EVALUATING THE IMPACT OF INFLATION ON STOCK MARKET IN CHINA

LI DENGKE

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BY
LI DENGKE

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ABSTRACT

This study attempts to investigate the possible relationship between stock price and inflation rate in China over the period of September 1997 to July 2015 using variables of share price index, consumer price index (CPI), interest rate and industrial production. Past studies mainly focus on the developed countries. Despite numerous theories, literature reveals that there is not enough information and investigation about developing countries especially China. This study aims to narrow this gap by examining the relationship between stock and inflation in China. The Vector Error Correction Model (VECM) has been employed to determine the long and short run relationships among the variables respectively. The cointegration test reveals a significant long run relationship between the underlying variables. Based on the VECM results, inflation is found to have a significant and positive influence on the stock market in the long run as well as in the short run. The Granger causality test also indicates that inflation has a unidirectional causality on the stock market index. In general, the results suggest a positive significant relationship between inflation and stock price.

ABSTRAK

Kajian ini bertujuan untuk mengkaji hubungan antara harga saham dan kadar inflasi di China sepanjang tempoh September 1997 hingga Julai 2015 menggunakan pembolehubah indeks harga saham, indeks harga pengguna (CPI), kadar faedah dan pengeluaran perindustrian. Kajian lepas terutamanya memberikan tumpuan kepada negara-negara maju. Walaupun terdapat banyak teori yang menerangkan hubungan antara harga saham dan kadar inflasi, maklumat yang ada masih lagi tidak mencukupi terutamanya penyiasatan yang melibatkan negara-negara membangun terutamanya China. Kajian ini bertujuan untuk merapatkan jurang dengan mengkaji hubungan antara saham dan inflasi di China. Model *Vector Error Correction* (VECM) telah digunakan untuk menentukan hubungan jangka panjang dan hubungan jangka pendek antara pembolehubah-pembolehubah asas. Ujian kointegrasi telah mengenalpasti wujudnya hubungan jangka panjang yang signifikan antara pembolehubah-pembolehubah asas. Berdasarkan keputusan VECM, inflasi didapati mempunyai pengaruh yang signifikan dan positif ke atas pasaran saham dalam jangka masa panjang dan juga dalam jangka masa pendek. Ujian kesan *Granger* juga menunjukkan bahawa inflasi mempengaruhi indeks pasaran saham. Secara umumnya, keputusan kajian menunjukkan bahawa wujudnya hubungan yang signifikan dan positif antara inflasi dan harga saham.

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Financial economists are always keen about the relationship between stock price and inflation. These financial economists have the feelings that equity can be used to hedge against the inflation. Even though there are numerous studies on stocks and pricing model, investigations on the relationship between stock prices and inflation in emerging countries are still limited. Furthermore, the inconclusiveness of empirical results across developing countries regarding the relationship between stock prices and inflation creates a gap to be studied.

Inflation and stock prices are two crucial indicators of a country's economy. In 1970s, because of the high inflation, western economists begin to examine the relationship between stock prices and inflation (Nelson, 2005). The impact of inflation on the stock market provides an important implication for risk management practices, financial securities valuation and government policy towards financial market. Inflation causes the redistribution of wealth. For the rational investors, there is a risk-return trade-off that they need to consider. At the same time, they need to evaluate whether the rate of return in the stock investments can compensate the loss of purchasing power as a result of inflation. In this study, we seek evidences of correlation and relationship between inflation, stock prices, industrial production and interest rate and mainly investigate the impact of inflation on stock prices through the time series data. Results of this study can benefit not just the shareholders but also the policy makers.

Earlier researches have been focusing on the Fisher Effect Theory (Fisher, 1965). According to

the theory, the expected nominal return of assets should be equal to expected real return and expected inflation, which means that the nominal return should correspond with inflation. Under the Fisher effect hypothesis, the eroding purchasing power of the investors due to inflation will be fully compensated.

Before 1970, the western economists generally believe that stock can be used to hedge against inflation. This general belief is based on the Fisher Effect that the real returns of stock market are independent of the inflation expectations. The relationship between stock price and inflation should be positive or at least non-negative argued by Eita (2012). However, after 1970s, a number of empirical studies show that there is a significant negative correlation between inflation and stock return. Studies by Bodie (1976), Jeffrey and Mandelker (1976), Fama and Schwert (1977), Schwert (1981), Gultekin (1983) and Cohn and Lessard (1981) highlight the negative correlation between nominal stock returns and inflation. For instance, Fama and Schwert (1977) using expected and unexpected inflation show that the relationships between inflation and returns of European and American stocks do not reflect the traditional Fisher effect hypothesis.

The differences that occur between theories and empirical results raise a question on the stock return and inflation relationship. Fama (1981) proposes a proxy hypothesis which illustrates this paradox. According to Fama (1981) the negative relationship that exists between the stock return and inflation is because of the positive relationship between stock returns and basic economic activities, such as capital expenditure. However, there are very rare empirical results supporting the Proxy hypothesis. Kaul (1987) uses US financial data to prove the validity of Fama's theory,

but the results are not significant.

Grier and Perry (1998) introduce the volatility hypothesis which explains the relationship between the stock returns and inflation. They believe that high inflation results in higher volatility, which leads to more uncertainty of the assets return in the future, eventually leads to lower stock returns. According to Hu and Willett (2000), the real stock returns have a negative relationship with inflation and the most reasonable explanation is the volatility hypothesis. Until now there are many other important hypotheses addressing this puzzle such as Tobin's (1958) risk premium hypothesis, Shoven (1975) and Frenc, Ruback and Schwert's (1983) decomposed the nominal Contracting Hypothesis, and Modigliani and Cohn's (1979) money illusion hypothesis.

A number of studies have been addressing the relationship between stock returns or real stock returns and nominal, expected or unexpected inflation in different financial markets, different periods, different hypothesizes. Still results are not conclusive. Different methods have been used to address the issue, yet the outcomes vary. So it is a fierce debate among academicians on how to explain the difference correlation between stock returns and inflation in theories and empirical studies.

Similar to other countries, the relationship between stock returns and inflation has become a major issue in China. There are three main unique phenomenons that distinguish the Chinese stock market from the west stock market (Kharas and Gertz, 2010): The first phenomenon is regarding the special equilibrium relationship between supply and demand conditions. The quantity and quality of the listed companies is not the results brought up by market but is the one

recommended by brokers and authorities. The second phenomenon is regarding the stock market segmentation. Different segments of the stock market result in varying stock prices. Even the same stocks owned by different shareholders have different prices. Finally, the third phenomenon is regarding the unique rules of stock pricing. The share prices of new listed firms are not based on the supply and demand condition or the intrinsic value, but they are established by certain people.

Obvious indicators of inflation are the prices of food and fuel continue rising. This causes the demand for Chinese Yuan to increase. The inflation behavior can be observed from the changes in the consumer price index (CPI). If the CPI sustains growth, we can assume that the economy is experiencing inflation. When CPI>3%, we call it inflation; when CPI>5%, it is serious inflation (Dornbusch and Fischer, 1993). In most of the years, on average, the inflation rate of China is 4 percent. However, in 2014, the inflation rate is quite high which is about 5.4 percent (China National Bureau of Statistics, 2014).

Because of this, before making any investment in the stock market, investors must have a rough idea on the relationship between stock returns and inflation. Does inflation affect the stock prices? Whether the stocks in China are good instruments against inflation? Which hypothesis can reasonably explain Chinese stock market? All of these questions are waiting to be answered.

1.2 An Overview of the China's Stock Market and Inflation

As the China's financial market evolved, there has been a raising demand for a more market-oriented approach towards resource allocation, leading to the gradual establishment and

development of China's capital market The development of the China's capital market can be observed from the establishment of the Shanghai Stock Exchange in December 1990, followed by the Shenzhen Stock Exchange in April 1991. The China's stock market continues to experience the tremendous growth within the Chinese capitalization development for about 25 years. Generally, the development process of the China's stock market can be divided into three stages (Hess, 2014) after the introduction of the reform and opening-up policy:

During the first phase, from early 1978 to 1992, before the policy reforming and innovation, China adopted a planned-economy. At this moment, the Chinese authorities initiated a full-scale economic reform. The Chinese capital market began to emerge in response to the incorporation process of China's enterprises. There were a number of companies functioned as brokers trading securities in Shenzhen as brokers. During the second Phase: from 1993 to 1998, the Chinese Central Bank approved and established a number of securities companies. Their main businesses were about buying and selling stocks. At the same time, with the establishment of China Securities Regulatory Commission (CSRC) as a key milestone, the government consolidated the supervision of capital markets. The regional pilot programs were implemented nationwide and national capital market began to emerge and develop. Shanghai and Shenzhen Stock Exchange were set up separately. During the third Phase which is from 1999 to 2007, with the promulgation of the Securities Law as a key milestone, the legal status of China's capital market in the economy is formalized and strengthened, and a series of major reforms were implemented to facilitate further development of the capital market. Tremendous numbers of companies were listed on the stock exchange and stock market evolved.

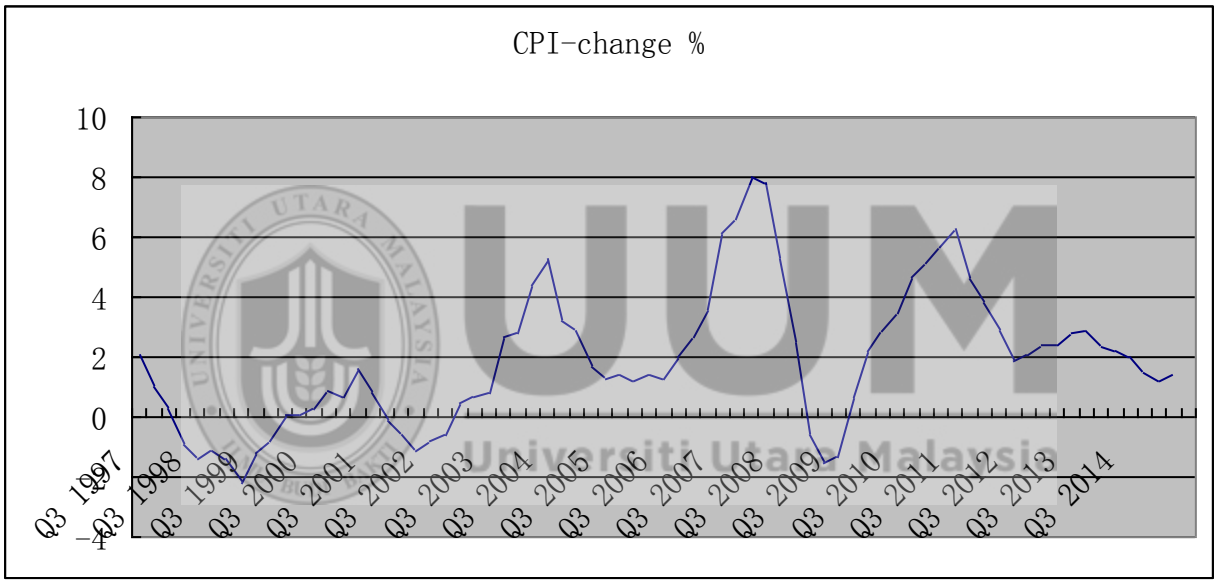
With the establishment of the stock exchange, on July 15, 1991, the Shanghai Stock Exchange (SSE) launched the SSE Composite Index and adopted December 19, 1990 as its base of 100 points. The SSE Composite Index is a market-capitalization-weighted index of all shares (A shares and B shares) which are traded on the Shanghai Stock Exchange. SSE Composite Index includes stocks of financial, industrial, insurance, transportation and other industries. Unlike the S&P 500, SSE Composite Index includes large and small companies, and it also considers speculative firms with low market capitalizations. Consequently, the movement of the SSE Composite Index generally indicates the performance of the whole economic industry as well as the investors' attitudes towards the stock market.

Since the economic reform and open policies which began in 1978, China is experiencing impressive economic performance. The fixed investment has been growing. The growth of real GDP is more than 8 percent per year. Monetary aggregates (such as M2) and the quality of RMB loans rise by approximately 15 percent annually. The Chinese economy is overheating because of these numbers. On the other hand, changes in CPI changes are very large (Databank from Bank of China 2014: http://www.boc.cn/fimarkets/summarize/).

According to the National Bureau of Statistics Yearbook 2014 (Chapter 5, pp.157-203), the inflation of China fluctuated in the past. From January 1992 to October 1994, the inflation rate change from 5.5 percent to 27.7 percent, which was quite high compared to the production capacity in the same period. After 1995, the Chinese government adopted the Tight Monetary Policy and the inflation rate declined immediately. However, because of the Southeast Asian Financial Crisis, China had a deflation during this time until March 1998. The deflation was over

in 2000, but from 2000 to December 2002, the inflation was negative again. From 2003 to January 2009, the inflation was positive and had been fluctuating. In 2009 owing to the Global Financial Crisis, there were nine months with negative CPI. Now Chinese inflation is around 3 percent because of the impact of quantitative easing monetary policy. Figure 1 illustrates China's inflation rates over the last 18 years, from September 1997 to July 2015.

Figure 1.1 Changes in the Consumer Price Index: China



Source: National Bureau of Statistics Database, China

1.3 Problem Statement

The stock market plays a very significant role in supporting fiscal and monetary policies for any countries (Chatziantoniou and Filis, 2013). Generally, we believe that stock market can develop an economy and act as a communication link between sectors that have surpluses and sectors lack of funds in which supply and demand for securities are brought together. In the secondary market, savers and investors can purchase and sell securities on the exchange at any time,

without affecting the firms directly. In the primary market, for the listed companies, it is also an issuers' market in which new issues can be placed. Since the stock market functions as a secondary market for investors to do transactions, the stock market functions as an important variable in a macro-economy.

With the economic development and growing financial market, stock investment has become a part of an individual economic life. Equities have become a common investing instrument for investors. According to the Wall Street Journal (2014), there are more 90 million individual investors until June 2015 in China. Consequently, the China's stock market plays an important role in both people's life and economic stability.

According to the research done by the Chinese financial statistic department, the world capitalization of listed companies is RMB73.6 trillion in the whole world, which is the same with the total global GDP at the end of 2013. In the end of the 2013, the listed companies' capitalization is 137 percent of GDP in America, 140 percent of GDP in UK, 105 percent of GDP in Japan, 133 percent of GDP in Canada, and for the emerging countries of BRICS is around 83 percent (Data resource: http://finance.china.com.cn/). At the same time, the China stock market experiences booming development. The ratio of stock market capitalization to GDP has increased from 17.7 percent in 2005 to 86.4 percent in May 2010. Now, there are 1476 listed companies in both Shanghai and Shenzhen Stock Exchanges. At the end of 2010, the total market capitalization has reached RMB26.8 trillion which is 107 percent of GDP. As of 2011, there are 109.3 thousand new investors joining the stock market recorded by China Securities Depository and Clearing Company Limited (http://www.chinaclear.cn).

Since the World War II, the inflation constantly influences the world's economies, especially the stagflation experienced by US in 1960s and the gruesome story of the great inflation in the 1980's, which Jeremy (1994) calls it "the greatest failure of American macroeconomic policy in the postwar period". Because of the side effect of inflation on the micro economy, all central banks try to control the inflation. From 1978 to 1980, the CPI of America shot up from 106.5 to 113.8 (Collard, 2007). The great inflation was said to be caused by oil prices. However, it was clear that monetary policies which provide large budget deficit were the main cause. The great inflation followed by a recession had destroyed many firms and hurt countless individuals (Friedman,1994). During the great inflation, the stock market was in mess. It lost 40 percent in the 18-months (Dan, 2008). At the same time, the economic recession had caused an unemployment rate to increase.

At the beginning of 2000, the global inflation began to rise, and for China, it saw the threats and pressures of inflation in 2004 and 2007 owing to the inflation. Kaaresvirta and Koivu (2008) believe that it is the cost-push inflation, because prices of international primary products go up, especially prices of raw materials and agricultural products which show a rapid upward trend. Similarly, food prices and wages rise. In some part of China, there exists the labor-shortage phenomenon. At the same time, money supply and bank loans intensify this crisis. The National Bureau of Statistics (2014) investigates the rationale behind increasing prices of final products for consumers. Based on China's Monetary Policy Report, there are a few reasons that cause the inflation. First, as the cost of agriculture products go up, the food prices increase as well. Second, an increase in the energy prices put pressure on other prices. Third, the cost of labor in China is

moving upward. Hence, the inflation is not just affect the real economic activities but also the stock market. Therefore, there is a need for investors and portfolio managers to secure their assets value against inflation.

Generally, investors believe that stocks are a good way to hedge against inflation and to keep their purchasing-power. Before 1950s, the western economists thought that stock could hedge against inflation, and they explored the famous Fisher Effect hypothesis. The hypothesis argues that the nominal interest rate equals to real interest rate plus the inflation rate, which means the value of the assets will assume the inflation in which they are positively correlated. However empirical results prove that stock prices and inflation may have a negative relationship. To explain this, Fama (1980) proposes the proxy hypothesis which explains the negative relationship among three variables: real economy, inflation and stock prices. Later, other scholars amend the proxy hypothesis making it closer to the reality. For instance, Kaul (1987) introduces the economy cycle into his paper. He points that in different period of business cycle, the inflation leads to different effect on the stock prices. For example, investors move money based on where they see future profit potential. So the business cycle can affect the overall market itself. There are numerous literature on the relationship between inflation and stock prices since 1920s, however their results are inconclusive.

From the controversy above, it is attention-grabbing to investigate inflation impact on stock market in China. As an emerging equity market, the China stock market has been experiencing an uncommon price movement recently. Within the China stock market, can stocks be used to hedge against inflation? Currently, there are very few studies on the relationship between

inflation and stock prices in developing countries. So this creates a gap to be studied. At the same time, other instruments such as mutual funds and financial directives are also being traded in the China stock market, so the knowledge regarding the relationship would give useful information for both investors as well as financial authorities.

1.4 Research Questions

There are three research questions that this study would like to highlight. They are:

- What is the relationship between inflation and stock prices during January 1990 to July 2015 in China?
- Can stock hedge against inflation in the short run and long run, in the case of China?

1.5 Research Objectives

The overall objective in this study is to investigate the relationship between inflation and stock prices in China. Specific objectives are as follows:

- To investigate the relationship between inflation and stock prices in China.
- To measure whether stock can be used to hedge against inflation in China.

1.6 Significance of the Study

It is a very meaningful work to study the relationship between stock prices and inflation. The significance and contribution of this study can be summarized as follows:

- The findings of this study regarding the relationship between China stock prices and inflation help investors to evaluate stock investment as instruments to hedge against inflation.
- The findings of this study will definitely enhance the understanding of related research.

- The findings of this study will provide an input to policy makers with respect to the variables that affect the China's capital market.

1.7 Organization of the Study

This study is organized as follows. Chapter 1 discusses background of the study, provides a brief overview on the China's stock market as well as the China's inflation condition, highlights the problem statement, research questions, research objectives and also the significance of the study. Chapter 2 gives an overview of the existing literature and theoretical background related to the study. Chapter 3 presents the proposed empirical models data and estimation techniques. Chapter 4 provides the empirical findings and discusses the findings. Finally, Chapter 5 summarizes and concludes the study.

CHAPTER 2

LITERATURE REVIEW

The relationship between stock prices and inflation has attracted considerable attention both in the theoretical and empirical literature. However there is no consensus being emerged. Basically, there are four main hypotheses related to stock prices and inflation: Fisher Effect hypothesis, Proxy hypothesis, Tax Effect hypothesis and Inflation hypothesis. Fisher (1930) argues that the expected rate of return is composed of a real return plus an expected rate of inflation. The 'Fisher effect hypothesis' assumes no relationship between real rate and monetary sector. So according to the formula, the expected rate of return is positive relating to the expected rate of inflation. However, Fama (1981) argues that stock returns are negatively related to inflation because stock returns are positively related to real activity and real activity is negatively related to change in the level of prices. Some scholars re-examine these hypothesis by using different financial market data, such as Ioannides Katrakilidis and Lake (2005), Geyser and Lowies (2001), Adam and Frimpong (2010), Limpanithiwat and Rungsombudpornkul (2010), Madsen (2004), Omotor (2010), Al-Sharkas and Al-Zoubi (2013).

Several empirical studies have investigated the relationship between inflation and stock prices in US and other industrialized countries (refer to Solnik, 1983; Feldstein, 1987; Ammer, 1994; Anari & Kolari, 2001; Rapach, 2002). For instance, Solnik (1983) in his attempt to study the relationship between stock returns and inflation expectation in nine countries (USA, Japan, UK, Switzerland, France, Germany, Netherlands, Belgium and Canada) from 1971 to 1980, shows that the stock price movements signal revision in inflationary expectations. He also highlights

that stock returns have a small impact on the real interest rate.

Similar to Solinik (1983), Feldstein (1978) discusses a crucial cause of the failure of share prices to rise during a decade of substantial inflation in USA from 1967 to 1976. According to him, results suggest that higher effective rate tax on corporate income caused by historic cost depreciation and the tax on the artificial capital gains caused by inflation reduce the real net yield. A study conducted by Ammer (1994) further supports Feldstein (1978). He investigates the empirical relationship between stock returns and inflation for ten industrialized countries from 1953 to 1971. His findings reveal that the higher inflation is always associated with both lower real dividends and lower required equity returns.

In another study performed by Anari and Kolari (2001), they use stock prices and goods prices to examine the long-run Fisher effect for stocks in US, Canada, UK, France, Germany and Japan from 1953 to 1998. Their results are consistent with most studies where inflation has a short run impact on stock returns. They also verify that the long-run relationship between stock prices and goods prices is positive and permanent in all cases. At the same time, the results also reveal that stock prices have a long memory with respect to shocks in goods prices, which means stocks are good inflation hedge over long period.

Rapach (2002) measures the long-run response of real stock prices to a permanent inflation shock for 16 individual industrialized countries from 1990 to 2000. Using a trivariate VAR framework, he finds the long-run real stock is positively related to a permanent inflation stock in a number of industrialized countries. Meanwhile the long run real interest rate is found to have a

negative relationship with the inflation shock in a number of countries.

In a different study, Ioannides, Katrakilidis and Lake (2005) examine the relationship between stock market returns and inflation for Greece from 1985 to 2000 and consider the possible structural breaks over the period of study. They argue that according to the Fisher effect stocks can be used to hedge against inflation and the real stock return is immune to inflation pressures. Their empirical results are divided into three different types: Firstly, the ARDL and Granger Causality results indicate a positive relationship between stock returns and inflation. Secondly there exists a long run negative relationship between the selected variables which is consistent with Fama (1981). Lastly, in the second sub-period (from 1995 to 2000), they find a mixed correlation. In the long run, the stock returns corresponds with inflation, however the real returns of the stocks does not change in this specific period.

Meanwhile, Geyser and Lowies (2001) investigate if the top-performing companies that are listed on the Johannesburg Securities Exchange and the Namibian Stock Exchange can provide a perfect hedge against inflation as proposed by the Fisher effect hypothesis from 1990 to 2000. Neither of the two countries offers a perfect hedge against inflation. Namibia shows a strong positive correlation between changes in stock prices and inflation. In contrary, Adam and Frimpong (2010), in testing the existence of a long run positive relationship between stock returns and inflation for Ghana from 1991 to 2007, indicate the validity of the Fisher Effect hypothesis. Their results strongly support the hedging hypothesis where higher inflation may not necessarily be associated with expectations of lower future returns.

While in the Asia region, Limpanithiwat and Rungsombudpornkul (2010) examine the relationship between inflation and stock prices in Thailand while considering the impact of specific events such as Tsunami and global economic recession on the relationship during the period from 2000 to 2010. Their VAR results show that the movement of stock prices is relevant to inflation which supports the Fisher Effect hypothesis advocated by the investors. On the other hand, Madsen (2004) indicates the shares cannot be used to hedge against expected inflation which is against the Fisher Effect. He advocates that the Fisher Effect hypothesis can be directly misleading and often does not reveal much about the validity.

Similar to Limpanithiwat and Rungsombudpornkul (2010), Omotor (2010), in studying the relationship between inflation and stock market returns for Nigeria from 1985 to 2008 suggests that stock market could provide an effective hedge against inflation, and this is consistent with the Fisher effect hypothesis. He recommends that investors in developing a good investment portfolio should perhaps consider equities as part of their portfolio to hedge against inflation. A study by Al-Sharkas and Al-Zoubi (2013) further support the long-run Fisher Effect hypothesis. Using four Arab countries from 2000 to 2009, their results indicate a long-run relationship between stock prices and good prices. Results on Jordan, Saudi Arabia and Morocco reveal the significance of the relationship. So they conclude that the stocks are a reasonably good inflation hedge over a long term.

Differently, Merikas and Merika (2006) examine the Fama's proxy hypothesis that stock prices respond positively to real economic activity and the negative relationship between stock return and inflation reflects the positive impact of real variables on stock returns. Their VAR results

indicate that the employment rate is significantly related to stock returns, and the employment growth forecasts inflation which is expected to erode the firms' profits. Another study conducted by Adrangi, Chatrath and Sanvicente (2011) investigates a puzzling negative relationship between stock returns and inflation rate in Brazil from 1986 to 1997. They use the Fama's proxy hypothesis framework to do the analysis. Their results reveal a significant negative relationship between inflation and real activity. However, the relationship between the real stock returns and real economic activities are positive which is consistent with Fama (1981).

Gallagher and Taylor (2002), in testing the Fama's proxy hypothesis in US over the last 40 years, find that the real stock returns to be insignificantly correlated with inflation due purely to demand innovation. They also notice that the stock returns strongly negative correlated with inflation due to supply innovations. A study by Al-Khazali (2003), in examining the short and long-term relationship between stock prices, inflation and output in 21 emerging capital markets from 1978 to 2001, supports that in the short run there is a negative relationship between stock returns and inflation. However, in the long run, his findings support the Fisher effect and the proxy hypothesis that the variables are positive correlated.

Meanwhile, Bekaert and Engstrom (2010) based on Fed Model using dynamic versions of Vector autoregressive framework in America help to do research. Their VAR results indicate that during the recession economic uncertainty and risk aversion may increase which leads to higher equity risk premiums, increasing yields on stocks. Similarly, Fazel (2008) examines the dynamic interaction between stock prices and inflation in US from 1950 to 2007. He concludes that rising inflation may have an adverse or a positive impact on stock prices. At the same time, in the long-

run, there is no stable and significant causal relationship found from inflation to stock prices.

There are some literature where they conclude more than one conclusion. Chidothi and Peyavali (2013) study the relationship between inflation and stock in Zambia for the period of 1999 to 2011. Their findings conclude that: 1) a one way causal relationship running from inflation to stock prices and not vice versa. 2) there is no co-integration found among the variables. 3) the results support the negative relationship between inflation and stock prices.

In a different study, Geetha, Mohidin, Chandran and Chong (2011) explore the relationship between inflation and the stock market and examine whether expected and unexpected inflation have significant relationships with the stock market in the short run and long run for US, Malaysia and China from 2000 to 2009. The results of VEC said that there is no short run relationship between the stock market, expected inflation, exchange rate, unexpected inflation, interest rate and GDP for Malaysia and US. China, however shows a short run relationship between expected inflation rates and the stock market.

In another research by Yeh and Chi (2009), they investigate the co-movement and long-run relationship between real stock return and inflation in 12 industrialized OECD countries using the quality data from 1957Q1 to 2003Q1. Their VAR model displays that a large portion of the sample of 12 OECD countries show negative relationship between inflation and stock returns in the long-run. However, the inflation in Australia, France and Ireland are inversely related to real stock return, regardless of whether variables are in the short or long-run relationship.

Floros (2004), in examining the relationship between stock returns and inflation for Greece from 1988 to 2002 using an OLS model, reveals positive relationship between inflation and the stock return. However, no long-run relationship is found between the variables in Greece. Most importantly, the stock returns and inflation are characterized as independent factors for Greece. On the contrary, Gregoriou and Kontonikas (2010) examine the long-run relationship between stock prices and goods prices and whether stock market investment can hedge against inflation. In conducting the study, they adopt different inflation regimes with the use of sub-sample regressions for 16 OECD countries over the period of 1970 to 2006. Results suggest there is a positive long run relationship between goods and stock prices and CPI is positive co-integrating with goods prices. Hence, these findings support the Fisher Effect hypothesis where stocks can be used to hedge against inflation in the long run.

Unlike Gregoriou and Kontonikas (2010), Shukairi, Waleed, AbdulBaset and Marwan (2012) indicate that even though stocks can be used to hedge against inflation, not all stock can hedge inflation perfectly. Their findings are based on a study conducted in Jordan for the period of 1998 to 2007. They justify that stocks may not be a perfect hedge because of the corporate cash flow are negative to the inflation. In the same vein, Choudhry (2001) investigates the relationship between stock returns and inflation in four high inflation countries (Argentina, Chile, Mexico and Venezuela) from 1981 to 1998. The findings confirm that stock return can hedge against inflation. Secondly they notice that previous rates of inflation also influence the current rate of stock returns. They mention that current real returns and current and one-period lagged inflation are inversely related.

Arjoon, Botes, Chesang and Gupta (2012) study integration and co-integration properties of inflation and stock prices and measure of the long run real stock prices response to a permanent inflation shock from 1980 to 2010 in South Africa. According to their study, results show that in the long-run real stock prices are invariant to permanent changes in the rate of inflation. However, any deviation in short run real stock prices is found to be corrected towards the long run value. On the other hand, Engsted and Tanggaard (2002), in studying the relationship between expected stock and bond returns and expected inflation at short and long horizons in US from 1925 to 1995, find that expected US bond returns and expected Danish stock returns move closely with expected inflation in the long term but not in the short term. Nevertheless, the positive relationship is not that strong.

Wei (2009) investigates the relationship between unexpected inflation and nominal stock returns across the business cycle from 1987 to 2007. His study indicates three main findings. Firstly, the share returns respond to unexpected inflation negatively in the economic contractions. Secondly, the lower book-to-market ratio and medium size firms' share returns are negatively related. Lastly, the excess return is the only factor responded to changes in the expected and unexpected inflation. Meanwhile, Campbell and Vuolteenaho (2004), in studying the relationship between inflation and stock return in America from 1927 to 1997, incorporate the expected long-run dividend growth. Their VAR results reveal that high inflation is positively correlated with rationally expected long-run dividend growth. Inflation is found to be almost uncorrelated with the subjective risk premium. They also find that inflation is highly correlated with mispricing supporting the Modigliani-Cohn views.

Even though there are quite a number studies addressing the issue on the relationship between inflation and the stock market, very few studies are found for developing economies. A summary of studies highlighted by Wilcox (2012) focuses mostly on the western countries. Examples of studies on the emerging countries include Bai (2014), Olufisayo (2013), Ibrahim, and Agbaje, (2013), Mahmood, Nazir, Junid and Javed (2014). Bai (2014) examines and verifies how the inflation influences the stock prices in China by focusing on the Fisher Effect hypothesis. The study applies the least squares and VAR models to illustrate the relationship between the Shanghai Composite Index and CPI using the yearly data from 2000 to 2012. They find that the inflation in China have a very limited effect on stock prices but cannot be ignored. Even during the high momentum of inflation, the stock market is still quite stable because of the government control and published policies. His macro-economy analysis indicates that even though there is no significant relationship between inflation and stock prices, the correlation between inflation and economy is very significant. Amongst the variables that affect the stock market is GDP. According to the impulse response and variance decomposition, even a small inflation change can still have a strong response effect on the stock prices.

Reddy (2012) investigates the impact of inflation and GDP on stock market returns in India from 1997 to 2009. He finds that if there is an increase in the GDP, it has a positive influence on the stock returns. Meanwhile Olufisayo (2013) investigates the relationship between inflation and stock price index in Nigeria from 1986 to 2010 both in the short and long run. He uses the Vector Error Correction Model to argue that the stock market can hedge against inflation in line with the Fisher Effect hypothesis. His empirical results support the theory of Fisher effect in the short run. Their co-integration test results confirm the Fisher Effect hypothesis in the long run. Hence

stocks can be used to hedge against inflation both in the short and long run. A study conducted by Ibrahim and Agbaje (2013) further supports Olufisayo (2013). They examine the dynamic interaction between stock returns and inflation in both short and long-run relationship in Nigeria from 1997 to 2010. Their results highlight a co-integration relationship between stock returns and inflation, and inflation is found to have a significant positive influence on stock returns. As such, this study affirms the proposition of the Fisher effect hypothesis. On the contrary, Mahmood, Nazir, Junid and Javed (2014) find that the inflation affects the stock prices negatively. Their study is conducted in Pakistan between 2005 and 2010 using the VAR model.

Even though there have been quite a number of studies investigating the relationship between inflation and stock price, the results are still ambiguous. Some of the studies support the Fisher Effect Hypothesis in which the stock market could be a good hedge against inflation, such as Olufisayo (2013), Ibrahim and Agbaje (2013), Yeh and Chi (2009), Chakravarty and Mitra (2013), Omotor (2010), Adam and Frimpong (2010). While some studies convey the opposite, like Chidothi and Peyavali (2013), Ioannides and Lake (2005), Adrangi and Sanvicente (2011), Mahmood and Javed (2014), Geetha, Mohidin, Chandran and Chong (2011), Bekaert and Engstrom (2010). Differences in the results are due to the different sample, period of study and the technique used.

This paper examines the relationship between stock price and inflation for China. From the literature review we can see that even though there are numerous researches about this topic, results are inconclusive. This study will try to fill the gap.

Table 2.1 Literature Review Map

No.	Author Title	Period of Study	Research Method (model)	Results / Foundlings
1	Bai (2014)	2000 – 2010 (yearly)	VAR model, impulse response, variance decompositions	1. The inflation has a very limited effect on the price index in China. 2. Currently the China experienced the fierce inflation momentum and the turbulence of the stock market. 3. the relationship between inflation and stock price is not obvious but the inflation on the macro economy is very significant. 4. a small change in the inflation creates a strong respond on the stock prices.
2	Olufisayo (2013)	Quarterly data from 1970 to 2010	Vector Error Correction Model	1. The results support the theory of Fisher Effect in the short run. 2. However, the results content some findings that is contradict towards the previous conclusions, in which there is a negative relationship between the inflation and stock prices. 3. The co integration test confirmed the theory of Fisher Hypothesis in the long run. 4. the study shows that stocks are a good detractive of hedging inflation both in the short and long period.
3	Chidothi and Peyavali (2013)	Monthly data from 1999 to 2011	VAR and Co-integration techniques	1. The results show a one way causal relationship running from inflation to stock prices and not vice versa. 2. There is no co-integration found among the variables 3. The results support the negative relationship between inflation and stock prices.
4	Ioannides, Katrakilidis and Lake (2005)	Monthly data from January 1985 to January 2000	ARDL and Granger causality tests	1. The evidence is in favor of a bidirectional negative long-run causal relationship. 2. Short run causal running from returns to inflation for the period between 1/1985 and 5/1992, while for the period 6/1992 to 1/2000 the direction is from inflation towards returns.
5	Geyser and Lowies (2001)	Yearly during the period 1990-2000	Dividend discount model	There is a strong positive correlation between changes in share prices and inflation.
6	Adrangi, Chatrath, and Sanvicente (2011)	From January 1986 to July 1997	The Johansen and Juselius co-integration tests	1. There is a negative relationship between inflation and real activity. 2. The relationship between the real stock returns and real economic activity is positive, that is to say, their founding supports the negative relationship between inflation and real stock returns.
7	Ibrahim and Agbaje (2013)	From January 1997 to 2010	ARDL bounds testing co-integration approach	1. There is a co-integration relationship between stock returns and inflation. 2. Inflation has a positive and significant effect on stock returns. 3. This study affirms the proposition of the Fisher hypothesis.

8	Mahmood, Nazir, Junid, and Javed (2014)	Monthly times series data from January 2005 to December 2010	VAR model	1. The results imply inflation affects stock prices negatively in Pakistan. 2. Investors would be certain about their returns from securities and stock prices will not be adversely affected.
9	Fazel (2008)	Employing data from January 1950 through March 2007	Sample regression and Granger causality tests	1. The results illustrated that at times rising inflation may have an adverse impact on stock prices; at other times the relationship may be positive. 2. In the long-run, there should not be any stable and significant causal relation from inflation to stock prices.
10	Geetha, Mohidin, Chandran, and Chong (2011)	Monthly time series data from January 2000 to November 2009	Cointegration test and Vector Error Correction Modeling.	1. The result of VEC said that there is no short run relationship between the stock market, expected inflation, exchange rate, unexpected inflation, interest rate and GDP for Malaysia and US. China, however, shows a short run relationship between expected inflation rates with China's stock market. 2. Stock market returns may be adversely affected by the inflation. Meanwhile, US and China should revise and improve their monetary policy to reduce the inflation and inflation expectations in the future.
11	Solnik (1983)	Monthly data from 1971 to 1980	Geske and Roll model	1. The results support the Geske and Roll model. 2. The impact of stock returns on the real interest rate is always small.
12	Yeh and Chi (2009)	Quality data from 1957Q1 to 2003Q1	VAR model and ARDL model	1. The results display that a large portion of the sample of 12 OECD countries show negative co-movement between inflation and stock returns in the long-run. 2. The inflation in Australia, France and Ireland are inversely related to real stock return, regardless of whether variables are in the c-movement or long-run relationship.
13	Chakravarty and Mitra (2013)	Monthly data from April 1994 to December 2010	VAR framework	1. The relationship is negative. 2. In the long run, inflation influences stock prices and that too in a positive direction. 3. the price rise shows a negligible effect on the production in the immediate short run. 4. Exchange rate shocks the production negatively though the impact on domestic prices is only negligible.
14	Omotor (2010)	Monthly data from January 1985 to December 2008	QGARCH model	1. The results suggest that in Nigeria, stock market return may provide an effective hedge against inflation. 2. Investors in making good portfolio decisions should perhaps view equities as long-term holdings against inflation's erosion of purchasing power. 3. The

				monetary and real sectors of the economy may not be independent of each other.
15	Adam and Frimpong (2010)	Monthly data from January 1991 to December 2007	Co-integration test	1. The result supports the hedge hypothesis. 2. Ghana market is efficient in inflationary environments. 3. Higher current inflation may not necessary be associated with expectations of lower future returns.
16	Feldstein (1978)	Theory only, no data	Self-making model	1. The higher effective rate of tax on corporate income caused by historic cost depreciation and the tax on the artificial capital gains caused by inflation both reduce the real net yield. 2. Although there is no clear evidence of a permanent fall in profitability, the transitory reduction may have caused some investors to project lower long-term pretax profitability.
17	Bekaert and Engstrom (2010)	Quarterly data from 1965 to 2010	VAR model	1. In recessions economic uncertainty and risk aversion may increase leading to higher equity risk premiums, increasing yields on stocks. 2. The proxy hypothesis is part of the explanation, their risk-based story clearly dominates.
18	Ammer (1994)	Monthly and quarterly inflation and treasury bill yield data from January 1953 to July 1971	Asset pricing model and Arbitrage Pricing Theory	1. The results show that the higher inflation always was associated with both lower real dividends and lower required equity returns in the future. 2. Inflation may increase the average cost of equity capital by around 50 basis points.
19	Anari and Kolari (2001)	Monthly data series for six national stock price indexes from January 1953 to December 1998	The method consistent with Engle and Granger(1987)	1. Their results consistent with previous studies of short-run inflation effects on stock returns. 2. The long-run relation between stock prices and goods prices is positive and permanent in all cases. 3. The results also reveal that stock prices have a long memory with respect to shocks in goods prices, which means stocks are good inflation hedge over long period.
20	Limpanithiwat and Rungsombudpornkul (2010).	Monthly data from January 2000 to March 2010	VAR Method	1. The results show that the movement of stock prices is relevant to inflation. 2. The findings are advocated by the investors.
21	Madsen (2004)	Data not available	OLS	1. Share returns are not hedged against expected inflation. 2. Fisher hypothesis can be directly misleading and often do not reveal much about the validity
22	Wei (2009).	Quarterly and yearly data from 1987 to 2007	Linear regression	1. The share returns respond to unexpected inflation negatively in the economic contractions. 2. The lower book-to-market ratio and medium size firms' share

				returns are negatively related. 3. The excess return was only factor responded to changes in the expected and unexpected inflation.
23	Merikas and Merika (2006)	Annual data from 1960 to 2000	VAR model	1. By the VAR test, the employment rate was significantly related to stock returns. 2. The employment growth forecasts inflation which is expected to erode the firms' profits
24	Rapach (2002)	Quarterly data from 1990 to 2000	Long-run neutrality propositions and Trivariate structural VAR framework	1. The results show little plausible evidence for a negative long-run real stock prices response to a permanent inflation shock in countries. 2. The long-run real stock positively related to a permanent inflation stock in a number of industrialized countries. 3. The long run real interest rate falls in related to inflation shock in large number of countries.
25	Shukairi, Waleed, AbdulBaset and Marwan (2012)	Annual data from 1998 to 2007	Excel and VAR model	1. Stocks can represent the value of the underlying real assets even though the growth of price level. 2. not all stocks can hedge the inflation perfectly. 3. the stocks are not a perfect hedge because of the corporate cash flow are negative to the inflation.
26	Floros (2004)	Monthly data from Athens stock Exchange the period October 1988 to December 2002	OLS model, Johansen CO-integration test and Granger-Causality test	1. The result is positive but not very significant relationship. 2. There is no long-run relationship between stock return and inflation in Greece. 3. The stock returns and inflation are characterized as independent factors in Greece.
27	Al-Sharkas and Al-Zoubi (2013).	Monthly time series of stock prices indexes and CPI for Four Arab Countries from January 2000 to December 2009	Method consistent with Engle and Granger (1987)	1. The results support there is a long-run relationship between stock prices and good prices. 2. In Jordan, Saudi Arabia and Morocco, the results support the Fisher hypothesis. 3. The stock prices have long memory which means stocks are a reasonably good inflation hedge over a long time.
28	Wilcox (2012).	Quarterly data from 1998 Q2 to 2012 Q2	Regression model for equity price sensitivity	1. Portfolio managers who believe expected inflation will increase significantly should tilt their portfolios toward low-yielding companies making significant investments in real assets. 2. Stocks rely heavily on nominal contracts as a funding source
29	Arjoon, Botes, Chesang and Gupta (2012)	Quarterly observations from January 1980 to February 2010	Structural bivariate vector auto-regressive methodology	1. The results show that in the long-run real stock prices are invariant to permanent changes in the rate of inflation. 2. Any deviation in short run real stock prices will be corrected towards the long run value.
30	Gregoriou and Kontonikas	Data from 16 OECD	Generalized Fisher hypothesis	1. The results suggest there is a positive long run

	(2010)	countries over the period January 1970 to June 2006	framework	relationship between goods and stock prices. 2. CPI is positive co-integrating with goods prices. 3. The founding supports the Fisher hypothesis and is consistent with the point that stocks hedge against inflation in the long run.
31	Campbell and Vuolteenaho (2004).	Monthly data from 1927 to 1997	VAR model and Fed model	1. High inflation is positive correlate with rationally expected long-run dividend growth. 2. Inflation is almost uncorrelated with the subjective risk premium. 3. Inflation is highly correlated with mispricing supporting the Modigliani-Cohn views
32	Choudhry (2001)	Monthly data from January 1981 to June 1998	The Gaussian semiparametric Method and VAR model	1. The findings confirm that stock return can be as a hedge against inflation. 2. Previous rates of inflation also influence the current rate of stock returns. 3. Current real returns and current and one-period lagged inflation are existing inverse relationship.
33	Engsted and Tanggaard (2002).	Quarterly data from 1925 to 1995	VAR model	1. Expected US bond returns and Expected Danish stock returns move closely with expected inflation at long horizons but not at short period. 2. In US, the expected returns and inflation is positive related but quite weak at all horizons. 3. For US stock returns the Fisher model does not perform better.
34	Gallagher and Taylor (2002)	Quarterly and annual data for the period 1957Q1 through 1997Q4	Multivariate innovation decomposition	1. The real stock returns were found to be insignificantly correlated with inflation due purely to demand innovation. 2. The stock returns strongly negative corrected with inflation very significantly due to supply innovations.
35	Al-Khazali (2003)	Monthly data from January 1978 to December 2001	The GARCH model	1. The study supports that in the short run there is a negative relationship between stock returns and inflation. 2. They reject the proxy-effect hypothesis in the short run. 3. In the long run, the findings support the Fisher effect and the proxy hypothesis.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter highlights the research methodology adopted for this study. In assessing the relationship between stock market and inflation, this study employed Vector Error Correction Model (VECM) estimation technique. This method was adopted for several reasons (MacKinnon, 1998). First, the VAR model seems to be the most reasonable method because it does not need a priori assumption of exogenous variables. Second, when estimating, the VAR accepts that for every variable they can interact by themselves without imposing a theoretical structure. Third, the VAR model gives us a convenient approach for analyzing the impact on themselves and all variables by using variance decomposition and impulse response function. Nevertheless, before the VECM could be employed, the underlying variables were exposed to a number of stationary tests to identify their integration order.

3.2 Data

This study employs monthly data sourced from the DataStream and World Bank spanning the sampling period from September 1997 to July 2015. Particularly, we use the Shanghai composite index to represent the stock price (SP), the inflation (INF) which is the Consumer Price Index (CPPY=100), interest rate and industrial production (IP) in China adopting the variables suggested by Olufisayo (2013).

The summary of the data characteristics employed in this study is shown in the Table 3.1. The

Skewness value is mixed including the positive and negative values, as we can see the stock price index, inflation and interest rate is positive, while industrial production is negative. The kurtosis of inflation is not equal to 3. So the values are not distributed normally on its variance and mean. There are 215 observations for each of stock price index, CPI, IP and interest rate. The stock index ranges from 1060.74 basis points to 5954.77 basis points and this large range reflects on its high standard deviation of 923.0435. Average index value between 1997 and 2015 is 2152.536 basis points. Regarding inflation, the average CPI during the investigation period is 101.8795. It ranges from 97.8 to 108.7 percent, and the volatility is comparatively high which is 2.34109. From the above mentioned variables characteristics, we can see that SP, INF and IP have high standard deviation.

Table 3.1 Summary of the variables characteristics

	SP	INF	INTEREST	IP
Mean	2152.536	101.8795	0.60235	112.4028
Median	2012.79	101.6	0.585	112.3
Maximum	5954.77	108.7	0.1008	123.2
Minimum	1060.74	97.8	0.0485	101.8
Std.Dev.	923.0435	2.34109	0.008076	4.04335
Skewness	1.481767	0.590324	1.77814	-0.00909
Kurtosis	5.518869	2.995907	6.97441	2.44452
Jarque-Bera	135.5148	12.48745	254.7978	2.767125
Probability	0	0.001943	0	0.250684
Sum	462795.3	21904.1	12.9505	24166.6
Sum Sq.Dev	1.82E+08	1172.87	0.013959	3498.618
Observations	215	215	215	215

3.3 Stationary Tests

The assumption of classical regression is that the data series must be stationary. If we use the nonstationary data, our regression results will be spurious. So in order to meet the requirement of stationary data, we always have to change the original data to stationary data by differential conversion, then we can use the stationary series modeling. However, another question exists that after the differential sequence, it will be difficult to explain on economic implication and it also loses the long-term information from the original data, which will have an impact on the modeling.

Stationary tests can be divided into two categories: 1) unit root tests based on the characteristics of time series diagrams and auto – correlogram and 2) an application of a quantitative test. So what is the unit root. For $\chi t = \rho\chi t{-}1 + \varepsilon_t$ (wherein t =1, 2,…, ε_t is a stationary series whose mean is 0). When ρ = 1 the time series χt is a random-walking- process which is a unit root process (Gujarati, 2003). Then the $\chi t = \rho\chi t{-}1 + \varepsilon_t$ can be like this:

$$(1 - \rho \mathrm{L})\, \chi_t = \varepsilon_t \qquad (3.1)$$

Wherein: L is lag operator, $1 - \rho \mathrm{L}$ is lag operator polynomial and its characteristic equation is $1 - \rho z = 0$, with a root being $z = 1/\rho$. When the $\rho = 1$, we can say there is a unit root for time sequence x_t. Then x_t experiences a unit root process and this sequence can be transformed into a stationary series by difference. When the $\rho < 1$, we can say that x_t is stationary time series. But when $\rho > 1$, x_t is a non-stationary process and it can not become a stationary process even after difference. Therefore, x_t is not an integrated process. Normally, an integrated process can

also be called a unit root process.

Basically, there are three unit root tests that are normally used to assess whether the variable contains a unit root or not. Among then include Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. For the purpose of this study, we are going to employ the ADF, PP and KPSS to test for the unit root.

3.3.1 Augmented Dickey-Fuller (ADF) Test

The most common method used to test the unit root of a variable is the Augmented Dickey-Fuller (ADF) test. The Null hypothesis of the ADF test is that the time series under consideration has a unit root meaning nonstationary. Usually if the P-value is less than 0.05, we can reject the null hypothesis in which the variables are stationary series.

ADF test (Augmented Dickey-Fuller test) was improved on the base of DF test by Dickey and Fuller in 1979. The ADF test was created by adding lagged dependent variable x_t at the right-hand in the formula to control high-order autocorrelation of ε_t. Equation (3.2) is called ADF test model 1. If we add constant term to model 1, we can get the ADF test model 2, which is equation (3.3). Then, add time-trend term to model 2, we can get the ADF test model 3, which is equation (3.4).

$$\Delta\chi_t = \delta\chi_{t-1} + \sum_{p}^{i=1} \theta_i \Delta\chi_{t-i} + \varepsilon_t \tag{3.2}$$

$$\Delta\chi_t = \alpha + \delta\chi_{t-1} + \sum_{p}^{i=1} \theta_i \Delta\chi_{t-i} + \varepsilon_t \quad (3.3)$$

$$\Delta\chi_t = \alpha + \beta t + \delta\chi_{t-1} + \sum_{p}^{i=1} \theta_i \Delta\chi_{t-i} + \varepsilon_t \quad (3.4)$$

For all these three models, the null and alternative hypotheses are: H0:$\delta = 0$; and H1:$\delta < 0$. The null hypothesis indicates that the variables contains unit root. As long as one of these three equations can reject the null hypotheses, the variables are considered to be stationary VECM sets a rule that before a VECM can be employed, the underlying variables must be stationary at first difference, in other words, they must be integrated of order 1 (*I*(1))

3.3.2 Phillips-Perron (PP) Test

In addition to the ADF test, the other test that we can use to test the unit root is the Phillips-Perron (PP) test. The PP test was proposed by Phillips and Peron in 1988. They made some nonparametric amendments on the ADF test and introduced the Phillips-Perron test statistics. Their statistics not only take the heteroscedasticity of ε_t into consideration, but also consider the impact of autocorrelation error. The results will have the same distribution of τ. Then we can use the statistic table of critical value τ (DF distribution table) to judge the results. Specifically, the Phillips-Perron model is as follows:

$$\Delta\chi_t = \delta\chi_{t-1} + \varepsilon_t, \text{ t} = 1, 2\ldots \quad (3.5)$$

The null hypothesis for the PP test is similar to the ADF test in which there is an indication of a

unit root. There are still many ways to test the unit root, such as KPSS which was created by Kwiatkowski, Phillips, Schmidt and Shin in 1992, DF-GLS which was proposed by Elliot, Rothenberg and Stock in 1996 and NP which was proposed by Ng and Perron in 2001.

3.3.3 Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test

Unlike unit root tests, the KPSS test has been made to complement unit root tests as the last have low power with respect to near unit root and long run processes (Shin and Schmidt1992). KPSS provide straightforward test of null hypothesis of trend stationary against the alternative of a unit root. The equation can be seen as follow:

$$Y_t = \beta t + (r_t + \alpha) + e_t \tag{3.6}$$

Where: $r_t = r_{t-1} + u_t$ is a random walk. The initial value $r_0 = \alpha$ serves as intercept. T is the time index, Ut are independent distributed.

The null and the alternative hypotheses are as follows:

H0: Yt is trend (or level) stationary

H1: Yt is a unit root process.

3.4 Cointegration Test and Vector Error Correction (VEC) Model

Traditional approaches describe the relationship between variables based on the economic theories. However, there is no very clear description on the dynamic link between the variables based on economic theory. In 1964, Sargen proposed the Vector Error Correction (VEC) Model (Watson, 1994). The VECM model is not based on the economic theory. It is in the form of multiple simultaneous equations in the model and for each equation, each endogenous variable

will be calculated on all the lagged values of the endogenous variables in the model. VECM is used to predict time series in which the variables are interrelated. So it can analyze the impact of random disturbance variables on the dynamic variable model, meaning, explaining the impact of economic shocks on the economic variables (Watson, 1994).

According to the Granger causality theory (Granger, 1987), cointegration test can be used to estimate both short and non-equilibrium parameters. If the variables Xt and Yt are cointegrated, they have a long-run relationship. In the short term these variables can be uneven, because the disturbance term is ε_t. However, the short term uneven relationship between the variables can be described by Error Correction Model (ECM). This model is as the following:

$$\Delta Y_t = I(\Delta Y_t, \Delta X_t) + \lambda \varepsilon_{t-1} + \upsilon_t \qquad (3.7)$$

Where $Y_t \sim I\,(1), X_t \sim I\,(1), X_t, Y_t \sim CI\,(1,1), \varepsilon_t = Y_t - \beta_0 - \beta_1 X_t \sim I\,(0)$

υ_t is the white noise and λ is the short-term adjustment coefficient term

Engle and Granger (1990) propose the cointegrating theory which is a linear regression with non-constant variables and the results have long run equilibrium relationship associating with economic implications. Therefore, we use the cointegration model proposed by Johansen (1988). Because there are K difference and N variables, the VAR model will be set as following:

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \Gamma_1 \Delta Y_{t-2} + \cdots + \Gamma_{k-1} \Delta Y_{t-k+1} + e_t \qquad (3.8)$$

However, when the economic variables are integrated with each other, there will be in violation of the endogenous hypothesis by using VAR model. So according to Engle and Granger (1987), they believe that there are error correction items in the model, it is necessary to solve this problem by establishing the Error Correction Model (VECM) for the cointegration relationship between the variables. The model is as following:

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \Gamma_1 \Delta Y_{t-2} + \cdots + \Gamma_{k-1} \Delta Y_{t-k+1} + \Pi_k \Delta Y_{t-k} + e_t \quad (3.9)$$

The Π_k is the long term impact matrix and $\Pi_k \Delta Y_{t-k}$ is the error correction item. In this paper, we use Johansen cointegration test to determine the optimal model for cointegration test and set the VECM. So there are five categories as following:

Model 1: (VAR without trend, VECM without intercept)

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{k-1} \Delta Y_{t-k-1} + \alpha \beta' Y_{t-1} + \phi D_t + e_t \quad (3.10)$$

Model 2: (VAR without trend, VECM with intercept)

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{k-1} \Delta Y_{t-k-1} + \alpha(\beta', \beta_1)(Y'_{t-1}, 1) + \phi D_t + e_t \quad (3.11)$$

Model 3: (VAR with trend, VECM with intercept)

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{k-1} \Delta Y_{t-k-1} + \alpha \beta' Y_{t-1} + \mu_0 + \phi D_t + e_t \quad (3.12)$$

Model 4: (VAR with trend, VECM with trend)

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{k-1} \Delta Y_{t-k-1} + \alpha(\beta', \beta_1)(Y'_{t-1}, 1) + \mu_0 + \phi D_t + e_t \quad (3.13)$$

Model 5: (VAR with quadratic trend, VECM with trend)

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{k-1} \Delta Y_{t-k-1} + \alpha\beta' Y_{t-1} + \mu_0 + \mu_{1t} + \phi D_t + e_t \quad (3.14)$$

The types of determine integrate rank respectively are three different categories:

(1) $Rank(\Pi) = \rho$, the Π is Null Rank, there are cointegration relationship between the variables and Yt is constant columns.

(2) $Rank(\Pi) = \rho$, Π is Full Rank, there are no cointegration relationship between the variables and Yt is un-constant columns.

(3) $0 < Rank(\Pi) = r < \rho$, from Yt, there are r long- term cointegration vector.

In order to determine the number of integration vector, Trace test and Maximum Eigenvalue test from Johansen Maximum likelihood estimation will be conducted. The models are following:

(1) Trace test

H_0: there are r integration vectors among the variables at most.

H_1: there are r+1 integration vectors among the variables at least.

The model is

$$LR = -T \sum_{i=r+1}^{p} ln(1 - \lambda_i) \quad (3.15)$$

(2) Maximum Eigenvalue test

H_0: there are r integration vectors among the variables at most.

H_1: there are r+1 integration vectors among the variables at least.

The model is $LR = -Tln(1 - \lambda_{r+1})$ (3.16)

In the model, $Tln(1 - \lambda_{r+1})$ is the test statistic. If it can not reject the H0, it indicates that there are r cointegrate vectors between the variables.

Given that all underlying variables are *I*(1), we can proceed with the VECM co-integration test. Engle and Granger proposed a co-integration test in 1987 which was a very useful method for modeling non-stationary sequence. If the variables are not stationary, according to co integration theory, their linear combination is called a cointegration equation, which is seen as a stable long-term equilibrium relationship. If there is long-term relationship between the variables, the deviation of the system must be random and bounded. Along with the time, this state can be measured or described based on co integration and error-correction (Gujarati, 2003).

Long-term equilibrium relationship means the underlying variables which are found to be co-integrated are converging towards equilibrium along with the time. It requires long-term collaborative movement between the components of the variables, which means all the variables must move along in a same way and same direction. Supposing the long-run relationship between X and Y is described by the following equation:

$$y_t = \alpha_0 + \alpha_1 \chi_t + \varepsilon_t \qquad (3.17)$$

The disturbing term ε_t is as a linear combination of X and Y, so ε_t is also called non-equilibrium error term and ε_t is a stationary series and has a mean equals to 0. In this situation, ε_t is called equalization error. When (3.7) random disturbance term is equalization error, then X and Y have a long run equilibrium relationship.

Cointegration means if $\chi t = \{x_{1t}, x_{2t}, ...x_{kt}\}$ are all D-order integration and their vector quantity is $\alpha = \{\alpha_1, \alpha_2, ...\alpha_k\}$, then it will result in $Z_t = \alpha\chi^T \sim I\,(d-b)$, wherein $b > 0$. Then we can believe that the sequence $\chi_t \sim CI\,(d,b)$ is (d,b)-order integration, said $\chi_t \sim CI\,(d,b)$, wherein $b > 0$. It can be seen that the number of co integrated vector called χt co integration rank (Gujarati, 2003, p.182).

3.4.1 Optimal Lag Selection

In time series modeling, the determination of lag length is an essential part in most econometric study. For a given data generating process (DGP), determining the lag is to find a model among the many options to make it close to real DGP (Li and Zhou, 2006). There are five alternatives lag length selection criteria for determining the optimal lag length. They are sequential modified LR test statistic (LR), Final Prediction Error (FPR), Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC) and Hannan-Quinn Information Criteria (HQ). In this study, we will consider the lag suggested by these criteria.

3.5 Granger Causality Test

Granger causality is a method that is used to analyze the causal link between the variables. This method was pioneered by Clive. W.J. Granger to analyze the causal relationship between

economic variables. Granger defines causality as "the best least-squares prediction which relies on all the information on some point in the past time" (Granger, 1990).

In the time series, the Granger Causality definition between two economic variables X and Y is that variable X that evolves over time Granger causes another evolving variable Y if predictions of the value of Y based on its own past values and on the past values of X are better than predictions of Y based only on its own past values. Then we can say that variable X is the Granger cause for variable Y (Gujarati, 2003, p.233).

The prerequisite of Granger causality test is the time series must be stationary, otherwise, the results are spurious regression. Therefore, before applying the Granger test, we need to determine the stationarity of the variables. The assumption of Granger causality test is that all the prediction information on variable X and Y are included in the time series of these variables. So the test estimates the following regression equations:

$$y_t = \sum_{q}^{i=1} \alpha_i x_{t-i} + \sum_{q}^{j=1} \beta_j y_{t-j} + \mu_{1t} \tag{3.18}$$

$$x_t = \sum_{i=1}^{s} \lambda_i x_{t-i} + \sum_{j=1}^{s} \delta_j y_{t-j} + \mu_{2t} \tag{3.19}$$

Wherein, the white noise μ_{1t} and μ_{2t} are assumed to be irrelevant.

3.6 Impulse Response and Variance Decomposition

The impulse response function is based on the VAR model. It gives a one standard deviation on the error term affecting the present value and future value of endogenous variables. Impulse

response can show how disturbance of a variable will impact on the other variables in the system and the processing of back to itself. We can get the equation as following (Gujarati, 2003, p.305):

$$Y_t = \int_{\propto}^{-\infty} X_\tau H\left(t-\tau\right) d\tau = X\left(t\right) * H\left(t\right) \tag{3.20}$$

Where the any input signal is $x(t)$ the corresponding output is $y(t)$

Variance decomposition indicates that when one variable in the system gets an impact of a standard unit shock, it can use the percentage of predicting variance to reflect the degree of interaction between the variables. Its basic idea is each endogenous variable change will be decomposed into the variance components of items associated with each random perturbation function (Robles, 2012). So we can understand the importance of each new message to the endogenous variables in the system.

3.7 Theoretical Framework

In this study, we apply a simple model which is supported by theories and empirical literature to estimate the relationship between stock prices, inflation, interest rate and industrial production in China. The model is represented as follows:

$$SP = F\ (INF,\ INTERE,\ IP)$$

$$LSP_t = \beta_0 + \beta_1 LINF_t + \beta_3 LINTERE_t + \beta_3 LIP_t + \varepsilon_t \tag{3.21}$$

Where,

LSP_t = the natural log of stock prices index at time t

$LINF_t$ = the natural log of inflation rate at time t

$LINTERE_t$ = the natural log of interest rate at time t

LIP_t = the natural log of industral production at time t

β = Parameters to be estimated

ε = White noise error term

t = Time

There are a few reasons that we use log transformation: 1) They look at normality of the outcome variable rather than normality of the errors. 2) They overestimate the importance of the normality assumption. 3) The variance of data is not homogeneous.

For the stock price index, we use Shanghai composite stock index. SSE composite index is a market- capitalization-weighted index of A shares and B shares. A shares represent the stocks issued by domestic companies for China's investors which are denominated by RMB and B shares represent the stocks issued by domestic firms for foreign investors which are denominated by US dollar. We use consumer price index (CPI) as a proxy variable for inflation from September 1997 to July 2015. For the interest rate, we use seven-day interbank interest rate as interest rate. To assess the impact of total production on the stock index, we use industrial production data to proxy for the total out production.

This chapter is mainly about the methods we use to conduct analysis on the relationship between inflation and stock prices. It covers stationary tests until the formulation of theoretical framework.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter, we report and discuss results and findings of the study. In Chapter 1, we have spelt out the objectives of this study which include: 1) To investigate the relationship between inflation and stock prices, and 2) To measure whether stock can be used to hedge against inflation. Hence, the techniques employed are tailored towards achieving the objectives.

4.2 Correlation Test

Table 4.1 highlights the correlation matrices between the variables. It shows the stock price index has a positive correlation with CPI, interest rate and industrial production. The correlation between inflation and stock price is around 53 percent. Industrial production is positively correlated with CPI and the stock price index but negative with interest rate. CPI is positively correlated with all the other three variables. In all case of positive correlation, the high coefficient of correlation is between stock price index and CPI.

Table 4.1 Spearman Rank Correlation

	CPI	SP	INTEREST	IP
CPI	1			
SP	0.530837	1		
INTEREST	0.252902	0.100707	1	
IP	0.359557	0.105371	-0.10638	1

4.3 Unit Root Tests

Before we can perform a VECM cointegration test, there is a need to verify the stationary of the data. The VECM estimation technique requires that the underlying variables should be stationary in their first difference level. To verify the stationary of the variables, we adopt Augmented Dickey Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS). Results of the unit root for each underlying variables are reported in Table 4.2. Results of ADF, PP and KPSS test indicate that all underlying variables of the stock price index, inflation, interest rate and industrial production are stationary at their first difference at intercept only as well as at intercept and trend.

Table 4.2 Unit Root Tests

Augmented Dickey-Fuller (ADF)				
	Intercept		Intercept and Trend	
	Level	First Difference	Level	First Difference
LSP	-1.50542	-12.93062*	-2.616155	-12.89979*
LINF	-2.43611	-6.158041*	-2.890238	-6.162992*
LINTEREST	-2.56832	-12.94172*	-2.512034	-12.90852*
LIP	-1.56281	-5.520615*	-1.607117	-5.718211*

Phillips-Perron (PP)				
	Intercept		Intercept and Trend	
	Level	First Difference	Level	First Difference
LSP	-2.02536	-13.36405*	-2.608097	-13.33729*
LINF	-2.64535	-14.06383*	-3.039594	-14.03664*
LINTEREST	-4.02474	-13.11836*	-3.888487	-13.09529*
LIP	-7.50996	-38.12646*	-7.51609	-38.92649*

Kwiatkowski-Phillips-Schmidt-Shin(KPSS)				
	Intercept		Intercept and Trend	
	Level	First Difference	Level	First Difference
LSP	0.925429*	0.044139	0.08981*	0.044222
LINF	0.672847*	0.040772	0.132639*	0.039834
LINTEREST	0.184956*	0.257843	0.154533*	0.176231
LIP	0.383817*	0.113856	0.375955*	0.041049

Notes: *significant at 1% level.

Given that all the underlying variables are stationary at first difference, this study proceeds with the cointegration test. According to Johansen and Juselius (1990), the cointegration is very sensitive towards the choice of lags. As indicated in Table 4.3, we have adopted lag 5 as suggested by LR test statistic.

Table 4.3 Optimal Lag Length Estimation

Lag	LR	FPE	AIC	SC	HQ
1	1847.486	6.20E-14	-19.0596	-18.73759*	-18.92938
2	51.90452	5.57e-14*	-19.16715*	-18.58755	-18.93276*
3	26.82872	5.67E-14	-19.15085	-18.31365	-18.81229
4	26.41405	5.76E-14	-19.13528	-18.04048	-18.69255
5	30.28486*	5.72E-14	-19.14352	-17.79111	-18.59662
6	12.02916	6.26E-14	-19.05502	-17.44501	-18.40395

* indicates lag order selected by the criterion.

4.4 Cointegration Test

The results of the trace statistic and maximum eigenvalue statistic prove that the Null hypothesis of no-integration can be rejected (refer to Table 4.4). There is at least one cointegrating vector in the model.

Table 4.4 Johansen-Juselius Test for Multiple Cointegrating Vectors

Trace Statistic and Max. Eigenvalue Statistic		
Hypothesized No.	Trace Statistic	Max-Eigen Statistic
None *	57.2855*	29.0607*
At most 1	28.2248	16.5992
At most 2	11.6256	9.9172
At most 3	1.7083	1.7083

Notes: * indicate significance at 5 percent.

4.5 Vector Error Correction Model (VECM)

Table 4.5 highlights long run VECM results of the cointegrating vector. The only variable that is significant is the inflation rate. The results indicate that inflation has a positive influence on the stock price index. A one percent increase in the inflation rate which is represented by the CPI is reflected into nearly 40 percent increase in the stock price index. This positive relationship between the stock price index and inflation reveals that stocks can be used to hedge against inflation. The results can be summarized as follows:

$$LSP = 3.8478LIP + 1.0717LINTERE - 38.3981LINF + 154.7940 \quad (4.1)$$

Table 4.5 Normalized Cointegrating Coefficients

Long run Cointegrating Equation From VECM			
Variable	Coefficient	Standard Error	T-statistic
LSP	1.00000		
LIP	3.84784	1.75613	1.92915
LINTERE	1.07172	0.62101	1.72577
LINF	-38.39816	5.89294	-6.51596*
C	154.79400		

Note: * significant at 5% level.

Then we proceed our investigation by estimating the VECM for each set of variables to report the corresponding equation. The VECM also can provide the correction terms that reflect influences of deviation of the relationship between the variables. In the short run, the VECM results (refer to Table 4.6) suggest that all fundamental variables have no impact on the stock price index in short term horizons of lag 1 to lag 3. However, at lag 4 all variables except the interest rate play an important roles in influencing the stock price index.

Table 4.6 Short run VECM results

Dependent Variable: LSP						
Coefficient Estimates of						
Lag	ECM	D(LSP)	D(LIP)	D(LINTERE)	D(LINF)	CD
	0.009850					0.003319
	[-2.91818]*					[0.57988]
1		0.037270	0.012625	0.387045	1.889831	
		[0.48882]	[0.04758]	[1.52435]	[1.79984]	
2		0.104070	-0.304111	-0.123393	0.652810	
		[1.39748]	[-0.92088]	[-0.48879]	[0.63386]	
3		0.003829	-0.505859	-0.082299	-1.058425	
		[0.05116]	[-1.45756]	[-0.32655]	[-1.03817]	
4		0.185831	-0.657831	0.058673	-1.992728	
		[2.42569]*	[-2.01840]*	[0.23145]	[-1.94732]*	
5		-0.010973	0.019116	-0.118073	-0.870361	
		[-0.13951]	[0.07363]	[-0.50668]	[-0.84017]	

Notes: *significant at 5% level and t-statistics in [ ]

The error correction term (ECT) shows the adjustment coefficient for the variables along with the short run dynamics. The ECT in D(LSP) is found to be statistically significant with the correct negative sign. The adjustment coefficient related to the stock price index is 0.0099 which indicates that 0.9 percent of last month's deviation is corrected in this month. This is confident to accept the cointegration hypothesis and showing the presence of a stable long run relationship between stock price index and other macroeconomic factors. However, the speed of adjustment to equilibrium is quite slow in all equation relatively.

4.6 Granger Causality Test

Granger Causality test is mainly used to test whether endogenous variables can be treated as an exogenous variables (Granger, 2003, p.492). The null hypothesis is the independent variable cannot Granger cause the dependent variable, and the alternative hypothesis is the independent

variables can Granger cause the dependent variable. Table 4.7 highlights the results of the Granger Causality/Block Exogeneity Wald Tests based on the VECM

Table 4.7: Granger Causality Test and Block Exogeneity Test Based on VECM

Null Hypothesis	Chi-square Test	Probability	
LIP does not Granger Cause LSP	7.7522	0.0407*	→
LINTERE does not Granger Cause LSP	2.6736	0.0502	
LINF does not Granger Cause LSP	8.6575	0.0235*	→
LSP does not Granger Cause LIP	5.6613	0.3406	
LINTERE does not Granger Cause LIP	1.6651	0.8933	
LINF does not Granger Cause LIP	10.1204	0.0719	
LSP does not Granger Cause LINTERE	8.6202	0.1252	
LIP does not Granger Cause LINTERE	8.4297	0.1341	
LINF does not Granger Cause LINTERE	8.3043	0.1402	
LSP does not Granger Cause LINF	6.9597	0.2237	
LIP does not Granger Cause LINF	18.8215	0.0021*	→
LINTERE does not Granger Cause LINF	9.3913	0.0494*	→

Notes: * is significant at 5% level

Results from the table indicate that industrial production and inflation Granger cause the stock price at 5 percent significance level. The interest rate is found to Granger cause the stock price at 10 percent significance level. Meanwhile, the industrial production and interest rate are found to Granger cause inflation at 1 and 5 percent significance levels respectively.

4.7 Diagnostics Tests

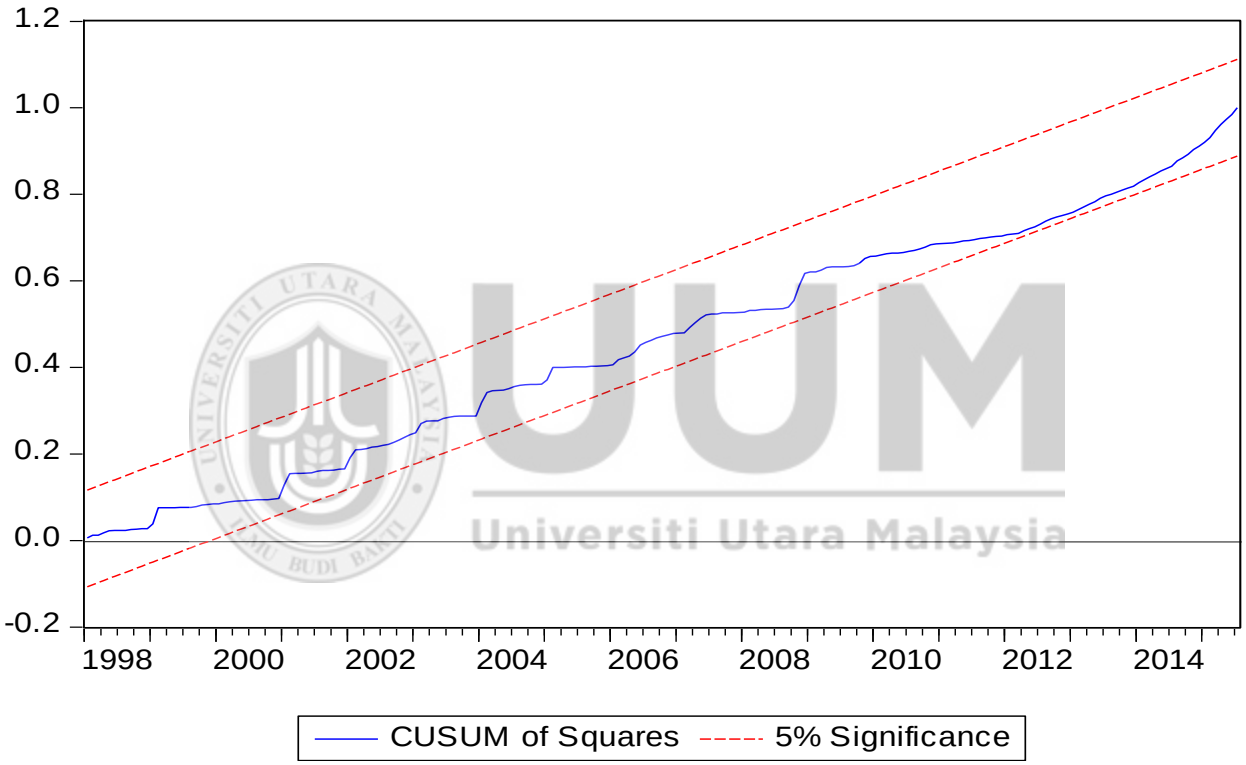
In order for the results to be approved and accepted, its residuals must satisfy the diagnostic tests of serial correlation, normality, heteroscedasticity and also the stability tests.

4.7.1 CUSUM Squares Test

In order to test the reliability of the model, we examine the stable structure of VECM using the

cumulative sum of squares of recursive residuals (CUSUM squares test). According to Lee and Na (2003), if the model structure is stable, CUSUM square's curves should be in a steady state at the 5 percentage significance level, which means they should be locked within the range of the two lines as indicated by Figure 4.1 which indicates that the stability of the model is preserved.

Figure 4.1: CUSUM square test



4.7.2 Serial Correlation Test

Table 4.8 conveys that the model satisfies the serial correlation assumption. According to the serial correlation test, the null hypothesis is no serial correlation at lag order. The results in Table 4.8 show that from Lag 1 to Lag 5, the P-value is higher than 0.05. So we cannot reject the null hypothesis where the variables do not exhibit serial correlation.

Table 4.8: VEC Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	19.61267	0.2001
2	25.27754	0.0651
3	14.99151	0.5253
4	13.52797	0.601
5	20.07267	0.217

4.7.3 Normality Test

Table 4.9 indicates that the residual at the long run relationship estimated previously on the stock price index does not meet the normality assumption. The results communicate that the residuals are not normally distributed. However, MacDonald and Ricci (2003) argue that non-normality as a result of excess Kurtosis does not affect Johansen's results.

Table 4.9 VEC Joint Tests for Skewness, Kurtosis and Jarque-Bera Test

Component	Skewness	Kurtosis	Jarque-Bera
1	-0.40852	4.202374**	18.40307*
2	-0.43312	7.12397	154.638*
3	-2.18404*	12.84448*	1010.113*
4	0.125154	3.17485	0.811843

Note: **significant at 5% level, *significant at 1% level. P-values

4.7.4 Residual Heteroskedasticity Tests

Table 4.10 shows the results of heteroscedasticity test. If the P-value is less than 0.05, we can reject the null hypothesis that there is heteroscedasticy among the variables. However, the probability value is 0.4941, we accept the null hypothesis that it meets the assumption of homoscedasticity and the VECM results are reliable.

Table 4.10 Residual Heteroskedasticity Tests

VEC Residual Heteroskedasticity Tests		
Joint test:		
Chi-sq	df	Prob.
516.9397	420	0.4941

4.8 Variance Decomposition Analysis

Variance decomposition and impulse-response functions help us to identify the effect of shocks to the stock prices. Variance decomposition is employed as a tool for evaluating the dynamic interactions and strength of causal relation among the set of variables in the model. The results of variance decomposition are presented in Table 4.11.

Results in Table 4.11 roughly indicate that the Shanghai stock prices index is an exogenous variable in the short run, in this case, for the period equals to 24 months. Even though industrial production and inflation do not explain much for variation in the stock price index, their proportion of explanation is increasing the longer the period.

Table 4.11 Variance Decomposition

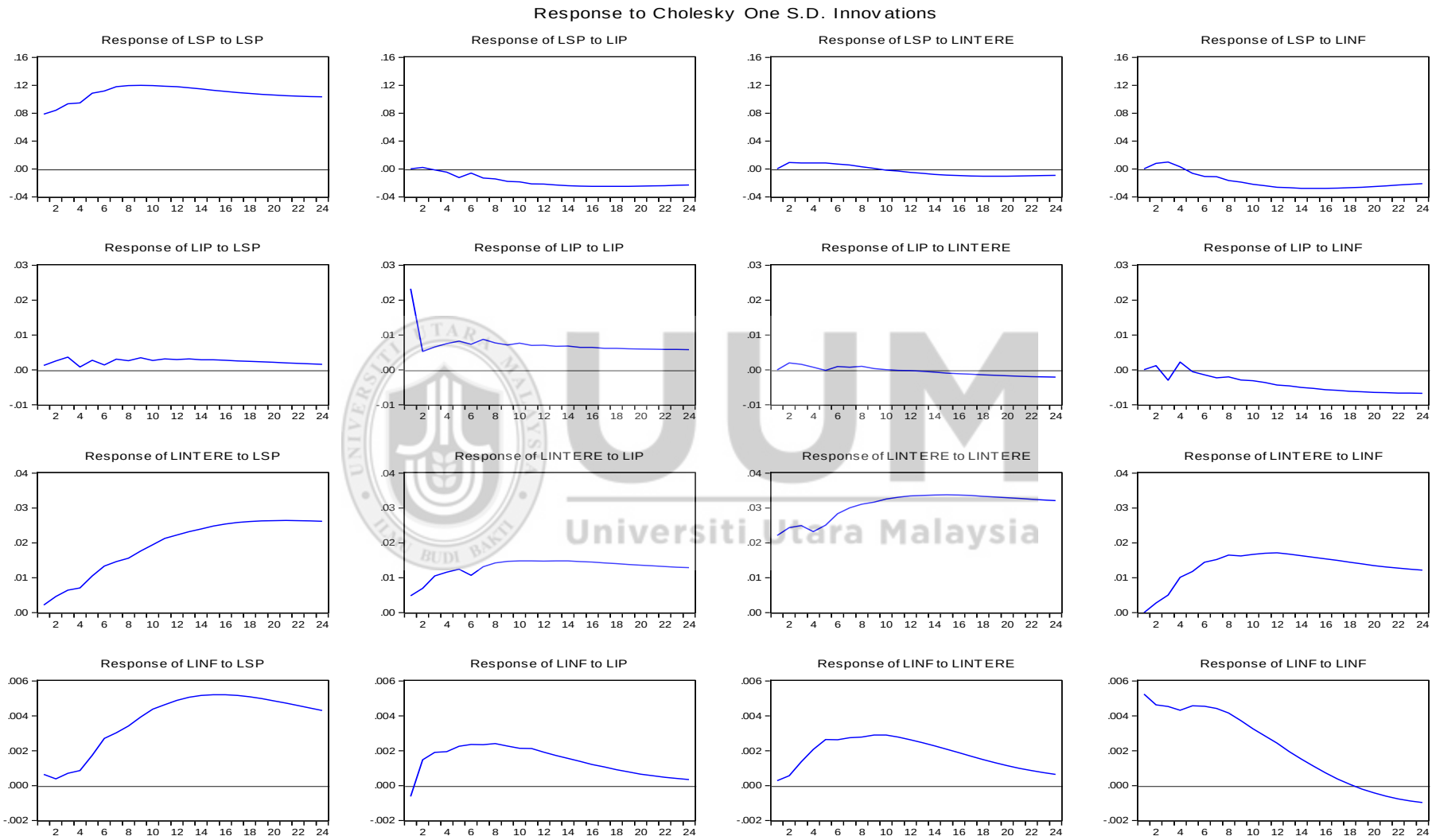
Variance Decomposition of LSP:					
Period	S.E.	LSP	LIP	LINTERE	LINF
1	0.0785	100.0000	0.0000	0.0000	0.0000
2	0.1156	98.8639	0.0339	0.6323	0.4700
3	0.1493	98.5289	0.0311	0.7141	0.7260
4	0.1770	98.6289	0.0883	0.7339	0.5490
5	0.2083	98.3945	0.4233	0.6945	0.4877
6	0.2369	98.4044	0.3899	0.6221	0.5836
7	0.2651	98.2650	0.5490	0.5435	0.6425
8	0.2917	97.9919	0.6929	0.4595	0.8556
9	0.3165	97.6191	0.9127	0.3911	1.0771
10	0.3395	97.2055	1.0906	0.3423	1.3616
11	0.3611	96.7296	1.3119	0.3097	1.6488
12	0.3814	96.2493	1.4997	0.2945	1.9565
13	0.4004	95.7815	1.6940	0.2924	2.2321
14	0.4182	95.3260	1.8796	0.3032	2.4911
15	0.4348	94.8996	2.0583	0.3214	2.7207
16	0.4505	94.5088	2.2240	0.3449	2.9222
17	0.4652	94.1623	2.3746	0.3702	3.0929
18	0.4791	93.8589	2.5122	0.3958	3.2332
19	0.4923	93.6005	2.6340	0.4202	3.3454
20	0.5049	93.3842	2.7433	0.4423	3.4302
21	0.5170	93.2086	2.8382	0.4614	3.4918
22	0.5285	93.0696	2.9214	0.4769	3.5321
23	0.5397	92.9639	2.9921	0.4890	3.5550
24	0.5505	92.8871	3.0525	0.4977	3.5628
Cholesky Ordering: LSP LIP LINTERE LINF					

4.9 Impulse Response Functions

The impulse response functions show the dynamic response to the effect of shock in one variable upon itself and on other variables. The impulse response functions are reported in Figure 4.2. In analyzing the impulse response, we focus on the following considerations: 1) the effect of inflation shock on stock prices; 2) the impact of stock market on inflation; 3) the inflation-growth relationship; 4) the effect of industrial production shocks on growth and stock prices.

As the graphs reveal, a one standard deviation shock applied to inflation shows a negative effect on stock prices both in the short and long run. What this seems to suggest the results support the Fisher Effect in China. A one standard shock to stock prices produces a marginal negative impact on the inflation in the very short period, however in the long run there exists a positive and increasing trend. Other significant outcomes from the repulse response functions are recorded in the followings: a one standard deviation shock to the interest rate produces a slight positive impact on the stocks in the short run, and then the tendency of stock prices is decreasing in the medium term and marinating a constant level in the long run. Industrial production has a slight negative impact on stock prices in the first period and continue negative in the medium and long run. A one standard deviation shock stock prices produces a positive effect on industrial problem in the short run but this effect is not so long. Inflation rate shows a positive impact on industrial production at the beginning, however in the medium and long run there is a negative influence. The industrial production has a positive effect on the interest rate and inflation through the time horizon, however, the influence reduces, the longer the period.

Figure 4.2 Impulse Response Functions



4.10 Summary

The results of the Vector Error Correction Model (VECM) imply that there is positive significant relationship between stock price index and inflation in the long run as well as in the short term. However, the significant of the short run influence of inflation on the stock price can only be seen in lag 4. These results are consistent with the findings of Olufisayo (2013) and Ibrahim and Agbaje (2013) where they find a positive cointegration relationship between inflation and stock prices significantly. These results also indicate that China's stock do have a long memory with inflation shocks, which means that stocks are a reasonably good instrument for hedging inflation in the long term.

The Granger causality results show that the China's stock market is positively influenced by both inflation and industrial production. This means the rise of economic activities will boost stock market response and investing behaviors. In the same way, if there is an increase in the economic growth, it will result in raising optimal consumption and shifting in the investment opportunity set for investors. Given the importance of positive relation is that it may indicate the hedging opportunities for investors, when the changes in the real economic activity. Inflation put pressure on the purchasing power, future corporate profits and normal discount rate.

Lastly, the insignificant relationship between interest rate and stock market should not be a surprise. This is due to the nature of the Chinese stock market which is less liquidity, less efficient and policy-oriented. The China's stock market also reflects information asymmetry. Asprem (1989) explains that the interest rate is inversely related to stock price, when the stock and financial market are illiquid and not efficient. Interest rate carries some information about

certain changes in the future, such as dividends and prices (Barsky, 1986). The fluctuation of interest rate leads to an increase in the risk, which may affect investors investment towards the stock market, shifting from risky assets (stocks) to less risky assets (bonds and real estate).

CHAPTER 5

CONCLUSION

5.1 Conclusion

This study provides an extensive idea about the relationship between the China's stock market and inflation. There are many scholars investigating the relationship between stock prices and inflation from different perspectives. However results of the studies vary both theoretically and empirically. Based on the review of the literature, we examine whether the stocks can be hedged against the inflation in China empirically.

Using monthly data from September 1997 to July 2015 for stock price index, CPI, interest rate and industrial production in China, conclusions that we can make for this study are as follows: 1) There is a significant correlation between stock prices and inflation in China. The China's stocks can hedge the inflation effect, in other words, stocks are inflation-hedging assets. Stock prices are volatile and one of the factors that affect the stock price is inflation. For China, the stock market is 25-year old in the reforming period. The China stock market is no longer a weak-form of efficient market as being revealed by many studies. Owing to this, the information from CPI can reflect something in the financial market, but other unpublished news may not bring huge dramatic shock to the stock prices with large volatility.

2) There is positive correlation between inflation and industrial production, however the relationship between stock prices and industrial production is not significant. The industrial production links the stock prices and inflation as pointed by Fama. According to the results, the

proxy theory cannot explain the relationship between inflation and stock prices. The Granger causality test also indicates a unidirectional causality in which the industrial production can Granger cause the inflation.

5.2 Policy Suggestions

Since there is a significant relationship between inflation and stock, when investors expect that the inflation will go up, stocks are a better vehicle for holding or preserving the value. At the same, the results prove that the monetary policy is non-neutral in the financial market. So the government can use the monetary policy to influence the inflation rate, then it will change the real returns of investment and real economic activities in China.

From the proxy hypothesis and variability hypothesis we learn that proper high inflation can increase the uncertainty of real economic activities. It can be seen that the fluctuations of price levels play a role in affecting the national economy. At present, China is experiencing the inflation with high assets and estate prices. So there is a need for the government to manage and control inflation through monetary policy and other economic factors. In the long run, these policies will not only improve the real economy development but also help to increase the stability of the stock market.

5.3 Limitation of the Study

The limitations of this study can stretch from the assumptions we made on this study. First, we assume that majority of investors and government are rational, they know well about the market. Second, the stock prices reflect the macroeconomic conditions and national policies. However,

these assumptions do not always hold. Third, we do not consider the impact of foreign currencies on stock prices. The China's economy heavily depends on the export, because of this, there are many foreign funds entering into China. These funds also have an influence on domestic stock prices and inflation. Because the reasons mentioned above, some conclusions may be one-sided and not objective.

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