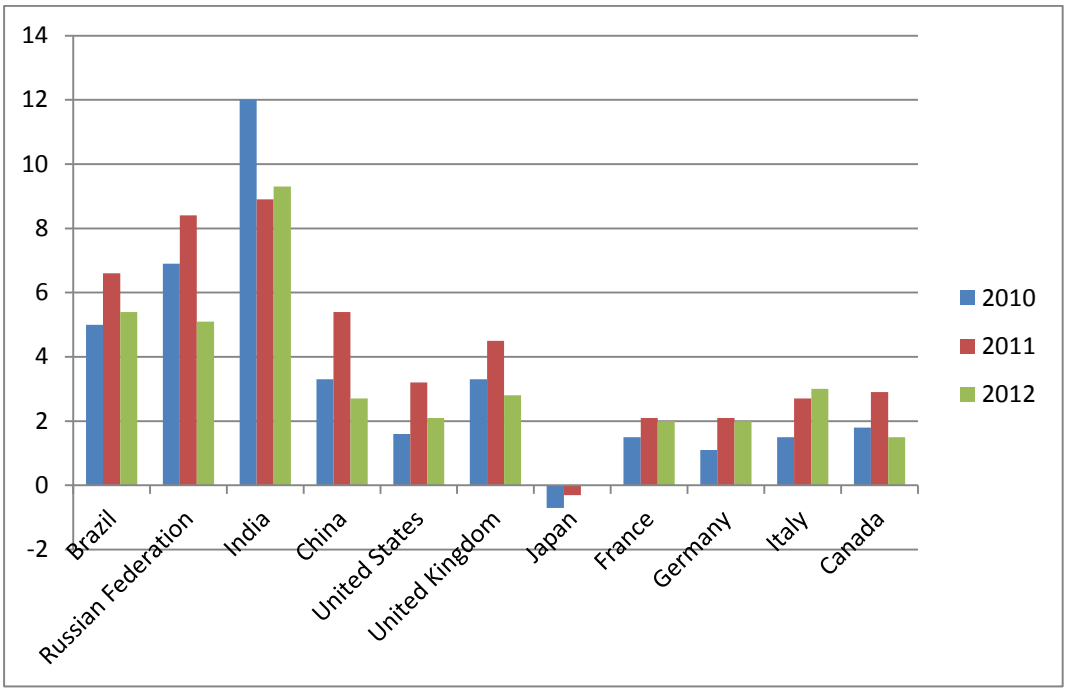


Figure 1.4: Inflation of BRIC and G7 (in percentage) in 2010, 2011 and 2012
Source: World Bank

The high inflation rate in BRIC countries is caused by the rise in the prices of food and energy. This is because given the size of population, a higher weighting of energy and food in consumer price indices in emerging markets has left the countries to be more exposed to the surge in commodity prices. Yet, there are several factors that had contributed to the rise in food prices such as the shortfall in domestic supplies relative to demand, hardening of international prices, shortage of storage facilities as well as insufficient logistics.

However, a too high inflation is unfavourable to the economic growth of a country because it indicates a reduction in the value of money which decreases the purchasing power of an individual. Besides that, the currency of a nation will also depreciate as a result of high inflation which leads to the high repayment of international loan. As a consequence, an increase in interest rate by the central bank in order to deal with the high inflation will increase the cost of borrowing which reduces the demand of consumers for goods and services. Therefore, the economy will slow down since there is a reduction in consumption by the consumers.

In a nutshell, since the BRIC are having a high inflation rate and at the same time the stock markets are performing well, we are interested to know that whether by investing in the BRICs' stock market can generate a return that is high enough to cover the high cost of inflation. Hence, this study is beneficial to be carried out to further examine the relationship between the stock return and inflation and also to determine on whether the Fisher hypothesis is applicable to the stock market in BRIC countries.

1.3 Research Questions

Our study aims to address research questions as follows:

1. Does the Fisher hypothesis holds in the stock market in BRIC countries?
2. Can stock return and expected inflation predict each other in the short-run in BRIC countries?
3. What is the difference of relationship between the stock return and expected inflation during the pre- and post-crisis sub-periods respectively?

1.4 Research Objectives

To answer the research questions mentioned, there are three specific objectives that we attempt to achieve in our study:

1. To determine whether the Fisher hypothesis holds in the stock markets among BRIC.
2. To determine the short-run dynamic linkage between the stock returns and expected inflation using Granger causality test, impulse response function and variance decomposition.

3 To compare the relationship between stock return and expected inflation during the pre- and post-crisis sub-periods among BRIC.

1.5 Significance of Study

This study aims to contribute to the following parties which consist of the investors and policymakers.

1.5.1 Investors

From the investors' perspective, their main objective is to generate extra income so as to hedge against the risk of decreasing in their purchasing power as a result of inflation. In order to achieve their main purpose, most of the investors would like to invest in the stock market rather than bond market since the investments in stock market will come along with a higher liquidity as well as a higher return to the investors. Hence, if the Fisher hypothesis is found to hold in BRIC, implying that the common stock return can provide a good hedge against inflation, then stock market could be an alternative for the investors to achieve their hedging purpose.

Besides that, it is very important for the investors in making an optimal decision based on the causality linkage between the stock return and inflation. If the inflation is found to Granger cause stock return, the investors could use the inflationary trend of BRIC to forecast their stock returns. For example, if the investors found that the inflation can negatively Granger cause the stock return, they can predict that their future stock returns will be lower given that there is a high inflation rate. As a result, the investors can choose to withdraw the possession of stocks to avoid the losing value on the portfolio. Meanwhile, if the inflation can positively Granger cause stock return, the investors can predict that there will be a rise in the stock return when there is a high inflation rate. As a

result, the investors can increase the quantity of stock on hand so as to earn a higher profit from the stock market.

1.5.2 Policymakers

Moreover, this study is very crucial for policymakers to be able to identify the direction of causality between changes in inflation and stock market volatility. If the stock market volatility is found to Granger cause inflation, the policymakers could use the stock market to forecast the future inflationary trend and implement the appropriate monetary policy for controlling the inflation. This is because if a well-performing stock market is found to positively Granger cause the inflation rate in BRIC, the policymakers will form a higher expected inflation when the stock market is booming. As a result, the policymakers can implement a contractionary monetary policy in controlling the future inflation rate during the bullish stock market. On the other hand, if the stock market does not lead inflation or both of the variables stand independently, it is worthless for the policymakers to implement policy for managing the inflation rate in BRIC based on the stock market performance.

1.6 Outline of Study

The remaining chapter of this study proceeds as follow. Chapter 2 is literature review of stock return and inflation relationship. In addition, the validity of Fisher hypothesis and other hypotheses used to explain the rejection of Fisher hypothesis are provided and explained. Besides that, the empirical research on the short-run relationship between stock return and inflation is also discussed in this chapter.

In Chapter 3, the data theoretical framework, econometrics models and research methodology used are explained. Our focus line is to explain the relationship between stock and consumer prices using Fisher hypothesis. In this

chapter, unit root test and cointegration test were employed to examine the validity of Fisher hypothesis in BRIC. Furthermore, Granger causality, impulse response functions as well as the variance decomposition were conducted to identify the short-run causality linkage between stock return and inflation among BRIC. The relationship between the stock and consumer prices was also compared during the pre- and post-crisis periods.

Subsequently, in Chapter 4, statistical results are presented in the form of table and interpreted. Other than that, the justification that leads to our major findings was also being provided in this chapter. Finally, Chapter 5 concludes our study's major findings and provides the policy implications and recommendations for future researchers.

1.7 Conclusion

In short, this chapter will provide a general guideline to the readers on what is going to be discussed in the following chapters to achieve our main objectives. Hence, our study aims to provide useful insights to the readers on whether the Fisher hypothesis is applicable to the stock market of emerging countries such as BRIC. Besides that, the readers will also have a better understanding on the Granger causality linkage between the stock return and inflation through this study.

CHAPTER 2: LITERATURE REVIEW

2.0 Overview

In this chapter, various hypotheses on relationship between stock return and inflation done in previous studies will be explained and discussed. Besides, the past studies on the dynamic relation between the stock returns and inflation are presented and discussed.

2.1 Fisher hypothesis

Irving Fisher (1930) hypothesized that the nominal interest rate was the sum of expected inflation rate and real interest rate. Under a perfect market, the expected inflation and nominal interest rate would possess a positive one-for-one relationship while the real interest rate would act independently in this case.

In principle, the long-run generalized Fisher hypothesis could be extended to the common stock market. If the positive one-for-one movement was found between the nominal stocks return and expected inflation rate, the real stock return should be remained constant. The stock return and inflation could fully compensate each other and provide an effective hedge against the inflation whenever the long-run generalized Fisher hypothesis hold.

For the past decades, the relationship between the stock returns and inflation has brought about huge attention among researchers. There are number of studies that support the Fisher hypothesis. For instance, Wong and Wu (2003) have investigated on whether the Fisher hypothesis holds in the G7 and several Asian countries. Their findings also supported Fisher hypothesis using the instrumental variables estimation method with long horizon data instead of using

ordinary least squares with short horizon data. In the long-run, nominal returns are positively related to expected inflation but not to contemporaneous inflation.

Other than that, Ling, Liew and Wafa (2007) have found that there was a positive relationship between stock return and inflation in the long-run in East Asian countries. They have concluded that monetary policy could be used as an effective tool to influence the long-term interest rates in these East Asian countries' economies to support the Fisher hypothesis. In addition, Alagidede and Panagiotidis (2010) have provided the evidence that common stock was a good shelter to protect investors against the high inflation risk in the major African stock market. Another research was carried out in examining the relationship between stock return and inflation on the Ghana stock market by Adam and Frimpong (2010). Their finding has supported the Fisher hypothesis and provided the signal that high inflation in the developing market would not necessary lead to lower stock returns in the future.

Moreover, there are some of the studies have found that the long-run relationship between stock return and inflation did not exist. Berument and Jelassi (2002) pointed out that the Fisher hypothesis did hold for 9 out of 12 developed countries and 7 out of 14 developing countries which were employed in their study. Their finding suggested that the Fisher hypothesis holds in developed countries rather than the developing countries.

Numerous of previous studies have emphasized on testing the validity of Fisher hypothesis in BRIC individually. For instance, Shanmugam and Misra (200 used the monthly data on real stock return, inflation and real activity from April 1980 to March 2004 to determine whether the Indian stock market returns can provide a good hedge against the inflation. Negative relationship between inflation and stock returns was found during the pre-reform period from April 1980 to March 1990. They argued that this negative relationship happened because of the unexpected inflation. However, the Fisher hypothesis was hold during the post-reform period from April 1990 to March 2004 and it might due to the structural change in the Indian financial system during this period.

Choudhry and Pimentel (2010) have tested the validity of Fisher hypothesis in Brazil during unstable inflation and stable inflation periods. Their finding indicated that the Fisher hypothesis holds in the unstable inflation period and the hypothesis was being rejected under the stable inflation period. According to Geetha, Mohidin, Chandran and Chong (2011), the inflationary pressure would reduce the company future expected profits and thus the stock market returns tend to negatively related to the expected inflation. It led to the rejection of the Fisher hypothesis which implied the positive long run relationship between the stock returns and inflation. The study of Bhatti and Pak (2013) has rejected the existence of Fisher hypothesis in Russia. The cointegration test result did not indicate that there is a long run relationship between stock return and inflation that both of the series acted as independently.

2.2 The Other Hypotheses

The previous section has discussed the Fisher hypothesis which indicated the positive relationship between the stock returns and inflation. The literature reviews about it in the previous studies are presented. In this section, some other hypotheses will be formed to explain the negative relationship between stock returns and inflation, for instance, Inflation illusion hypothesis (Modigliani and Cohn, 1979), Tax effect hypothesis (Feldstein, 1980), Fama's proxy hypothesis (Fama, 1981), Reverse causality hypothesis (Geske and Roll, 1983) and 2-Regime hypothesis (Hess and Lee, 1999).

2.2.1 Inflation Illusion Hypothesis

Modigliani and Cohn (1979) have carried out an interesting implication for both monetary policymakers and investors as they tend to find whether their investments in stock or real assets could provide an effective hedge against the

inflation. They have explained that the negative relationship exists between the inflation and stock return is due to the mispricing driven by inflation illusion.

Besides that, Modigliani and Cohn (1979) also found out that the ratio of profitable market value began to decline in the late 1960s. The stock market investors might misinterpret that the interest rate would raise parallel with the nominal interest rate during the inflation period. Based on this reason, the investors would misuse the higher nominal interest rate to discount the cash flows. The stock price would be undervalue and could not reflect the actual stock market performance.

Inflation illusion hypothesis stated that some particular form of money illusion, wrong discounting of real cash flows with nominal discount rates might troublesome those stock market investors. When the inflation condition of a country was high, the rational expectation of investors would be higher than the market's subjective expectation, and hence the stock market was undervalued in this case.

Cohen and Vuolteenaho (2005) have used cross-sectional evidence to conclude that the market was affected by the inflation illusion. Lee (2010) revaluated on whether the inflation illusion exists in the stock return-inflation relation using long sample period of US international data. He found that investor would use the wrong cost of capital to discount the stock prices under high inflation during the post war period.

2.2.2 Tax Effect Hypothesis

Feldstein (1980) has pointed out that the company needed to pay a higher tax payment under the situation of high inflation. The reason was that the higher inflation would raise the effective tax rate on corporate source income which led to the reduction in the after-tax profit. As a result, the investors would not choose to purchase the company's common stock and lead to a lower stock price. Hence,

the stock return would decrease and thus the relationship between stock return and inflation should be negatively related.

Furthermore, Feldstein (1980) stated that an increase in inflation would reduce the purchasing power of investors to pay for shares which caused the price-earnings ratio of stock return to decline. Therefore, inflation and stock returns would consist of a negative relationship. In fact, their result was contradicted with the Fisher hypothesis which stated that the stock returns and inflation were positively correlated.

Besides that, Feldstein (1980) explained that a higher inflation would raise the nominal interest but not the real rate of interest as explained by the Fisher hypothesis. In Feldstein's view, the entire nominal interest was subjected to the personal income tax under existing tax rules. Therefore, the real rate of interest which excluding the personal income tax would actually fall.

2.2.3 Fama's or Proxy Hypothesis

The seminar paper of Fama (1981) has found that stock return and inflation were negatively correlated. He mentioned that there was a spurious relationship of dual effect between the inflation and stock returns. The correlation between the two variables was not a causal one. As a result, he explained the negative relationship between stock return and inflation through the money demand theory.

Fama's hypothesis stated that the rising in the inflation would diminish the real activity and money demand. This reduction in the real economic activity would decrease the corporate profit and stock price. Thus, this negative relationship between the inflation and stock return should be linked indirectly. It was due to the proxy effect of high inflation on real activity.

Durai and Bhaduri (2009) examined the relationship between stock prices, inflation and output for the post-liberalized period in India. Their results showed

that the Fama's Proxy hypothesis was held in short and medium terms. Moreover, Adrangi, Chatrath and Sanvicente (2011) investigated the relationship between stock return and inflation in Brazil using Fama's Proxy hypothesis framework. Their results have suggested that the proxy effect might be valid in the long-run and became invalid in the short-run. They argued that the reason of the negative relationship between the stock returns and inflation was due to the future business profits would affected by the pressure of high inflation. Hence, the stock performance would decline and lead to a drop on the stock returns.

2.2.4 Reverse Causality Hypothesis

Elaborating on the Fama's (1981) work, Geske and Roll (1983) have come out with another explanation on the negative relationship between inflation and stock return. They argued that the linkages between fiscal and monetary policies could be used to explain it. For instance, a reduction in the real economy activity would cause the government to encounter a fiscal deficit. In order to pay off the deficit balance, the treasury would either borrow or issue money through the central bank. The higher the money supplied, the higher the inflation and thus it would bring out the negative reverse causality effect from the stock return to inflation.

Besides that, Geske and Roll (1983) have critiqued on inflation illusion through the theory of rational expectations and market efficiency. Inflation illusion implied that the investors would undervalue the stock price using the higher nominal interest rate to discount cash flow during high inflation period. However, Geske and Roll (1983) believed that the investors were able to make accurate and rational analysis on expected stock return after reviewed the relevant market information, such as the inflation rate. Thus, this rational expectation and market efficiency theories were conflicted with the inflation illusion theory.

On the other hand, Geske and Roll (1983) have also mentioned that Fama's regressions might point wrong direction in terms of the causative arrow. Fama's result showed that the estimated effect of inflation on stock return was far

too large to be plausible. For example, 10 per cent increase in expected inflation would lead to a 50 per cent reduction in expected stock return. Therefore, there were the possibility of reverse causality and spurious correlation between the inflation and stock return. These possibilities have motivated Geske and Roll (1983) to extend the Fama's (1981) work and demonstrated that there was a reserve causality effect from stock return to inflation.

2.2.5 2- Regime Hypothesis

Fama (1981) used the money demand theory to demonstrate a strong negative relation between expected inflation and anticipated real activity. However, he has ignored the impact of the monetary supply in the model of monetary sector because he assumed that the movement in money supply was invariant with respect to real shocks. As a result, Hess and Lee (1999) suggested that a complete model of monetary sector should include both the money demand and money supply process. They stated that the equilibrium process in monetary sector, such as money demand and supply factors have influenced the relationship between the inflation and stock returns.

A negative relationship between stock return and inflation was caused by money demand and counter-cyclical money supply effects. According to Kaminsky, Reinhart and Vegh (2005), the counter-cyclical money supply worked when a country faced recession in its economy which indicated that the stock return has declined in this case. In order to recover from recession, the government would adopt counter-cyclical or expansionary monetary policies by increasing the money supply and depreciating the home currency. Thus, the interest rate has fall due to the rise in money supply. The lower interest rate and depreciated home currency would induce the investment volume and economic output which was able to create employment opportunities for local workers. An increase in the employment rate reflected a decrease in unemployment rate. According to the theory of Philip curve, there was a negative relationship between

unemployment rate and inflation. As a result, the stock returns and inflation should consist of negative relationship.

On the other hands, there would be a positive relationship between stock return and inflation if there were pro-cyclical movements in money, inflation and stock price. When the economy has suffered from recession, implying that the stock return would decline and huge volume of capital outflow occurred. It would lead to the domestic currency to depreciate steeply because the demand for holding domestic currency would decrease. According to Vegh and Vuletin (2012), if the central bank implemented a pro-cyclical monetary policy, it would raise the interest rate in order to prevent the drop in the value of currency. An increase in interest rate would attract the investors to save their money in local bank. Thus, the domestic currency would appreciate back to its initial value.

Yet, an increase in the interest rate would cause the investors to save their money in bank rather than use the money for investment purpose. Thus, the reduction in terms of investment volume has caused the economic output to decline and unemployment rate to rise. At last, the expected inflation would decrease as explained by the Philip's negative relationship between inflation and unemployment rate. Therefore, the pro-cyclical monetary policy would lead to a positive relationship between stock returns and inflation.

2.3 Dynamic Relation

The hypotheses reviewed in the earlier part of the chapter were used to explain the long-run relationship between stock return and inflation. However, numerous of the previous literature emphasized on the short-run causal effect between the stock returns and inflation.

According to Granger (1969), a technique was proposed to determine the direction of causality between two series in the short-run whereby the relationship can be either of a unidirectional or bidirectional relationship. Niarchos and

Alexakis (2000) employed the Granger causality as a tool to test the forecasting ability of stock return based on inflation rate. They have found the reason of the positive dynamic relationship between the inflation and stock return. They have suggested that either the news was reflected with some delay on stock market prices or the stock market was influenced by psychological factors. For instances, increasing price level has led to optimism and further price increase; decreasing price level has led to pessimism and further price decrease.

In addition, Ray (2012) has investigated that stock return was positively related to inflation and hence acted as a hedge against inflation in India. Pal and Mittal (2011) have observed a unidirectional negative causality relation between inflation and stock return in India which was conflicted with Ray's (2012) finding and indicated that stock return was unable to hedge against inflation in the short-run.

DeFina (1991) has explained that negative causality relationship between the stock returns and inflation. The immediate rising costs due to the unexpected inflation would reduce company profits if it could not adjust the output prices quickly. Thus, the stock return price of company would decrease and lead to a decline in stock return. The reason which the company could not adjust the output price immediately was because of the company has the contract signed with its partners. The company has to maintain the output price in the short run based on the contracts. As a result, the unforeseen inflation would negatively cause the company income and decrease its stock price.

2.4 Conclusion

After reviewing several relevant past studies, there are seven hypotheses that had been discussed in explaining the relationship between inflation and stock return. For instance, Fisher (1930) has proposed a hypothesis to explain the positive one-for-one relationship between stock return and inflation which indicated that the stock return will be able to hedge against the inflation. However, some past

studies had come out with the negative relationship between inflation and stock return, which can be explained by the Feldstein's Tax effect hypothesis (1978), Fama's Proxy hypothesis (1981), and Geske and Roll's Reverse causality hypothesis (1983).

Although the previous literatures emphasized on stock return-inflation relation in Brazil, Russia, India and China have been conducted individually, none of any studies grouped these countries as a group to determine the relationship between both series. In recent, the issue on whether the high inflation in BRIC will decrease the purchasing power of the individuals become one of the main concerns for the policymakers and investors in the BRIC. As a result, we would like to further explore the relationship between stock return and inflation in BRIC through our methodology part in the following chapter in order to investigate on whether the Fisher hypothesis holds in BRIC. And also, the causality linkage between both series is determined in order to know that whether they can be used as the indicators to forecast each other.

CHAPTER 3: METHODOLOGY

3.0 Overview

This chapter illustrates employed methodologies in collecting vital information to meet the research objectives of our study. First of all, Fisher hypothesis will be explained in theoretical and empirical frameworks for model interpretation. Subsequently, the source and sample period of the data will be presented. Lastly, some econometric methods will be introduced. For instance, Phillips-Perron (PP) for unit root test, Engel-Granger and Johansen-Juselius test for cointegration test, Vector Autoregressive Model (VAR) and Vector Error Correction Model (VECM) for model regression, and Granger causality test, impulse response function and variance decomposition to examine the dynamic relationship between stock return and inflation in BRIC countries.

3.1 Theoretical Framework

According to Fisher (1930), nominal interest rate is the sum of real interest rate and expected inflation rate. This relationship is called as Fisher hypothesis as follows:

$$N = R + \Pi^e \quad (1)$$

where, N = nominal interest rate

R = real interest rate

Π^e = expected inflation rate

Nominal interest rate is defined as income that lenders received for money lent out or coupon rate for fixed income investments. However, it does not

represent real income for investors because expected inflation rate has taken into account. Therefore, expected inflation rate must be excluded from nominal interest rate in order to determine the real interest rate. So, equation (1) can transform into equation (2).

$$R = N - \Pi^e \quad (2)$$

Equation (2) determines that real interest rate equal to nominal interest rate minus expected inflation rate. Therefore, value of real interest rate is depending on interaction between nominal interest rate and expected inflation. There are three scenarios can be assumed.

Firstly, when the expected inflation rate is greater than the nominal rate ($\Pi^e > N$), the real interest rate is negative-valued. Individuals will lose their purchasing power because the price of goods rise in a higher proportionate than estimated. The interest income received is insufficient to cover the rise in the price of goods.

Secondly, when the expected inflation rate is equal to the nominal rate ($\Pi^e = N$), the real interest rate will equals to zero. In this situation, the purchasing power of the individuals will not be affected. It is because interest income received is sufficient to cover the rise in the prices of goods.

Thirdly, when the expected inflation rate is lower than the nominal rate ($\Pi^e < N$), the real interest rate is positive-valued. Purchasing power of individuals strengthens in this situation. It is because interest rate received is more than sufficient to cover the overall increase in the price of goods.

These scenarios determine how the real income is affected by the nominal rate and expected inflation. To further understand the Fisher hypothesis, equation (1) will become as equation (3):

$$N_t = (E_{t-1}[R_t]) + (E_{t-1}[\Pi_t]) + u_t \quad (3)$$

where, N_t = nominal interest rate

E[ ] = conditional expectation operator

$E_{t-1}[R_t]$= ex-ante real interest rate

$E_{t-1}[\Pi_t]$= ex-ante expected inflation rate

u_t = residual

According to Alagidede and Panagiotidis (2010), stationary with zero mean forecast error,v_{1t} exists between expected and actual inflation rate under rational expectations[1].

$$\Pi_t = E_{t-1}[\Pi_t] + v_{1t} \quad (4)$$

In other word, expected inflation rate equals to actual inflation rate minus zero mean forecast error, which shows in equation (5).

$$E_{t-1}[\Pi_t] = \Pi_t - v_{1t} \quad (5)$$

Similarly, there is a stationary with zero mean forecast error, v_{2t} exists between ex post and ex ante real interest rate as well.

$$R_t = E_{t-1}[R_t] + v_{2t} \quad (6)$$

In other word, expected real interest rate equals to actual real interest rate minus zero mean forecast error, which shows in equation (7).

$$E_{t-1}[R_t] = R_t - v_{2t} \quad (7)$$

[1] Rational expectation proposed by Muth in 1961. This hypothesis stated that economy does not waste information and expectations formed based on structure of entire system. Expectations formed by individuals might be incorrect, but it will be constant over time.

By substituting equations (5) and (7) into equation (3),

$$N_t = (R_t - v_{1t}) + (\Pi_t - v_{2t}) + u_t \quad (8)$$

Replacing ω_t for error terms ($\omega_t = u_t - v_{1t} - v_{2t}$), then equation (8) will be become as equation (9).

$$N_t = R_t + \Pi_t + \omega_t \quad (9)$$

Rapach and Weber (2004) stated that the stationary properties of R_t can be identified by the stationary properties of N_t and Π_t, by assuming ω_t is stationary. For instance, R_t will be stationary at level form because both N_t and Π_t are stationary at the level form. However, if both variables are differenced to be stationary, then the long-run relationship between the series might exist.

3.2 Empirical Framework

Fisher hypothesis is applicable in the stock market because common stocks can represent the claims on real assets and it serves the similar function as interest rate. In the context of stock market, nominal stock return is the sum of real stock return and expected inflation. If real stock return remains constant in long-run, this indicates that Fisher hypothesis holds and common stock can provide a good hedge against inflation. The regression of stock price on consumer price is shown as equation (10).

$$P_t = \alpha + \beta CPI_t + \varepsilon_t \quad (10)$$

where, P_t= stock price

CPI_t= Consumer Price Index

α = real rate of stock return

ε_t= residual

The coefficient is valued at unity ($\beta = 1$), when the stock market can fully hedge against inflation. If inflation is partially hedged, then the coefficient value will be between zero and one. Lastly, if stock market has superior performance, then the coefficient value will be greater than one. The cointegration techniques, especially the Engle-Granger (1987) and Johansen and Juselius (1990) tests are used to investigate the long-run and short-run relationship between stock and consumer prices. The Fisher hypothesis holds if the estimated coefficient of the CPI is found to be close to one ($\beta = [1, -1]$).

3.3 Data

The data of stock price index and Consumer Price Index (CPI) are collected for Brazil, Russia, India and China (BRIC). Monthly stock index and CPI data are retrieved from Yahoo! Finance and UTAR Datastream respectively. The sample period of data ranges from November 2001 to December 2013. However, some observations have to waive due to the structure break during the 2007-2008 global financial crisis.

The stock index data collected are IBOVESPA for Brazil, RTSI for Russia, S&P BSE SENSEX for India, and SSE Composite for China. These stock markets are considered as one of the most capitalized markets for BRIC. CPI is served as proxy for inflation variable because it measures price changes of consumer goods and services purchased by households.

Some modifications on data have been carried out. Firstly, both stock index and CPI data are standardized using November 2001 as the base month for pre-crisis period. The last observation for BRIC during pre-crisis period is taken based on the starting point of the structural break on the data. Meanwhile, the base month for BRIC during post-crisis period is based on the ending point of structural break in the data and the last observation is on December 2013. The sample period and total of observation for BRIC during both periods are presented

in Table 3.1. Subsequently, both series are transformed into natural logarithms form in order to reduce the variation of series.

Table 3.1: Sample Period of BRIC during Pre- and Post-Crisis

Country	Pre-crisis Period	Observations	Post-crisis Period	Observations
Brazil	Nov 2001* – May 2008	79	Nov 2008* – Dec 2013	62
Russia	Nov 2001* – May 2008	79	Jan 2009* – Dec 2013	60
India	Nov 2001* – Dec 2007	74	Feb 2009 *– Dec 2013	59
China	Nov 2001* – Oct 2007	72	Oct 2008* – Dec 2013	63

Note: * is base month.

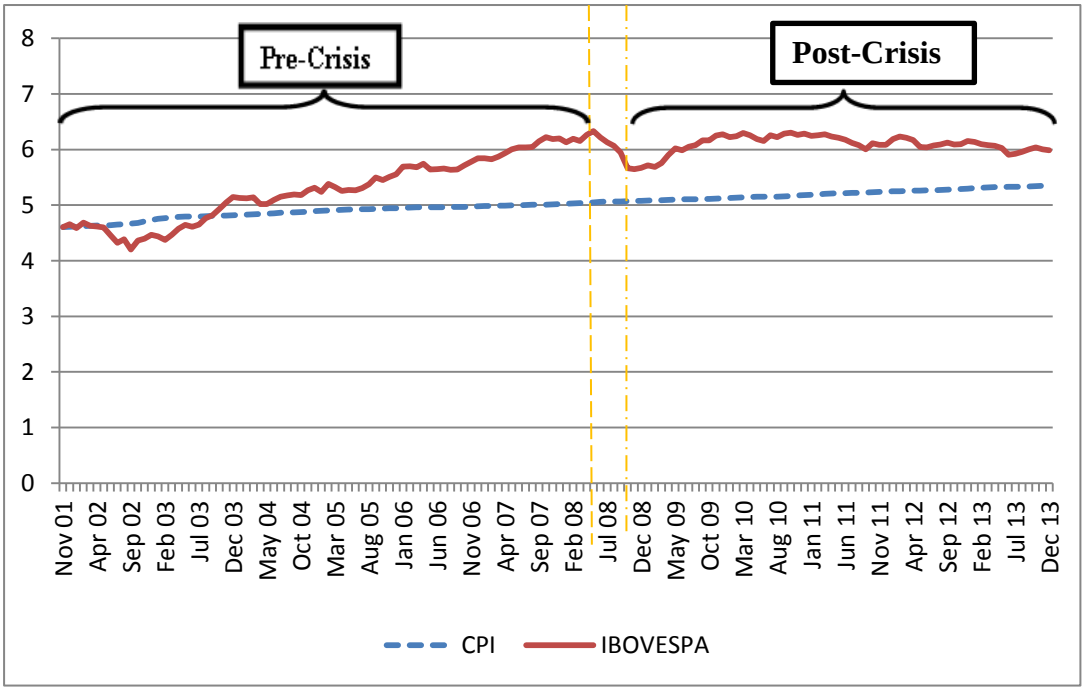


Figure 3.1: The stock and consumer prices movement in Brazil from November 2001 to December 2013

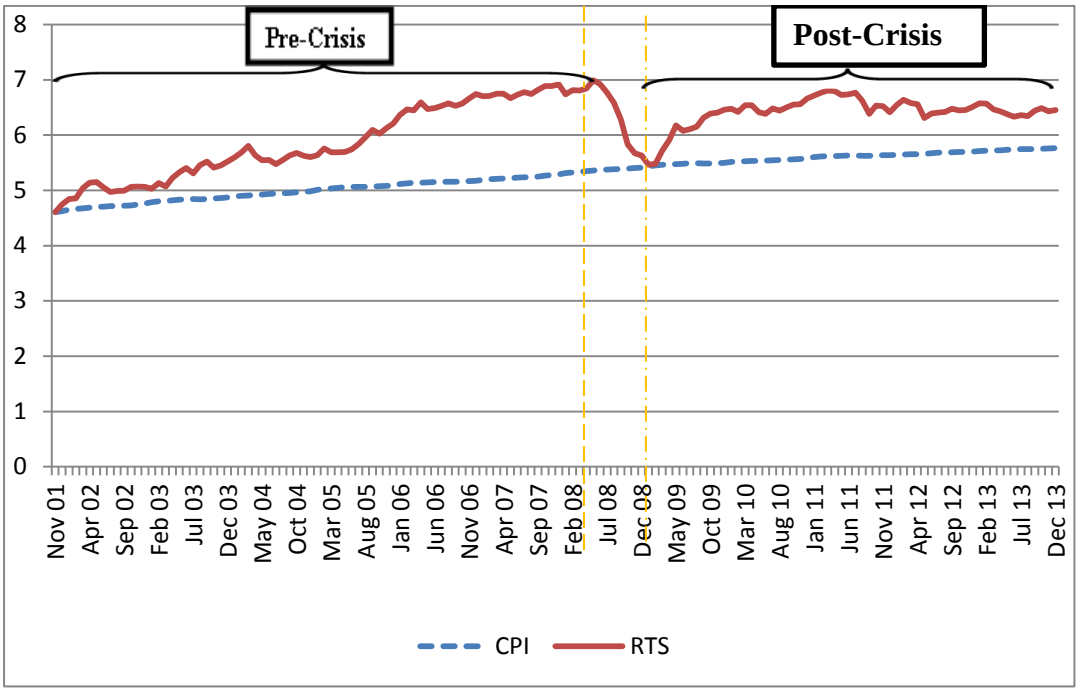


Figure 3.2: The stock and consumer prices movement in Russia from November 2001 to December 2013

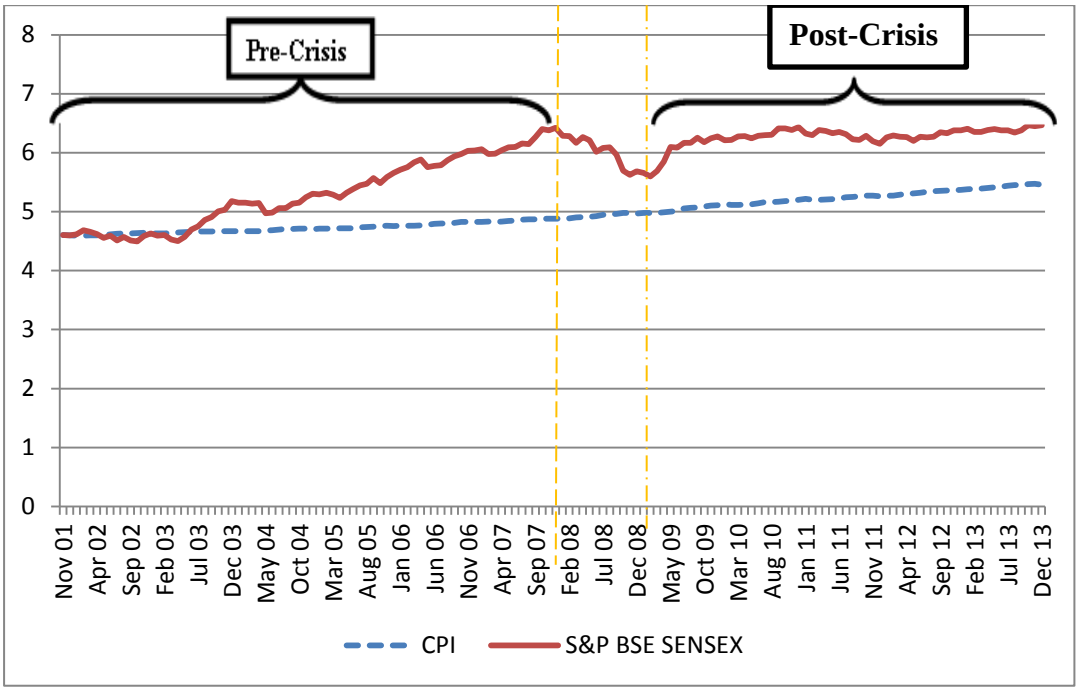


Figure 3.3: The stock and consumer prices movement in India from November 2001 to December 2013

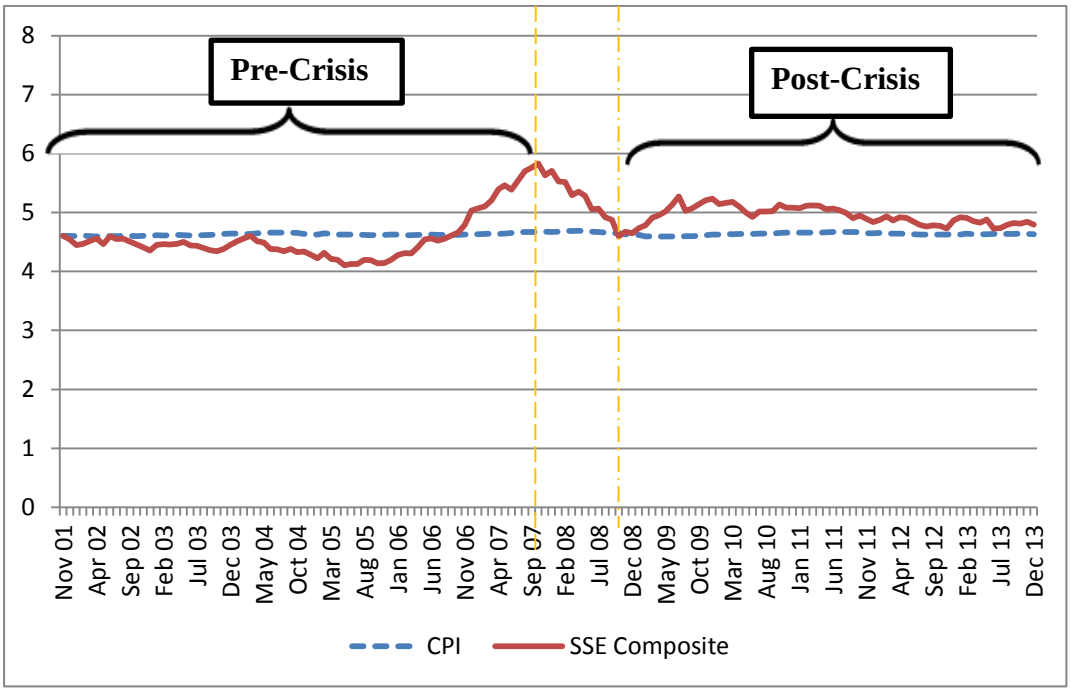


Figure 3.4: The stock and consumer prices movement in China from November 2001 to December 2013

3.4 Econometric Methods

In this study, the EView 6 is used to perform the time-series oriented econometric analysis on the stock and consumer prices. The methodologies, such as PP unit root test, JJ cointegration test, VAR and VECM frameworks, Granger causality test, impulse response function and variance decomposition are conducted in EView 6 to determine the relationship between stock and consumer prices.

3.4.1 Unit Root Test

Stock and consumer prices have long-run relationship if both non-stationary variables follow the same integrated order. Therefore, a unit root test is used to determine the number of integrated orders for stock and consumer prices individually.

The unit root test was firstly developed by Dickey and Fuller (1979) to test the null hypothesis of presence of a unit root. However, this test will lead to the autocorrelation problem because it does not consider the dynamic effect in the time series data. In current, there are two common unit root tests to identify the stationarity of time series data, namely augmented Dickey-Fuller (ADF) and Phillips-Perron (PP). Since there is a small sample size in each sub-period in our study, PP test is being employed because it is more powerful than ADF test in small sample size.

3.4.1.1 Phillips-Perron (PP) Test

PP test is conducted to test the null hypothesis of a unit root ($H_0: \gamma = 0$). The null hypothesis is rejected if the test statistic less than lower bound of critical value. Otherwise, do not reject the null hypothesis. The stock or consumer prices follow integrated order of zero when the null hypothesis of a unit root is not rejected at the level form. If null hypothesis of a unit root is rejected at level form, indicating that variable is not stationary at level form. The null hypothesis of a unit root has to be tested again for the first difference of the variable. It should be tested until the variable is found to be stationary.

$$\Delta y_t = \beta\left(t - \frac{n}{2}\right) + \gamma y_{t-1} + \varepsilon_t \qquad (11)$$

3.4.2 Cointegration Test

If the stock and consumer prices are found to follow the same integrated order, the cointegration analyses are employed to identify these series have long-run relationship. In this study, Engle-Granger (EG) test is used to identify whether long-run relationship exists among the stock and consumer prices by testing the stationarity of the error term. After that, Johansen and Juselius (JJ) cointegration test is conducted to verify the results of EG test by determine the cointegrating

vector (R) among stock and consumer prices. If EG and JJ have conflict result, JJ test's result shall be a priority because it counters problem of EG test.

3.4.2.1 Engle-Granger (EG) test

Engle-Granger test is univariate cointegration approach that able to determine single cointegrating relationship. Once the stock and consumer prices have same order of integration, the Engle-Granger (1987) test will be conducted to identify whether the linear combination of the stock and consumer prices is stationary by identifying the integrated order of residuals. This test is a two-step procedure cointegration analysis approach. First step is to form a long-run equation ($P_t = \alpha + \beta CPI_t + \varepsilon_t$) to obtain the residual (ε_t). Second step is to employ PP test to identify the integrated order for the residual. The null hypothesis for this test is residual is non-stationary. In other word, stock and consumer prices are not cointegrated as residual from long-run equation is not stationary at level form. On the other hand, if the null hypothesis of this test is rejected, which indicate that residual is stationary at level form. At the same time, it also reveals that there is a long-term relation between the stock and consumer prices.

3.4.2.2 Johansen and Juselius (JJ) test

Johansen and Juselius (1990) test is more applicable than the EG test because it introduced multivariate cointegration approach to identify more than one cointegrating relationship. In JJ approach, long-run relationship exists when cointegrating vectors (r) is between zero and maximum number of variables.

There are few steps in conducting JJ test. First of all, Vector Autoregressive (VAR) model is formed to identify optimal lag length of stock return and inflation rate[2]. The optimal lag length is selected based on Schwarz

[2] Stock return is first difference of stock price, and inflation rate is first difference of consumer price.

(1978) Information Criterion (SIC) as SIC provides lowest lag length compared to other criteria, such as Akaike Information Criterion (AIC) and Hannan-Quinn (HQ). The lowest lag length can avoid to loss much information from data because the degree of freedom in the model will be maximized.

Subsequently, hypothesis testing is conducted. There are two test statistics, namely Trace and Eigenvalue tests, used to identify the number of cointegrating vectors (r) between stock and consumer prices. Yet, the null hypothesis for both tests is different. The null hypothesis of Trace test is $H_0: r \leq i$ $(i = 0,1,2)$, while null hypothesis of Eigenvalue test is $H_0: r = i(i = 0,1,2)$. The null hypothesis is rejected if the Trace statistics or Maximum-Eigenvalue statistics is greater than critical value at significance level of 5%.

Since there are two variables in this study, the long-run relationship exists when the number of cointegrating vector is in between zero and two. Therefore, if $H_0: r \leq 1$ and $H_0: r = 1$ are not rejected that indicates that there is one cointegrating vector between the stock and consumer prices, the stock and consumer prices are cointegrated.

After the stock and consumer prices are found to be cointegrated, equation (10) has to be estimated to obtain the estimated coefficient for consumer price (CPI_t). The common stock can provide a good hedge against inflation whenever the coefficient of CPI_t is positively close to one.

3.4.3 Regression Modeling

The cointegration analysis can only determine the long run relationship between stock and consumer prices, yet it unable to analyze short-run relationship between both series. Therefore, Vector Autoregressive Model (VAR) and Vector Error Correction Model (VECM) are used to explain the short run relationship between the two series. If the stock and consumer prices are not cointegrated, this implies that both series only have short run relationship. The VAR is adopted to conduct

the dynamic analysis. However, if both series are found to be cointegrated, the error correction term (ECT_{t-1}) should be added to explain the long run adjustment between both series. Therefore, the VECM should be used to conduct the dynamic analysis.

3.4.3.1 Vector Autoregressive Model (VAR)

This model is an extension of an autoregressive (AR) model by adding multiple variables. The VAR must form by using the stationary series and all series were treated as endogenous in model in order to capture the dynamic effect. As a result, it expresses that each variable depends on its own lag and other variables' lag. Besides, VAR is a simultaneous model that two series in this study can be treated as the dependent variable to explain the dynamic effect. The order (p) of VAR is identified by using SIC in this study. The estimated VAR model for our study is written as follows which all the variables used in the model are all stationary:

$$SR_t = \alpha_1 + \sum_{i=1}^{q} \beta_i INF_{t-i} + \sum_{i=1}^{p} \gamma_i SR_{t-i} + v_{1t} \quad (12)$$

$$INF_t = \alpha_2 + \sum_{i=1}^{q} \beta_i INF_{t-i} + \sum_{i=1}^{p} \gamma_i SR_{t-i} + v_{2t} \quad (13)$$

where, SR_t = stock return

SR_{t-i}= lag term of stock return

INF_t= inflation rate

INF_{t-i}=lag term of inflation rate

v_{1t}, v_{2t}= residual

α_1, α_2= intercept

β_i= estimated parameter for INF , $i = 1,2, \dots, q$

γ_i= estimated parameter for SR , $i = 1,2, \dots, p$

3.4.3.2 Vector Error Correction Model (VECM)

VECM is formed if there is a long-run relationship exists between stock and consumer prices. It is designed to ensure stability of model by putting conditions

on error correction coefficients. Negative error correction coefficient (θ_{11}) in equation (14) serves to ensure that the SR_t falls, while positive error correction coefficient (θ_{21}) in equation (15) serves to ensure that the INF_t rises, thereby correcting the error. The estimated VECM model for our study is written as follows which all the variables are stationary in the system:

$$SR_t = \alpha_{10} + \theta_{11}ECT_{t-1} + \sum_{i=1}^{q} \beta_i INF_{t-i} + \sum_{i=1}^{p} \gamma_i SR_{t-i} + u_{1t} \quad (14)$$

$$INF_t = \alpha_{20} + \theta_{21}ECT_{t-1} + \sum_{i=1}^{q} \beta_i INF_{t-i} + \sum_{i=1}^{p} \gamma_i SR_{t-i} + u_{2t} \quad (15)$$

where, $ECT_{t-1} = P_{t-1} - \alpha_1 - \beta_1 CPI_{t-1}$

u_{1t}, u_{2t} = residuals

α_{10}, α_{20} = intercept

θ_{11}, θ_{21} = error correction coefficients

3.4.4 Short-Run Analysis

Short-run relation between stock returns and inflation will be studied by using either VECM or VAR formed. Three approaches are used to identify the causality effect between the two series. Granger causality analysis is carried out to determine the causal linkage between the stock returns and inflation in BRIC. Variance decomposition and Impulse response function is used to investigate the response of stock return and inflation towards shocks of each other over period.

3.4.4.1 Granger Causality

Granger (1969) causality technique is proposed to determine the direction of causality between two series in the short-run and also identify on whether one series is useful in forecasting another (Harasheh and Abu-Libdeh, 2011). There are two null hypothesis to be tested in Wald test, (1) stock returns does not Granger cause inflation and (2) inflation does not Granger cause stock returns.

There are three possible types of Granger causality under different conditions. If either one of the null hypothesis is not rejected, there is a unidirectional effect among the series. Meanwhile, bidirectional effect is identified whenever both of the null hypotheses are rejected. Whenever the two null hypotheses are not rejected, the stock return and inflation can be concluded as to stay independently in BRIC.

One main disadvantage of Granger causality test is that although it can detect on whether each of the variables will Granger cause another variable, the positive or negative impact between stock returns and inflation is still remained unknown. Moreover, it captures the mean value of the past to affect the current mean value, but not variance. As a result, impulse response function (IRF) and variance decomposition (VD) are conducted to overcome the limitations of this testing.

3.4.4.2 Impulse Response Function (IRF)

IRF shows the reaction of VAR in response to external changes. In our study, IRF is shown in a graph and there are the possibilities for bivariate shocks to exist in the VAR system: one is stock return to inflation and the reverse. The IRF of the stock return or inflation towards each other is considered statistically significant while both the error bands are above or below zero on the y-axis (Weinhagen, 2002). It provides the usefulness to identify the accuracy of the Granger causality test. Besides that, IRF provides a better view than Granger causality analysis as it shows the negative or positive impact, size of shocks' impact and the rate of adjustment over time.

3.4.4.3 Variance Decomposition (VD)

VD is used to interpret the VAR model once it has been fitted. It is constructed from VAR with orthogonal residuals. The variance decomposition table is

constructed in this study to reveal the effect of shocks on stock returns and inflation using the percentage of impact toward the variance of each other. Besides that, it can be used to forecast the stock returns and inflation if strong impact on each other is found. The impact can be either increasing or decreasing significantly (Kazi, 2008).

3.6 Conclusion

In a nutshell, this chapter gives brief introduction towards models, data and methods. First of all, theoretical and empirical frameworks of Fisher hypothesis have been discussed. Subsequently, monthly stock index and CPI has been collected from November 2001 to December 2013. The period of study has to be separated into two sub-periods, namely the pre and post-crisis periods due to the global financial crisis during 2007-2008. Therefore, different number of observations during financial crisis is waived for BRIC. Lastly, econometric methods are presented to serve for several functions, such as PP test for unit root test, EG and JJ test for cointegration test, VAR and VECM, and Granger causality, IRF and VD for short-run analysis.

CHAPTER 4: DATA ANALYSIS

4.0 Overview

In this chapter, methodologies will be employed to conduct the empirical analysis. Statistical results on the nexus between stock return and inflation in Brazil, Russia, India and China (BRIC) on each sub-period are being reported, interpreted and justified. Following by that, the results of each sub-period will be compared with each other in order to identify whether stock return and inflation in both sub-periods have different characteristic.

First of all, the integrated order of the stock and consumer prices is first determined using Phillips-Perron (PP) unit root test. After the integrated order of the series is identified, the cointegration between the two series is tested using the Engle-Granger (EG) and Johansen-Juselius (JJ) Cointegration tests to identify whether there is a long-run or equilibrium relationship between the stock and consumer prices. If the two series are found to be cointegrated, it can be concluded that Fisher hypothesis holds in the BRIC countries.

Subsequently, the Granger causality test is conducted in order to determine the causality linkage between stock return and inflation in the short run. The impulse response function (IRF) is used to determine the change in variance toward one unit shock on the other variable in a system in next six month periods. Besides, variance decomposition (VD) has been employed to reveal the percentage impact of the shock on stock return or inflation toward each other.

4.1 Empirical Results

The results of the econometric analyses which have done in the EView 6 will be presented as a sequence.

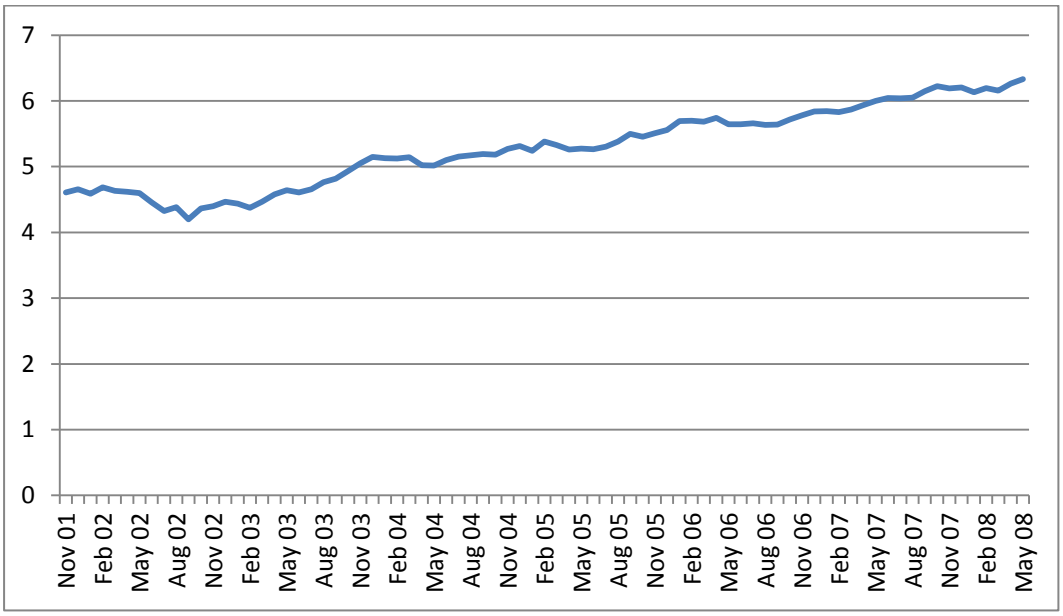
4.1.1 Unit Root Tests

As shown in Figures 4.1 - 4.6, increasing trend can be found for consumer price index (CPI) in Brazil, Russia and India. This indicates that CPI acts dependently during each sub-period and the direction of movement for the consumer price is completely predictable by using the information from the past. Yet, as shown in Figures 4.7 and 4.8, the CPI in China has exhibited a high volatility in terms of fluctuation. The deterministic trend is found on the CPI in Brazil, Russia and India, while there is a stochastic trend on the CPI in China during both sub-periods.

Moreover, the stock price is unstable and has demonstrated a higher volatility than CPI over the entire sample period in BRIC. Figures 4.1 – 4.6 also show that the trend movement on the stock price in BRIC during both sub-periods. Since the cointegration between stock and consumer prices are difficult to be identified based on Figures 4.1 - 4.6, the cointegration analysis has to be employed in order to determine the long run relationship between these series.

Brazil: Pre-Crisis

Stock Price



Consumer Price

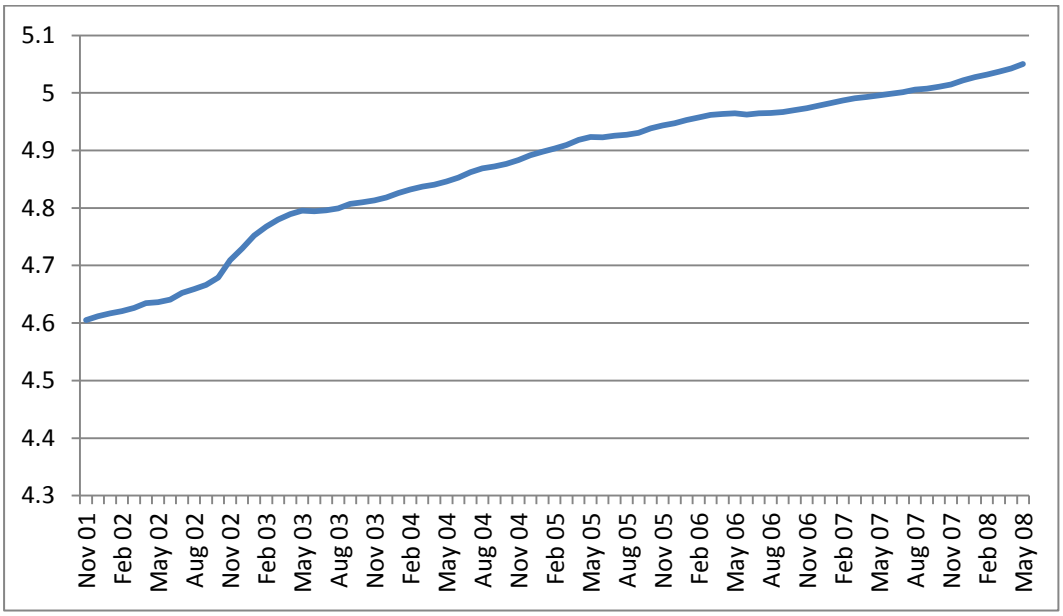
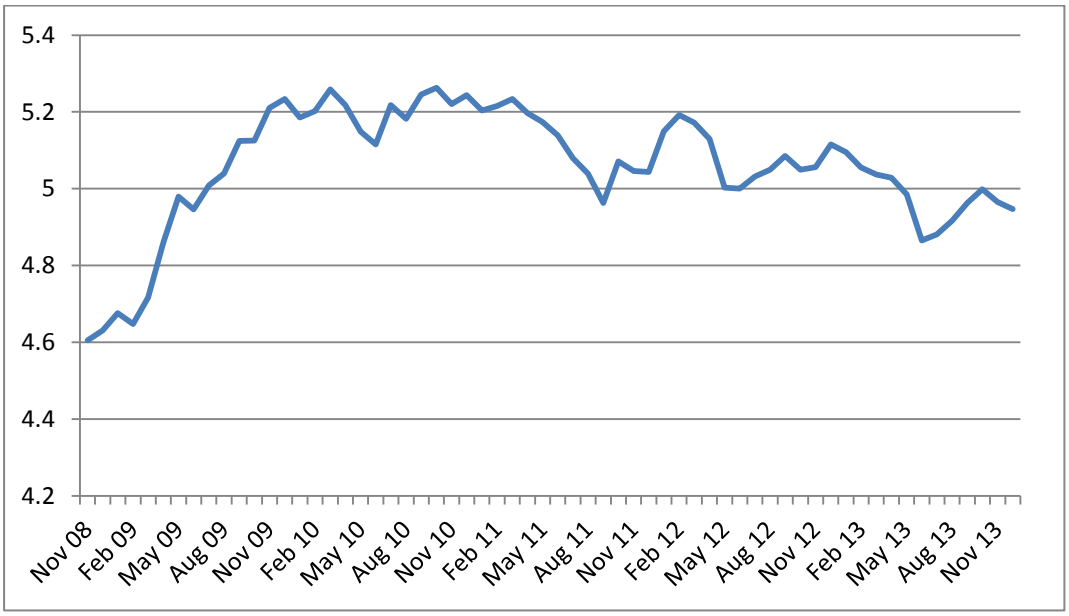


Figure 4.1: Stock and consumer prices movement in Brazil from November 2001 to May 2008.

Brazil: Post-Crisis

Stock Price



Consumer Price

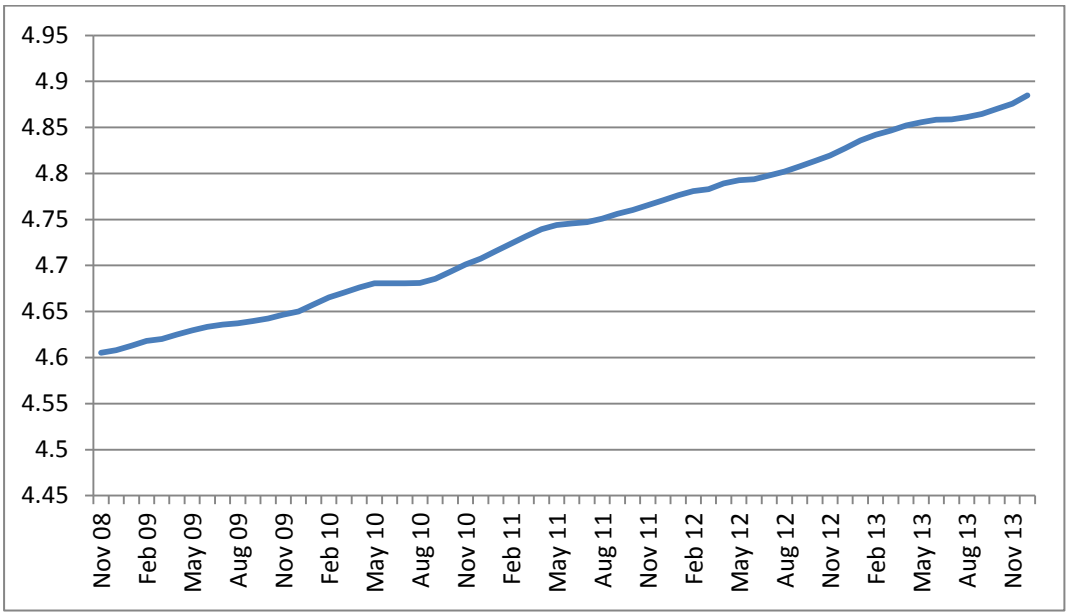
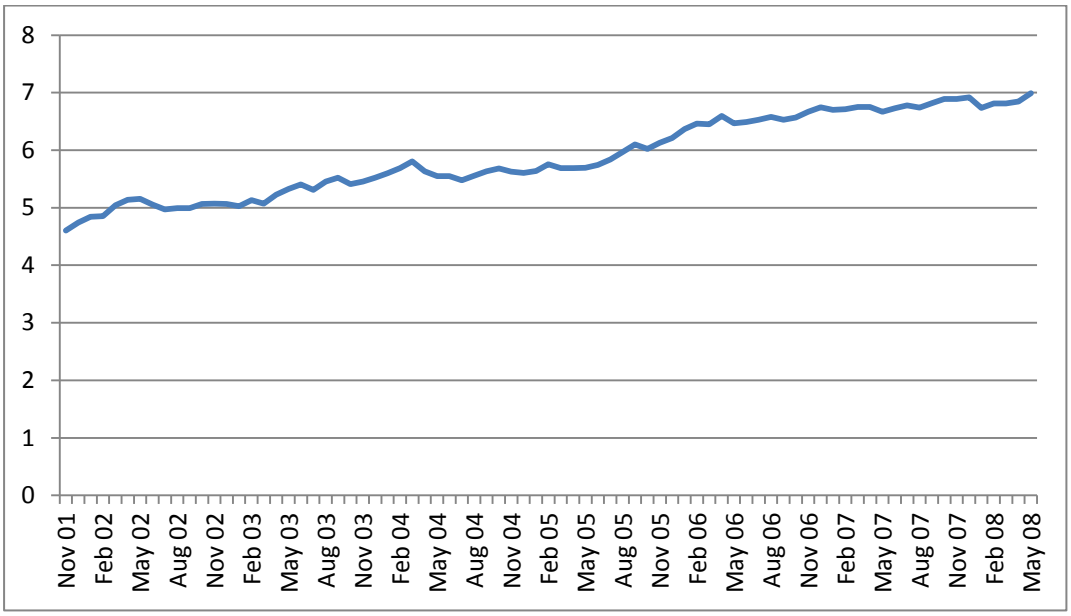


Figure 4.2: Stock and consumer prices movement in Brazil from November 2008 to December 2013.

Russia: Pre-Crisis

Stock Price



Consumer Price

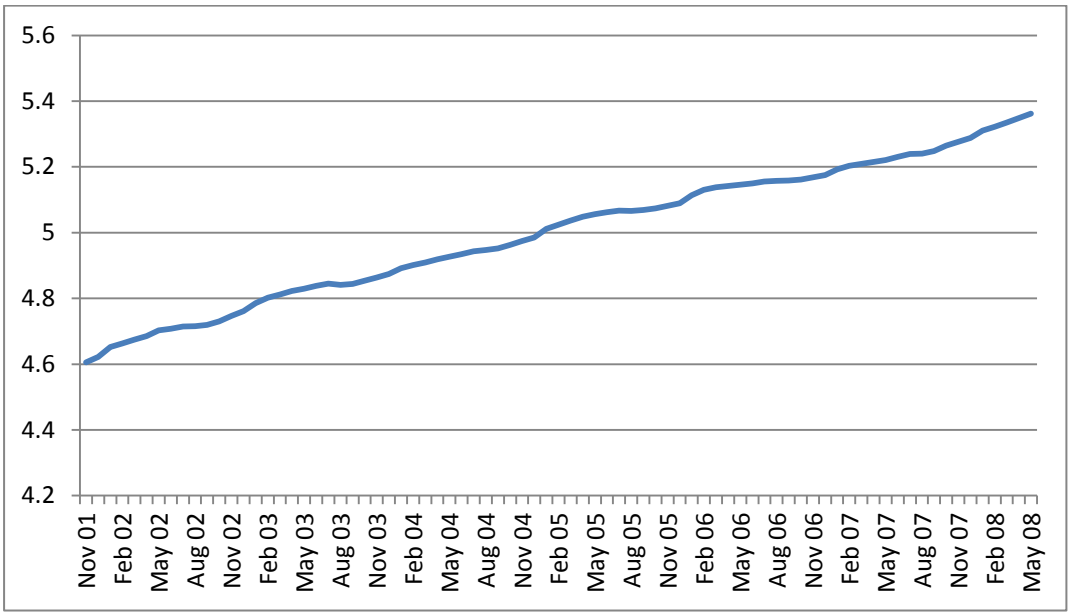
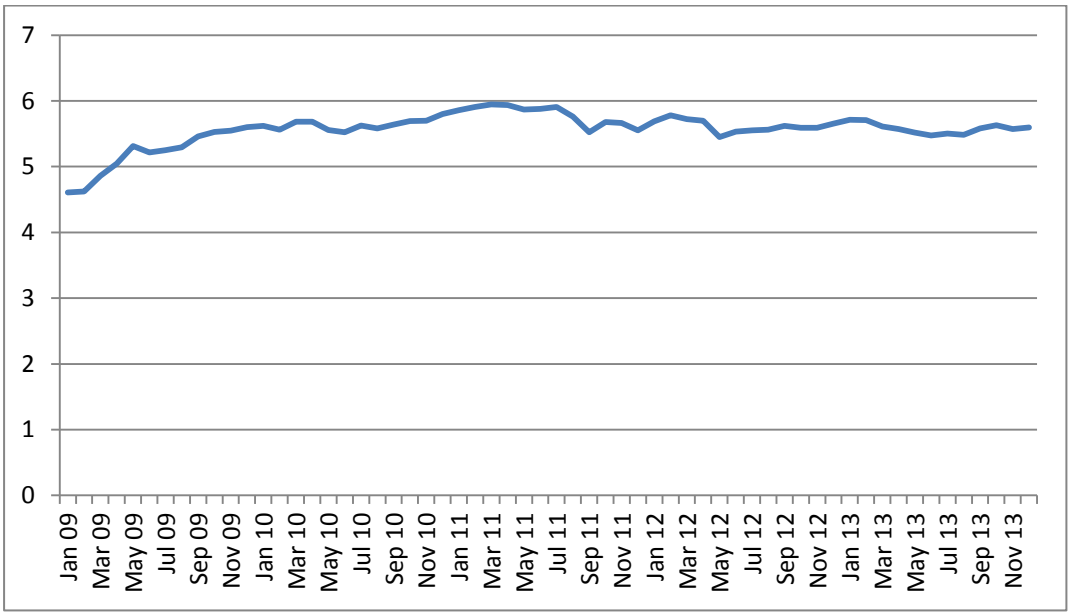


Figure 4.3: Stock and consumer prices movement in Russia from November 2001 to May 2008.

Russia: Post-Crisis

Stock Price



Consumer Price

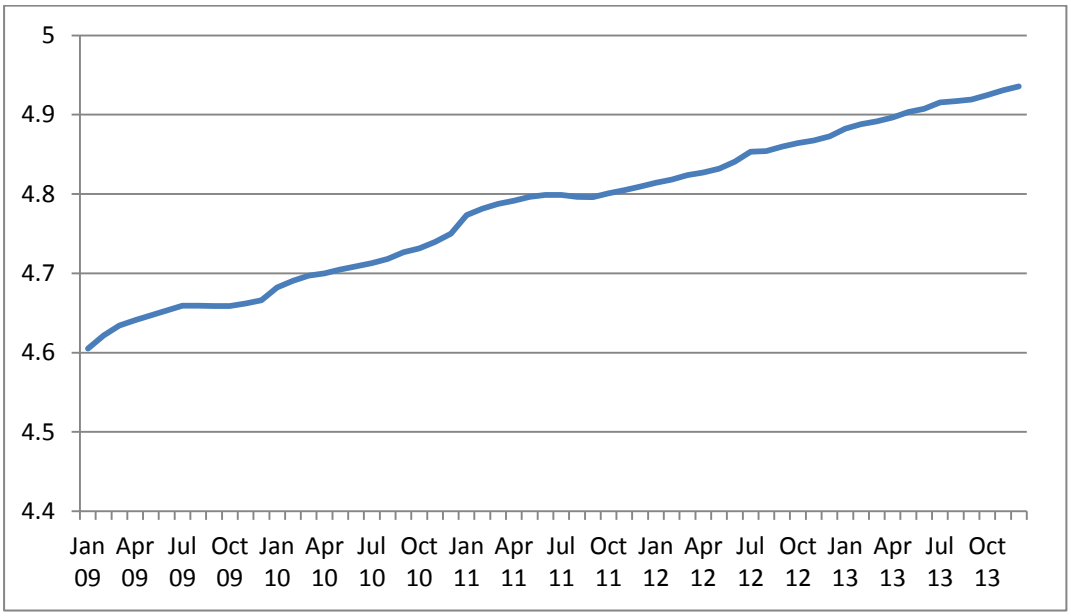
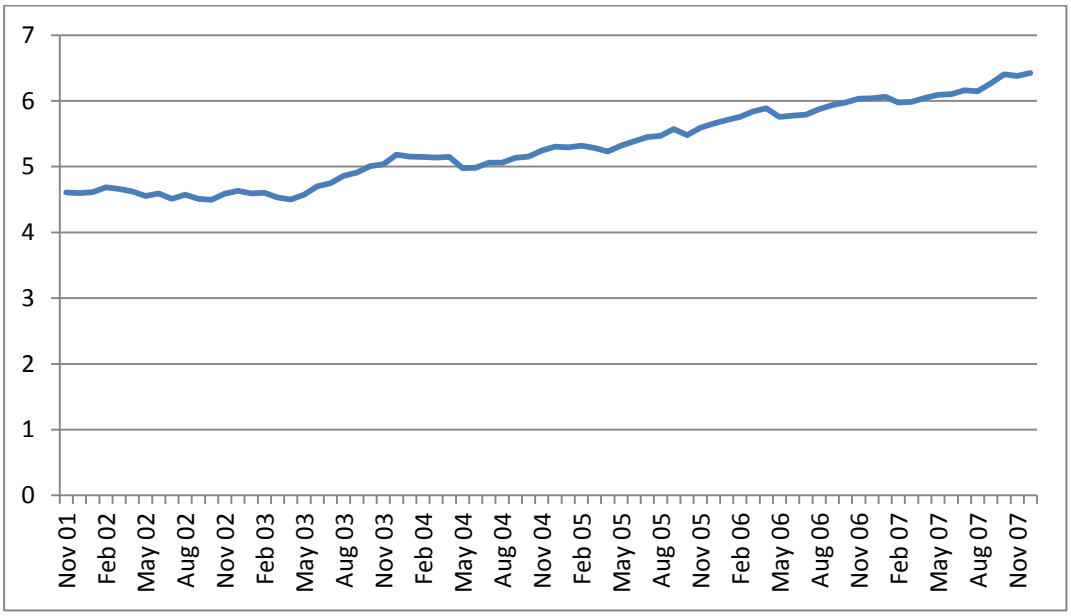


Figure 4.4: Stock and consumer prices movement in Russia from January 2009 to December 2013.

India: Pre-Crisis

Stock Price



Consumer Price

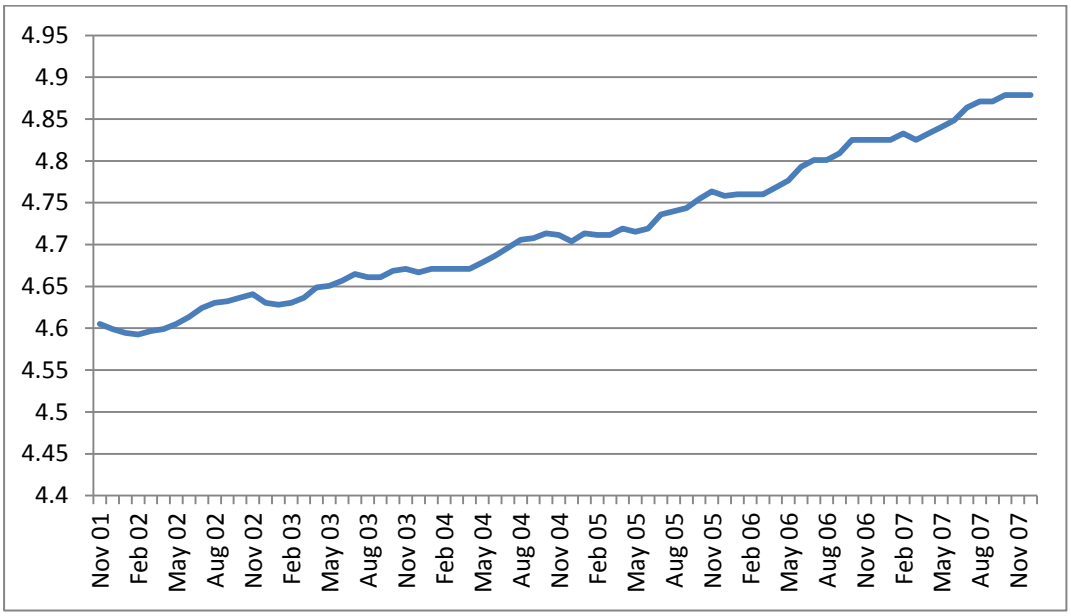
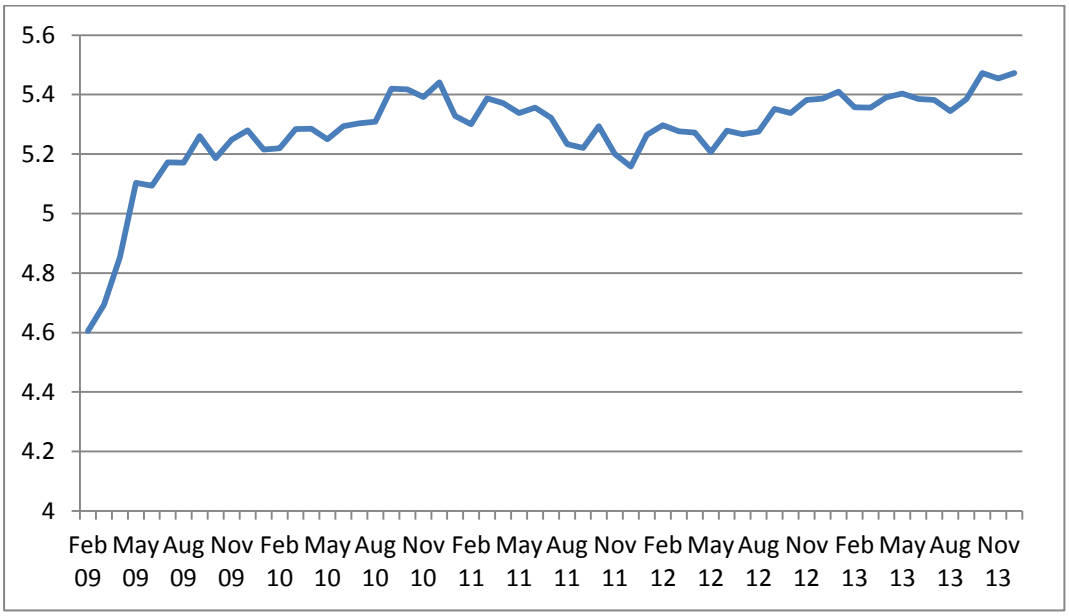


Figure 4.5: Stock and consumer prices movement in India from November 2001 to December 2007.

India: Post-Crisis

Stock Price



Consumer Price

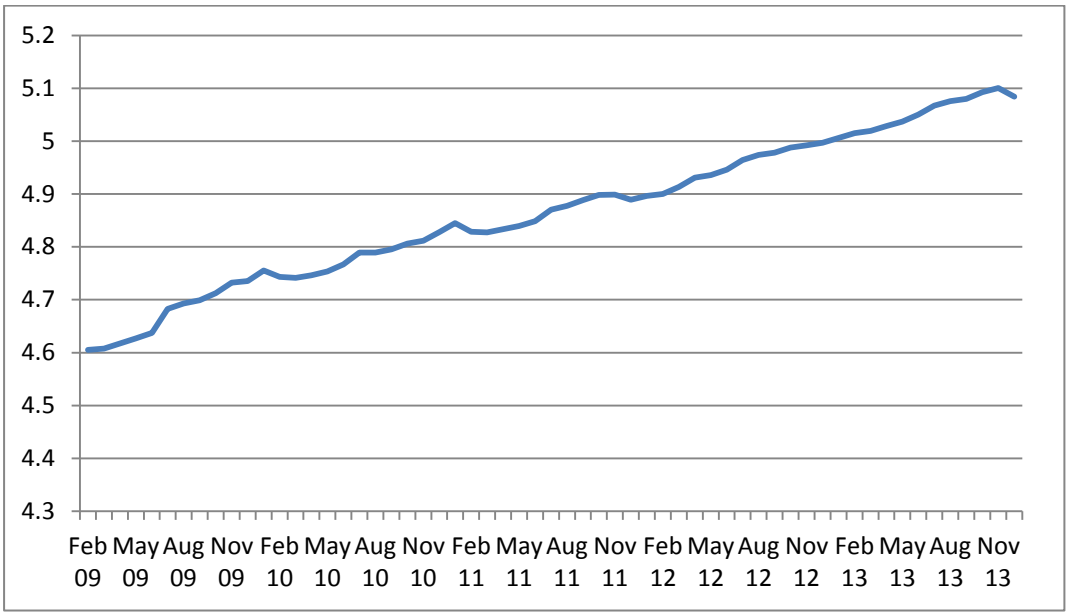
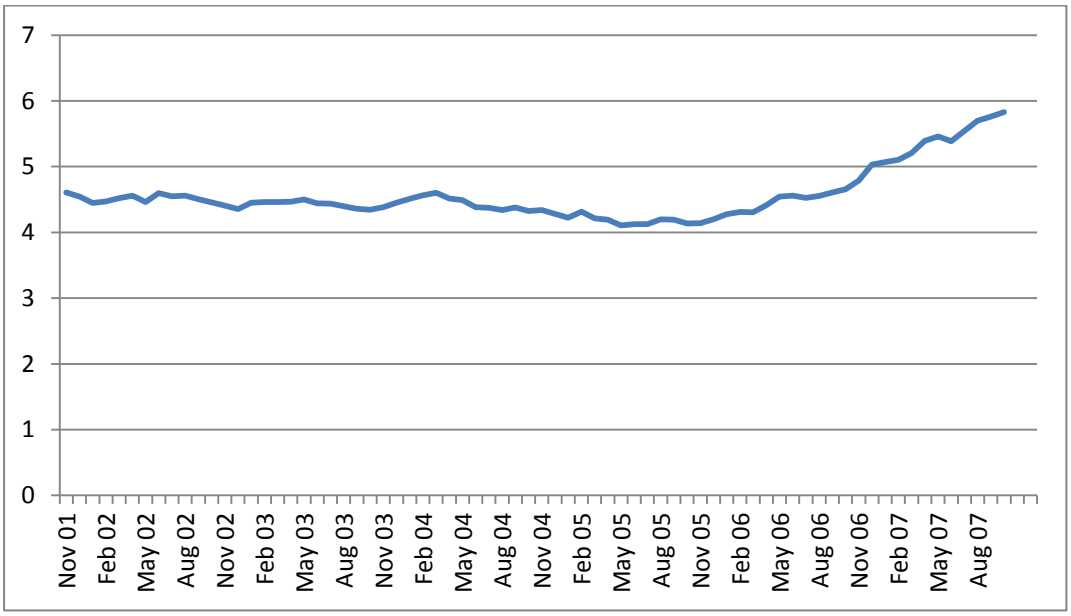


Figure 4.6: Stock and consumer prices movement in India from February 2009 to December 2013.

China: Pre-Crisis

Stock Price



Consumer Price

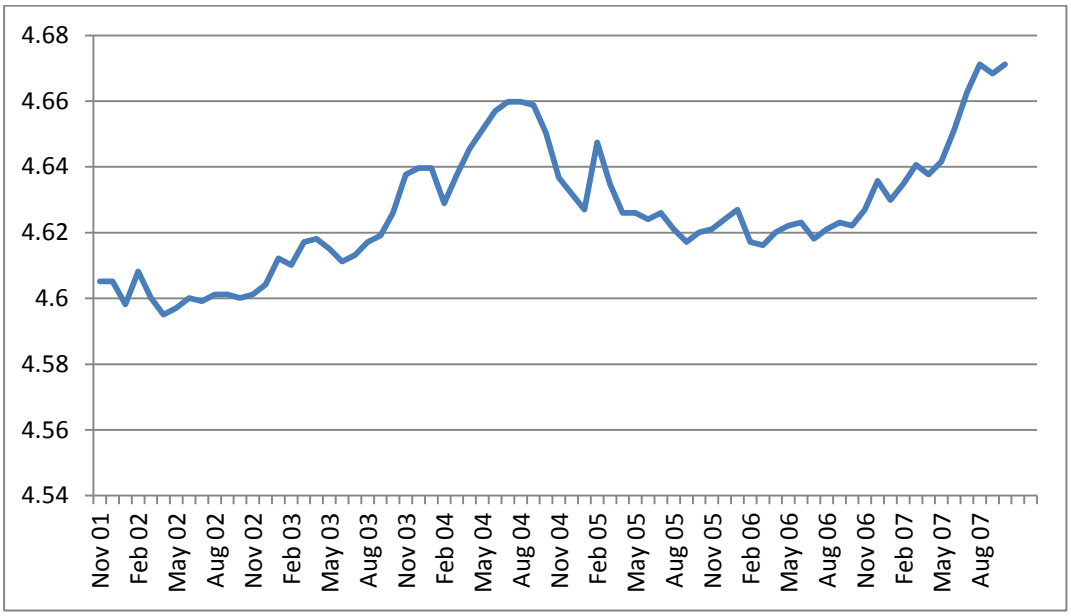
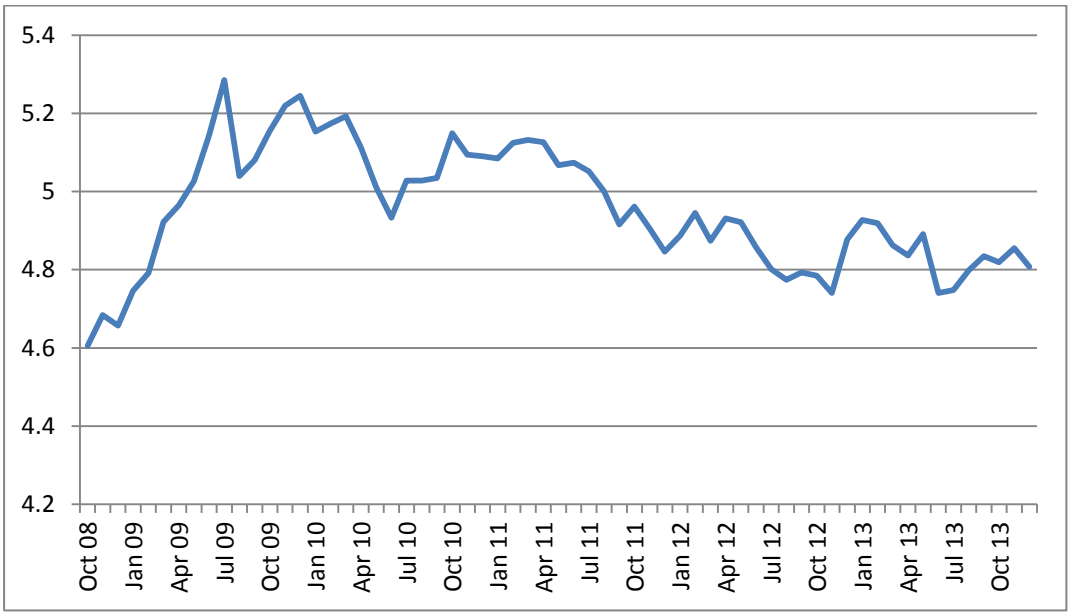


Figure 4.7: Stock and consumer prices movement in China from November 2001 to October 2007.

China: Post-Crisis

Stock Price



Consumer Price

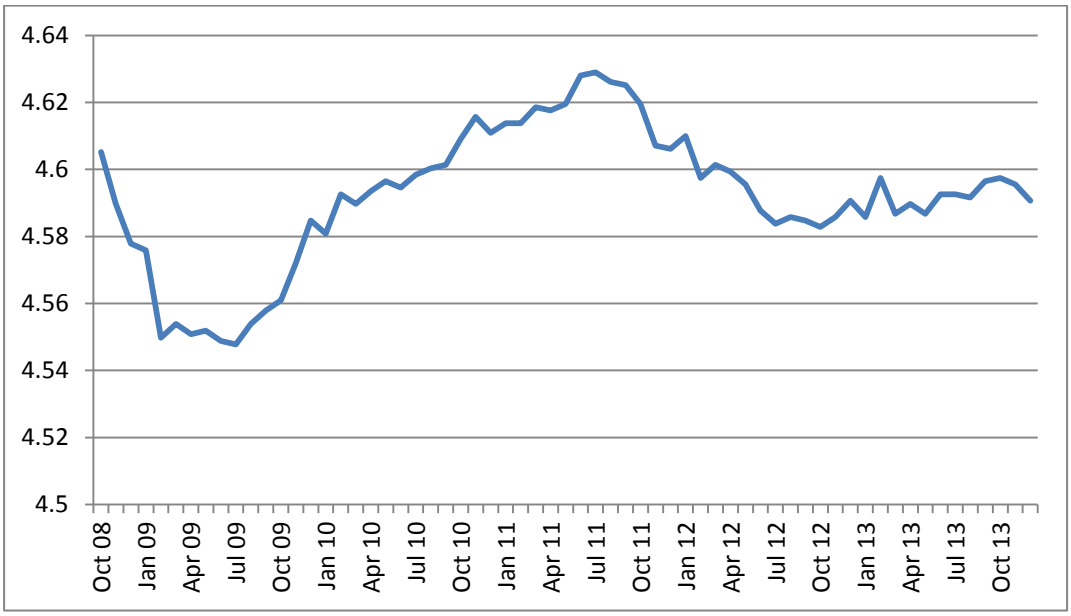


Figure 4.8: Stock and consumer prices movement in China from October 2008 to December 2013.

Notes: Stock Prices represents Ibovespa, RTSI, S&P BSE Sensex and SSE Composite in Brazil, Russia, India and China respectively. Stock and consumer prices are measured in natural logarithm form.

First of all, the stock and consumer prices must have the same integrated order to conduct cointegration analysis. Phillips-Perron (PP) unit root test is employed to test the null hypothesis of a unit root. PP regression model with trend is used to capture the deterministic and stochastic trends in the two series as absented in Figures 4.1 – 4.6. The results of unit root test are shown in the Table 4.1

During the pre-crisis, the null hypothesis of a unit root is not rejected at the level form even at significant level of 10 percent for the stock and consumer prices in BRIC. After undergoing the first difference of the two series, the null hypotheses of non-stationary for stock return and inflation are rejected by significance level of 1 percent in all cases. Therefore, we concluded that the stock and consumer prices in BRIC follow the integrated one order.

During the post-crisis, stock and consumer prices are found to be stationary at first different except of the stock price for Russia and China. However, the rejection of null hypothesis at higher significant level of 1 percent tends to be more reliable and taken in our study. The stock price and consumer price in BRIC during both sub-periods follow integrated order of one process. As a result, our study can proceed to cointegration analysis in order to determine the long run relationship between stock and consumer prices.

Table 4.1: Unit Root Tests Results

	Trend and Intercept							
	Brazil		Russia		India		China	
	Ibovespa	CPI	RTS	CPI	S&P BSE SENSEX	CPI	SSE Composite	CPI
Pre-Crisis								
Level	-3.016	-1.564	-2.849	-3.148	-2.784	-2.538	-1.310	-1.384
First Diff	-9.023 ***	-3.697 **	-8.769 ***	-5.157 ***	-8.233 ***	-7.287 ***	-7.499 ***	-7.797 ***
Post-Crisis								
Level	-2.829	-2.694	-3.863 **	-2.734	-2.744	-2.861	-3.509 **	-2.081
First Diff	-6.940 ***	-3.663 **	-7.213 ***	-5.072 ***	-6.242 ***	-6.556 ***	-8.228 ***	-7.870 ***

Notes: 1) Ibovespa, RTS, S&P BSE and SSE Composite represent the stock price index in the Brazil, Russia, India and China respectively. Stock price and CPI are measured in the natural logarithm forms. 2) *** and ** represent the significance level at 1% and 5% respectively.

4.1.2 Cointegration Analysis

After the stock and consumer prices are found to have the integrated process at order one, the cointegration techniques, such as Engle-Granger and Johansen-Juselius methodologies are carried out to determine the number of cointegrating vector between the two series. The Fisher hypothesis is applicable for the stock markets in BRIC if the stock and consumer prices are cointegrated.

4.1.2.1 Engle-Granger Test

Since Engle-Granger test is a two-step method, a regression of stock price (lnP) on consumer price index (lnCPI) is estimated to obtain the residuals. To determine the stationary of the residuals, PP unit root test with no intercept and trend is conducted to test the null hypothesis of a unit root for residual. The results show that error term in all cases is found to follow integrated order one process, I (0). It

indicates that the stock and consumer prices are cointegrated. Afterward, the Johansen-Juselius can be proceeded further to analyze the cointegration between the stock and consumer prices.

4.1.2.2 Johansen-Juselius (JJ) Cointegration Test

Table 4.2 reports the results of JJ test which are based on Trace and Maximum Eigenvalue test statistics. Both of the tests provide the consistent results which indicate that the stock and consumer price are not cointegrated because the null hypotheses of the cointegrated vector (R) equal to zero and one are rejected in all the cases. Hence, it can be concluded that there are two cointegrating vectors exist in the model which indicates that the stock and consumer prices do not consist of a long-term relation.

Table 4.2: JJ Test Results

Trace Test	Pre-Crisis				Post-Crisis			
Null hypothesis	Brazil	Russia	India	China	Brazil	Russia	India	China
$R \leq 0$	25.631 ***	40.094 ***	46.090 ***	28.060 ***	29.263 ***	34.435 ***	46.064 ***	28.956 ***
$R \leq 1$	8.091 ***	15.274 ***	19.357 ***	8.997 ***	11.092 ***	13.980 ***	17.519 ***	8.848 ***
Maximum Eigenvalue Test	Pre-Crisis				Post-Crisis			
Null hypothesis	Brazil	Russia	India	China	Brazil	Russia	India	China
$R = 0$	17.540 **	24.820 ***	26.734 ***	19.063 ***	18.171 **	20.455 ***	28.545 ***	20.108 ***
$R = 1$	8.091 ***	15.274 ***	19.357 ***	8.997 ***	11.092 ***	13.980 ***	17.519 ***	8.848 ***

Notes: (1) Based on the Schwartz information Criterion (SIC), the optimal lag length is 2 for BRIC. (2) ***/**/* represent significant at 1%/5%/10% respectively.

Based on the JJ test result, the Fisher hypothesis is proven to be rejected in BRIC during both sub-periods. The common stock cannot provide good hedge against the increasing inflation in BRIC. There must be some reasons that cause the Fisher hypothesis does not hold in each country.

According to Choudhry and Pimentel (2010), the relationship between stock price and consumer price is investigated in Brazil during unstable inflation period of 1986 - 1994 and stable inflation period of 1994 - 2008. Their finding shows that Fisher hypothesis does not hold in the stable inflation period, while it holds under unstable inflation period. Since our observation period of November 2001 to December 2013 is similar to their stable inflation period of 1994 – 2008, the stability price is the reason that leads to the failure of Fisher hypothesis in Brazil during both sub-periods.

Brazil government adopts inflation targeting policy to achieve price stability since 1999 (Barbosa, 2008). Brazil's central bank will target at a preferred inflation rate and uses the interest rate as a tool to affect the inflationary condition. If the inflation appears to be above the target, central bank will raise the interest rate, people will save more and consume less. As a result, it will bring down the inflation to target because of the decrease in money demand, vice versa. In our study, a smoothly increasing consumer price movement can be identified in Figures 4.1 and 4.2. The inflation targeting policy is successful to achieve stable price level in Brazil. As a result, this policy has provided high credibility to the investor toward the stable price is sustainable. The investors will have constant expected inflation as shown in equation (16).

$$N = R + \Pi^{e} \qquad (16)$$

The equation (16), as a long-run generalized Fisher hypothesis determines that the nominal stock return is a sum of real stock return and expected inflation. If the nominal stock return (N) can move parallel with the expected inflation (Π^{e}) which consist of one-to-one relationship, the stock return can provide a fully hedge against the high inflation. The real stock return which reflects the purchasing power of the investor will not be reduced by the increasing inflation and it can remain as constant. Generally, the nominal stock return and expected inflation must have a same movement to promise the Fisher hypothesis to be hold.

Since the credibility of the inflation targeting policy, the expected inflation of the investors in Brazil will remain as constant. Figures 4.1 and 4.2 show that the Ibovespa stock price index in the Brazil has an unstable movement as compared to the consumer price. This fluctuation in the stock price will cause the nominal stock return to increase or decrease. The equation (16) shows that the real stock returns will depend on the nominal stock price if the expected inflation remains unchanged. Therefore, the stock prices should act independently with expected inflation in Brazil. The stock and consumer prices should have their own pattern of movement and without long run relationship. Under this condition, the relationship between the stock and consumer prices explained in the Fisher hypothesis has been rejected. Thus, the stock return cannot be treated as tool to hedge against the inflation in Brazil because the purchasing power of the investors will still be affected by the fluctuation in stock price.

On the other hands, Central Bank of Russia adjusts its fixed exchange rate policy to floating exchange rate policy started from late 1990s. It leads to independently monetary policy with less of the interest rate adjustment and enable to achieve stable price level. This policy is similar to the Brazil's target inflation policy in term of the purpose to stabilize price level. The Russian investors will form a constant expected inflation since they believe on Russia's floating exchange rate policy. However, the volatility in stock price can be identified in Figures 4.3 and 4.4. Equation (16) can be used to explain the relationship between stock and consumer prices in Russia that the constant expected inflation and volatility in stock price will lead to the rejection of Fisher hypothesis. This reason is similar to Brazil which indicates that the stock return is not an efficient tool to protect the investors' purchasing power.

Moreover, the study of Vegh and Vuletin (2012) found that India become countercyclical started from 2000. Countercyclical monetary policy indicates that the central bank will increase the interest rate during the high economy growth condition. The rise in the interest rate will advise people to save more and consume less. Therefore, the inflation will tend to decline as the reason of the decrease in money demand. This monetary policy aims to the price stabilization during the well performed economic condition. Same to the inflation targeting and

flexible exchange rate policies in Brazil and Russia, the stable price level will stand independently with stock price. As a result, the long run relationship between the two series is rejected and lead to the rejection of Fisher hypothesis. The stock return will not provide good hedge against the inflation in India.

According to Zheng, Wang and Guo (2012), they found that the China's monetary policy behavior is unstable. The changing in the interest rate by Central bank in response to the inflation and output is asymmetric. It should be the reason lead to the high fluctuation in consumer price level in our observation period. The unstable monetary policy will lead the public to keep on revising their expected inflation. Meanwhile, China's economy is driven by large unsustainable investment. Central bank targets at fixed exchange rate and tightly manages its interest rate to attract the foreign and domestic investors. The capital inflow and foreign direct investment can expand the scope of the firms to achieve a better performance. The rising value of the firm will improve the stock market performance and increase the stock price. The stock price might be improved as result of the monetary policy in attracting the foreign direct investment but the fluctuation in inflation is due to the temporary monetary policy. As a result, the Fisher hypothesis should be rejected in China because the stock and consumer price do not link directly in the long run.

4.1.3 Vector Autoregressive (VAR) Model Analysis

Since the long-term linkage between the stock consumer prices has been rejected, the short-run dynamic effect exists between the stock returns and inflation in BRIC for each sub-period has become a crucial question. To answer it, VAR model for each country is formed using the first difference of the stock price and consumer price, which are stock return and inflation. The appropriate lag length is selected based on the Schwartz (SIC) Information Criteria. Afterward, VAR analysis, such as the Granger causality test, impulse response functions and variance decomposition are employed to identify the causality linkage between the stock return and inflation.

4.1.3.1 Granger Causality

Table 4.3 shows the Granger causality results at pre and post-crisis periods in BRIC. The null hypothesis of inflation does not Granger cause stock returns and stock return does not Granger cause inflation during both sub-periods are not rejected in all cases even at the significance level of 10 percent.

The results indicate that stock return and inflation act independently in all cases. Since the price stability policies adopted in Brazil, Russia and India are creditable to the public, the changing in the inflation rate will be treated as the temporary effect. The central bank of these countries will take action to adjust the inflationary condition to achieve the stable price level. As a result, public or investor will not take into account of the inflation when they decide to enter stock market. And also, the change in stock return will not have strong effect on inflation because public believe that only the central bank can influence the inflation.

Moreover, the monetary policy in China aims to specific purpose, such as attracting foreign direct investment, make the stock return and inflation does not link to each other. Therefore, the dynamic effect between stock return and inflation is weak and thus there is no feasibility to forecast stock return and inflation by using each other.

Table 4.3: Granger Causality Test Results

Pre-Crisis Period				
Null hypothesis of inflation does not Granger cause stock returns				
	Brazil	Russia	India	China
F-statistic	0.558865	0.086386	0.757503	0.894037
Null hypothesis of stock returns does not granger cause inflation				
	Brazil	Russia	India	China
F-statistic	2.067295	0.575410	0.176719	2.064984

Post-Crisis Period				
Null hypothesis of inflation does not Granger cause stock returns				
	Brazil	Russia	India	China
F-statistic	1.346232	2.796581	2.208907	0.036689
Null hypothesis of stock returns does not granger cause inflation				
	Brazil	Russia	India	China
F-statistic	1.303047	0.003824	1.683882	0.582252

4.1.3.2 Impulse Response Function (IRF)

To further explain the causality linkage between stock return and inflation, we are employing the impulse response function in graphical. The Impulse response function in Figures 4.5, 4.6, 4.7 and 4.8 show that how the stock return and inflation response toward shock of itself or another variable. The impulse response function can demonstrate whether there is any strong causality relationship between the stock returns and inflation. As shown in Figures 4.5 – 4.8, none of the error bands (red color dot lines) are found to be above or below the zero. It indicates that no significant Granger-causality effect can be identified between the stock return and inflation in BRIC during both sub-periods.

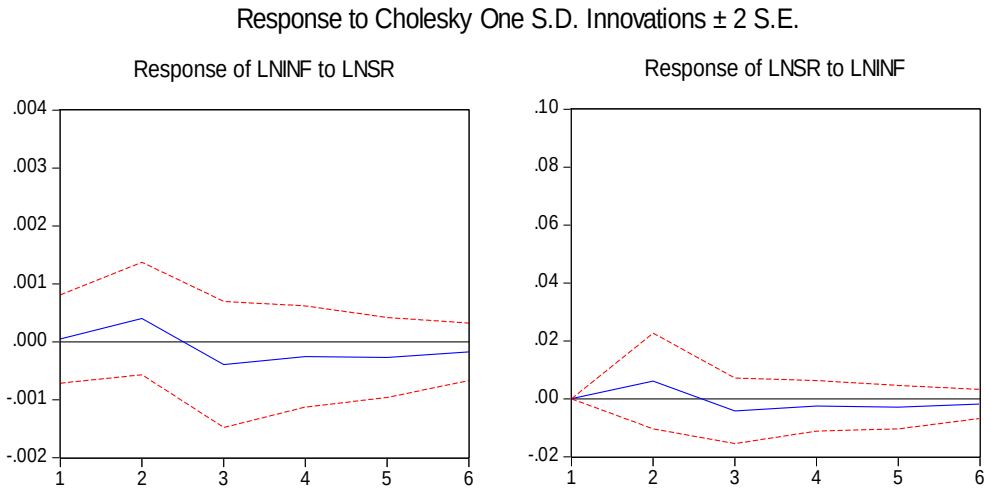
This result is consistent with the Granger causality test results as shown in Table 4.3, which indicates there are no any strong causality linkages between the stock return and inflation in BRIC. As mentioned earlier, the monetary policy taken by the central bank of BRIC cause the public believe that the change in either stock return or inflation will not affect each other in short run. The dynamic effect between the two series is weak and leads them to stay independent with each other.

Besides, the positive or negative impact of the shock on stock return or inflation toward the each other can be determined clearly through the Figures 4.5,

4.6, 4.7 and 4.8. The upward sloping curve represents the positive impact and the downward sloping curve stands for negative impact. From Figures 4.5 – 4.8, we find that stock return and inflation are positively responding toward the shock on each other at the first month in all cases during pre-crisis period except of China's inflation. It acts negatively toward the shock on stock return in the first month. Yet, the two series' response toward the shock on each other during post-crisis period is ambiguous. However, the impact between each other remains as constant after three month in most of the cases.

The impulse response function can only tell us graphically about the information of the causality linkage between stock return and inflation. In order to show the impact between these series more accurately, variance decomposition table is constructed to show the percentage impact between them.

Pre-Crisis



Post-Crisis

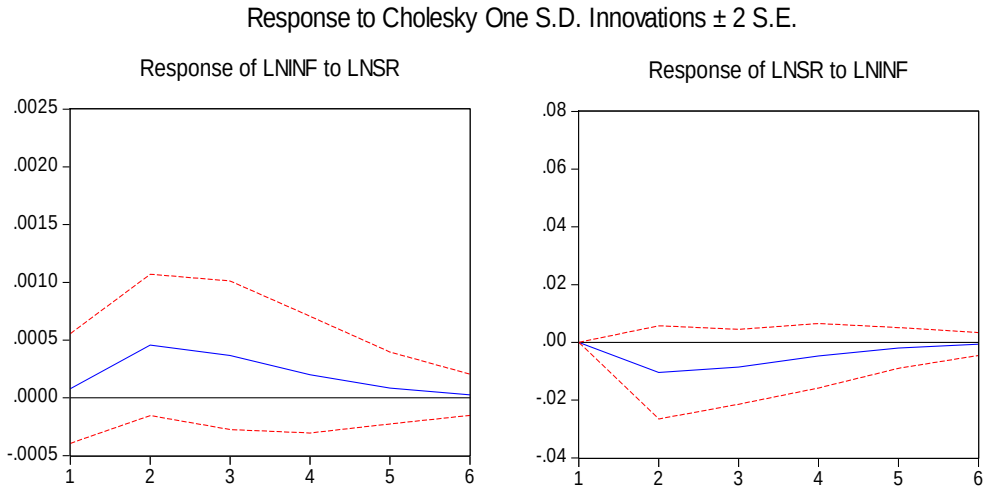
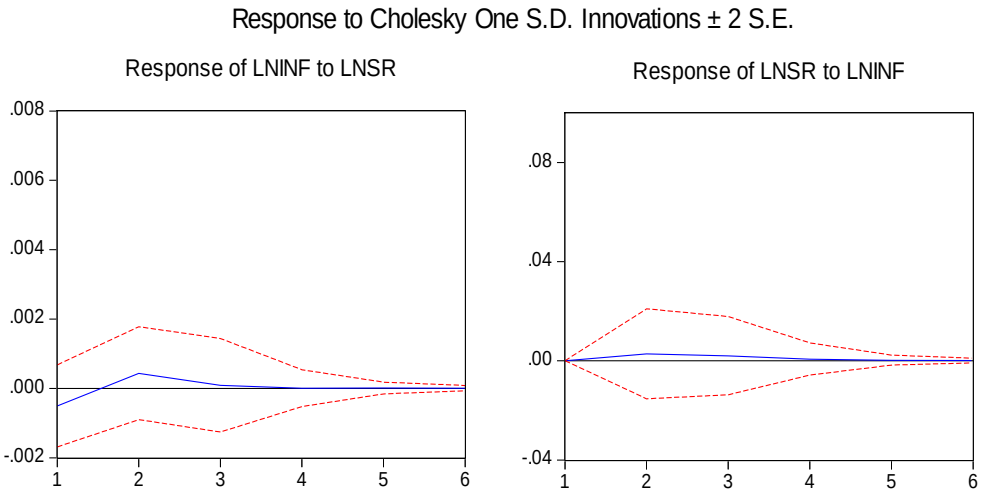


Figure 4.9: Impulse response function for stock returns and inflation in Brazil during pre- and post-crisis periods

Pre-crisis



Post-crisis

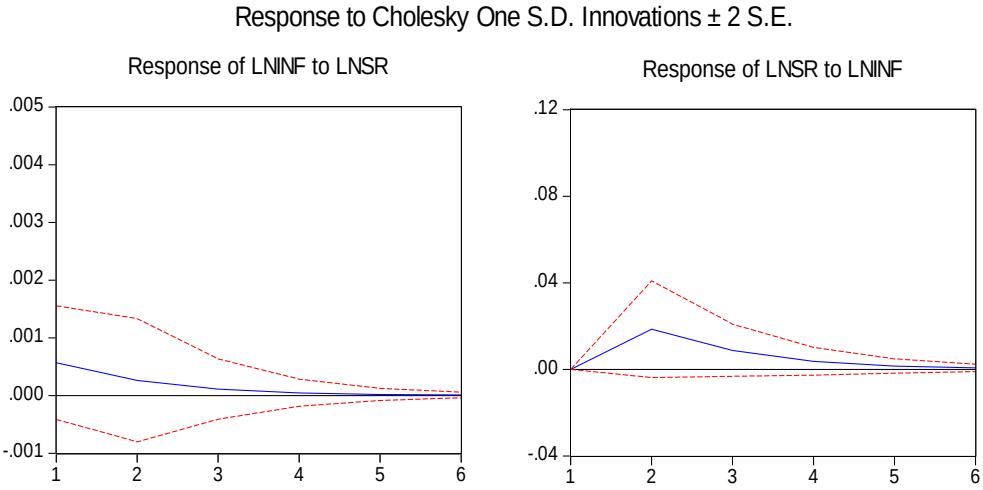
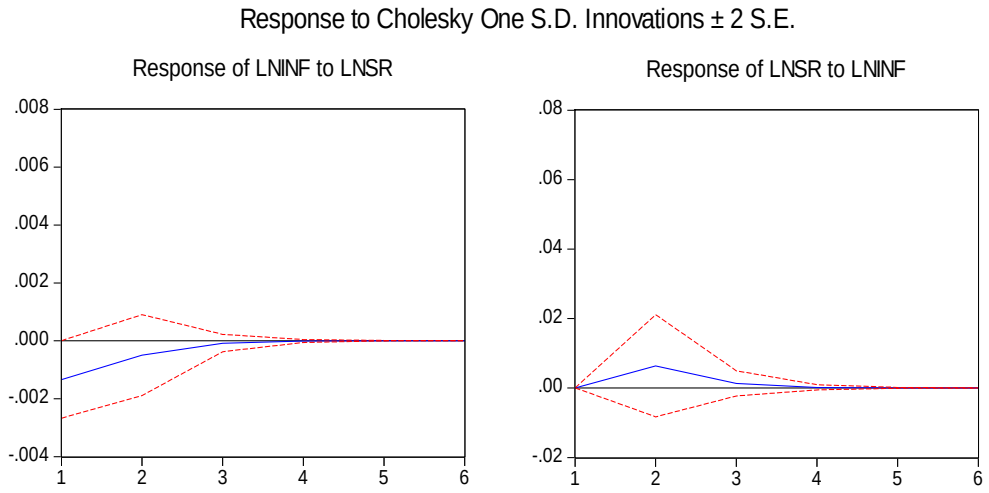


Figure 4.10: Impulse response function for stock returns and inflation in Russia during pre- and post-crisis periods

Pre-crisis



Post-crisis

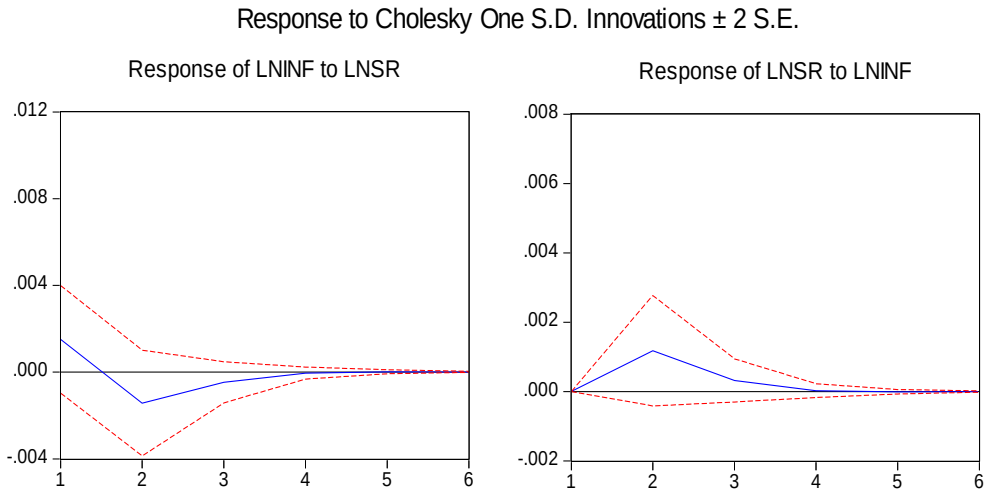
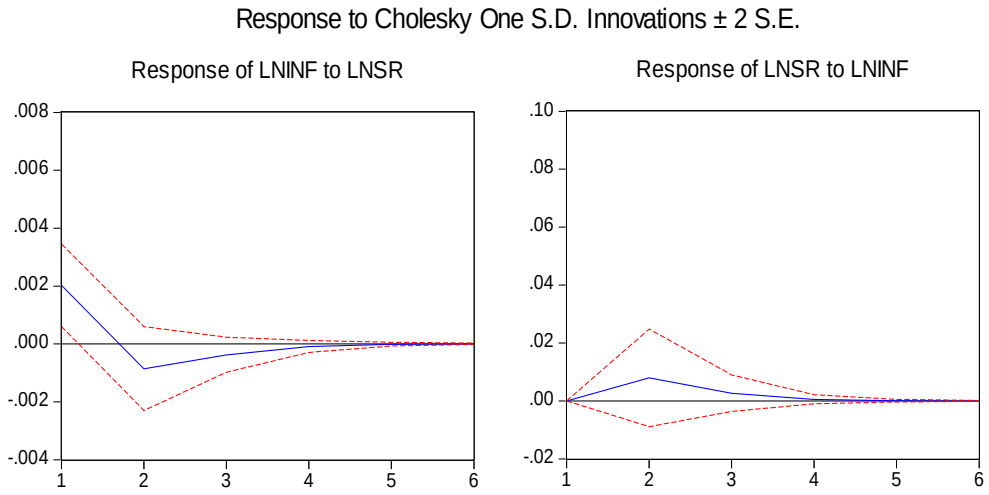


Figure 4.11: Impulse response function for stock returns and inflation in India during pre- and post-crisis periods

Pre-crisis



Post-crisis

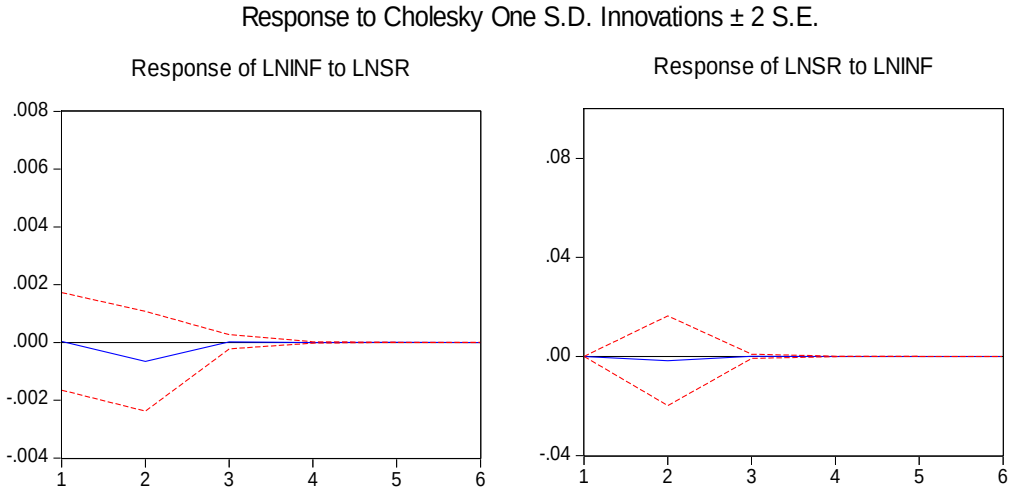


Figure 4.12: Impulse response function for stock returns and inflation in China during pre- and post-crisis periods

4.1.3.3 Variance Decomposition

According to Tables 4.4 - 4.7, the inflation's shock provides a small percentage impact toward stock returns in BRIC during pre-crisis, which not achieve one percent every month. Inflation only can capture small percentage of the forecast error variance for stock return in all cases. Same situation is found on the stock return's impact on inflation; the percentage impact is almost the same over the next six months. These results indicate that there is a weak causal relationship between stock return and inflation in BRIC during pre-crisis.

At the post-crisis, except of China, the stock returns react toward the shock on inflation in Brazil, Russia and India at around four percent at the second period. This impact is decreasing in the following period and ends to remain constant. The inflation's effect on stock return in China is near to zero. Yet, inflation is responding to the stock return at a lower percentage which similar to the pre-crisis. The Brazil stock return affects the inflation the most, having around four percentages in the second period. It implies that the causality linkage from stock return to inflation in Brazil is the strongest among the four countries. However, the impacts are still considered weak because they can only be used to explain the variance of each other with a small percentage.

In overall, the percentage impact between stock return and inflation provided from the Tables 4.4 - 4.7 indicates that the impact of stock return and inflation on each other is weak and decreasing over the periods during both sub-periods. It is consistent with the insignificant relationship between the series found from Table 4.3 and Figure 4.5 – 4.8.

Table 4.4: Variance Decomposition of Stock Return and Inflation in Brazil during Pre- and Post-Crisis Period

Brazil	Pre-Crisis				Post-Crisis			
	VD of Stock Return		VD of Inflation		VD of Stock Return		VD of Inflation	
Period	S.E	Inflation	S.E	Stock Return	S.E	Inflation	S.E	Stock Return
1	0.07103	0.00000	0.00333	0.01925	0.05632	0.00000	0.00183	0.18914
2	0.07131	0.73355	0.00421	0.91823	0.05774	3.26090	0.00231	4.04604
3	0.07184	1.05844	0.00464	1.47697	0.05837	5.32049	0.00243	5.93922
4	0.07192	1.17402	0.00482	1.64544	0.05860	5.92089	0.00245	6.51185
5	0.07199	1.33587	0.00493	1.87970	0.05864	6.02404	0.00245	6.61784
6	0.07201	1.39747	0.00499	1.95983	0.058650	6.03326	0.00245	6.62797

Table 4.5: Variance Decomposition of Stock Return and Inflation in Russia during Pre- and Post-Crisis Period

Russia	Pre-Crisis				Post-Crisis			
	VD of Stock Return		VD of Inflation		VD of Stock Return		VD of Inflation	
Period	S.E	Inflation	S.E	Stock Return	S.E	Inflation	S.E	Stock Return
1	0.08230	0.00000	0.00516	0.96847	0.09511	0.00000	0.00377	2.25995
2	0.08242	0.11292	0.00564	1.39926	0.09731	3.61800	0.00407	2.35082
3	0.08253	0.17328	0.00572	1.38544	0.09772	4.38975	0.00412	2.36610
4	0.08254	0.18028	0.00574	1.37913	0.09779	4.52485	0.00413	2.36869
5	0.08254	0.18118	0.00574	1.37824	0.09780	4.54794	0.00413	2.36913
6	0.08254	0.18136	0.00574	1.37813	0.09780	4.55188	0.00413	2.36921

Table 4.6: Variance Decomposition of Stock Return and Inflation in India during Pre- and Post-Crisis Period

India	Pre-Crisis				Post-Crisis			
	VD of Stock Return		VD of Inflation		VD of Stock Return		VD of Inflation	
Period	S.E	Inflation	S.E	Stock Return	S.E	Inflation	S.E	Stock Return
1	0.06346	0.00000	0.00577	5.39715	0.00549	0.00000	0.00943	2.55798
2	0.06381	0.99978	0.00585	5.96583	0.00572	4.20910	0.00959	4.69475
3	0.06383	1.04084	0.00585	5.98320	0.00573	4.50649	0.00961	4.92145
4	0.06383	1.04162	0.00585	5.98348	0.00573	4.50750	0.00961	4.92331
5	0.06383	1.04163	0.00585	5.98348	0.00573	4.50783	0.00961	4.92342
6	0.06383	1.04163	0.00585	5.98348	0.00573	4.50788	0.00961	4.92347

Table 4.7: Variance Decomposition of Stock Return and Inflation in China during Pre-and Post-Crisis Period

China	Pre-Crisis				Post-Crisis			
	VD of Stock Return		VD of Inflation		VD of Stock Return		VD of Inflation	
Period	S.E	Inflation	S.E	Stock Return	S.E	Inflation	S.E	Stock Return
1	0.07107	0.00000	0.00613	10.93725	0.07226	0.00000	0.00660	0.00249
2	0.07399	1.15299	0.00622	12.51518	0.07233	0.05773	0.00663	0.98526
3	0.07411	1.27794	0.00623	12.83464	0.07233	0.05778	0.00663	0.98608
4	0.07411	1.28300	0.00624	12.85120	0.07233	0.05778	0.00663	0.98610
5	0.07411	1.28306	0.00624	12.85149	0.07233	0.05778	0.00663	0.98610
6	0.07411	1.28306	0.00624	12.85148	0.07233	0.05778	0.00663	0.98610

As a conclusion, there is no strong evidence to conclude that the stock returns and inflation can Granger cause each other. The Granger causality Test reveals that there none of significant causality effect between the two series in BRIC during each sub-period. The Impulse response function and variance decomposition show the consistent results to Granger causality test.

The stock return and inflation in all cases do not consist of bidirectional or even the unidirectional effect. And also, the shock on the stock return or inflation does not provide the strong information to explain variance of each other. Any change in the stock return or inflation does not indicate that there will be a relatively impact on each other. As a result, stock returns and inflation in BRIC cannot provide the sufficient dynamic information to forecast each other. Investors or policymakers cannot use these series as the indicators to predict the movement of each other.

Inflation targeting policy, flexible exchange rate and countercyclical monetary policy which are implemented by Brazil, Russia and India are successfully achieving the stable price level. The expected inflation of investors in these countries will remain constant because they believe that those policies are effective in achieving price stability. As a result, they think that any change in current inflation is considered as temporary effect and it will be solved through the policies. For example, when there is a high inflation in the current, the central bank will take action by revising the interest rate and thus the inflation can adjust to the target level in the future. This temporary effect on the fluctuation in

inflation will not be the main concern for the investors to enter the stock market. This is the reason that causes the weak dynamic effect between these series. Therefore, the inflation will not Granger cause stock return.

Moreover, since the constant expected inflation will be formed toward the price stabilization monetary policy in Brazil, Russia and India, any change in the inflation is believed to be adjusted to the target level soon. Therefore, the impact of stock market return will be meaningless to the inflation because the movement in inflation might be predictable due to the action by central bank in BRIC. Any change in stock return will not significantly affect inflation in the short run since people will only adjust the expected inflation based on the monetary policy. Thus, the inflation and stock returns should not exist of strong causal relationship.

On the other hand, China's monetary policy is not purely independent because it aims to attract the foreign investors. As a result, the monetary policy will keep on revising based on the current situation and thus it only has the temporary effect on the investors. The impact of stock return will not affect the inflation since the investors will have their own expected inflation. Since the central bank will decrease or increase the interest rate frequently to attract foreign direct investment, its impact on inflation should be ambiguous and thus it is meaningless for the investors. Therefore, the investors will ignore the short run impact of inflation on stock return. The stock return and inflation should not consist of a strong dynamic relationship in China.

4.2 Conclusion

In this chapter, the cointegration analysis is employed to achieve the objective of whether the Fisher hypothesis is hold in BRIC. First of all, the PP unit root test conclude that both stock and consumer price have the same integrated process of order one. Therefore, the Engle-Granger (EG) and Johansen-Juselius (JJ) cointegration tests are conducted to determine the long run relationship between stock and consumer prices. EG test result indicates that the two series might be

cointegrated. Yet, JJ test concludes that there are two cointegrating vector between these series and thus the long run relationship between the two series is rejected in BRIC. As a result, the Fisher hypothesis is rejected in BRIC and common stock return cannot provide good hedge against inflation. Then, the VAR model is formed by using stock return and inflation and the dynamic analyses are conducted. Granger causality test result indicates that stock return and inflation cannot Granger cause each other. Impulse response functions and variance decomposition show that the causality linkage between stock return and inflation is weak. Thus, the stock return and inflation cannot be used as the indicator to predict each other. The same results are presented for all findings during both sub-periods.

CHAPTER 5: CONCLUSION

5.0 Overview

This study emphasizes on investigation of relationship between the stock return and inflation in Brazil, Russia, India and China (BRIC) from November 2001 to December 2013. The sample period is separated into the pre- and post-crisis to examine the impact of structural break on both series of relationship. This study performs an empirical analysis on whether the stock returns can hedge against inflation in BRIC in both sub-periods using cointegration analysis. In addition, the short-run causality effect between stock returns and inflation is also examined using Vector Autoregressive (VAR) analysis. Hence, the major findings are summarized and presented in this chapter. Based on the major finding, some policy implications are suggested. Lastly, the limitations and recommendations of our study are also discussed to improve our scope of study.

5.1 Major findings

There are three major findings in our study which serve to answer our research questions. Firstly, our result indicates that the common stocks in BRIC do not provide a good hedge against the inflation during the pre- and post-crisis periods. The validity of the Fisher hypothesis in BRIC is determined by using cointegration analysis and find that the stock and consumer prices are not cointegrated in all countries during both sub-periods. As a result, the existence of the long-run generalized Fisher hypothesis is rejected for all cases.

The rejection of Fisher hypothesis in BRIC can well be explained by the government's policy adopted. Brazil, Russia and India have adopted policies in their countries for the price stabilization purpose, which are the inflation targeting, floating exchange rate and countercyclical monetary policies respectively during

the observed period. During the price stabilization period, investors' expectation towards the change in inflation will remain constant. However, the volatility of stock price in Brazil, Russia and India is still large in the market. As a result, the Fisher hypothesis is not hold in these countries due to the stock and consumer prices do not act dependently.

In the case of China, the central bank set the fixed interest rate and exchange rate in order to attract foreign domestic investment and capital inflow. It can improve the stock performance and increase the stock price. However, the high fluctuation in inflation of China is the central bank's unstable monetary behaviour. The investors will keep on changing their expectation toward inflation because the monetary policy is always revised in China. In example, when the domestic investment is weakening, the central bank will decrease the interest rate to attract foreign investors to borrow money and invest. As a result, the stock and consumer prices do not interact with each other in the long-run and it explained that the Fisher hypothesis does not hold in China.

Secondly, we find that the stock returns and inflation cannot be treated as the indicator to forecast each other. This is because the causality relationship between the two variables is found to be weak impact among BRIC during both sub-periods. In our study, the short-run dynamic relationship between stock returns and inflation has been explained by using the Granger causality test, impulse response function and variance decomposition. From the results obtained, it can be concluded that the stock returns and inflation do not granger cause each other in the short-run.

The credibility of the price stabilization monetary policy in Brazil, Russia and India has led to the investors and policymakers to form a constant expected inflation. As a result, in short-run, the investors and policymakers will be less responsive to the shock in stock market or they will even ignore it. This is because under price stabilization policy, they believe that the price levels will eventually adjust back by government to the targeted level. Besides that, the investors will also think that any shock in the inflation is considered temporary. Therefore, the investors will not take the change in inflation into consideration in making

investment decision. These reasons have caused the stock return and inflation is found to not granger cause each other in Brazil, Russia and India.

Moreover, the investors in China will form their own expectation because of the low credibility of the monetary policy. The monetary policy' behaviour is unstable in China due to they have to keep revised the monetary policy to reach the fixed interest rate and exchange rate. As a result, the inflation cannot be used to make investment decision in the short run. The stock return also cannot use as the indicator to forecast the inflation because of the fast adjustment of inflation. These reasons can explain that the stock prices and inflation do not granger cause each other in China.

Last but not least, by using the same methodology on different sample sizes, the results to answer to earlier questions are found to be consistent in both sub-periods. The characteristics of the movement in stock and consumer prices are similar in BRIC during the pre- and post-crisis periods.

5.2 Policy Implications

Since our finding rejects the long-run generalized Fisher hypothesis in BRIC stock markets, it implies that the common stocks return does not provide a good hedge against inflation in these countries. Hence, it is advisable for investors in BRIC to choose other financial instruments, such as the treasury bills and commodity future contracts in order to avoid from the reduction in their purchasing power.

Treasury bills can provide the interest rate which follows the risk-free rate of BRIC. Therefore, the investors can protect their purchasing power from the fluctuation in inflation. The investors do not need to worry for the default risk because the treasury bills are secured by the government. Moreover, commodity future contract that secure by the brokers give the obligation for buyer and seller to exercise at a certain price when maturity. Normally, when the inflation rises, the commodity prices will rise as well. In order to avoid from the fluctuations in

terms of price level which may be caused by inflation, the investors can buy the future contract to hedge against expected rising price in commodity in the future. Treasury bills and commodity enable the investors to avoid from decreasing purchasing power.

Besides, our finding shows that the investors in BRIC cannot hedge against the inflation using common stock return if the policymakers concentrate in implementing price stabilization monetary policy, such as inflation targeting policy, floating exchange rate and countercyclical policies adopted by Brazil, Russia and India. Those policies might able to stabilize the consumer price level but the stock price is still remaining high volatility. The nominal return will be affected by the fluctuation in stock price and subsequently lead to the unstable real return. Therefore, the stock returns in those countries that adopted price stabilization policy will not able to provide a good hedge against the inflation.

On the other hand, the stock returns and inflation in BRIC have been demonstrated to stand independently without affecting each other in the short-run after conducting Granger causality, impulse response function and variance decomposition. This implies that the stock returns and inflation cannot be used to predict each other in the short-run due to both variables do not Granger cause each other. Therefore, the investors cannot use inflationary condition in BRIC to forecast the stock return in the short-run. Any change in the inflation rate will not significantly affect the stock return of the investors. In other words, an increase (or decrease) in inflation rate cannot be used to determine the optimal investment decision for investor to earn profit from the stock market.

In addition, the policymakers in BRIC should not use the stock return as an indicator to forecast the inflationary trend in the short-run. When the stock market performs well and offers a high return to the investors, it does not necessary indicate that there will be a change in the inflation rate since the granger cause effect between stock return and inflation is found to have only weak impact with each other. Hence, if the policymakers conduct the monetary policy to control the inflation based on the movement in stock return, the policy might end up ineffective. For example, the policymakers may misunderstand that a well-

performed stock market will lead to the increase (or decrease) in inflation. As a result, they will advise the central bank to decrease (or increase) inflation by increase (or decrease) the interest rate. However, the actual inflation rate is not necessary same as the expected inflation rate. Hence, the monetary policy implemented will provide an adverse outcome.

Finally, the results which are found in our study have shown a consistent result in explaining the relationship between stock and consumer prices among BRIC during the pre- and post-crisis periods. This implies that the characteristics of the movement in stock and consumer prices during both sub-periods are similar. As a result, the policy targeting on these two variables can be adopted if it is found as successful. In example, if the monetary policy is successfully maintain a stable price level by increasing the interest rate in the BRIC during the pre-crisis period, this policy should also be applicable during the post-crisis period.

5.3 Limitation and Recommendation

This study emphasizes in identifying the validity of Fisher hypothesis among BRIC countries after they are grouped together since November 2001. In 2010, South Africa has started the effort to join the BRIC grouping and has officially become one of the member nations on 24 December 2010. In current, Brazil, Russia, India, China and South Africa are treated as a group, namely BRICS. Since South Africa is excluded in our study, therefore we suggest future researchers to include South Africa into study to examine on whether the Fisher hypothesis is hold.

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