The impact of oil price shocks on the three BRIC countries' stock prices

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Abstract

Although a lot of empirical research has studied the relationship between changes in oil price and economic activity, it is surprising that little research has been conducted on the relationship between oil price shocks and the BRIC (Brazil, Russia, India, and China). Therefore, this paper modifies the procedure of Kilian and Park (2009) and investigates how explicit structural shocks that characterize the endogenous character of oil price changes affect three BRICs' stock-market returns, in order to fill this gap. From the empirical analysis, we find that the impact of oil price shocks on stock prices in three BRICs has mixed, it has partially in contrast to the effects on the U.S. and developed countries' stock market. Firstly, we find that all shocks have no significant impacts on India's stock returns. Additionally, in contrast to the early traditional literature that higher oil prices necessarily causes lower stock prices, both global and oil specified demand shocks have significantly positive impacts on Russia stock returns. However, the impact of oil price shocks on China stock returns has the mixed condition between Russia and India. This means that only oil specified demand shock has significantly positive effects, but both global supply and demand shocks have no significant impacts on China stock returns. The reason for the lack of significant impacts is that the positive expectation effect of China's fast economic growth may be just offset by the negative effect of a precautionary demand driven effect. This result is also consistent with the previous empirical findings that the segmented and integrated three BRICs' stock market is mixed, and it implies that the three BRICs' stock market is "partially integrated" with the other stock markets and oil price shocks.

JEL classifications: C22, C32, F32, F36, G15
Key words: Oil price shock; Stock market; BRIC, China.

1. Introduction

NYMEX crude oil futures were trading near $10 at the beginning of 1999. Over the next decade, the crude oil prices move explosively to $147 by July 2008.[1] What cause the 2008 high oil prices? Hamilton (2009) concludes that there are three key variables responsible for the high oil prices in summer of 2008: (1) the low price elasticity of demand; (2) the strong growth in demand from some large newly industrialized nations, such as Brazil, Russia, India, and China or BRIC; and (3) the failure of global production to increase. Among them, BRIC

[1] See Tokic (2010, p. 6010) exhibit1 for detail.

was first prominently used in the thesis of Goldman Sachs investment bank (Wilson and Purushothaman 2003). They argues that the growth and high returns of the BRIC countries should persist over the next 50 years and lead to a sharp rise of the BRICs in global investment portfolios. Furthermore, since the energy intensiveness of these economies as they experience a rapid economic growth and energy is used less efficiently, the economic impact of higher oil prices on developing countries is generally more severe than that for industrialized countries. According to the International Energy Agency (IEA) report,[2] on average, developing countries use more than twice as much oil to produce a unit of economic output as do OEDC countries. Therefore, the rise of BRIC should be the main reason to cause the high oil prices from now to the future.

In fact, higher oil prices may affect the global economy through a variety of channels, including transfer of wealth from oil consumers to oil producers, a rise in the cost of production of goods and services, and impact on inflation, consumer confidence, and financial markets. In a pioneer work, Hamilton (1983) indicated that higher oil prices were responsible for almost all U.S recessions after World War II. Later, the bulk of the empirical researches have studied the relationship between oil price changes and macroeconomic activities. However, it is surprising that little research has been conducted on the relationship between oil price shocks and financial markets. Few studies have examined the effects of oil shocks on the stock market and economic activities, and these have been mainly for a few industrialized countries such as the United States, United Kingdom, Japan, and Canada. Furthermore, Economic liberalization and integration of international markets, characterized with increased level of capital flows and international investments in these emerging economies, have made global investors more vulnerable to oil price impact on emerging stock markets. But little attention has been devoted to inquiring about the impact of the fluctuations in the price of

[2] See "Analysis of the impact of high prices on the global economy," (May 2004) for detail.

crude oil on stock markets for some large, newly industrialized economies (NIEs).[3] Therefore, understanding the level of susceptibility of stock prices in emerging economies to movement in global oil prices is very important.

However, even changes in the price of crude oil are often considered an important factor for understanding fluctuations in stock prices, there is no consensus about the relation between stock prices and the price of oil among literatures. Since there is a strong presumption in the financial press that oil prices drive the stock market, economists, such as Kilian (2009), Kilian and Park (2009), recently began asking whether changes in macroeconomic variables cause oil price changes, leading to the decomposition of those oil price changes into the structural shocks hidden behind such changes. That is, different sources of oil price changes may imply non-uniform effects on certain macroeconomic variables. Therefore, the conventional wisdom that higher oil prices necessarily cause lower stock prices is shown to apply to oil-market specific demand shocks such as increases in the precautionary demand for crude oil. In contrast, positive shocks to the global demand for industrial commodities cause both higher real oil prices and higher stock prices, which helps explain the resilience of the U.S. stock market to the recent surge in the price of oil in 2008. Consequently, this paper studies the dynamic interactions between oil price and stock returns utilizing a structural vector autogressive model (SVAR) approach for these Large NIEs, in order to understand the relationship between oil price shocks and BRICs' stock market.

The remainder of this paper is arranged as follows. Section 2 provides a brief review of existing work and outlines our contribution to the literature. Section 3 briefly reports economic situation in the BRICs. Section 4 describes the data and empirical methodology applied in this study. Section 5 reports the estimation results. Finally, Section 6 concludes the main findings of our analysis.

[3] See Papapetrou (2001) for detail.

2. Literature review

A lot of empirical research has studied the relationship between oil price shocks and macroeconomic variables. Some papers investigated the impact of oil price shocks on different countries' real GDP growth rates, inflation, employment, and exchange rates (such as Akram, 2004; Chen and Chen, 2007; Cunado and Gracia, 2005; Davis and Haltiwanger, 2001; Hamilton, 1983, 2003; Hamilton and Herrera, 2004; Hooker, 2002; Huang and Guo, 2007; Lee et al. 2001; Lee and Ni, 2002; Nandha and Hammoudeh, 2007, among others). However, there is relatively little work on the relationship between oil price shocks and financial markets. Jones and Kaul (1996) tested whether the reaction of international stock markets to oil shocks can be justified by current and future changes in real cash flows and changes in expected returns. They found that in the postwar period, the reaction of United States and Canadian stock prices to oil shocks can be completely accounted for by the impact of these shocks on real cash flows. In contrast, the results for the United Kingdom and Japan are not as strong. Huang et al. (1996) examined the link between daily oil future returns and daily United States returns. Their evidence suggested that oil returns do lead some individual oil company stock returns, but oil future returns do not have much impact on general market indices. Using monthly data over the period 1947-1996, Sadorsky (1999) shown that oil price and its volatility both play important roles in affecting real stock returns. In particular, oil price movements after 1986 explained a larger fraction of the forecast error variance in real stock returns than did interest rates. Papapetrou (2001) applied a VAR approach to examine the dynamic relationship among oil prices, real stock prices, interest rates, real economic activity, and employment for Greece. His empirical evidence found that oil price changes affect real economic activity and employment. Oil prices are important in explaining stock price movement.

Generally speaking, even changes in the price of crude oil are often considered an important factor for understanding fluctuations in stock prices, there is no consensus about the relationship between stock prices and the price of oil among economists. More specifically, the

relevant literature generates mixed views regarding the effect of such oil-price shocks on asset prices, such as stock prices. Kaul and Seyhun (1990) and Sadorsky (1999) found a negative effect of oil-price volatility on stock prices. Papapetrou (2001) reported that an oil price shock has a negative impact on stocks, since they negatively affect output and employment growth. Hong et al. (2002) also identified a negative associate between oil-price returns and stock-market returns. O'Neil et al. (2008) and Park and Ratti (2008) shown that oil price shocks have a statistically significant negative effect on stock prices for an extended sample of 13 developed markets. By contrast, Sadorsky (2001), using a multifactor market which takes into consideration the presence of several risk premiums, identified certain factors, such as exchange rate and interest rate along with oil prices themselves as the main determinants of oil and gas stock returns. He also shown a significant positive relationship between oil prices and stock returns coming from oil and gas firms. Gogineni (2007) and Yurtsever and Zahor (2007) also provided statistical support for a number of hypotheses, such as oil prices being positively associated with stock prices if oil price shocks reflect changes in aggregate demand, but negatively associated with stock price if they reflect changes in supply. In addition, stock prices respond asymmetrically to changes in oil prices, in the sense that higher oil prices are associated with lower stock prices, while lower oil prices are not associated with higher stock prices. Furthermore, Wei (2003) concluded that the decline of U.S. stock prices in 1974 cannot be explained by the 1973-74 oil price increase.

Additionally, the BRICs are four biggest emerging economies combined they account for two-fifths of the total GDP of all emerging economies. Wilson and Purushothaman (2003) firstly identified these four emerging markets which together could be larger than the G6 within the next forty years. In financial terms, between 1986 and 1995stock market capitalization in emerging countries grew ten-fold from $171 billion to 1.9 trillion and market share held in capitalization increased from 4 percent to 11 percent, mostly to these major emerging markets. According to Energy Information Administration (EIA) report, 18 percent of

total annual oil demand in 2006 came from the BRICs, and approximately 23 percent in 2030. However, there are not many studies explaining the relationship among oil price shocks and stock market returns, such as Bhar and Nikolova (2009) investigates the level by which global oil prices influence the stock price creation process and volatility in the BRIC equity markets, and observes the time varying conditional correlation between BRIC equity returns and oil prices. They conclude that the level of impact of oil prices on equity returns and volatility in the BRIC countries depends on the extent to which these countries are net importers or net exporters of oil. They also deducts that despite the aggressive economic growth of the BRIC countries in the past 25 years, the volatility of stock prices in these economies does not have significant impact on the volatility of global oil prices. Gay (2008) studies the time-series relationship between stock market index prices and the macroeconomic variables of exchange rate and oil price for BRIC using the Box-Jenkins ARIMA model. He finds no relationship between respective exchange rate and oil price on the stock market index prices of either BRICs. Also, there was no significant relationship found between present and past stock returns, suggesting the markets of BRIC exhibit the weak-form of market efficiency. Bénassy-Quéré et al. (2007) studied cointegration and causality between the real price of oil and the real price of the Dollar over the period between 1974 and 2004. Their results suggested that a 10% increase in the oil price coincides with a 4.3% appreciation of the Dollar in the long run, and that the causality runs from oil to the Dollar.

Furthermore, Kilian (2009) criticized all these early conventional studies, because economists treat oil-price shocks as exogenous. Certain work, however, argued that oil prices respond to factors that also affect stock prices (such as Barsky and Kilian, 2002, 2004; Hamilton, 2005; Kilian, 2008). Thus, economists must decompose aggregate oil price shocks into the structural factors that reflect the endogenous character of such shocks. This decomposition of shocks eliminates not only the deficit of previous studies that considered oil prices as exogenous variables with respect to other variables that determine that course of the

economy, but also the failure of those studies to document the relative importance of such differentiated shocks for the course of asset prices. Therefore, Kilian and Park (2009) shown that the response of aggregate U.S. real stock returns may differ greatly depending on whether the increase in the price of crude oil is driven by global oil-specific demand shocks or by global supply shocks in the crude oil market. However, in contrast to a huge literature on valuation of the relationship between oil price shocks and macroeconomic variables, no empirical work has yet been conducted explicitly so far to investigate how the explicit structural shocks characterizing the nature of oil-price changes affect stock prices across a sample of BRIC. To respond to this perspective, this paper modifies the procedure of Kilian and Park (2009) and investigates how explicit structural shocks that characterize the endogenous character of oil price changes affect BRICs' stock-market returns, in order to fill this gap.

3. Energy and Economic Situation in the BRICs

a. Brazil

According to IEA calendar year 2009, Brazil is the 10th largest energy consumer in the world and the 3rd largest in the Western Hemisphere, behind the United States and Canada. In addition, increasing domestic oil production has been a long-term goal of the Brazilian government, and recent discoveries of large offshore, pre-salt oil deposits could transform Brazil into one of the largest oil producers in the world. Consequently, Brazil was a net importer of crude oil until April 2006, when it celebrated the achievement of self-sufficiency.

Characterized by large and well-developed agricultural, mining, manufacturing, and service sectors, Brazil's economy outweighs that of all other South American countries and Brazil is expanding its presence in world markets. Brazil was one of the first recovery emerging markets after the 2008 global financial crisis. Consumer and investor confidence revived and GDP growth returned to positive in the second quarter, 2009. The Brazil central bank expects economic growth of 5% for 2010 after it is 6.1% in 2007, 5.1% in 2008, and -0.2% in 2009 respectively.

b. Russia

Russian industry is primarily split between globally-competitive commodity producers -

in 2009 Russia was the world's largest exporter of natural gas, the second largest exporter of oil, and the third largest exporter of steel and primary aluminum - and other less competitive heavy industries that remain dependent on the Russian domestic market. This reliance on commodity exports makes Russia vulnerable to boom and bust cycles that follow the highly volatile swings in global commodity prices. The government since 2007 has embarked on an ambitious program to reduce this dependency and build up the country's high technology sectors, but with few results so far. A revival of Russian agriculture in recent years has led to Russia shifting from being a net grain importer to a net grain exporter. The economy had averaged 7% growth since the 1998 Russian financial crisis, resulting in a doubling of real disposable incomes and the emergence of a middle class.

The Russian economy, however, was one of the hardest hit by the 2008-09 global economic crisis as oil prices plummeted and the foreign credits that Russian banks and firms relied on dried up. The Central Bank of Russia spent one-third of its $600 billion international reserves, the world's third largest, in late 2008 to slow the devaluation of the ruble. The government also devoted $200 billion in a rescue plan to increase liquidity in the banking sector and aid Russian firms unable to roll over large foreign debts coming due. The economic decline appears to have bottomed out in mid-2009 and by the second half of the year there were signs that the economy was growing, albeit slowly. Long-term challenges include a shrinking workforce, a high level of corruption, and poor infrastructure in need of large capital investment. Russia economic growth rate is -7.9% in 2009, 5.6% in 2008, and 8.1% in 2007 respectively.

c. India

India's fiscal deficit increased substantially in 2008 due to fuel and fertilizer subsidies, a debt waiver program for farmers, a job guarantee program for rural workers, and stimulus expenditures. The government abandoned its deficit target and allowed the deficit to reach 6.8% of GDP in FY10. Nevertheless, as shares of GDP, both government spending and taxation are among the lowest in the world. The government has expressed a commitment to fiscal stimulus in FY10, and to deficit reduction the following two years. It has increased the pace of privatization of government-owned companies, partly to offset the deficit. India's long term challenges include widespread poverty, inadequate physical and social infrastructure, limited employment opportunities, and insufficient access to basic and higher education. Over the long-term, a growing population and changing demographics will only exacerbate social, economic, and environmental problems.

India has capitalized on its large educated English-speaking population to become a major exporter of information technology services and software workers. An industrial slowdown early in 2008, followed by the global financial crisis, led annual GDP growth to slow to 6.5% in 2009, still the second highest growth in the world among major economies. India escaped the brunt of the global financial crisis because of cautious banking policies and a relatively low dependence on exports for growth. Domestic demand, driven by purchases of consumer durables and automobiles, has re-emerged as a key driver of growth, as exports have fallen since the global crisis started. India economic growth rate is 9% in 2007, 7.4% in 2008, and 7.4% in 2009 respectively.

d. China

In recent years, China continues to lose arable land because of erosion and economic development. In 2006, China announced that by 2010 it would decrease energy intensity 20% from 2005 levels. In 2009, China announced that by 2020 it would reduce carbon intensity 40% from 2005 levels. The Chinese government seeks to add energy production capacity from sources other than coal and oil, and is focusing on nuclear and other alternative energy development. In 2009, the global economic downturn reduced foreign demand for Chinese exports for the first time in many years. The government vowed to continue reforming the economy and emphasized the need to increase domestic consumption in order to make China less dependent on foreign exports for GDP growth in the future.

China has re-invigorated its support for leading state-owned enterprises in sectors it considers important to "economic security," explicitly looking to foster globally competitive national champions. After keeping its currency tightly linked to the US dollar for years, China in July 2005 revalued its currency by 2.1% against the US dollar and moved to an exchange rate system that references a basket of currencies. Cumulative appreciation of the Renminbi against the US dollar since the end of the dollar peg was more than 20% by late 2008, but the exchange rate has remained virtually pegged since the onset of the global financial crisis. The restructuring of the economy and resulting efficiency gains have contributed to a more than tenfold increase in GDP since 1978. Measured on a purchasing power parity (PPP) basis that adjusts for price differences, China in 2009 stood as the second-largest economy in the world after the US, although in per capita terms the country is still lower middle-income. China economic growth rate is 13% in 2007, 9% in 2008, and 9.1% in 2009 respectively.

4. The data and empirical methodology

4.1 Data

The data applied in this paper are monthly, from 2001/1 to 2008/9. The global oil production change rate data are from the US Department of Energy, while the global real activity change rate is from Kilian's homepage. The China real import oil price change rates are from China's monthly statistics, the India real import oil price change rate and Russian export oil price change rate are from the website of the U.S. department of energy.[4] However, we cannot find any detail Brazil oil price data from all international energy statistic institutions, then we only discussing other three emerging economies in the later of this paper and left this gap as the future research. In addition, other three economies' real stock index returns are from the Taiwan Economic Journal database.[5] The global real activity data, which are calculated by representative single voyage freight rates, are applied to measure the global demand for oil. Kilian (2009) has full explained the reason for adopting the global real activity indicator to capture the global oil demand effect. Finally, import oil price change rate is applied to capture the specific oil demand effect which is driven by the precautionary demand for crude oil. This means that investors will expect the economic and the firm's profit growth rate to decrease when the oil price increases, then they will sell their stocks to prevent capital loss. On the other hand, export oil price of Russia is applied to capture the specific oil supply effect. This means that the investors will expect the economy of Russia and the profits of Russian firms increase due to the increasing export oil price.[6] In addition, since the Shanghai stock market and Shenzhen stock market are the main stock markets of China, we adopt the value-weighted return between Shanghai "A" and Shenzhen "A" shares to represent the China stock market

[4] Because the import oil price data of India is difficult to find, we use OPEC export oil price to be an instrumental variable of its import oil price. Moreover, export oil price data is used to be Russia's oil data because Russia is mainly oil export country in the world.

[5] To obtain the change rate of all variables, we use take the first difference in all variables and use the CPI index of these three economies to obtain the real change rate of all variables in our paper.

[6] There is little difference to Kilian and Park(2009). Because Russia is mainly oil supplier in the world, we use specific oil supply effect as its own oil shock.

return.

4.2 Methodology

Since most time series variables have a unit root, we cannot use those data without considering their unit root property. Otherwise, a spurious regression problem may occur and the results may not be reliable. To avoid this problem, we have to check whether the variables applied in this study have a unit root or not. Therefore, we use the ADF test first to check the unit root property as follows.

The ADF test is called the augmented Dicker-Fuller test. By considering the variables to be an autoregressive process with order p (AR(p)) process in Said and Dickey (1984), the ADF test can be applied to check whether the high order autoregressive variables have the unit root process. Let us illustrate the ADF test as follows:

$$y_t = \varsigma_1 \Delta y_{t-1} + \varsigma_2 \Delta y_{t-2} + \cdots + \varsigma_p \Delta y_{t-p} + \alpha + \delta t + \rho y_{t-1} + \eta_t, \eta_t \sim N(0, \sigma_\eta^2) \quad (1)$$

where y_t is the stock return, $\Delta y_{t-1}, \ldots, \Delta y_{t-p}$ are the first difference of the stock return, t is the trend of the stock return, y_{t-1} is the lagged term of the stock return, and η_t is an identical independent distribution (*i.i.d.*) white noise process. From Equation (1), $|\rho| = 1$ means that the data in question have the unit root property and the data are non-stationary. On the other hand, $|\rho| < 1$ means that the data have no unit root, thus they are stationary.[7]

We need to continue checking the cointegration relationship if the data are non-stationary and this implies all variables have a long-run equilibrium relationship.[8] In addition, we have to take the first difference to deal with the non-stationary property if the cointegration relationship does not exist. Thereafter, we use VAR to analyze the relationship among the variables.

Consider a VAR(p) process as follows,

$$Y_t = A_0 + A_1 Y_{t-1} + \ldots + A_p Y_{t-p} + e_t, \quad e_t \sim N(0, \Omega) \quad (2)$$

[7] If neither mean nor autocovariance depend on the date *t*, the process y_t is called a (weakly) stationary process.

[8] For details, see Engle and Granger (1987).

where Y_t contains $n \times 1$ variables and Y_{t-i}, $i = 1,2,\ldots, p$, are lagged dependent variables, and e_t represents the residuals from VAR(p) model. From above, we consider the appropriate order selection by ADF test and VAR(p) process. Here we use Akaike's information criterion (hereafter AIC, see Akaike (1974)) for the model fitting. AIC is defined as:

$$AIC(M) = -2\ln[\max likelihood] + 2M \tag{3}$$

where M is the number of parameters in the model. The optimal order of the model is chosen by the value of M, which is a function of p, such that *AIC(M)* is a minimum.

After choosing the optimal order for the VAR(p) process, we can collect the residuals from the VAR(p) process as above. We give these residuals as a structure, which is adopted by Kilian and Park (2009), to calculate the Structural VAR model (hereafter SVAR). This SVAR is as follows.

$$\mathrm{e}_t \equiv \begin{pmatrix} \mathrm{e}_{1t}^{\text{global oil production}} \\ \mathrm{e}_{2t}^{\text{global real activity}} \\ \mathrm{e}_{3t}^{\text{real price of oil}} \\ \mathrm{e}_{4t}^{\text{each BRIC stock returns}} \end{pmatrix} = \begin{bmatrix} \mathrm{a}_{11} & 0 & 0 & 0 \\ \mathrm{a}_{21} & \mathrm{a}_{22} & 0 & 0 \\ \mathrm{a}_{31} & \mathrm{a}_{32} & \mathrm{a}_{33} & 0 \\ \mathrm{a}_{41} & \mathrm{a}_{42} & \mathrm{a}_{43} & \mathrm{a}_{44} \end{bmatrix} \begin{pmatrix} \varepsilon_{1t}^{\text{oil supply shock}} \\ \varepsilon_{2t}^{\text{aggregate demand shock}} \\ \varepsilon_{3t}^{\text{oil-specific demand shock}} \\ \varepsilon_{4t}^{\text{other shocks to stock returns}} \end{pmatrix} \tag{4}$$

where ε_t represents a white noise process of which covariance matrix is an identity matrix. From the above setting, we can calculate the structural impulse response function. By using an impulse response function, we can implement impulse response analysis (hereafter IRA) and we can also plot the impact of one unit increase in the *j-th* variable's innovation at t on the i^{th} variable at date $t+s$. At the same time, we can find the response of the key variable's change when shocks occur in other variables. In our paper, we want to use IRA to analyze how different shocks affect on the three BRICs' stock markets.

5. Empirical findings

5.1 Basic statistics description and stationary test

From Table 1, we can find that the mean profit of India stock return is the highest among the three economies' stock returns. From all stock returns' skewness and kurtosis, we see that the financial time series data have fat tail properties. Firstly, the positive mean of the global real activity change rate (4.12%) shows that global demand will increase as oil prices rise. This increasing demand effect could explain the global boom in commodity markets in the early 21st century, which was driven by strong economic growth worldwide. In addition, the mean of global oil production change rate (0.05%) shows that the global oil supply shock is also positive, and this means that the global oil shock will gradually increase with the higher global demand. Finally, the positive mean of specified oil demand or supply change rate of all markets could reveal that all three economies' oil demand or supply will increase due to their fast economic growth among the three BRICs.

From Table 2, the results of ADF test show that stock returns in all economies have no unit root property. These means that all variables have no persistent impacts, and the current effect of one market shock on the others will disappear in the future. Hence, we can implement the SVAR estimation and IRA to process our analysis in the following section.

Table 1: Basic Descriptive Statistics Unit: %

Variables	GOP	GRA	OSDIN	OSDRU	OSDCN	INR	RUR	CNR
Mean	0.0578	4.1262	1.4537	0.8834	1.6338	1.1808	1.6346	0.5974
Std. Dev.	0.9242	42.7490	8.0814	8.6132	6.1174	5.9782	5.1851	8.3587
Skewness	0.2336	-0.1537	-0.5036	-0.3732	0.0296	-0.5006	-0.0459	0.1709
Kurtosis	3.9874	16.5570	2.6066	2.8551	3.5731	2.9842	2.7855	3.3346

Note: 1. GOP means the global oil production change rate, GRA means the global real activity change rate, OSDIN means the specified demand change rate of India, OSDRU means the specified demand change rate of Russia, OSDCN means the specified demand change rate of China, INR means India stock return, RUR means Russia stock return, and CNR means China stock return.

2. The data used in this paper are from 2001/1 to 2008/9. After the first difference, the number of observations in our sample is 93.

Table 2: Stationary tests (ADF test)

Variables	Statistic (No trend)	Statistic (Trend)
GOP	-8.8431***	-8.7832***
GRA	-11.823***	-11.806***
OSDIN	-6.1030***	-6.1381***
OSDRU	-4.4221***	-4.3482***
OSDCN	-6.1135***	-6.3012***
INR	-8.8634***	-8.8607***
RUR	-9.2272***	-9.6015***
CNR	-4.8587***	-4.8656***

Note: 1. ** *represents 1% significant level.

2. Stationary test in this paper is ADF test. The 1% critical value without trend is -3.50 and 1% the critical value with trend is -4.06.

4.2 Estimation results

4.2.1 SVAR estimation

In this section, we present the SVAR parameters estimation in Table 3.[9] The structural estimation is from Equation (4) above, which is similar to Kilian and Park (2009). Firstly, the global oil production (or supply) shock has no significantly effect s on the India, Russia, and China stock markets. The reason is obviously that the negative supply shock may hurt the economy, but the good economic performance of three BRICs could mitigate this negative impact.[10] Secondly, we can find that the global demand shock significantly only affects the Russia stock market but not in India and China stock markets. The reason for this finding is that both India and China stock markets may be relatively isolated from the world stock markets and global economy.

Additionally, the specific oil demand shock has no significantly impact on India stock market. But the oil supply shock has a significantly positive impact on Russia stock market. The result is reasonable because Russia is the oil exporter and increasing export oil price will make the Russia economy better than before. However, even China as the oil importer, the specific oil demand shock has also significantly positive effect on China stock markets. This means that there could be other effects among them. For instance, the good expectations will make China still experience strong economic growth during the higher oil price period, and this positive effect may be larger than the former negative precautionary demand effect.[11]

Finally, the last "other" shock has a significant positive effect on the stock return. This shock (or residual) is defined as unobservable effect on the stock markets. Consequently, the positive effect means that this is not captured by our model, such as the noise in three BRICs' stock markets or relaxation of the limits on investment in these countries, which could make

[9] For VAR estimation, we let the optimal lagged periods for the three models be 24.

[10] For example, China's economic growth rate was 11.1% in 2006, 11.4% in 2007 and 9% in 2008 and the average economic growth rate in the past three years was the largest among all Asian economies.

[11] The positive effect of average economic growth in China from 1997 to 2007 is 9.5% per year. However, this positive effect could become smaller since Chinese capital mobility control is stricter than in other economies, and then China's stock market is relatively isolated from the world stock markets and global economy.

the stock return increase.

Table 3: SVAR Parameters Estimation

Regressors	INR	RUR	CNR
GOP	-0.0013	0.0264	-0.6663
	(0.0072)	(0.4825)	(0.8873)
GRA	1.1520	0.9961**	-0.2377
	(0.7228)	(0.4760)	(0.8855)
OSD	-0.6925	0.9722**	2.0691**
	(0.7091)	(0.4631)	(0.8703)
Other	6.3230**	4.0851 **	7.6948**
	(0.4998)	(0.3230)	(0.6046)

Note: 1. ** represents 5% significance level.
2. The definition of variable is the same in Table 1.
3. In the parentheses is the standard error.

5.2.2 Impulse response analysis

In this section, we employ IRA to investigate how these three shocks affect three BRICs' stock markets. As described in Kilian (2009) and Kilian and Park (2009), we find that the effect in these stock markets are partially in contrast to that in the U.S. stock market, as shown in Figure 1-3. These results show that the response of large-sized NIEs' real stock returns may differ greatly depending on whether the increase in the price of crude oil is driven by demand shocks or supply shocks in the crude oil market. This imply that the oil specific demand shock (OSD) has a significantly positive impact on Russia and China stock return, the global demand shock (GRA) has a significantly positive impact on Russia stock return. However, only the global supply shock (GOP) has no significant impact on all these emerging countries which similar to Kilian's finding in the U.S.

Firstly, we find that all shocks have no significant impacts on India's stock return as show

in Figure 1. This finding is contrast to Kilian (2009), and Kilian and Park (2009), who found that the global and the oil specific demand shocks have different significant effects on the U.S. stock market. Since the regulation limit and capital mobility control are with much more restrictions than other countries, it makes India's stock market more separate and independent from the world economy. Therefore, the reason that there is no significant impact is that the positive expectation effect of India's fast economic growth may be just offset by the negative precautionary demand driven effect.

Additionally, in contrast to the early traditional literature that higher oil prices necessarily causes lower stock prices, we find that all global supply and demand two shocks have significantly positive impacts on Russia stock returns in Figure 2. This finding is partially in contrast to that in Kilian (2009), and Kilian and Park (2009), who find that the oil specific demand shock is driven by precautionary demand for crude oil, and then has a negative impact on the stock market. Since Russia is the oil exporter, the reason for the positive effect on the Russia stock market is that the positive expectation effect of Russia's fast economic growth and no negative effect of the precautionary demand driven effect. In addition, this positive expectation effect means that the investors expected the Russia economy to still perform well and capital to continue to flow in during the higher oil price period. In fact, the average economic growth rate of Russia from 1997 to 2007 was one of the highest around the world. Consequently, we can find that the response of Russia stock markets to these shocks is always positive.

Finally, only oil specific demand has significantly positive effects, but both global supply and demand shocks have no significant impacts on China stock returns. This finding is also partially in contrast to that in Kilian (2009) and Kilian and Park (2009), and the effect has mixed condition between Russia and India. At first, similar to the Russia condition, the reason for oil specific demand shock has positive effect on the China stock market is that the positive expectation effect of China's fast economic growth may be greater than negative effect of the

precautionary demand driven effect. Since the average economic growth rate of China from 1997 to 2007 was about 9.5%, the highest around the world. However, similar to the India condition, the result of global demand and supply shocks have no significant impacts is obviously that the regulation limit and capital mobility control are with much more restrictions than other countries, it makes China's stock market more separate and independent from the world economy. Therefore, the reason that there is no significant impact is that the positive expectation effect of China's fast economic growth may be just offset by the negative precautionary demand driven effect. In fact, this result is also consistent with Wang and Firth (2004)'s empirical findings that the segmented and integrated China stock market is mixed. It implies the China's stock market is "partially integrated" with the other stock markets and oil price shocks.

Figure 1 Impulse Response of India's Stock Returns to Different Shocks

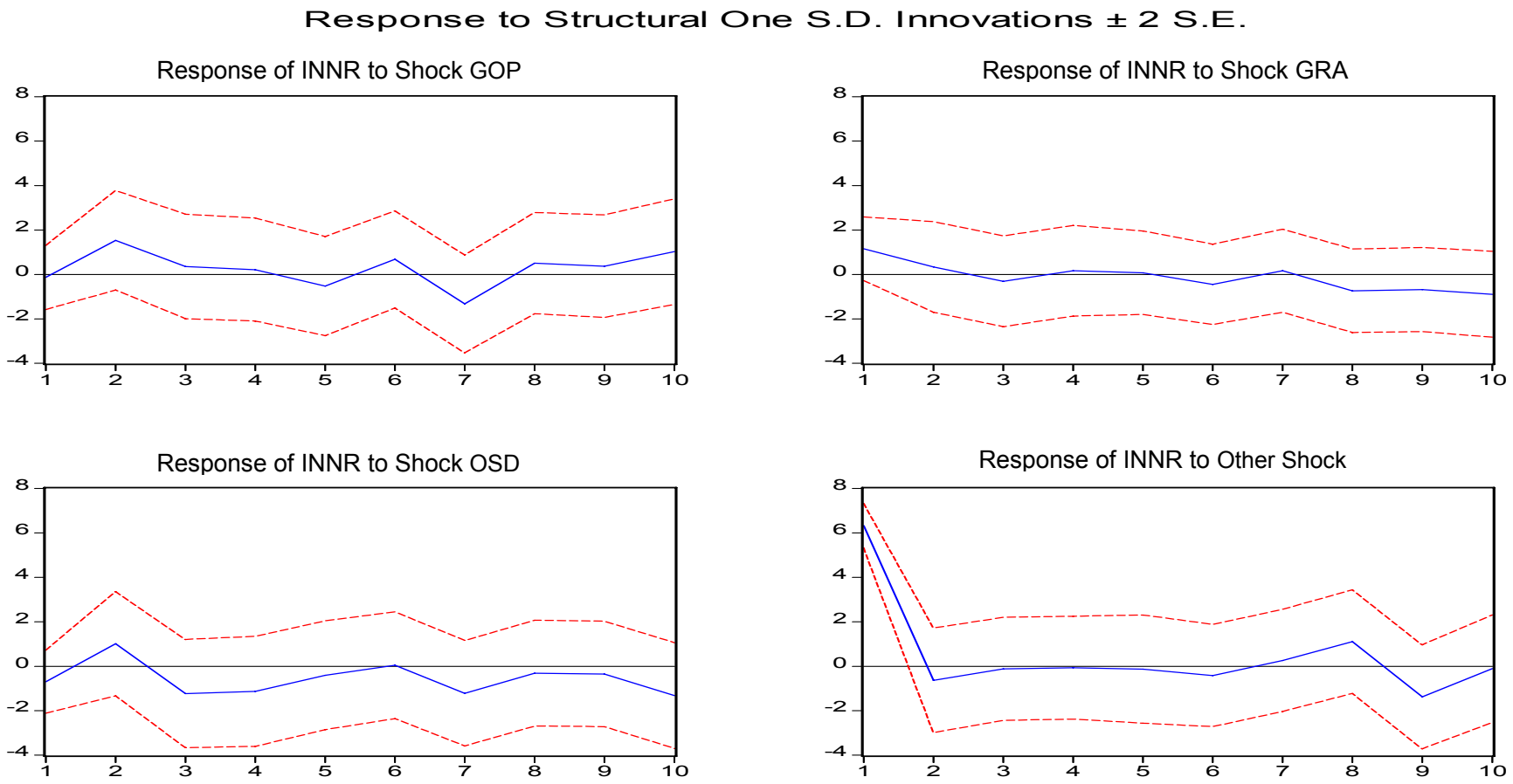


Figure 2 Impulse Response of Russia's Stock Returns to Different Shocks

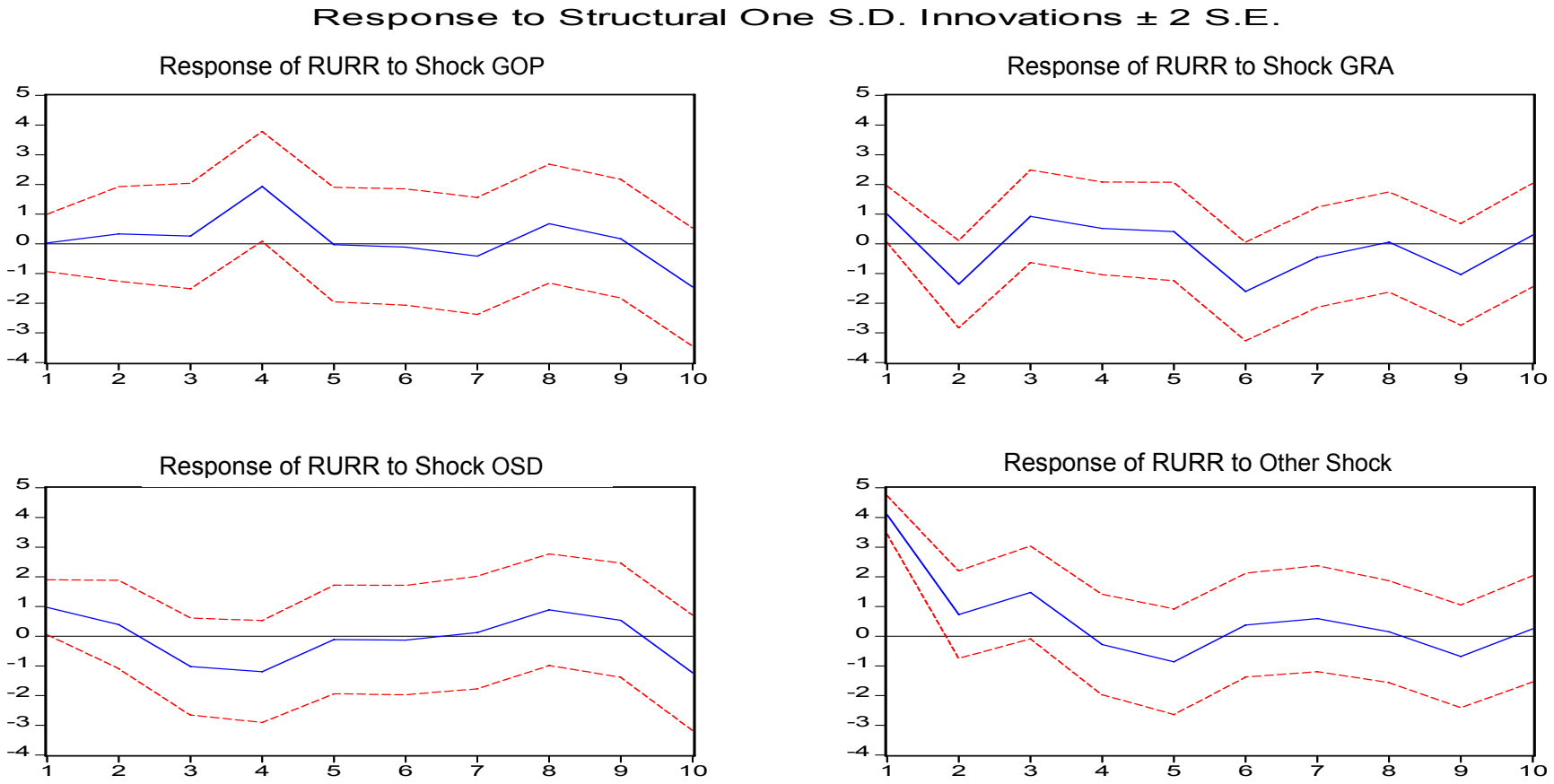
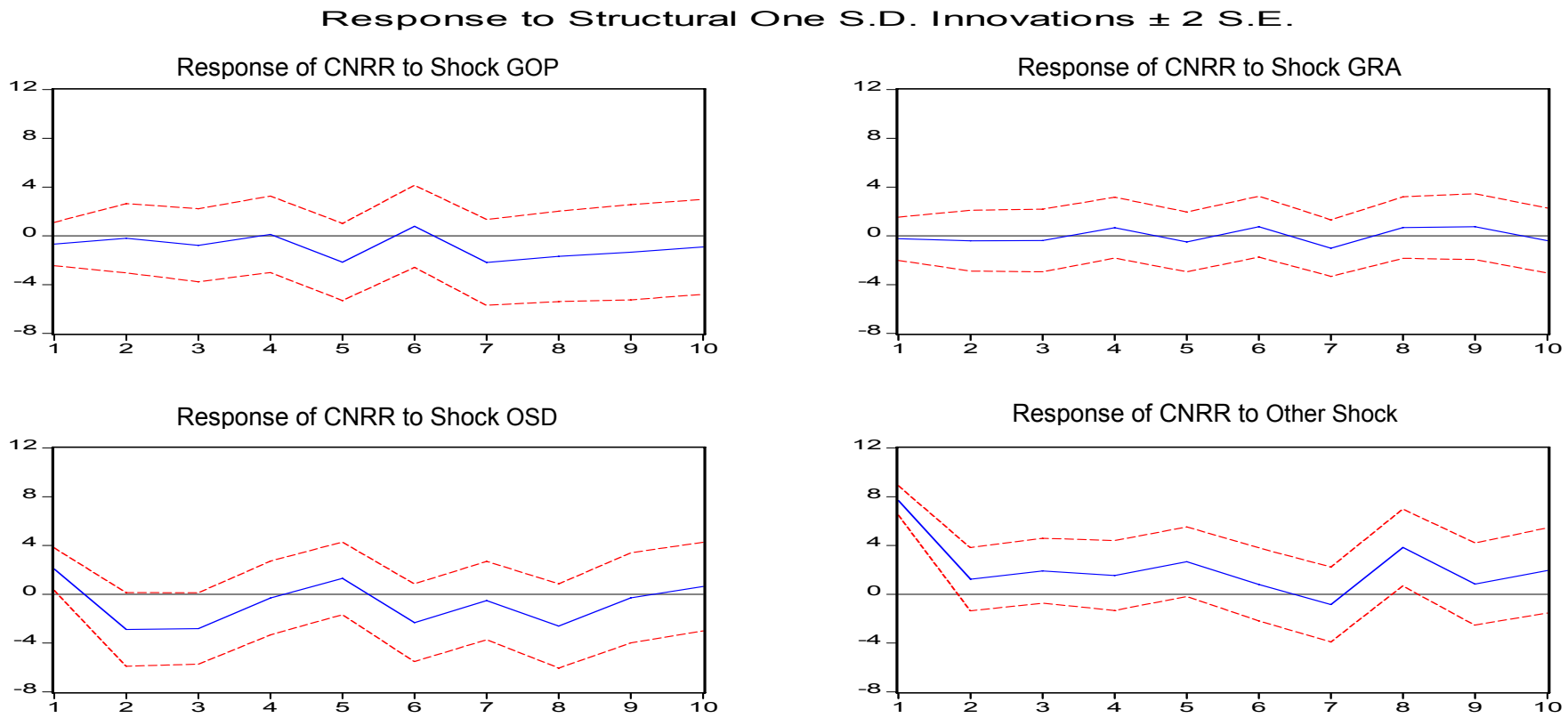


Figure 3 Impulse Response of China's Stock Returns to Different Shocks



6. Concluding remarks

Although a huge body of empirical research has studied the relationship between oil price changes and macroeconomic activity, it is surprising that little research has been conducted on the relationship between oil price shocks and BRICs' stock returns. Some studies have examined the impacts of oil shocks on the stock market and economic activity, but mainly for a few industrialized countries such as the United States, United Kingdom, Japan, and Canada (See Papapetrou (2001)). Furthermore, one major impact in both oil markets and in the international monetary system since the late 1990s is the emergence of BRICs. The BRICs are four biggest emerging economies combined they account for two-fifths of the total GDP of all emerging economies. Wilson and Purushothaman (2003) firstly identified these four emerging markets which together could be larger than the G6 within the next forty years. In financial terms, between 1986 and 1995 stock market capitalization in emerging countries grew ten-fold from $171 billion to 1.9 trillion and market share held in capitalization increased from 4 percent to 11 percent, mostly to these major emerging markets. In addition, 18 percent of total annual oil demand in 2006 came from the BRICs, and approximately 23 percent in 2030. However, there are not many studies explaining the relationship among oil price shocks and stock market returns in BRICs.

Additionally, Kilian and Park (2009) were the first to show that the response of aggregate U.S. real stock returns may differ greatly depending on whether the increase of the price of crude oil is driven by demand or by supply shocks in the crude oil market. Therefore, the main goal of this paper is to study the dynamic interactions between oil price and stock returns utilizing a SVAR approach for BRICs. We employ a new and detailed monthly data set from 2001/1 to 2008/9, in order to

understanding the relationship between different oil price shocks and the return of BRICs' stock market in detail, and fill this gap..

Unfortunately, we cannot find detail Brazil oil price data from all international energy statistic institutions, then we only discussing other three emerging economies in this paper and left this gap as the future research. From this paper empirical analysis, we find that the impact of oil price shocks on the three BRICs' stock prices has been mixed. Firstly, we find that all shocks have no significant impacts on India's stock return. Since the regulation limit and capital mobility control are with much more restrictions than other countries, it makes India's stock market more separate and independent from the world economy. Therefore, no significant impact is that the positive expectation effect of India's fast economic growth may be just offset by the negative precautionary demand driven effect. Additionally, in contrast to the early traditional literature that higher oil prices necessarily causes lower stock prices, we find that all global and oil specified demand shocks have significantly positive impacts on Russia stock returns. Since Russia is the oil exporter, the positive effect on the Russia stock market is that the positive expectation effect of Russia's fast economic growth and no negative effect of the precautionary demand driven effect. Finally, the impact of oil price shocks on China stock returns has the mixed condition between Russia and India. This means that only oil specified demand shock has significantly positive effects, but both global supply and demand shocks have no significant impacts on China stock returns.

This result is also consistent with the previous empirical findings that the segmented and integrated three BRICs' stock market is mixed, and it implies that the three BRICs' stock market is "partially integrated" with the other stock markets and oil price shocks.

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