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Comparison of Macroeconomic Factors Explanatory Power Between Chinese and Swedish Stock Market

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Abstract: In order to seek the difference between Chinese and Swedish stock market, this thesis makes a comparison of explanatory power of macroeconomic factors between the stock markets in respective country. The vector autoregressive (VAR) models are implemented to analyze the relationship among the market returns and macroeconomic variables, i.e., GDP, CPI, exchange rate, unemployment rate and interbank offered rate in China and Sweden. The empirical result illustrated that Chinese stock market is more sensitive to the changes of macroeconomic variables than Swedish stock market. To make a clear interpretation for the estimation result, impulse responses functions and variance decompositions are applied to support the empirical test. Moreover, we analyzed the potential reasons that may cause the differences between Chinese and Swedish stock markets.

Key words: Chinese and Swedish stock market, macroeconomic variables, VAR, impulse responses functions, variance decompositions

Contents

1.Introduction

As countries are diverse in size and openness, each country has unique economy structure, different stock markets are affected by varieties level of domestic and foreign shocks. The relationship between stock market and macroeconomic factors is a hot topic in recent years. There are plenty of studies focused on this field, the stock markets in varieties of countries were examined. However, these researches generally concentrated either on a single market, such as the United States, China, India, Pakistan etc, or on a group of countries in similar developing level, for instance, EU, ASEAN-5 and BRIC countries. Few studies pay attention to the comparison between specific countries with different economy structures, that is, a country with high degree of economy freedom, and characterized by innovation with a large number of knowledge-intensive industries operating both in domestic market and international market, and a country that is less open and regulated by government policies, owns cheap labor and relatively high productivity in the prime and secondary industry mainly serve to domestic market, with few companies expand their operations to global competition. Therefore, this paper chooses two individual countries, China and Sweden to be investigated, and aims to analyze what exactly the difference is between the two countries in the aspect of how stock market responses to macroeconomic factors. Furthermore, we made an attempt to find the causes to the diversity.

1.1 Background

As a result of the economy reform and opening-up policy, China has experienced a booming economy during the past three decades. During this long-term reforming period, reformist transformed the original planned economy in the Mao Era to market-oriented economy, this strategy significantly stimulate the vigor of China's falling economy. Economists estimate that China has a 9.5% a year of GDP growth from 1978 to 2005. This estimation made this country become the second largest economy after the United States. In the past ten years, Chinese government

continuously reduces tariffs, trade barriers and regulations, in order to be integrated with international economic system. China's accession of WTO in 2001 leads to market diversification and greater increase of export. With this trend, although a managed floating exchange rate system is still adopted by China, since 2005, the RMB exchange rate float with a basket of currencies, no longer pegged to the U.S. dollar. This adjustment of foreign currencies' policy reflects that increasing international cooperation is unavoidable to involve China into economic globalization. However, although Chinese market is opened to private capital and foreign investment, the state monopolies still exit in some sectors such as energy, communication, and banking system. In other words, key economic sectors are under control by the country meanwhile other sectors are not. This so-call "dual-track" economy indicates that China cannot be defined as a relative high freedom economic country. In 2012, China was rated as "mostly unfree" for ranked by 138th among 179 countries in Index of Economic Freedom World Rankings[1].

The stock market in China has been closed for 40 years since the Mao Era. With the development of a series of reform implementations, Shanghai Stock Exchange (SSE) was finally re-established on November 26th, 1990, marks the beginning of stock market in People's Republic of China. Few days later, on December 1st, 1990, Shenzhen Stock Exchange (SZSE) was founded. SSE and SZSE made up of the financial market in China. The Chinese stock market developed well in the past 20 years, SZSE even opened a NASDAQ-type exchange board for high-growth, high-tech start-ups in 2009. Up to 2011, the total market value of the two stock exchanges is over 3.3 trillion U.S. dollars. Concerning the stock markets are young, many of the companies listed in stock market are subsidiaries of state monopolies, Chinese government constituted a number of regulations to restrict the market operation, therefore it is hard to say that the Chinese stock market is efficient.

Different from China, as a typical Nordic country, Sweden maintains a steady

[1] Source: http://www.heritage.org/index/ranking

economy growth. During both World Wars, Sweden declared itself to be neutral, this strategy prevented this country from rebuilding its economic basement like many other countries did. Another feature Sweden possessed is an export-oriented economy, which means Sweden economy relies heavily on international trade. As a member of EU, the trade policy of Sweden is the same as other members'. Companies in Sweden are mostly under private control. To achieve a high standard of basic living and suitable welfare system, Sweden has the second highest tax revenue. Due to the efficient regulatory and transparent policies, Sweden was ranked at 21st among 179 countries in Index of Economic Freedom World Rankings, which rated as "mostly free".

The stock market in Sweden has longer history than China'. The Stockholm Stock Exchange (Stockholmsbörsen) was founded in 1863. Although it was acquired by OMX in 1998, and in 2003 the operations were merged with those of the Helsinki Stock Exchange, the Swedish stock market performed well and steady. In 2011, the total market value of NASDAQ OMX Stockholm is 4230 billion SEK. Because of the trend of integration in European stock markets, the Swedish stock market is highly related to the whole European market. Thus the market performance can no longer only represents its individual, but also indicates the whole European, especially the Nordic countries' financial situation.

It is believed that the maturity of stock market is effective when stock prices are cointegreted with macroeconomics factors, and the movement of stock market is bond to the macroeconomy in the same direction. The Chinese stock market is less efficient because the government implements fiscal and monetary policy to manage stock market, consequently to influence macroeconomic function, the policy plays the role of transmission mechanism between stock market and macroeconomy. Whereas in Sweden, the reaction of stock market is the response to macroeconomics movement, thereafter fiscal and monetary policies are brought into effect, in other words, the policy is the result of efficient market. Furthermore we should keep in mind that the

difference between Chinese and Swedish market is led by respective policy regime, degree of openness, and the maturity of development, therefore when we investigate the explanatory power of macroeconomic factors to Chinese and Swedish stock market, different macroeconomic indicators may be better for a significant effect observed on stock market than that with the same macroeconomics variables. In spite of this, considering this thesis stresses on the comparison, we maintain to test the two stock markets with the same set of macroeconomics factors.

1.2 Purpose

Our purpose is to estimate the relationship between stock returns and macroeconomic factors in China and Sweden respectively, and we emphasize on the comparison of explanatory power of macroeconomic factors between SZSE and Stockholmsbörsen. Moreover we aim to explore rational explanations, which cause the difference. The idea comes from the Efficient Market Hypothesis (EMH), which asserts that stock returns can reflect all the public macroeconomic information available in a specific time. Based on this theory, we choose gross domestic production (GDP), consumer price index (CPI), exchange rate (ER), unemployment rate (UR) and interbank offered rate (IR) as target macroeconomic variables. And we apply vector autoregressive model (VAR) to test how the stock returns are explained by these variables in each country. To make clear the size, direction and proportion of the effect, impulse response functions and variance decompositions are used to interpret the estimated VAR model. We aim to inspire investors and policy makers from our result, it could be a reference for latest economy situation.

The thesis is divided into several parts: The first part is topic introduction and objective description, which has been presented above. The second part is a literature review of previous findings. The third part concerns to a brief overview of relevant theory. The fourth part focuses on data description, such as the categories and the motivations of chosen historical data. The fifth part mainly applies the methodology on the chosen database to perform an analysis on how each macroeconomic variable

can explain the stock market of each country. In the sixth part, there will be conclusions based on the obtained empirical results, and reasonable explanations of the cause of differences between both countries.

2.Literature Review

The relationship between macroeconomic factors and stock market is concerned in a variety of literatures. Up to now, the stock markets of both developing and developed countries have been included in the previous studies. For example, Wongbangpo and Sharma (2002) analyzed interdependence between stock markets and fundamental macroeconomic factors in the ASEAN-5 countries. Nasseh and Strauss (2000) pointed out the existence of a significant, long-run relationship between stock prices and domestic and international economic activity in six European countries, i.e., France, Germany, Italy, Netherlands Switzerland and the United Kingdom. Robert (2008) investigated the time- series relationship between stock market index prices and the macroeconomic variables of exchange rate and oil price for Brazil, Russia, India, and China (BRIC countries), the results indicated that there is insignificant association among stock prices and macroeconomics variables, which can reflected the level of market efficiency. Moreover, in BRIC countries, domestic factors influence on stock markets more than external factors. Araujo (2009) studied the economic sources underlying the co-movement of real stock returns in Latin America. Besides, another sets of studies focused on the stock market in a single country. Sundaram (2009) examined the relationship between macroeconomic parameters like exchange rate and foreign institutional investment with stock returns in India. Mohammad et al (2009) explored the correlation among the macroeconomics variables and share prices of Karachi Stock Exchange in context of Pakistan. Billura and Saida (2010) analyzed the interactions between Kazakhstan stock market index and macroeconomic variables.

When choosing the suitable macroeconomic factors, different authors had their own considerations. Ibrahimi, Oxelheim and Wihlborg (1991) mainly explored the

exchange rates and macroeconomic influences on real stock price. Their results indicated that the effect on real equity returns of macroeconomic disturbances is unstable across exchange rates and monetary regimes. Rapach et al (2005) examined the predictability of stock returns using macroeconomic variables in 12 industrialized countries, and they found that interest rates are the most consistent and reliable predictors of stock returns across countries. Yinxia (2008) test the efficiency of the Chinese stock market with respect to monetary policy, money supply and interest rate are chosen to be representative of monetary policy.

With regarding to the main methodology which was realized in previous literatures, Chen, Roll and Ross (1986), Ferson and Campbell (1993) employed Arbitrage Pricing Theory (APT) illustrated that the spread between high- and low-grade bonds, the spread between long and short-term interest rate, the expected and unexpected inflation and the industrial production can be considered as sources of risks, which are significantly priced and explain US stock market movement. Cheung and Ng (1998), Humpe and Macmillan (2007), Mukherjee and Naka (1995), based on Vector Regressive (VAR) model investigated that industrial production, inflation, long-term interest rate, money supply, consumer price index (CPI) and the exchange rate influence stock returns in developed countries, like United States, Japan, Australia, Canada and some European countries. Furthermore, Mukherje and Naka (1995) found that the exchange rate is positively relates to stock prices in Japan. Flannery and Protopapadakis (2001), Liu and Shrestha (2008) applied Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model in their researches. The former found that realized returns and their conditional volatility depend on macro-series' announcements. The latter drawn the conclusion that industrial production and money supply are positively related to the stock prices, while inflation, interest rates and currency value are negatively related to the stock prices in China. Maysami and Sims (2002), Maysami and Koh (2000), Maysami, Howe and Hamzah (2004) employed Engle and Granger's (1987) Error Correction Model (ECM) and Johansen's (1990) Vector Error Correction Model (VECM) in analyzing macroeconomics variables and

stock markets in developing regions, i.e., Hong Kong, Singapore, Malaysia, Thailand and Korea. In particular, Singapore market was influenced more by exchange rate and interest rates, which shows that Singapore market was more sensitive to external factors than internal factors. It is worth to mention that Maysami et al concluded that the more integrated country the larger effect of international risk factors, i.e., exchange rate on its stock markets. At the same time, Nasseh and Strauss (2000) applied both VECM and unrestricted VAR model to conclude that the coefficients for industrial production, CPI, short term interest rate and business expectations are positive, while the coefficients for long term interest rate are negative. Moreover, they found that European stock markets are highly integrated with that of Germany and the explanatory powers of macroeconomics variables are different for specific countries.

3. Theoretical Background and Methodology

3.1 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) is one of the main theories explaining stock price changes and formation. Under the efficient market hypothesis, the prices in stock market reflect all the available information, and rational investors react immediately to the new release information and adjust their investments. The goal that investors pursue is to maximize their value with lowest risk, as macroeconomics variables such as gross domestic product (GDP), consumer price index (CPI, proxy for inflation), unemployment rate, interest rate and exchange rate are believed having significant impact on the returns, in asset pricing model macroeconomic factors are taken into account to price stocks and are identified as macroeconomics risks. Therefore, the macroeconomic explanatory power in stock market is motivated by the sensitive of stock market returns to the macroeconomic conditions.

3.2 VAR models

VAR model is the extensive form of Autoregressive (AR) model for multi-factors time series data, it was popularized in econometrics by Sims (1980). The VAR models are used to estimate the system with all endogenous variables including stock returns and macroeconomic variables. All the variables are endogenous and there is high flexibility for no restrictions. Each variable is not only determined by its own lags but allows for depending on others' past disturbances, each equation can be estimated separately by ordinary least square (OLS). Comparing with previous methodology as mention in literature reviews, VAR estimation is a simple technique to capture the interdependencies among multiple time series and modeling macroeconomics relationships.

A VAR model with g variables and k lags in a compact matrix is expressed as:

$$\underset{gx1}{y_t} = \underset{gx1}{\beta_0} + \underset{gxg}{\beta_1}\underset{gx1}{y_{t-1}} + \underset{gxg}{\beta_2}\underset{gx1}{y_{t-2}} + \cdots \underset{gxg}{\beta_k}\underset{gx1}{y_{t-k}} + \underset{gx1}{u_t}$$

where y_t is the explained (dependent) variables, β is the sensitivity of explanatory (independent) variables to explained variables, u_t is the error terms. In VAR model, we assumed variables and error terms to be uncorrelated with each other.

Although in VAR system, there are six equations to be estimated, since we aim to analyze how stock market returns (R) are affected by selected macroeconomics variables: GDP, CPI (inflation), rate of unemployment (UR), exchange rate (ER) and interbank offered rate (IR), only the equation which R_t as explained variable is our main target. Based on the VAR model we presented in Chapter III, we primarily establish the following model.

$$R_t = \alpha_{1t} + \beta_{11}R_{t-1} + \cdots \beta_{1k}R_{t-k} + \gamma_{11}GDP_{t-1} + \cdots \gamma_{1k}GDP_{t-k} + \delta_{11}CPI_{t-1} \cdots + \delta_{1k}CPI_{t-k} + \varepsilon_{11}UR_{t-1} + \cdots \varepsilon_{1k}UR_{t-k} + \theta_{11}ER_{t-1} + \cdots \theta_{1k}ER_{t-k} + \lambda_{11}IR_{t-1} + \cdots \lambda_{1k}IR_{t-k} + \mu_{Rt}$$

where k is the lag length.

4. Variables and Data Description

4.1 Choice of Variables

The following variables were chosen for the thesis to test how the stock market can be explained by macroeconomic factors in Chinese and Swedish stock market. Stock indices came from the historical data of the main stock exchanges in both countries. In the aspect of macroeconomic factors，we choose the gross domestic product level (GDP), the consumer price index (CPI), the Exchange rate (ER), the rate of unemployment (UR) and the interbank offered rate (IR) of each country as the explanatory variables.

The GDP level represents a country's overall economy condition, the high GDP usually stands for a strong economy growth and prosper financial market. In addition, a country with high GDP means the companies in that country have extensive returns, thus the increase of GDP would lead to high stock prices. On the contrary, the rate of unemployment is a negative signal of the economy to the investors. Therefore investors lower the expectation for the stock returns.

With respect to the inflation, consumer price index (CPI) is considered as proxy. It could be used for diagnosing indirect effect of inflation. Some researches showed that the inflation has a positive relation with stock returns, while some researchers presented an opposite opinion that the inflation has a negative influence on stock returns. Further researches argued that there is no relationship between inflation and stock returns. The same situation goes to exchange rate and interest rate.

Exchange rate is regarded as the value of currency of one country. The appreciation of

domestic currency is the consequent of increasing export. The increase of export is usually considered as a good signal of economic development for increasing foreign exchange reserve on national layer. However, for export oriented companies, with the appreciation of domestic currency, the expense of exported goods and services counteracts the company's profit and drives up the stock returns. Overall, the direction of relationship between exchange rate and stock returns is relies on whether a country was characterized by import or export dominance. Besides, the fluctuation of exchange rate is a reflection of international trade activities and the openness of one country's policy.

Since the level of interbank offered rate is an indicator of the cash flows in the market, meanwhile banks act as an important role in capital distribution and macroeconomics operation, it is reasonable to consider interbank offered rate has the same utility as interest rate to be a representation of macroeconomics factor. The interbank offered rates are closely link with the liquidity of financial market. Generally the increase of interest rate reflects a tightening monetary policy, in this condition, capital shifts from market to banks, corresponding with the financial market fluctuations, the interbank offered rate would be raised up. Therefore, the increase of interbank offered rate, on banks' side, ensures liquidity requirements, whereas on market' side, indicate insufficient or week financial flexibility, so that the interbank offered rate most likely to have a negative effect on stock markets.

Although with the primary hypotheses discussed above, it is noticeable that due to the diversity of openness, monetary policies and economic structure across different countries, the chosen variables are expected to have various effects on the stock returns, even the influences are unstable and dynamic. Besides, each macroeconomics variable cannot be viewed as independent factor, because these variables are not only interdependent with stock market but with each other.

4.2 Data Description

There are 108 monthly data as observations in our sample. The whole testing period

ranges from January 2002 to December 2010, which is relative effectiveness to explain current situation in stock markets. The data are collected from Stock Exchanges, National Statistics Institution and Central Bank in Sweden and China.

Nasdaq OMX Stockholm 30 Index is our base source for measuring the performance of Swedish stock market. For China, we select SZSE Composite Index as our researching target. It is known that there are two stock exchanges in China, the reason why we choose Shenzhen Stock Exchange is that the data of Shanghai Stock Exchange in estimation period cannot be gathered completely.

The raw data of GDP, CPI and rate of unemployment came from the National Bureau of Statistics of China and Statistics Sweden, whereas the sources of exchange rate and interbank offered rate from People's Bank of China and Sveriges Riksbank. Since it is unavailable to observe GDP monthly data, we use quarterly data instead, so here we made an assumption to simulate monthly data. We converted the low frequency time series data to high frequency by using cubic-match last method in Eviews, then we obtained three monthly data in one quarter. When process the quarterly data of rate of unemployment in China, same approach was applied. For the exchange rate, we use U.S. dollar as the benchmark currency, which means that Chinese and Swedish currency, i.e., CNY and SEK are valued in one dollar for each country. The interbank offered rate is chosen as one of our explanatory since continuously data stream of other interest rates is not sufficient for either of the country.

In order to catch the changes of stock performance as well as the other macroeconomic variables, all the observations are transformed in first difference. Besides, to minimize the gap between the increments of each variable, stock indices and GDP records are transformed in log values. The transformed stock indices are therefore represent the continuously compounded returns. All in all, we denote R, GDP, CPI, ER, IR and UR as the performance of stock returns, GDP level, CPI index, exchange rate, interbank offered rate and rate of unemployment respectively. And we add _CH or _ SE as suffix to differ both countries. All these abbreviation will make it simple to interpret the following empirical test.

The summary of statistical properties is listed in table 1. The standard deviation of CPI is higher than that of UR, IR and ER in both countries, which illustrates that CPI has higher macroeconomics risk. Refer to the values of skewness and kurtosis, which are departed from 0 and 3, we know that the interbank offered rate in Swedish stock market is more sensitive to volatility, while it is the exchange rate in Chinese stock market.

Considering the potential multicollinearity problem, we construct a correlation matrix. Table 2 shows that all the variables are not highly correlated. To ensure stationary of all the data in case of spurious relationship, we run Augmented Dickey-Fuller (ADF) unit root test before we estimate VAR models. The ADF test for individual series indicates that GDP has a unit root in both countries, therefore GDP have to be first differenced to remedy non-stationary. Then we reject the null hypothesis that the time series of the variable has a unit root, so that all variables are stationary even at 1% significance level. The results are presented in table3.

5. Empirical Results

Once the preliminary of data is processed, we can use them for empirical test.

5.1 Lag Length Selection and Estimation of VAR models

To obtain a reasonable conclusion, the selection of lag length is a key determinant factor to establish the appropriate VAR model. In Eviews, we use lag length criteria to determine the optimal lag length, which has the highest value of likelihood ratio (LR) LR and lowest information criteria (IC). According to the criteria selection output in Table 4, different lag lengths are indicated for each county. Considering the more lag length, the more previous periods we can refer to, lag equals 5 is applied for the VAR model estimation of Sweden and for China, the lag length is 8. Thus the target equations of VAR model for each country is derived respectively.

$$
\begin{aligned}
R\_SE_t = {} & \alpha_{1c} + \beta_{11} R\_SE_{t-1} + \cdots \beta_{15} R\_SE_{t-5} + \gamma_{11} GDP\_SE_{t-1} + \cdots \gamma_{15} GDP\_SE_{t-5} \\
& + \delta_{11} CPI\_SE_{t-1} \ldots + \delta_{15} CPI\_SE_{t-5} + \varepsilon_{11} UR\_SE_{t-1} \\
& + \cdots \varepsilon_{15} UR\_SE_{t-5} + \theta_{11} ER\_SE_{t-1} + \cdots \theta_{15} ER\_SE_{t-5} + \lambda_{11} IR\_SE_{t-1} \\
& + \cdots \lambda_{15} IR\_SE_{t-5} + \mu\_SE_{Nt} \\
R\_CH_t = {} & \alpha_{1c} + \beta_{11} R\_CH_{t-1} + \cdots \beta_{18} R\_CH_{t-8} + \gamma_{11} GDP\_CH_{t-1} \\
& + \cdots \gamma_{18} GDP\_CH_{t-8} + \delta_{11} CPI\_CH_{t-1} \ldots + \delta_{18} CPI\_CH_{t-8} \\
& + \varepsilon_{11} UR\_CH_{t-1} + \cdots \varepsilon_{18} UR\_CH_{t-8} + \theta_{11} ER\_CH_{t-1} \\
& + \cdots \theta_{18} ER\_CH_{t-8} + \lambda_{11} IR\_CH_{t-1} + \cdots \lambda_{18} IR\_CH_{t-8} + \mu\_CH_{Nt}
\end{aligned}
$$

The VAR estimation outputs showed in table 5. In the target equation for respective country we estimated, the R^2 of China' VAR (0.6) is higher than that of Sweden'(0.4), it is means that the explanatory power of macroeconomic factors to Chinese stock market is stronger than that in Swedish stock market, meanwhile the values of F-test for both countries are similar (1.6), and smaller than critical value at 10% significant level (1.837), in particular only variables i.e., IR_SE(-4), GDP_CH(-3) and R_CH(-4) show significant t-stat at 10% level (>2.015). Besides, the coefficients for each macroeconomics variables for different lags do not have the same sign. We consider that huge amount of parameters produced by VAR estimation is the consequence of the insignificant result, therefore we need a more ocular way to interpret what exactly effects macroeconomic variables had on stock returns. So Granger causality test, impulse responses function and variance decompositions tests are employed to interpret VAR estimation.

5.2 Granger Causality Test

Granger causality is to test the joint significance of all lags of a variable in a VAR model. The Wald tests showed in Table 6 indicates that both in Sweden and China, it is insignificant that all these macroeconomics variables Granger-cause the stock market indices, however the stock returns Granger-cause the unemployment rate but not in the opposite direction at 5% level. In addition, Swedish stock market index Granger-cause the interbank offered rate in this country. Since Granger causality cannot provide us the information of economically significant, further techniques are implemented.

5.3 Impulse Responses

To assess the size and direction of the effect of one variable in the system on another, the impulse responses in a VAR model is constructed. We give the impulse responses for the each macroeconomic variables associated with separate unit shocks to stock returns. The responses of stock returns in each country to their macroeconomic variables are compared below.

Figure 1 shows the effect of GDP growth on stock returns in China and Sweden. There exist dissimilar responses between two countries. In Sweden, GDP growth has insignificant impact on its stock market performance, while in China the impact is significant and hardly dies down until 20 months. This indicates that the Chinese stock market is more sensitive to GDP growth than Swedish. The same situation sustains in the aspect of rate of unemployment, which presents in figure 2. According to the confidence band around the IRF, the sensitivity of Chinese stock market is larger than that in Sweden. Figure 3 displays the effect of changes in CPI to stock market in both countries. The impulse response output gives polarity results in two cases. In Sweden, the impact is negative and reaches at maximum in 5 lagged steps, then dies away after 10 periods. On the contrary, a shock of CPI increments makes positive and instant response to Chinese stock market. In real cases, this phenomenon could be explained that inflation depresses stock market in Sweden while inflation in China promotes its stock market.

With regard to exchange rate, there are diverse results. As shown in figure 4, changes of exchange rate in Sweden do not give significant impact instantly, but there would be tiny positive responses after 5 steps lagged. Situation in China goes against that. A shock of exchange rate changes produces negative impact contemporaneously, however, it tends to be positive after 2 periods later and reaches a peak in 5 lagged periods. Thus, Chinese stock market can vary due to the volatility of its exchange rate. This phenomenon is not distinct in Sweden.

Figure 5 discloses difference of the response of stock returns to interbank offered rates volatilities between two countries. Swedish stock market gives a lagged negative response to interbank offered rate changes, the lag length is around 5 months. Then the impact dies away. In China, impacts are repeating on both directions continuously, which means stock market is indeed sensitive to its liquidity.

By using impulse responses technique, we further observed and confirmed our expectation in Chapter 4.1 and VAR estimation for coefficients in Chapter 5.1 that overall the effects of macroeconomics factors on the both countries' stock markets are unstable and dynamic.

In addition, we use variance decompositions, i.e., innovation accounting to offer us a slightly different method of "visualizing" shocks to the system.

5.4 Variance Decompositions

The variance decompositions give the proportion of the movements in the dependent variables that are due to their "own" shocks, and the proportions due to shocks to the other variables. The technique illustrates that the shocks are transferable, so that we can find out how much the effect a macroeconomic variable have on stock returns is.
Table 7 and table 8 give the variance decompositions of stock returns of Sweden and China. We generated that in Eviews and the ordering we chose is the baseline assumed as：

Cholesky Ordering: R GDP CPI ER IR UR

From table 7 we can see that the Swedish stock market can explain itself about 71% even in 30 periods. GDP growth accounts only about 1% of the impact. Shock in CPI starts to account 14% in 5 periods. The proportion of the influence from other variables is respectively less than or around 5%. When it came to China, there are some differences. The stock market can only reveal itself about 51% in 30 periods. The last part is distributed by the macroeconomic variables, where each of them accounts 10% more or less. This result follows what we have in impulse response

analysis. To sum up, Chinese stock price indices are more significantly dependent on its national macroeconomic variables than that in Sweden. Comparing with the results of variance decompositions in the two countries, the proportion of macroeconomics variables explain the Chinese stock market (1-51%=49%) is more than that of Swedish stock market (1-71%=29%). This conclusion is consistent with our VAR estimation and impulse response analysis.

6. Conclusion

When comparing how Chinese and Swedish stock markets are explained by their macroeconomic variables respectively, it is easy to notice the differences between them. The whole stock market in China is more sensitive to the macroeconomic information, this kind of variation is not only significant but also instant. On the contrary, for Swedish stock market, macroeconomic variations cannot entirely affect the stock market moreover the effect is hysteretic. This phenomenon can be explained by the gap of maturity in the two stock markets.

Specifically, GDP growth affects Chinese stock market more than that in Sweden. In real world, China is holding a high GDP growth rate while Sweden has a moderate and steady economy status. The possible reason might be that as Sweden has a relatively high degree of economy freedom, and many companies have international business, therefore investors are consisted of both domestic citizens and foreigners, the Swedish companies' profits are volatile to national and international markets, as the consequence, the Swedish financial market cannot response to these shocks efficiently. As to China, the financial markets are less open and immature, majority of companies are state monopolies, therefore, foreign investors are restricted to participate in Chinese financial activities, the largest proportion of investors are national institutions. Under this circumstance, the drivers of economics growth are coming from the consuming, investments and exports, which are regulated by government policies. Furthermore, due to this reason, the economy status is

considered as a more valuable reference than market-oriented information by investors. Since the GDP and unemployment rate are reflection of macroeconomic status in one country, the influence of rate of unemployment also consolidate the hypothesis mentioned above.

In inflation aspect, increment of CPI decreases Swedish stock returns, whereas it is reverse in China. This finding represents the double-edged sword effect of inflation. On one hand, the increase of CPI stimulates the domestic demand in China, it can be said that CPI promotes the Chinese stock markets. As we analyzed before, the Chinese stock markets are more like policies-oriented than other countries', therefore irrational investments are made by the misleading relationship of monetary demand and supply. At the same time, high consumer price tends to shift the capital from consuming to investment. This phenomenon also explains the reason why the inflation can prospect the Chinese stock markets. On the other hand, we should aware that inflation increases the consumer price and investment cost, this intuition is more applicable for Swedish financial market, that the investors' expectations for stock market' reaction are influenced by high inflation rate negatively, thus the inflation depress the Swedish stock market.

With regard to exchange rate and interest rate, they follow the same condition. Due to the overall companies' characteristics and the openness of international trade, the significances of stock markets response to exchange rate changes in both countries are not identical either. In the aspect of the changes of interbank offered rate, Swedish stock market gives a lagged reaction but in China this reactions are various and rapidly. It is observable that the currencies policies implemented by Chinese authorities account more in interfering with stock markets than that in Sweden.

The responses of stock market to macroeconomics factors in China and Sweden are distinctive. The influences of macroeconomics variables on stock market in the two specific countries are found to be unstable and dynamic. Different from Sweden, this variation in China is not only significant but also instant, for GDP, CPI,

unemployment rate, exchange rates and interbank offered rates. To sum up, Chinese stock market is more sensitive to the macroeconomic fluctuation than Swedish stock market. That is to say the explanatory power of macroeconomic factors to Chinese stock market is stronger than that in Swedish stock market.

The causes of the differences result from the maturity of the financial markets, the speed of economic development, the diversity of economic structure, as well as the degree of economic freedom.

7. Contribution and Limitation

7.1 Contribution

Regarding the subject, there are few articles included Swedish study in recent years. This thesis introduces VAR model to investigate the relationship between macroeconomics factors and stock returns, and compare differences of China and Sweden in some aspects. Moreover, the implementation of impulse responses shows a way to capture an instant, unstable and dynamic effect in the two countries. This is different from other researches, which showed either a positive or negative correlation among macroeconomics variables and stock returns in one country or a group of similar development countries.

7.2 Limitation

The sample period is from 2002 to 2010, during which most countries were subjected to the financial crisis, including Sweden and China. However, in our empirical study, we relied on 30 periods, which cannot capture the effect of financial crisis. Another limitation is that possible implications might be difficult to suggest for different interested parties based on the empirical results we found. It is perspective to have a further study on this topic with various models and discuss the differences deeper. We suggest that future studies notice the impact of financial crisis.

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Appendix

Table1: Summary of Statistics for all variables

Sweden

	R_SE	GDP_SE	CPI_SE	UR_SE	ER_SE	IR_SE
Mean	0.003361	0.002255	0.373178	0.018692	-0.033472	-0.022493
Median	0.014563	-0.000980	0.400000	0.000000	-0.033800	0.000400
Maximum	0.136071	0.065250	3.100000	1.100000	0.754700	0.381400
Minimum	-0.225667	-0.048091	-4.070000	-0.800000	-0.532600	-1.804300
Std. Dev.	0.051899	0.030623	1.241189	0.362156	0.226576	0.247082
Skewness	-1.110720	0.256188	-0.381246	0.327202	0.402297	-3.928869
Kurtosis	6.102127	1.968847	3.740763	3.124727	3.800220	27.32937
Jarque-Bera	64.90436	5.910883	5.038469	1.978611	5.741094	2914.243
Probability	0.000000	0.052056	0.080521	0.371835	0.056668	0.000000
Sum	0.359635	0.241326	39.93000	2.000000	-3.581500	-2.406800
Sum Sq. Dev.	0.285511	0.099405	163.2983	13.90262	5.441668	6.471237
Observations	107	107	107	107	107	107

China

	R_CH	GDP_CH	CPI_CH	UR_CH	ER_CH	IR_CH
Mean	0.010495	0.013543	0.052336	0.004847	-0.015189	0.014300
Median	0.017517	0.027179	0.100000	0.001854	-0.000600	0.020000
Maximum	0.254171	0.120484	2.000000	0.074690	0.013900	2.503100
Minimum	-0.268091	-0.136509	-2.600000	-0.080051	-0.135000	-1.649400
Std. Dev.	0.096729	0.067896	0.704078	0.027666	0.027457	0.543399
Skewness	-0.483834	-0.495080	-0.460672	0.148716	-2.104429	0.570116
Kurtosis	3.548840	2.361707	4.417698	3.959370	7.534814	8.331591
Jarque-Bera	5.517664	6.187429	12.74522	4.497822	170.6607	132.5284
Probability	0.063366	0.045333	0.001708	0.105514	0.000000	0.000000
Sum	1.122963	1.449049	5.600000	0.518599	-1.625200	1.530071
Sum Sq. Dev.	0.991794	0.488651	52.54692	0.081131	0.079913	31.29989
Observations	107	107	107	107	107	107

The highlight parts in Table 1 illustrate that in both Sweden and China, CPI has higher macroeconomics risk. And the interbank offered rate in Swedish stock market is more sensitive to volatility, while it is the exchange rate in Chinese stock market.

Table 2: Correlation matrix

Sweden

	R_SE	GDP_SE	CPI_SE	UR_SE	ER_SE	IR_SE
R_SE	1.000000	0.049915	-0.091790	0.025105	-0.175412	-0.136405
GDP_SE	0.049915	1.000000	-0.085736	0.018287	-0.070354	-0.011884
CPI_SE	-0.091790	-0.085736	1.000000	-0.044942	-0.073045	0.543687
UR_SE	0.025105	0.018287	-0.044942	1.000000	0.023358	-0.129232
ER_SE	-0.175412	-0.070354	-0.073045	0.023358	1.000000	-0.180929
IR_SE	-0.136405	-0.011884	0.543687	-0.129232	-0.180929	1.000000

China

	R_CH	GDP_CH	CPI_CH	UR_CH	ER_CH	IR_CH
R_CH	1.000000	-0.154885	0.142163	-0.055945	-0.005785	-0.084146
GDP_CH	-0.154885	1.000000	0.018192	0.136248	0.018477	0.111890
CPI_CH	0.142163	0.018192	1.000000	-0.188197	-0.107659	0.040054
UR_CH	-0.055945	0.136248	-0.188197	1.000000	0.212550	-0.123380
ER_CH	-0.005785	0.018477	-0.107659	0.212550	1.000000	-0.005763
IR_CH	-0.084146	0.111890	0.040054	-0.123380	-0.005763	1.000000

Table 2 shows that all the variables are not highly correlated.

Table 3: Summary of Augmented Dicky-Fuller Unit Root Test for each variable

Sweden

Null Hypothesis: the time series of the variable has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.208998	0.0000
Test critical values:	1% level	-3.493747	
	5% level	-2.889200	
	10% level	-2.581596	

Variable	Coefficient	5% t-Stats	t-Statistic	Prob.
R_SE(-1)	-0.684452	-2.888932	-7.357820	0.0000
D(GDP_SE(-1))	-3.196019	-2.892879	-5.115932	0.0000
CPI_SE(-1)	-0.784446	-2.888932	-8.109565	0.0000
UR_SE(-1)	-1.301265	-2.889474	-5.549513	0.0000
ER_SE(-1)	-0.579853	-2.889474	-4.509479	0.0000
IR_SE(-1)	-0.450594	-2.888932	-5.485301	0.0000

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

China

Null Hypothesis: the time series of the variable has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.208998	0.0000
Test critical values:	1% level	-3.493747	
	5% level	-2.889200	
	10% level	-2.581596	

Variable	Coefficient	5% t-Stats	t-Statistic	Prob.
R_CH(-1)	-0.663744	-2.889200	-5.208998	0.0000
D(GDP_CH(-1))	-5.901716	-2.892879	-5.620023	0.0000
CPI_CH(-1)	-0.845429	-2.892200	-4.643189	0.0000
UR_CH(-1)	-0.114250	-2.891871	-3.658849	0.0004
ER_CH(-1)	-0.318885	-2.889200	-3.628408	0.0004
IR_CH(-1)	-1.331399	-2.888932	-13.92693	0.0000

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

From table 3, the ADF test for individual series indicates that GDP has a unit root in both countries, therefore GDP have to be first differenced to remedy non-stationary. Then all variables are stationary even under 1% significance level, we reject the null hypothesis that the time series of the variable has a unit root.

Table 4: Lag length selection

Sweden

VAR Lag Order Selection Criteria
Endogenous variables: R_SE GDP_SE CPI_SE UR_SE ER_SE IR_SE
Exogenous variables: C
Date: 05/22/12 Time: 01:59
Sample: 2002M01 2010M12
Included observations: 99

Lag	LogL	LR	FPE	AIC	SC	HQ
0	189.9273	NA	9.80e-10	-3.715702	-3.558422	-3.652067
1	303.4892	211.0646	2.05e-10	-5.282610	-4.181650	-4.837160
2	429.7209	219.3116	3.34e-11	-7.105472	-5.060832*	-6.278208*
3	469.8558	64.86452	3.13e-11	-7.189006	-4.200686	-5.979927
4	507.9599	56.96366	3.12e-11	-7.231513	-3.299513	-5.640619
5	590.1571	112.9175*	1.31e-11*	-8.164791	-3.289111	-6.192083
6	628.8912	48.51533	1.36e-11	-8.220023	-2.400664	-5.865501
7	669.1195	45.51090	1.44e-11	-8.305445*	-1.542406	-5.569108
8	697.0020	28.16412	2.08e-11	-8.141455	-0.434735	-5.023304

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

China

VAR Lag Order Selection Criteria
Endogenous variables: R_CH GDP_CH CPI_CH UR_CH ER_CH IR_CH
Exogenous variables: C
Date: 05/22/12 Time: 02:44
Sample: 2002M01 2010M12
Included observations: 99

Lag	LogL	LR	FPE	AIC	SC	HQ
0	468.5748	NA	3.52e-12	-9.344946	-9.187666	-9.281310
1	613.8915	270.0835	3.87e-13	-11.55336	-10.45240	-11.10791
2	775.9678	281.5871	3.06e-14	-14.10036	-12.05572*	-13.27309
3	847.4588	115.5411	1.52e-14	-14.81735	-11.82903	-13.60827
4	898.9064	76.91149	1.16e-14	-15.12942	-11.19742	-13.53853
5	963.8489	89.21400	6.88e-15	-15.71412	-10.83844	-13.74141*
6	1006.762	53.74972	6.59e-15	-15.85378	-10.03442	-13.49926
7	1051.264	50.34584	6.40e-15	-16.02554	-9.262499	-13.28920
8	1116.540	65.93559*	4.33e-15*	-16.61698*	-8.910258	-13.49883

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

According to the criteria selection output, different lag lengths are indicated for each county. Considering the more lag length, the more previous periods we can refer to, lag equals 5 is applied for the VAR model estimation of Sweden and for China, the lag length is 8.

Table 5: Output of estimated VAR models (Summarized Version)

Sweden

Lag Periods	(-1)	(-2)	(-3)	(-4)	(-5)
R_SE	0.202625	-0.196329	0.202823	-0.013739	0.154837
t-stat in [ ]	[1.67022]	[-1.72294]	[1.60538]	[-0.10888]	[1.26409]
GDP_SE	-0.150552	1.386958	-1.771132	1.005001	-0.183836
	[-0.19542]	[0.98497]	[-1.07569]	[0.73524]	[-0.24502]
CPI_SE	-0.002525	-0.012113	-0.008986	-0.007412	0.005484
	[-0.38217]	[-1.94395]	[-1.35573]	[-1.06365]	[0.81284]
UR_SE	-0.014559	0.010815	-0.013177	-0.024362	-0.030832
	[-0.78482]	[0.48084]	[-0.56337]	[-1.12997]	[-1.74813]
ER_SE	0.010012	-0.025822	0.004715	-0.004356	-0.027501
	[0.38155]	[-0.87129]	[0.15455]	[-0.15247]	[-1.05097]
IR_SE	-0.003684	0.003856	0.005412	-0.079136	0.002781
	[-0.10714]	[0.10953]	[0.15697]	[-2.48807]*	[0.09083]
C	0.010955		R-squared	0.406055	F-statistic
	[1.33222]		Adj.R-squared	0.155092	1.617990

In the highlight parts, the R-squared of China's VAR (0.6) is higher than that of Sweden's (0.4), it is means that the explanatory power of macroeconomic factors to Chinese stock market is stronger than that in Swedish stock market, meanwhile the values of F-test for both countries are similar (1.6), and smaller than critical value at 10% significant level (1.837).

In particular, variables with "*" i.e., IR_SE(-4), GDP_CH(-3) and R_CH(-4) show significant t-stat at 10% level (>2.015). Besides, the coefficients for each macroeconomics variables for different lags do not have the same sign.

China

Lag	(-1)	(-2)	(-3)	(-4)	(-5)	(-6)	(-7)	(-8)
R_CH	0.093827	0.215820	0.104058	0.360707	-0.028473	-0.239349	-0.062466	-0.158000
t-stat in [ ]	[0.63214]	[1.54773]	[0.70968]	[2.53098]*	[-0.20591]	[-1.79169]	[-0.41152]	[-1.07942]
GDP_CH	1.330564	-2.700164	3.192270	-1.770137	-0.225301	1.243890	-0.371706	-0.430503
	[1.30874]	[-1.98427]	[2.06364]*	[-1.13565]	[-0.14743]	[0.82071]	[-0.25754]	[-0.40653]
CPI_CH	0.012819	0.028883	-0.004017	-0.014310	-0.002977	0.009752	-0.027932	-0.011164
	[0.77882]	[1.68267]	[-0.23140]	[-0.85883]	[-0.18492]	[0.58893]	[-1.70384]	[-0.68300]
UR_CH	-0.168249	-3.021257	4.172141	1.733028	-3.101102	-4.214711	5.467725	-1.580478
	[-0.04959]	[-0.42805]	[0.54381]	[0.24252]	[-0.38811]	[-0.49716]	[0.73984]	[-0.47340]
ER_CH	-0.705337	0.432715	0.815471	0.478117	-0.072580	-0.665828	0.059332	-0.422079
	[-1.31834]	[0.76591]	[1.40384]	[0.71825]	[-0.10631]	[-1.00621]	[0.09459]	[-0.71372]
IR_CH	0.015437	-0.037139	0.009646	-0.010731	0.038130	-0.010686	-0.010478	0.011802
	[0.51341]	[-1.13028]	[0.25592]	[-0.28243]	[0.96448]	[-0.29085]	[-0.30330]	[0.38419]
C	0.006549		R-squared	0.612965		F-statistic	1.649732	
	[0.25482]		Adj. R-squared	0.241410				

Table 6: VAR Granger Causality/Block Exogeneity Wald Tests

Sweden

Dependent variable: UR_SE			
Excluded	Chi-sq	df	Prob.
R_SE	11.25874	5	0.0465

Dependent variable: IR_SE			
Excluded	Chi-sq	df	Prob.
R_SE	22.54323	5	0.0004

China

Dependent variable: UR_CH			
Excluded	Chi-sq	df	Prob.
R_CH	21.27348	8	0.0065

The Wald tests showed in Table 6 indicates that both in Sweden and China, the stock returns Granger-cause the unemployment rate but not in the opposite direction at 5% level. In addition, Swedish stock market index Granger-cause the interbank offered rate in this country.

Table 7: Variance Decompositions of R_SE

Period	S.E.	R_SE	GDP_SE	CPI_SE	UR_SE	ER_SE	IR_SE
1	0.045944	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.047381	98.76878	0.030825	0.384040	0.613710	0.190157	0.012493
3	0.049382	91.66074	0.320534	5.401273	1.572058	1.018518	0.026875
4	0.051004	88.76509	0.400528	7.876611	1.976738	0.955757	0.025276
5	0.055600	76.03918	0.347965	13.83841	2.815451	1.780526	5.178463
6	0.056361	74.95351	0.370477	14.07669	3.046166	1.758313	5.794845
7	0.056785	74.16067	0.379339	14.03266	3.643732	2.073714	5.709886
8	0.057439	72.48644	0.461659	14.44054	3.565339	3.026236	6.019782
9	0.057705	72.54488	0.504528	14.40202	3.574959	3.004711	5.968902
10	0.058141	72.11630	0.768477	14.20348	4.019589	2.968870	5.923291
20	0.058702	71.66819	0.959641	14.11597	4.291892	3.003186	5.961122
30	0.058832	71.44227	1.202576	14.09999	4.295883	3.009460	5.949818

Cholesky Ordering: R GDP CPI ER IR UR

From table 7 we can see that the Swedish stock market can explain itself about 71% even in 30 periods. GDP growth accounts only about 1% of the impact. Shock in CPI starts to account 14% in 5 periods. The proportion of the influence from other variables is respectively less than or around 5%.

Table 8: Variance Decompositions of R_CH

Period	S.E.	R_CH	GDP_CH	CPI_CH	UR_CH	ER_CH	IR_CH
1	0.086102	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.089884	94.11488	1.349488	0.928975	0.009915	3.060700	0.536043
3	0.098220	81.05923	4.226409	6.493374	1.613093	3.250447	3.357451
4	0.101915	76.53746	7.212611	6.481194	1.547400	3.307858	4.913473
5	0.107619	73.98468	6.559989	6.087952	1.622237	6.657678	5.087469
6	0.113084	70.75399	6.990334	5.735858	4.756478	6.153543	5.609799
7	0.118856	64.13631	7.079466	7.388868	6.271149	7.404551	7.719657
8	0.120655	62.78372	8.101191	7.972697	6.357525	7.220769	7.564102
9	0.123656	59.77857	7.798430	8.342581	9.254811	6.918567	7.907037
10	0.125940	57.87317	7.823185	8.825295	8.925946	6.747073	9.805329
20	0.139077	52.92315	9.842253	9.612345	8.705196	8.205196	10.71186
30	0.142218	51.65682	10.35166	9.744952	8.857921	8.141441	11.24721

Cholesky Ordering: R GDP CPI ER IR UR

When moving our focus to China, there are some differences. The stock market can only reveal itself about 51% in 30 periods. The last part is distributed by the macroeconomic variables, where each of them accounts 10% more or less. This result follows what we have in impulse response analysis.

Figure 1: Compare of the Impulse Response of R to GDP

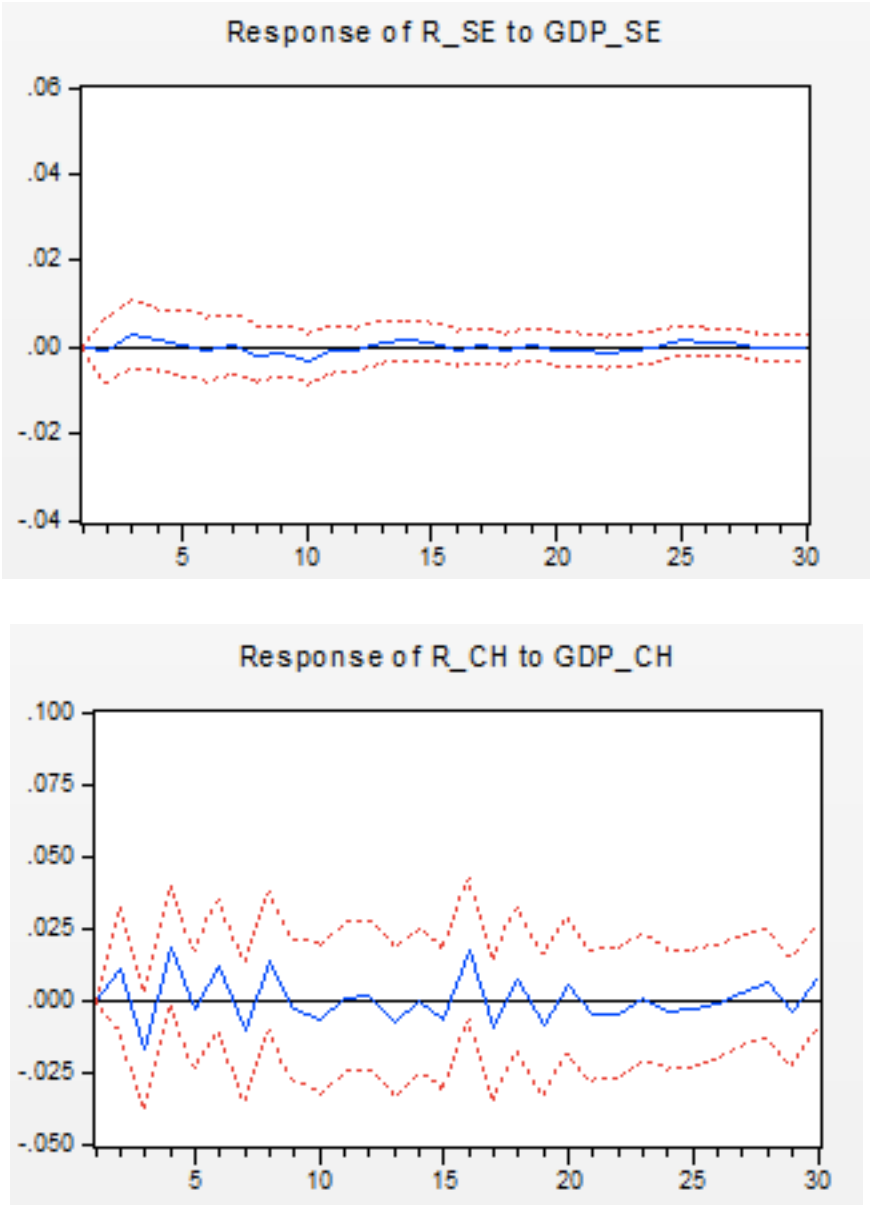
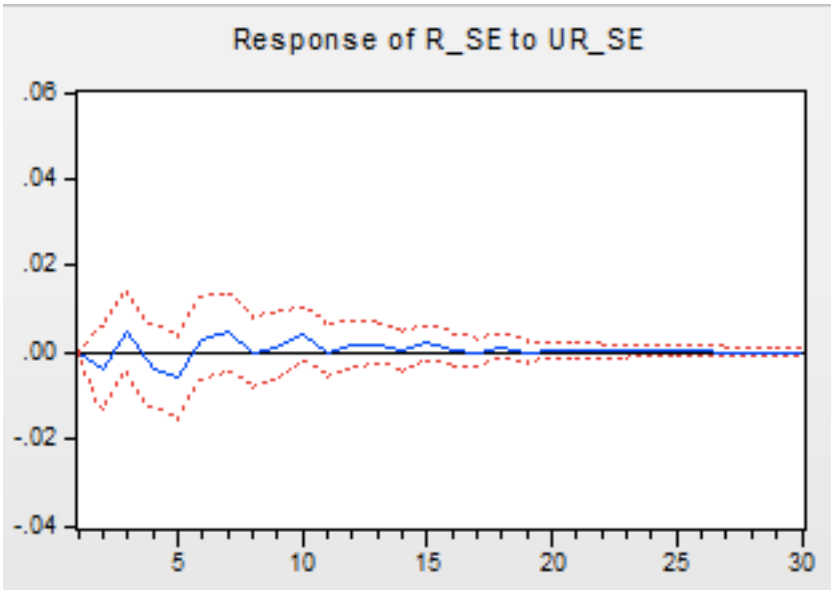


Figure 1 shows the effect of GDP growth on stock returns in China and Sweden. There exist dissimilar responses between two countries. In Sweden, GDP growth has insignificant impact on its stock market performance, while in China the impact is significant and hardly dies down until 20 months.

Figure 2: Compare of the Impulse Response of R to UR



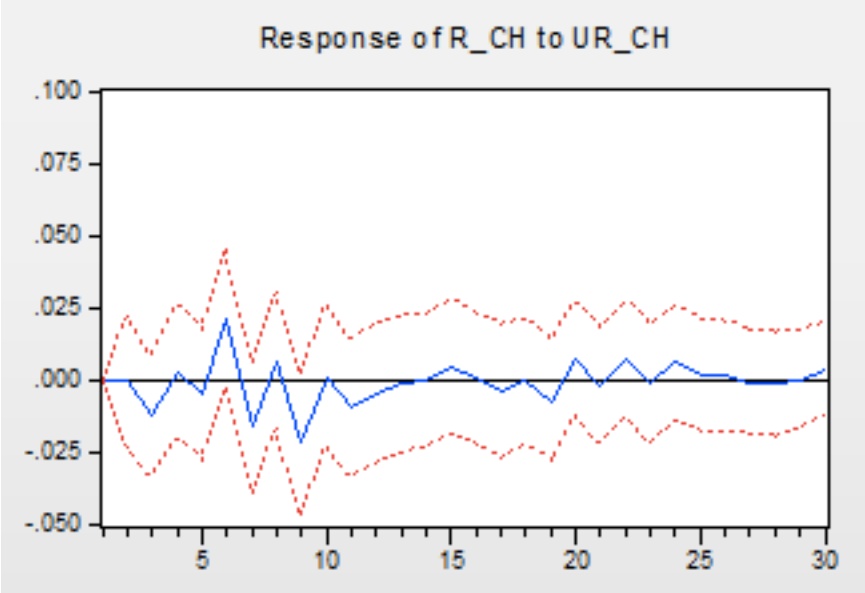
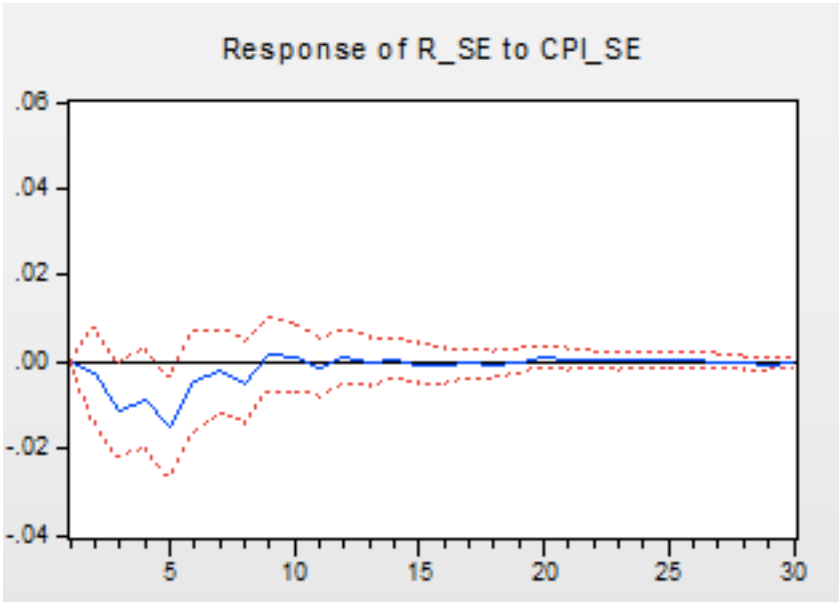


Figure 2 shows the effect of CPI growth on stock returns in China and Sweden. In Sweden, CPI growth has insignificant impact on its stock market performance, while in China the impact is significant and sustained.

Figure 3: Compare of the Impulse Response of R to CPI



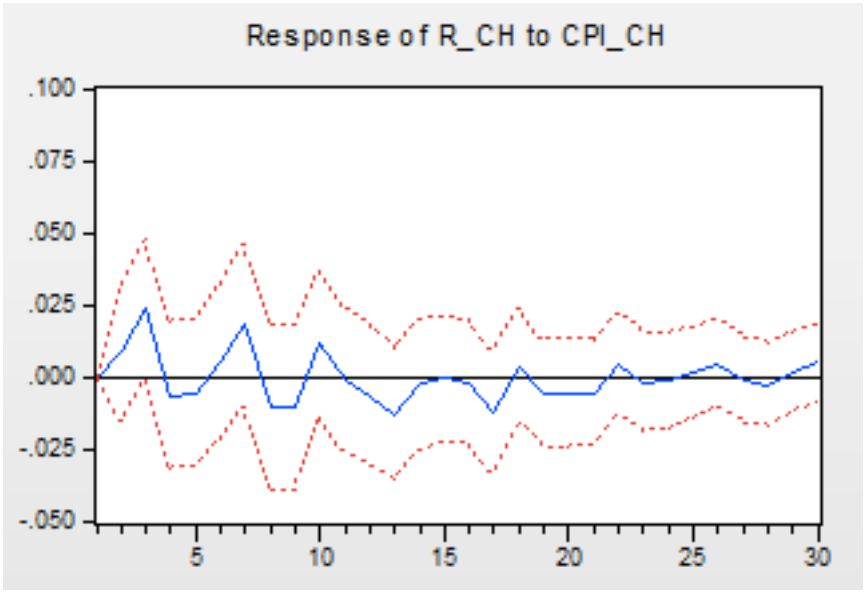


Figure 3 displays the effect of changes in CPI to stock market in both countries. In Sweden, the impact is negative and reaches at maximum in 5 lagged steps. On the contrary, a shock of CPI increments makes positive and instant response to Chinese stock market.

Figure 4: Compare of the Impulse Response of R to ER

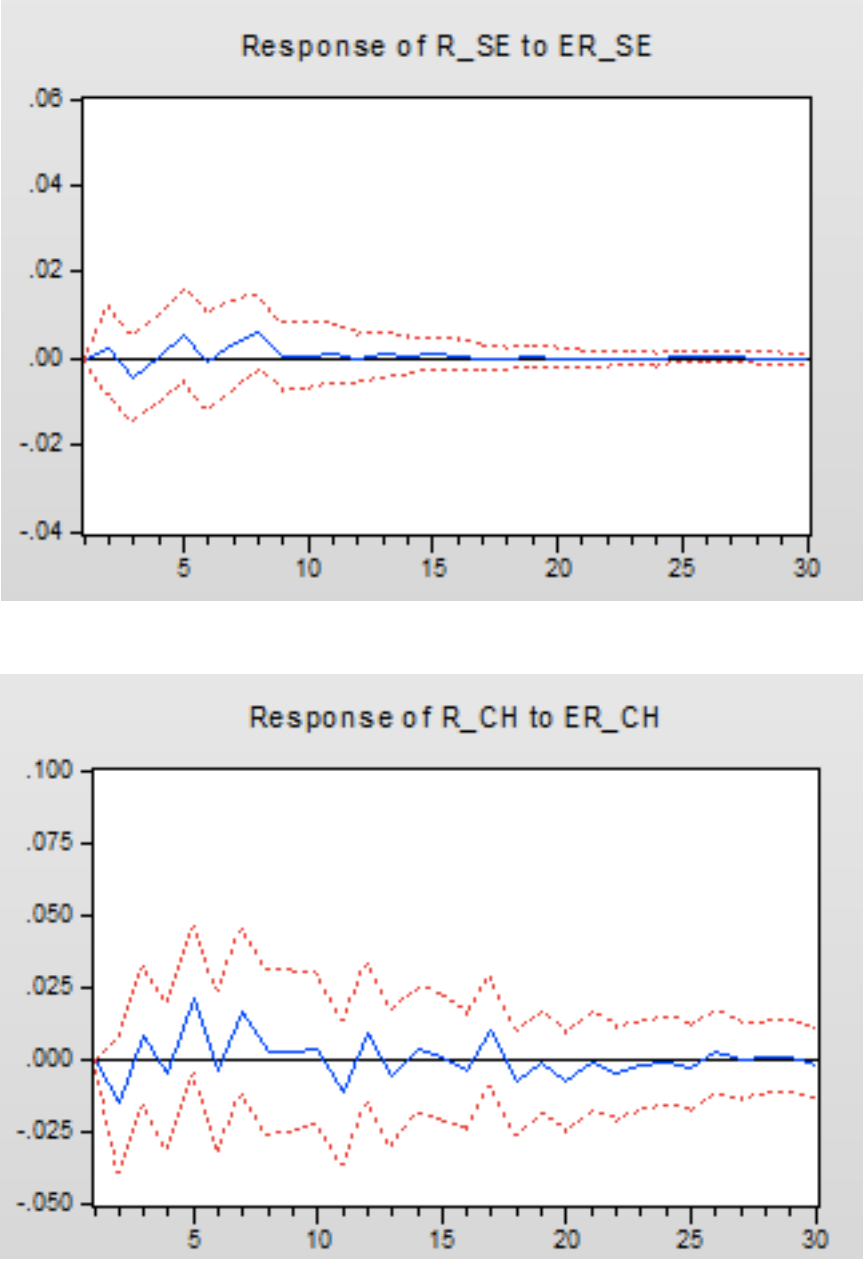
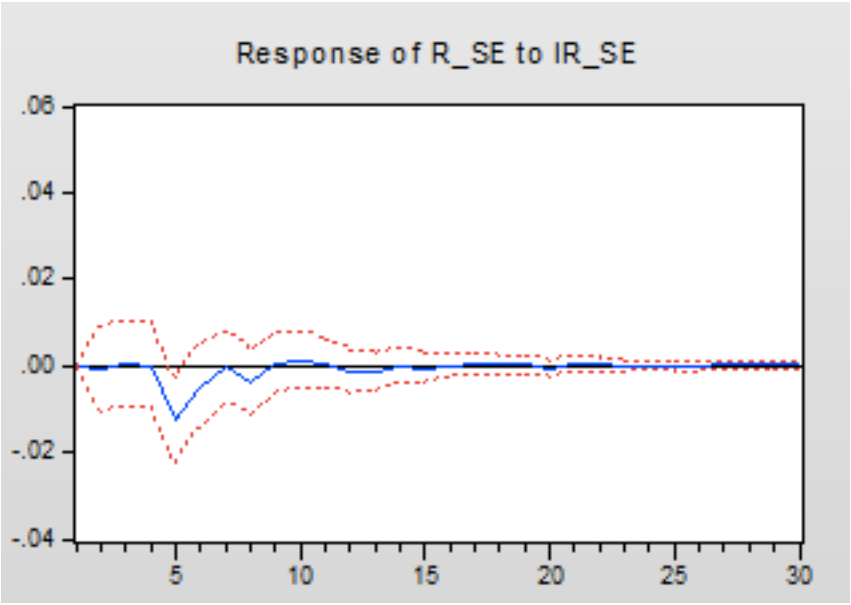


Figure 4 showed that changes of exchange rate in Sweden do not give significant impact instantly, but there would be tiny positive responses after 5 steps lagged. Situation in China goes against that. A shock of exchange rate changes produces negative impact contemporaneously, however, it tends to be positive after 2 periods later and reaches a peak in 5 lagged periods.

Figure 5: Compare of the Impulse Response of R to IR



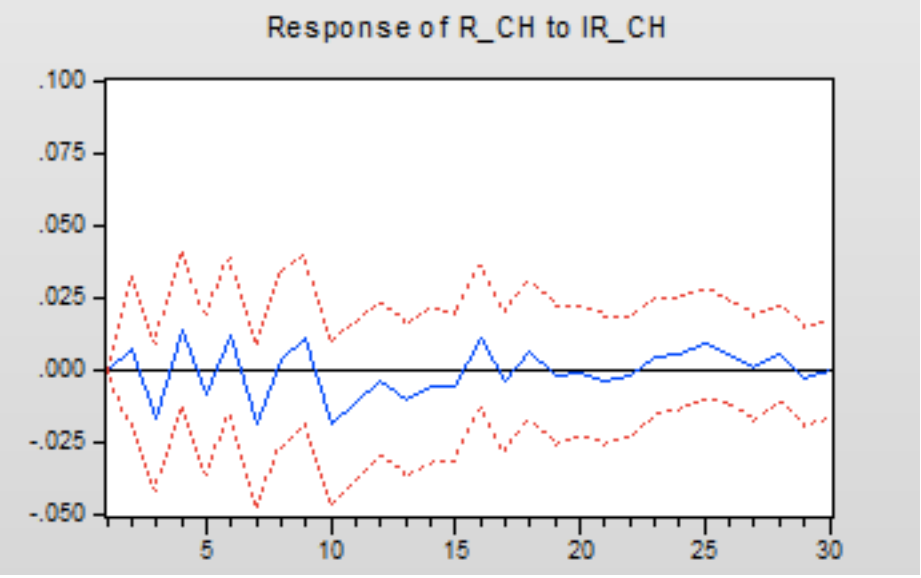


Figure 5 discloses difference of the response of stock returns to interest rates volatilities between two countries. Swedish stock market gives a lagged negative response to interest rate changes, the lag length is around 5 months. Then the impact dies away. In China, impacts are repeating on both directions continuously