DO OIL PRICE SHOCKS MATTER FOR TRANSITION ECONOMIES?

EVIDENCE FROM KAZAKHSTAN, RUSSIA AND UKRAINE

By

Ramiz Rahmanov

Submitted to

Central European University

Department of Economics

In partial fulfillment of the requirements for the degree of Master of Arts in Economics

Supervisor: Professor Katrin Rabitsch

Budapest, Hungary

2007

ABSTRACT

This thesis empirically analyzes the effects of oil price shocks on three transition countries of which Kazakhstan and Russia are oil exporters, and Ukraine is an oil importer. Employing the VAR methodology and asymmetric specifications of oil price shocks, I find that economies of these countries are vulnerable to oil price changes. In particular, in Kazakhstan, oil price increases affect inflation. In Russia, oil price increases have effect on GDP growth and oil price decreases have effect on wage growth, real exchange rate, and inflation. In Ukraine, oil price increases affect wage growth and inflation, and oil price decreases affect real exchange and interest rate. The differences in the responses are due to whether a country is an oil importer or an oil exporter, and the monetary and fiscal policies implemented by these countries.

Contents

1. Introduction

This paper contributes to the rare literature on the effect of oil price changes on both oil importing and oil exporting transition countries. In particular, it is the first detailed study of such kind on the Kazakh, Russian and Ukrainian economies at least in English. Using a broad array of variables capturing all spheres of economy, six specifications of oil price shocks and three analytical tools the paper provides a broad picture on how oil price shocks and which type of oil price shocks affect oil producing and consuming economies in transition.

The finding of this paper is that oil price shocks do matter for transition economies. Three econometric tools are applied to the estimated unrestricted six variable VAR models: granger causality test, impulse response functions and variance decomposition. For each country six VAR models are built using quarterly data for the period between 1995Q1 and 2008Q2, one model for each specification of oil price shocks. The specifications are symmetric oil price shocks, positive oil price shocks, negative oil price shocks, net oil price increases (NOPI), net oil price decreases (NOPD), scaled oil price increases (SOPI) and scaled oil price decreases (SOPD). The last six specifications are used to allow macroeconomic variables to respond differently to positive and negative oil price changes.

The results of the granger causality test show that the forecast of at least one macroeconomic variable of these countries can be improved if past movements of oil price shocks are considered. The computed impulse responses show that in Kazakhstan, an oil exporter, inflation positively responds to oil price increases. For Russia, an oil exporter, it is found that GDP growth negatively reacts to oil price decreases and positively to oil price increases. Negative oil price changes negatively affect inflation, interest rate and positively affect real exchange rate. In Ukraine, an oil importer, positive oil price changes have a positive effect

on real wage growth and inflation. On the other hand, it is found that negative oil price changes lead to real exchange rate appreciation and interest rate decline.

Variance decomposition analysis shows that positive oil price changes contribute significantly to the inflation variation of Kazakhstan. Oil price decreases play an important role in the variation of all Russian macroeconomic variables. In the Ukrainian case, oil price increases contribute significantly to the variability of GDP growth, real wage growth, real exchange rate and inflation. Negative oil price changes take an important part in the variation of real exchange rate and interest rate.

The remainder of the paper is organized as follows. The second chapter provides theoretical background on how oil price fluctuations affect economies using a standard economic model. In the third chapter literature is reviewed. The next chapter gives economic outlooks of each country under study and can be skipped if a reader is familiar with these transition economies. The fifth chapter describes the data and time series properties of the variables, and provides definitions of oil price shocks. The sixth chapter presents the employed methodology. In the seventh chapter, the results are provided and compared with those of other studies. Finally, the thesis concludes with policy implications.

2. Theoretical foundations

The routes via which oil price shocks affect economies can be depicted through a standard macroeconomic model, such as AD-AS. However, *how* oil price shocks affect these models depends on which type of shocks an economy experiences (oil price increases or oil price decreases) and which type of a country (an oil exporter or an oil importer) is affected.

For oil producing countries, oil is a main source of the budget income and of the foreign currency reserves. Thus, the government spending and the real exchange rate are very vulnerable to oil price fluctuations. The income distribution is also highly dependent on oil prices because it is carried out via transfers from the profits of oil extracting enterprises to the poor. Additionally, the monetary and fiscal relieves which their governments implement are provided at the expense of the oil revenues. Generally, it can be said that in oil exporting countries the economic life is determined by oil prices.

The role of oil in oil importing countries is a bit different. For them, oil affects mostly through changes in exchange rate and production costs. Oil is an important commodity in the trade balance, thus, the fluctuation of its price affects exchange rate. The changes in oil prices alters the production costs of enterprises which use oil as an input and this affects the quantity of real output supplied and the price level.

The AD-AS model is comprised of three curves, however, in this paper I will focus only on two curves: the aggregate demand curve (AD) and the short run aggregate supply curve (SAS). The AD curve shows how households, entrepreneurs and government adjust their demand when the price level changes, other things held equal. The aggregate demand consists of consumption, investment, government spending and net exports (NX).

$$Y = C + I(r) + G + NX \quad (3)$$

The assumption used in this model is that the world exchange rate is equal to the domestic one. The SAS curve shows how enterprises adjust real output level when the price level changes, other things held constant.

In the case of oil exporters, in the short run, an increase of oil prices leads to the shift of the AD curve to the right (inflation rises). The explanation is that an oil price increase leads to the surge of the AD curve components resulting in the rightward move of the curve. A decrease of oil prices leads to the shift of the AD curve to the left (inflation declines). The leftward shift of the curve is caused by the decrease of the AD components following an oil price drop.

For oil importers, in the short run, an oil price increase means the move of the SAS curve to the left (inflation rises). The result is due to an increase of the production costs of the firms using oil. An oil price decrease means the rightward move of the SAS curve (inflation decreases) because oil price fall leads to a decrease of production costs.

The interpretation of oil price shocks using a standard macroeconomic model helps us comprehend better the routes by which oil price changes affect economies when the impulse responses for each country are analyzed.

3. Literature review

The coincidence of fluctuations of oil prices with those of macroeconomic indicators has attracted the attention of many economists. All papers on the topic can be conditionally divided into three categories on the grounds of the development status of a country: developed, developing and transition. Additionally, each category is divided into two subcategories: oil exporters and oil importers. This paper will contribute to both subcategories of the transition countries.

One of the earliest and most influential studies is done by Hamilton (1983). Building a six variable VAR model of the USA and using data covering the period between 1946 and 1973, he finds that seven of eight postwar recessions are caused by positive oil price shocks. Reconsidering Hamilton's results, Mork (1989) extends the data set to mid 1988 and shows that oil price shocks had less significant impact on total output fluctuations than they had in Hamilton's paper. He notes that before the 1980s the world economy suffered only from positive oil price shocks and only in the 1980s did the economy start observing negative oil price shocks. To account for the change in types of the shocks he suggested distinguishing positive and negative oil shocks. Mork's version of definition of oil shocks is called asymmetric. The reestimation of the VAR model shows a strong negative effect of positive oil price shocks on total output, but displays an insignificant effect of negative oil price shocks. Additionally, the introduction of the asymmetric oil price shocks improves the fit of an oil price-output relationship. Following finding of Mork (1989) on asymmetric effects of oil price shocks, Lee et al (1995) and Hamilton (1996) introduce their own definitions of oil price shocks accounting for asymmetries. Lee et al (1995) argue that high volatility of oil prices diminishes the effect of oil price shocks because people consider high volatility as a sign of transition and do not change

spending habits. Thus, to account for a volatile nature of oil prices they suggest using GARCH modeling. Hence, their definition is named as a scaled specification. Hamilton's (1996) argument was also in the same vein as the argument of Lee et al (1995). In his opinion, changes in oil prices do not have an immediate effect on consumers' purchasing decisions and consequently do not affect total output instantly. Assuming the lag between variations in oil prices and total output, Hamilton (1996) defines an oil price shock as a yearly change of oil prices. In a later paper, Hamilton (2003) defines an oil shock as a three year change of oil prices. His definitions of oil price shocks are named as net specifications. All subsequent papers on the topic, starting from 1996, employ at least one of four definitions of oil price shocks or all of them: symmetric, asymmetric, scaled specifications and net specification.

The above papers are written about the US. However, there is a number of other papers studying the effect of oil price shocks on the economies of developed countries. In a more recent paper, Jimenez-Rodriguez and Sanchez (2005) carry out an extended study on the effect of oil shocks on the economies of developed countries which include oil importing and oil exporting countries. The countries are individual G-7, Norway and the Euro area. Two of the countries, the UK and Norway, are oil exporting and the rest are oil importers. Using all four definitions of oil shocks and applying the VAR methodology to quarterly data, they find that a linear specification of positive oil shocks have a negative effect on output growth for all oil importing countries except Japan, and non-linear specifications showed larger negative impact on GDP growth than a linear one in all importers except Canada. The scaled specification of positive oil shocks shows a larger negative impact than shocks by net specification. In the case of oil exporting countries, the authors observe a positive response of GDP growth to positive changes in oil prices. In the case of scaled specification of oil shocks, the Norwegian GDP growth responds positively to an

increase in oil prices, but the UK, at first, responds by an increase; however the positive response dies out soon and in the third quarter the response is negative. In their opinion, the UK's 'strange' response can be explained by the exchange rate appreciation following an oil price increase.

Although most of the papers on the topic have been written for the US and the other developed countries, there is also growing literature on oil exporting and importing developing countries. Cunado and Perez de Garcia (2005) analyzed the impact of oil price changes on six Asian countries: Japan, Singapore, South Korea, Malaysia, Thailand and the Philippines; all are developing countries (except Japan) and oil importers. The work uses three variables and its sample includes the quarterly data for the period between 1975 and 2002. The authors employ three definitions of oil shocks: asymmetric, scaled specification and net specification. The applied cointegration test does not show any long run relationship among variables. Thus, focusing on the short run relationship, they note that asymmetric shocks do not cause output growth rates in any of the countries. However, when the other specifications are used, they find that only output growth variables of Japan and the South Korea are caused by oil price shocks. Regarding inflation, they conclude that inflation only in Japan and Thailand is caused by oil price shocks.

The article by Farzanegan and Markwardt (2009) studies the effect of oil shocks on the Iranian economy which is an oil exporter. They use a six variable VAR and refer to two definitions of oil price shocks: symmetric and asymmetric. The symmetric definition of oil price shocks shows that an increase of oil prices affects the industrial output considerably. The asymmetric definition of oil price shocks demonstrates that industrial output in Iran responds positively to positive oil price shocks and output reacts negatively to negative oil price shocks.

The symmetric and positive asymmetric oil price shocks lead to appreciation of real effective exchange rate and a negative asymmetric oil price shock leads to significant depreciation of the domestic currency.

The vulnerability of the transition economies has been only considered in few studies. The most likely reason for that is the lack of data for most transition countries. One of the first works on transition economies was done by Rautava (2003) who studied the effect of oil prices and exchange rates on the Russian economy. The author uses quarterly data covering the period between 1995 and 2002 and employs four variables. In the paper, it is assumed that an oil price is an exogenous variable. Applying a cointegration test to the variables, Rautava (2003) finds two cointegrating relationships. The estimation of VECM shows that a ten percent increase in oil prices leads to 2.2 percent increase in the GDP level and 4.6 percent increase in federal government revenues. Another paper, by Starcheva (2006), examines the effect of oil supply shocks on twelve economies of Central and Eastern Europe. The work uses monthly data on industrial production, inflation and interest rate for the period between 1993 and 2006, and employs the VAR methodology. The author, following Kilian (2005), defines an oil supply shock as a ratio of change in oil supply over the exogenous production fall calculated as a sum of all major production shortfalls since 1973. The empirical results do not show a significant effect of oil supply shocks on interest rates and inflation in all CEE countries except Russia. Regarding industrial production, Starcheva (2006) finds that industrial production positively reacts to negative oil supply shocks and this is a surprising result. Varabei (2007) analyzes the effect of oil price shocks on the economies of ten CEE oil importing countries. The author applies a six variable VAR model to quarterly data for the period between 1995 and 2005. In defining oil price shocks, all four specifications are used. The empirical results show that the effects of oil

price shocks on the outputs are negative; however they are statistically insignificant for all CEE countries with few exceptions. The exceptions are Hungary in the case of negative oil price shocks, Slovakia in the case of scaled specification of negative oil price shocks, and Estonia and Lithuania in the case of positive oil price shocks.

The current work studying the impact of oil price shocks on three transition countries (Kazakhstan, Russia and Ukraine) provides more evidence on the extent to which transition economies are vulnerable to fluctuations in oil prices. New evidence certainly advances the contemporary state of knowledge on the effect of oil price shocks on transition economies.

4. Economic overview of Kazakhstan, Russia and Ukraine

After the fall of the communism, all countries of the Former Soviet Union experienced a long period of decline in production which was reversed only after 1995. However, the positive trend did not last long because of the Russian financial crisis which started in August 1998. The recovery from the consequences of the crisis started only in the end of 1999 and at the beginning of 2000 when a surge in the total production was observed. Economists have different opinions on the factors which caused such an increase in the economic activities of the Commonwealth of Independent States (CIS). Some argue that it was due to very high oil prices; others think that it was due to inflation control and the post crisis devaluation. There is also an opinion that the revival was caused by the institutional reforms. Others suggest that it was just a return from the extremely low levels of production in the early 1990s to its natural level (Vinhas de Souza and Havrylyshyn, 2006).

4.1 Kazakhstan

After the dissolution of the USSR, Kazakhstan, like many other post Soviet republics, chose the way toward market economy. However, the transition from central planning system to the market economy was not smooth. The country faced a lot of challenges when implementing the economic reforms. The most painful consequence of the split of the Union was the dramatic fall in GDP which in the first four years of independence declined to forty percent of the country's GDP in 1989. The reason was typical for all post Soviet countries – the break of the trade link among republics. After such a big drop, a positive trend was observed, but the growth did not last long. The economy again experienced a recession as the consequences of the Russian crisis which resulted in decrease of the demand on the Russian export market. Only at the end of

1999 did growth resume. It happened mostly due to an increase in oil and metal prices. Nevertheless, in 2001 Kazakhstan produced only sixty five percent of GDP of the 1989 level (EIU, 2008a).

Together with the decline in total output, Kazakhstan experienced extremely high inflation. However, the country managed to decrease it by fiscal tightening. During the 1998 crisis, the story started again and the National Bank decided to devalue the national currency - tenge. After the devaluation, the prices were still rising and the inflation reached the level of twenty percent in March, 2000. The inflation was decreased to below than ten percent in 2001 as a result of the tight monetary policy. However, since 2005 the inflation has acquired an acceleration speed due to the rise in commodity prices and loosening of the fiscal policy. Thus, annual inflation was about twenty percent in June, 2008 (EIU, 2008a).

The oil boom following the Russian crisis positively affected the Kazakh labor market. The unemployment rate declined from 19.3 percent in 1999 to 7.3 percent in 2007. The economic growth also stimulated the rise of real wages which improved the country living standards. The stability of tenge also played an important role in raising the quality of the citizens' lives (EIU, 2008a).

The foreign direct investment (FDI) plays a significant role in Kazakh GDP; by the end of 2007, the state has attracted more than forty billion USD. It is even more important than in any other post-socialist country except Azerbaijan, for example Russia or Poland, even though the size of Russia is much bigger than the size of Kazakhstan. The FDI is mostly directed to the oil and gas industry which attracted sixty seven percent of FDI over the 1993 – 2000 period. The huge inflow of the foreign currency into the economy has been influential because it helped to

stabilize the balance of payments and had a spillover effect on the domestic economy. FDI is predicted to have a further significant impact (EIU, 2008a).

One of the main tasks of the Kazakh National Bank is to maintain the balance between consumer price disinflation and the exchange rate appreciation. Additionally, to secure the development of the non-oil sectors, the National Bank maintains the financial liquidity which is done by decreasing the refinancing rate. However, in 2005 due to the inflationary pressures the National Bank was forced to start increasing the rate and only in July 2008 did it cease its tightening policy (EIU, 2008a).

4.2 Russia

The economic performance of Russia during the transition period is paradoxical. The fall in GDP was more profound and long-lived than the majority of the former Soviet republics and the countries of Central and Eastern Europe not involved in military conflicts although it had much better initial conditions in terms of energy self-sufficiency and mineral resource abundance. In 1991 real GDP declined by twelve percent, the budget deficit accounted for about twenty six percent of GDP and inflation reached three digit figures. However, after applying monetary tightening policy, Russia managed to curb hyperinflation in 1995 and relative macroeconomic stability continued until August, 1998 when the Russian default happened. The main factors of the Russian crisis were the decline in oil prices, the Asian crisis in 1997, raising concerns regarding the reliability of the emerging markets and the absence in the advancement of the reforms on the micro-level. In August 1998 the currency depreciated by around two hundred percent. By the end of the year inflation rose by eighty five percent, however the threat of the hyperinflation was avoided due to the wise decision of the government – not to print excessive amount of money (EIU, 2008b).

Russia managed to cope with the financial crisis quite fast. The rapid recovery was due mainly to several factors: fiscal tightening, increase of oil and steel prices, and the rouble devaluation. The most remarkable explanation is the domestic currency devaluation which led to the growth of the domestic and foreign demand for the Russian goods which put in use unutilized capacities (Yudaeva et al, 2004). The execution of the fiscal tightening was done by refusing to index expenditure which combined with the decline in the real wages after the devaluation increased the poverty in the country. The inflation declined to twenty percent at the end of 2000 and then decreased further to seven percent at the beginning of 2007.

Although at the beginning the recovery was partially indebted to the import substitution, the subsequent growth mostly was due to the growing export of fuel, metals and forestry. They provided about seventy percent of the growth in the industrial production of which forty five percent belonged to the oil industry alone. Hence, it can be concluded that over the period, before the current crisis, the oil industry produced about twenty five percent of GDP growth. At the same time if one considers the spillover effect of the oil industry via procurement contracts and increase of wages on the domestic demand, the actual contribution of the industry has been much bigger (Ahrend, 2006).

The post-crisis period was followed by an increase in private consumption which was mainly driven by the growth of the real wages and the real exchange rate appreciation. The real wages grew by about 130 percent during 1999 – 2000. The exchange rate appreciation and the increase of the real wages increased the size of imports, but it did not affect the trade balance seriously because of the growing oil exports. However, the real exchange appreciation adversely affected the competitiveness of the manufacturing sector. The rouble became twice as strong as it was in 1999 in the real terms. The real wage growth cannot be blamed for the decrease of the

domestic enterprise competitiveness because the growth was accompanied by the labor productivity growth. The yearly productivity growth accounted for around ten percent during 1999-2004 (Ahrend, 2006).

4.3 Ukraine

In the early years of the transition period, many experts predicted prosperous future for Ukraine because the country was not involved in any military conflict, and managed to slow down the hyperinflation and the economic decline. However, the predictions did not come true. During the early transition era, monetary and fiscal authorities were not able to fulfill their tasks properly, the result of which was the budget deficit, reaching the value of nearly ten percent of GDP. The sources of the deficit were quasi-fiscal operations aimed at supporting the energy sectors. As it can be expected, the subsidization played its role in boosting the inflation (EIU, 2008c).

However, the situation changed toward a positive side when in 1994 the stabilization program was launched. The program included trade liberalization, exchange rate unification and partial fiscal consolidation. In 1996, the program was enhanced by the introduction of the national currency – hryvnia. The exchange rate was tied to the US dollar and a rate band was imposed. The band also played a significant role in the inflation halting from four hundred percent in 1994 to ten percent in 1997 (EIU, 2008c).

However, the Russian crisis in 1998 showed the inconsistency of the maintenance of the fixed exchange rates. As the aftermath of the crisis, the foreign exchange reserves fell tremendously forcing the authorities to devalue the currency by more than fifty percent and impose restrictions on the transactions involving the foreign currency. During the crisis, inflation rose in the short term; however, it started to decline at he beginning of the 2000s (EIU, 2008c).

Like in other CIS countries, the Ukrainian economic growth was resumed during the post-crisis period starting in the early 2000s. This is mainly attributed to such factors as fiscal and tax reforms initiated immediately during the crisis, revival of other CIS economies, high steel prices and the hryvnia devaluation. The currency devaluation boosted both domestic demand for food and the foreign demand for the traditional Ukrainian export commodities – steel and chemicals leading to the positive trade balance (Vinhas de Souza et al, 2006). The increased demand from Russia on machinery products also played a positive role in the GDP growth which reaches the 7.2 level in 2007. The economic development also affected real wages. From 2000-2006 the annual average growth rate of the real wages was about nineteen percent; however, the rate decreased to twelve percent in 2007.

Since 2000 the exchange rate of hryvnia has been said to be free floating. However, in reality it is not true. The National Bank monitors the exchange rate and intervenes. The intervention is carried out via open market operations. Additionally, there was a requirement for all enterprises to sell fifty percent of their foreign currency on the inter bank exchange. Such practices helped to sustain the relative stability of the hryvnia up to the recent crisis (EIU, 2008c).

It can be concluded that after the collapse of the USSR each of the countries experienced the decline in GDP, although the depth of the decline and the recovery period varied among them. In addition to the break of the trade links explanation of the growth failure during the first transition period (before the 1998 crisis) there also exist two other explanations depending on the country. The first one is that the failure was due to the absence of favorable conditions such as presence of the natural resources. This version is usually suggested to explain the GDP fall of the

oil importing countries. However, this explanation cannot be applied to resource abundant countries such as Russia and Kazakhstan. The second explanation is that the economic failure was due to the lack of the institutions (Yudaeva et al, 2004). It seems that in the case of oil exporting countries, the second explanation is the right one and in the case of oil importing, both explanations are applied.

5. Data

5.1 Variables' description

In this paper, I examine the quarterly data for six macroeconomic variables in three countries: oil price, GDP, inflation, interest rate, wage and real effective exchange rate. Kazakhstan and Russia are oil exporters and Ukraine is a net oil importer. The data for all countries covers the period between the first quarter of 1995 and the second quarter of 2008. Most of the data were extracted from the database of International Monetary Fund[1] (IFS); however, when the series were incomplete, additional sources, such as the databases of International Labor Organization[2], central banks[3], the local statistical office of Ukraine[4] and European Intelligence Unit[5] were used. Oil prices are average world prices expressed in US currency. Additionally, in estimations, one dummy variable is used to distinguish between before and after the Russian crisis periods. The inclusion of the dummy variable will help avoiding a possible bias of the results. The Russian crisis started in August, 1998, however there is no exactly defined period when the crisis ended. To determine the exact quarter of the end of the rouble crisis, the criteria developed by Atmadja (2005) are used. The criteria are the following:

- The inflation starts decreasing to before crisis rates
- The exchange rate starts appreciating and it is not volatile anymore
- GDP starts growing at least at the pre-crisis rates
- The interest rate returns at least to the pre-crisis levels

[1] http://www.imfstatistics.org/IMF/
[2] http://laborsta.ilo.org/
[3] http://www.nationalbank.kz/ (Kazakhstan), http://www.cbr.ru/ (Russia), http://www.bank.gov.ua/ (Ukraine)
[4] http://www.ukrstat.gov.ua/
[5] http://www.eiu.com/

Based on the criteria, the crisis in all these countries ended at the same time which is the first quarter of 2000.

All variables are deseasonalized by X11 procedure, with multiplicative adjustment for all variables except an interest rate and an inflation for which an additive adjustment is used. The decision to used deseasonalized data instead of including seasonal dummies was made to restrict the size of the models. The monthly data were transformed to quarterly by taking their average. All variables except inflation and interest rates are expressed in logarithms. Nominal variables (oil price, wage and GDP) are converted to real terms by deflating them by CPI.

5.2 Definition of oil price shocks

In the paper four definition of oil price shocks are used: symmetric, asymmetric, scaled specification and net specification. Symmetric oil price shocks are defined as a quarterly change of oil prices:

$$oil\_price\_shock_t = oil\_price_t - oil\_price_{t-1}$$

Asymmetric oil price shocks are calculated following Mork (1989) who captured an asymmetric feature of oil price shocks by distinguishing positive and negative oil price shocks:

$$oil\_price\_shock_t^+ = \begin{cases} oil\_price\_shock_t & if \quad oil\_price\_shock_t > 0 \\ 0 & otherwise \end{cases}$$

$$oil\_price\_shock_t^- = \begin{cases} oil\_price\_shock_t & if \quad oil\_price\_shock_t < 0 \\ 0 & otherwise \end{cases}$$

The computation of scaled specification of oil price shocks is done according to Lee et al (1995). The idea behind a scaled specification is that a change in oil prices will have a smaller impact on macroeconomic variables when the volatility of oil prices is high. To take into account

the volatility, a univariate GARCH error process is employed in computations of the specification:

$$oil\_price\_shock_t = \alpha_0 + \sum_{i=1}^{4} \alpha_i oil\_price\_shock_{t-i} + \varepsilon_t$$
$$\varepsilon_t / I_{t-1} \sim N(0, h_t)$$
$$h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 h_{t-1}$$
$$SOPI = \max\left(0, \hat{\varepsilon}_t \Big/ \sqrt{\hat{h}_t}\right)$$
$$SOPD = \min\left(0, \hat{\varepsilon}_t \Big/ \sqrt{\hat{h}_t}\right)$$

where *SOPI* stands for a scaled oil price increase and *SOPD* – for scaled oil price decrease.

Finally, a net oil price shock specification is proposed by Hamilton (1996). He observes that majority of oil price increases were adjustments to oil price decreases. To know exactly how disturbing an oil price increase is for consumers' spending, it is more realistic to compare the current oil price with a maximum oil price over the previous year. Thus, he suggests calculating an oil price shock in the following way:

$$NOPI = \max(0, oil\_price_t - \max(oil\_price_{t-1}, ..., oil\_price_{t-4}))$$

where *NOPI* stands for a net oil price increase.

Following Hamilton's logic Farzanegan and Markwardt (2009) introduce a formula for a net oil price decrease (*NOPD*):

$$NOPD = \min(0, oil\_price_t - \min(oil\_price_{t-1}, ..., oil\_price_{t-4}))$$

5.3 Time series properties of variables

Prior to the selection of the methodology to analyze the effect of oil price shocks on macroeconomic variables, it is required to investigate the time series properties of the variables. For that, an ADF test (Dickey and Fuller, 1979) and a PP test (Phillips and Perron, 1989) are

carried out. In total, three specifications of each test are employed: with a constant and a trend, with a constant and finally, with no constant and no trend. The lag is selected based on the Schwartz information criteria which is a parsimonious criterion. The results of the tests are presented in Appendix I. The null hypothesis that the variable has a unit root is rejected for all specifications of oil price shocks by both tests at the conventional levels. The interest rates and inflation of all countries are considered to be stationary processes and the log levels of the real exchange rates, GDP and real wages are found to be unit root processes. When there is a disagreement between tests and among specifications the decision to consider a variable as a stationary or nonstationary was based on the majority and economic sense principles. In the case of the variables with unit roots, both tests in all specifications showed that their log differences are stationary. Thus, inflation and interest rate variables will be used in levels while the others – in log differences.

6. Methodology

The effect of oil price shocks on macroeconomic variables will be investigated by the VAR methodology. Although three of six variables are I(1) process, for several reasons, it was decided not to estimate Vector Error Correction models. First, the sample period under investigation is short and a trace test is prone to reject the null of no cointegration in small samples. Johansen (2002) notes that the ratio of the product of the number of lags and the number of the variable over the sample length has to be less than 0.20 to consider the results to be robust. For the models of this paper, depending on a country and specification the ratio is below 0.20 only for six models of Kazakhstan. Finally, although today any linear combination that is stationary is called a cointegration relation, the original definition of cointegration requires that all variables have to be of the same order. In the case of this study the integration order of one half of the variables is one and the integration of the other half is zero. Thus, the variables do not satisfy the original conditions for cointegration.

There are also a few studies which argue that in the short horizons the results obtained from an unrestricted VAR are more accurate than those from VECM. Engle and Yoo (1987), Clements and Hendry (1995), and Hoffman and Rasche (1996) conclude that when imposed restrictions are correct, an unrestricted VAR produces more superior forecast variance than a restricted VECM in the short run. Additionally, using Monte Carlo simulations, Naka and Tufte (1997) conclude that the loss of efficiency in the VAR estimations of cointegrating variables was not significant at the short horizons. Moreover, they find that in the short run the VAR estimates are superior to those of the VECM. Considering above mentioned facts, the usage of the unrestricted VAR can be regarded as justified.

6.1 Unrestricted VAR

For a set of six variables $y_t = (y_{1t},...,y_{6t})'$ employed in this work, a general model reflecting their dynamic relations has the following form (Lutkepohl, 2004):

$$\mathrm{A}y_t = a + \Pi_1 y_{t-1} + ... + \Pi_p y_{t-p} + \mathrm{B}u_t \quad (1)$$

where $c = (c_1,...,c_6)'$ is (6 x 1) intercept vector , the Π_i's are (6 x 6) coefficient matrices for *i*=1, 2, …p and $u_t = (u_{1t},...u_{6t})'$ is an unobservable error term. The u_t is an independent stochastic vector with $u_t \sim (0, \Sigma_u)$, $\Sigma_u = \mathrm{E}(u_t u_t')$. The invertible (6 x 6) matrix A allows modeling contemporaneous relations among the variables and the invertible (6 x 6) B allows some shocks to directly affect more than one variable in the model.

The reduced form of (1) is called a VAR model and has the following representation:

$$y_t = c + A_1 y_{t-1} + ... + A_p y_{t-p} + e_t \quad (2)$$

where $A_i = \mathrm{A}^{-1}\Pi_i$ for *i*=1, 2…, p, $c = \mathrm{A}^{-1}a$, $e_t = \mathrm{A}^{-1}\mathrm{B}u_t$ and thus, $\Sigma_u = A^{-1}B\Sigma_e \mathrm{B}'A^{-1}$

The VAR model can be viewed as a seemingly unrelated regressions model with the same regressors in each equation. Thus, each equation of the model may be estimated by ordinary least squares (OLS) and the OLS estimator is as efficient as a generalized least squares (GLS). This result is due to Zellner (1962). All variables are treated as endogenous and there is no restriction on structural relationships among them in unrestricted models.

6.2 Lag order selection

In the VAR estimation the lag order selection is an important issue. There are about a dozen criteria which can be used in determination of the autoregressive order, among the most

popular are Akaike Information Criteria (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn information criterion (HQ). AIC usually overestimates the true order and the other criteria estimate the order consistently under general conditions provided the autoregressive order is finite and the maximum lag order is larger than the true order. Sometimes the lag order is chosen based on some theoretical or institutional grounds. For example, the lag order can be of one year and hence, four lags can be included in case of quarterly data or twelve lags in case of monthly data (Lutkepohl, 2004).

In this paper a different approach to the lag order selection is employed because when the traditional criteria (AIC, SC, HQ) are used they often suggest different number of lags. Even when each suggestion is tried, the formal tests, such as the inverse roots test and the autocorrelation LM test, indicate the instability and/or the presence of the serial correlation in the errors. This means that VAR does not adequately represent the data generating process. Thus, the approach used here is to select the minimum number of lags provided the stability and no serial correlation conditions are satisfied.

6.3 Granger causality

After specifying models, the granger causality among the variables is tested using pairwise granger causality tests. The tests examine the joint significance of the lags of each endogenous variable in the equation of the other variable. The finding of the granger causality implies that the forecast of the current value of "the other variable" can be improved if the past values of the lags of the endogenous variable are included.

6.4 Impulse responses

If the VAR model is stable $\left(\det\left(I_6 - A_1 z - \ldots - A_p z^p\right) \neq 0, \textit{ for } \ |z| \leq 1\right)$, (2) can be rewritten as a moving average representation:

$$y_t = \left(I_6 - \sum_{i=1}^{p} A_i L^i \right)^{-1} c + \sum_{i=1}^{p} \sum_{j=0}^{\infty} A_i^j e_{t-j} = \bar{y} + \sum_{i=1}^{p} \sum_{j=0}^{\infty} A_i^j e_{t-j} \quad (3)$$

The coefficients in the powers of A_i are the multipliers of the system, L is the lag operator and $\bar{y}$ is the mean (equilibrium) of the system. When y_t is equal to its mean, an injection of one shock to the system would cause it to move from the equilibrium. The path along which the variables return to the equilibrium is called the impulse response of the VAR (Green, 2003).

The Cholesky decomposition of the covariance matrix Σ_e is used to orthogonalize innovations. The reason for orthogonalization is to isolate the underlying shocks in case if the components of u_t are instantaneously correlated. If C is a lower triangular matrix, such as $\Sigma_e = CC'$, the ortogonalized shocks are $u_t = C^{-1} e_t$. Thus, (3) can be expressed in the following way:

$$y_t = \bar{y}_t + \sum_{i=1}^{p} \sum_{j=0}^{\infty} A_i^j C C^{-1} e_{t-j} = \bar{y}_t + \sum_{i=1}^{p} \sum_{j=0}^{\infty} \Psi_i^j u_{t-j} \quad (4)$$

The logic behind Cholesky decomposition is that a shock in the first variable contemporaneously affects all other variables, while being not affected by the others. A shock in the second variable affects all variables, except the first one, while being affected by only the first one and so on. In this paper I use the following ordering: oil price shock, real GDP, real wage, inflation, real exchange rate, and interest rate. Hence the following error structure can be obtained:

$$\begin{pmatrix} c_{11} & 0 & 0 & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 & 0 & 0 \\ c_{41} & c_{42} & c_{43} & c_{44} & 0 & 0 \\ c_{51} & c_{52} & c_{53} & c_{54} & c_{55} & 0 \\ c_{61} & c_{62} & c_{63} & c_{64} & c_{65} & c_{66} \end{pmatrix} \begin{pmatrix} e^{oil\_price\_shock} \\ e^{GDP} \\ e^{Wage} \\ e^{Inflation} \\ e^{Real\_exchange\_rate} \\ e^{Interest\_rate} \end{pmatrix} = \begin{pmatrix} u^{oil\_price\_shock} \\ u^{GDP} \\ u^{Wage} \\ u^{Inflation} \\ u^{Real\_exchange\_rate} \\ u^{Interest\_rate} \end{pmatrix}$$

where c_i's are the Cholesky restrictions.

The applied ordering implies that oil shocks are contemporaneously exogenous. Even though two countries under study are net oil exporters, small country assumption is plausible because oil prices are determined on the world market which is influenced by numerous factors such as quotas imposed by OPEC, energy intensity and growth rates of economies, levels of strategic reserves of International Energy Agency countries, expectations of oil producers regarding future oil demands, and speculative oil trading operations. Thus, the exogeneity assumption of oil prices seems to be valid not only for oil importers, but also for oil exporters (Farzanegan and Markwardt, 2009).

The placement of aggregate output after oil price shocks means that it is only contemporaneously affected by their shocks. In the order wages follow GDP assuming that it is affected contemporaneously by oil price and GDP growth shocks. Such an arrangement supports a conventional view that wage growth is determined by productivity growth. It is also assumed that inflation responds immediately to oil price, GDP growth and wage growth shocks. According to Jimenez-Rodriguez (2007), the positioning of real sector variables right before monetary variables is in line with the idea that the response of aggregate output to monetary shocks is slow.

The monetary policy variable was placed at end of the order assuming that the monetary authority sets interest rate after observing changes in oil prices, GDP growth, wage growth, inflation and exchange rate. In contrast, some authors, for example Jimenez-Rodriguez and Sanchez (2005) and Bjornaland (2008), put interest rate before exchange rate. However, it is disputable to argue that a policy maker disregards an exchange rate when the decision on an interest rate is made. Moreover, Bjornland and Leitemo (2008) find that the restriction of interest rate from contemporaneous impact of exchange rate biases the effect of an interest rate shock.

Runkle (1987) likens reporting impulse responses without standard error bands to reporting regression coefficients with t statistics. In this paper, for all impulse responses, the standard error bands are reported at the ninety five percent significance level and they are computed by Monte Carlo simulations with 1000 replications.

6.5 Variance decomposition

The variance decomposition shows a share of changes in a variable that are due to its own shocks contrary to shocks of other variables at each forecast horizon. If one variable has no share in variance of other variable in all periods, it can be said that the latter variable is completely exogenous, which means that movements in values are independent from movements of others. In the opposite case, when every variable under study has some proportion in variance of other, it can be said that the later variable is completely endogenous. However, in practice, a variable itself explains most of its variance at early periods and less at late periods (Enders, 1995).

The computation of variance decomposition also requires identification. The identification is achieved by imposing the same structure as in the case of impulse responses. Here, the standard errors are also computed via Monte Carlo simulations with 1000 repetitions.

6.6 Robustness check

However, it has been found if lower triangular Cholesky decomposition is employed, impulse responses and variance decompositions are sensitive to variable orders. Thus, different variable orders may produce different impulse responses and variance decompositions (Lutkepohl, 2004). To check the robustness of the results, impulse responses and variance decompositions are computed using an alternative ordering: oil price shock, GDP growth, wage growth, inflation, interest rate, real exchange rate. Thus, in the new ordering real exchange rate is put before interest rate and the order of other variables remained unchanged. The placement of exchange rate at the end of the order is due to the debate on whether real exchange rate is to be placed after or before interest rate. For example, Jimenez-Rodriguez (2007) suggests that real exchange rate as an asset price should be contemporaneously affected by all macroeconomic variables.

7. Empirical results and analysis

In this chapter, effects of oil price shocks on three transitions economies are analyzed by three analytical tools: granger causality test, impulse response functions and variance decomposition. In addition, the results of the thesis are compared with the results of other papers. The presented results are statistically significant at the five percent level. The tests are applied to the VAR model of each specification of oil price shocks for each country.

Although the results obtained for each specification of oil price shocks are discussed, the comparison of the results and policy implications are done based on the results of the "best" models for each country. The "best" models are selected based on SC criteria (see Appendix II). Thus, during periods of oil price increases, for Kazakhstan and Ukraine, the "best" models are those where NOPI specification of oil price shocks is used and during periods of oil price decreases the "best" models are those where NOPD specification of oil price shocks is used. For Russia, during oil price increases, the "best" model is the one which employs positive oil price shocks and during the periods of oil price decreases the "best" model is the one which uses NOPD specification of oil price shocks.

7.1 Lag order selection

Based on the principle suggested in 6.2 the following lag orders for each model are selected:

- For Kazakhstan, in all models, except one which uses SOPI specification of oil price shocks, one lag is included. In a model using SOPI specification of oil price shocks, three lags are included

- For Russia, in all models, except those which employ NOPI and SOPI specifications of oil price shocks, five lags are included. In models employing NOPI and SOPI specifications of oil price shocks, three lags are included.
- For Ukraine, in all models, except those which use symmetric and NOPI specification of oil price shocks, four lags are included. In models using symmetric and NOPI specifications of oil price shocks, three lags are used.

7.2 Granger causality test

The results for granger causality test for the macroeconomic variables for Kazakhstan, Russia and Ukraine are presented in Appendix III.

In the case of Kazakhstan the test results show that almost all specifications of oil price shocks do not granger cause macroeconomic variables. The exception is NOPI specification of oil price shocks for which the test shows that it granger causes inflation.

For Russia, the granger causality test shows that there exists a unidirectional causality between changes in oil prices and GDP growth rates for the cases of symmetric and negative oil price shocks, and SOPD. Another finding is that negative oil price shocks granger cause significantly interest rate. In addition, NOPD specification of oil price shocks can significantly help predicting real exchange rate. The findings may indicate that the Russian macroeconomic variables are more sensitive to negative oil price shocks than to positive ones.

In the Ukrainian case, the interesting finding is that GDP growth is significantly influenced by all three positive specifications of oil price shocks. The Ukrainian result contrasts dramatically to the Russian one. Real wages are found to be granger caused by symmetric oil price shocks, positive oil price shocks and NOPI which in principle means that positive changes in oil prices help predicting fluctuations in real wage growth. Another finding is that past

movements of symmetric and positive oil price shocks, NOPI and NOPD help to forecast inflation, when in the Russian case no specification of oil price shocks appears to predict inflation, and in the Kazakh case only NOPI does. This finding probably implies that monetary stability in oil importing transition economies is more sensitive to past oil price movements in ether direction. Regarding real exchange rate it can be noted that it is affected only by NOPD specification of oil price shocks.

Based on the results of the test for the "best" models, I can affirm that in the Kazakh economy the past movements of positive oil price changes help to predict current movements in inflation. In the Ukrainian case, present values of GDP growth and real wage growth can be more accurately predicted if past values of positive oil price changes are used. For a forecast of real exchange rate only past negative oil price changes have weight and for inflation forecast both positive and negative oil price changes matter. In the Russian case, negative oil price changes granger cause real exchange rate.

7.3 Impulse response analysis

The ortogonalized impulse responses of macroeconomic variables of three transition countries to one-standard-deviation oil price shocks with ninety five percent confidence intervals are presented in Appendix IV.

7.3.1 Kazakhstan

In the case of Kazakhstan, only significant responses of inflation to symmetric and positive oil price shocks, NOPI and SOPI specifications of oil price shocks are observed. For other variables the null hypothesis of no effect of oil price changes on macroeconomic variables

cannot be rejected at the five percent level. The response of inflation to oil price shocks is significant only during the first quarter for symmetric oil price shocks, positive oil price shocks and NOPI specification, and the first two quarters for SOPI specification. In all cases inflation responds to shocks by upward jump. In the first quarter the raise of inflation above a preshock period is 0.66 percent in symmetric oil price shock specification, 0.91 percent in a positive oil shocks specification, 0.90 percent and 0.95 in NOPI and SOPI specifications correspondingly. However, the effect dies out completely within a year.

The positive response of inflation to oil price increases in an oil exporting country can be interpreted via the AD-AS model. An oil price increase leads to a rapid increase of government spending and income distribution because the oil industry of Kazakhstan is mostly owned by the state. Additionally, being a main export commodity, an increase of oil prices leads to an increase of net exports. The combination of these factors leads to the shift of AD to the right. The rightward shift of the AD curve results in an inflation increase.

7.3.2 Russia

If in the Kazakh case the significant response was only found in periods of oil price increases, in the case of Russia several macroeconomic variables react significantly to oil price decreases and increases at some periods. Nevertheless, the most significant responses are observed in the case of negative oil price changes. Thus, in all three specifications of oil price declines, GDP responds significantly in the first quarter by a jump of the range between 0.023 percent and 0.031 percent. The increase lasts until the second quarter after which a decline is observed. The drop hits its minimum in the forth quarter and it is only significant in the NOPD case in which the value of the fall is 0.045 percent. The observed rise in GDP growth in the first quarter after negative oil price changes and that the fall starts only after about two periods

suggest that oil price declines have a delayed impact on the Russian economy. During periods of oil price increases, the significant responses to oil price shocks are only produced by GDP growth in the case of positive oil price shock specification. It happens in the first quarter and the increase is 0.01 percent.

The immediate reaction of real wages to negative oil price changes is negative, however, marginal, and it is only significant in the NOPD specification. After one period of the statistically insignificant increase, real wage growth starts dropping, and the largest drop is observed in the forth quarter and it is significant only for a negative oil price shock specification. The magnitude of the significant decline is 0.031 percent. This result is consistent with what economic theory would suggest in the case of an oil producing economy.

The inflation responds by a rise to negative oil price shocks and NOPD specification of oil price shocks in the first quarter; however, initial responds are not significant in all cases. Later, it starts declining and a maximum decline is observed in the fourth quarter when it is statistically significant at the five percent in negative oil price shock and NOPD cases and the drops are 2.98 percent and 3.2 percent correspondingly. An inflation decline can be explained in the framework of the AD-AS model. A fall of oil prices results in a decrease of government revenues causing cuts in government spending. Additionally, a drop of oil prices means a decline of the Russian net exports. Together these factors shift the AD curve to the left. The movement of the AD curve in this direction leads to an inflation decline.

The response of a real exchange rate to oil price decreases is negative at the first horizon, even though it is not significant. Following the drop, it starts rising and reaches a peak in the fourth quarter. The peak values are significant in negative oil price shock case, in which the value is 0.036 percent and NOPD case in which the value is 0.045 percent. The switch from

the decline of real exchange rate to its growth is not in line with what economic theory would suggest because oil is a main export commodity and its decline has to lead to the domestic currency depreciation. The rise of real exchange rate can be explained by the fact that decline of inflation of the Russian trading partners goes faster than in the Russian economy itself. One of the reasons of the disproportion may be trading barriers set by the Russian government.

Interest rate reacts significantly to negative oil price shocks and NOPD specification of oil price shocks in the third period when it attaints its largest drop. In the first case the drop is 6.42 percent, and in the second 6.56 percent. The result is in line with the theory because when an oil price falls, inflationary pressures on an economy also fall and thus, there is no need of a tight monetary policy.

7.3.3 Ukraine

The responses of macroeconomic variables of Ukraine to oil price shocks show an interesting regularity: real sector variables significantly react to negative oil price changes and monetary variables significantly react to positive oil price changes. The outcome is possibly related to the type of the Ukrainian economy, which is oil importing.

GDP responds significantly only to positive oil price shocks in the second and third quarters. Immediately after experiencing a shock, it starts growing and the reaction attains a maximum value of 0.21 percent in the third period. There are two factors for the positive reaction of the Ukrainian GDP to oil price increases. First, the Ukrainian economy is highly dependent on the Russian one which is an oil exporter. An increase of oil prices causes an increase of the demand of the oil industry on steel which is one of the most important export commodities of Ukraine. Thus, oil price surge drags the steel industry which in its turn drags the coal industry and growth in both sectors has an overall positive impact on the economy. Second, Ukraine has

considerable refinery capacities. Hence, increase of oil prices leads to increase of petroleum product prices. This also affects positively the Ukrainian GDP.

The response of real wages to oil price increases is significant in positive oil price shock and NOPI cases. In the first case the reaction is significant at the second quarter and in the second case – in the third and forth quarters. The maximum positive responses in both cases are produced in the fourth period and their values are about 0.02 percent. Oil price increases are favorable for real wages because an increased demand for steel and coal raises the wages of people employed in the coal and steel industries which are the mainstay of the Ukrainian economy.

The other real sector variable, inflation, reacts significantly only to NOPI specification of oil price shocks during the third and fourth quarters. The response is positive and reaches the largest value in the forth quarter which is equal to 1.17 percent. Inflation surge can be explained via the AD-AS model. An increase of oil prices leads to an increase of production costs of the Ukrainian firms which results in the shift of the AS curve to left. The outcome of the shift is an increase in inflation.

Real exchange rate significantly reacts only in the NOPD case and the reaction is positive and significant only in the first and fourth periods. The reaction reached a maximum value of 0.02 percent in the fourth quarter. A decrease of oil prices causes a decrease of a total value of imports of an oil importer and this leads to domestic currency appreciation.

The other monetary variable, interest rate, negatively responds to oil price decreases and these responses are significant in all three negative oil price change specifications. Thus, in the negative oil price shock case, the response is significant during the first two periods; in the NOPD case the reaction is significant in the first three periods and in the SOPD case – only in

the first period. The largest magnitude of the significant responses varies between 2.44 and 3.61 percent. A decrease of oil prices leads to a decrease of production costs. This causes a decline of the price level which eventually removes a need for a tightening policy.

Relying on the results of the "best" models, I can assert that only positive shocks matter for Kazakhstan and they are transmitted to the economy via inflation. The effect of one-standard-deviation NOPI shock on inflation lasts one quarter and inflation responds by a 0.90 percent increase. Some macroeconomic variables of Russia respond to oil price changes with some delay. To one-standard-deviation NOPD shock GDP growth responds by a 0.045 percent drop in the fourth quarter, wage growth reacts by a 0.007 percent decline in the first quarter, inflation responds by a decrease of 3.2 percent in the fourth quarter, real exchange rate responds by an increase of 0.045 percent in the fourth quarter, and finally, interest rate reacts by a drop of 6.56 percent in the third quarter. Only GDP growth of Russia reacts to positive oil price shocks and the reaction is a 0.01 percent increase in the first quarter. In the Ukrainian case there are also delayed responses to oil price fluctuations. Thus, one-standard-deviation NOPI shock leads to a real wage growth increase by 0.02 percent and inflation raise by 1.17 percent in the fourth quarter. On the other hand, a one-standard deviation NOPD shock causes real exchange rate growth by 0.02 percent in the fourth quarter and an interest rate decline by 3.51 in the third quarter.

7.4 Variance decomposition analysis

Tables presented in Appendix V display variance decompositions of estimated VARs with standard errors in parentheses.

7.4.1 Kazakhstan

In the Kazakh case, only contributions of symmetric oil price shocks and the other three specifications of oil price increases to inflation variation are statistically significant during all ten quarters. The average share varies between nineteen and forty percent. The contribution of all specifications of oil price shocks to the rest of variables is insignificant at the five percent level. This confirms high inflationary pressures of the increased spending caused by windfalls of oil revenues.

7.4.2 Russia

In contrast to Kazakhstan, in Russia the statistically significant contribution of oil price shocks to the variation of all variables can be found. In the case of symmetric oil price shocks, positive oil price shocks, and SOPD, oil's share is significant in the first quarter and the share varies between twenty two and forty two percent. In NOPI and SOPI cases, oil's share is insignificant during all ten periods. During oil price falls, the proportion of oil price shocks in the GDP variance is significant in the negative oil price shocks case during the first quarter and between the fourth and eighth quarter; the average share is 31.21 percent. In the NOPD case, an oil share is significant starting from the fourth period to tenth period with an average share of 25.33 percent. Oil price shocks' share in a real wage variation is significant only in the negative oil price shocks case and it is around twenty eight percent.

The role of oil price shocks in inflation's variation is significant only in two specifications of oil price declines: negative oil price shocks and NOPD. Thus, in negative oil price shock case, an oil share is significant only in the fourth quarter and it is roughly thirty percent. In the NOPD case, oil's share is significant only between the fourth and tenth quarters

with an average share of about twenty five percent. The outcome confirms the significant role of oil price fluctuations in inflation.

The part of a real exchange rate variance which is due to oil price changes is significant only in the negative oil price shock and NOPD specifications. An oil proportion, in the case of negative oil price shocks, is significant from the third quarter to the last quarter; an average share is 30.77 percent. In the NOPD case, an oil contribution becomes significant from the fourth quarter and remains significant during the rest of the quarters; an average share is 35.12 percent.

The contribution of oil to interest rate's variation is significant between the third and fifth quarters in the negative oil price shock case and between the third and the tenth quarters in the NOPD case. In the former case, the average share is 33.60 percent and in the latter case – 28.08 percent. This result and a high oil share in exchange rate variation show the importance of oil price fluctuations for the Russian financial market.

7.4.3 Ukraine

An oil share in the variation of GDP is significant only in the positive oil price shock case between the third and sixth quarters and in the NOPI case between the fourth and tenth quarters. In both cases, an average share is around twenty six percent.

The variance decomposition of real wage shows that an oil share is significantly different from zero only in the symmetric oil price shock, positive oil price shock, and NOPI cases. In the first two cases, the share is significant between the fourth and tenth quarters and in the last case – between the third and last quarters. An average proportion of oil price shocks in a real wage variation varies between twenty one and thirty one percent.

The proportion of oil price shocks in an inflation variance is significant only in positive oil price shock case between the fourth and sixth quarters and NOPI case between the fourth and

tenth periods. An average share in the former case is 26.46 percent and in the latter – 32.83 percent.

The oil price shocks' contribution to a real exchange rate variation is significant at some periods in all specifications of oil price shocks except SOPI. In the symmetric and positive oil price shock specifications, an oil share is significant between the fifth and tenth quarters; the average shares are 25.79 percent and 29.13 percent. In the NOPI case, an oil contribution is statistically different from zero from the seventh to tenth periods and the average is 24.15 percent. In the case of negative oil price shocks, NOPD, and SOPD, an oil proportion is significant between the fourth and tenth quarters with the average ranging between twenty three and twenty nine percent.

The contribution of oil price shocks to the variability of interest rate is significant in the case of positive and negative oil price shocks, and NOPD. In the case of positive oil price shocks, an oil proportion is significant between the fourth and tenth period; in the negative oil price shock case – between the second and the sixth quarters; in the NOPD case, an oil share is statistically different from zero between the third and ninth periods The average oil share in all cases varies between twenty six and twenty nine percent.

Considering the results for the "best" models, I can claim that the contribution of oil price increases play an important role in the variation of inflation in Kazakhstan where its average share is 29.45 percent. In the case of Russia, only oil price decreases contribute variations of macroeconomic variables. Around forty one percent of the variation of GDP growth in the first quarter belongs to oil price shocks. In all cases afterwards, the oil contribution to variations of macroeconomic variables is significant mostly from the third or fourth quarters. In the variability of inflation oil price shocks contribute on average about twenty five percent. Oil' share in the

real exchange rate growth variation is 35.12 percent. For interest rate oil price shocks' contribution is 28.08 percent on average. In the case of Ukraine, the contributor to variations of the real sector variables is oil price increases. Oil contributions to GDP growth and inflation variations are 26.65 percent and 32.83 percent respectively. In the variability of real wage growth, an oil' proportion is 30.55 percent. A contribution of oil price increases in the variability of real exchange rate is 24.15 percent. On the other hand, a contribution of oil price decreases is 28.52 percent. In the case of interest rate, the average oil share is 26.14 percent.

7.5 Robustness check

For all three countries, impulse responses and variance decompositions computed via the alternative ordering are the similar to those computed via the base line ordering (see Appendix VI). Only slight changes in the standard errors are observed, however, it does alter the quantitative and qualitative inferences made from the impulse responses and variance decompositions computed by the initial order. This confirms the robustness of the results obtained in this paper.

7.6 Comparison with the results of other studies

This section compares the empirical results of this thesis with the results of two other papers. The Kazakh and Russian results are compared with the results of Jimenez-Rodriguez and Sanchez (2005) on the UK and Norway (both are oil exporters) and the Ukrainian results are compared with the results of Varabei (2007) on ten transition oil importing economies. Varabei (2007) finds that oil price increases granger causes GDP growth of Czech Republic, Estonia, Hungary, and Lithuania and oil price decreases only improve the prediction of GDP growth in Czech Republic and Hungary. In my study, I find that oil price increases granger cause GDP

growth of oil importing Ukraine. Thus, my result is in line with hers that in oil importing transition country at least oil price increases influence GDP growth. In addition, Jimenez-Rodriguez and Sanchez (2005) find that oil price changes do not granger cause GDP growth in the UK and only oil price decreases granger cause GDP growth in Norway. My findings that oil price shocks do not granger cause the Kazakh GDP growth and oil price decreases granger cause GDP growth of Russia are in line with theirs. Thus, for oil exporting countries GDP growth is either not granger caused by oil price shocks or granger caused by oil price decreases. The authors of both papers do not report the results of the granger causality tests for the other variables. For this reason, I cannot make any comparisons for other macroeconomic indicators.

Varabei (2007) reports no numerical information regarding the magnitude of the impulse responses of variables to one-standard-deviation oil price shocks. However, she mentions that oil price decreases affect GDP growth of Hungary and oil price increases affect GDP growth of Czech Republic, Slovakia, Estonia and Lithuania. The effect is mostly negative in all cases. For the rest five of CEE countries, no significant impact is found. It is also mentioned that peak responses are attained during the second and fourth quarters. In this thesis, according to the "best" model, oil price changes do not affect the Ukrainian GDP growth. Thus, in general, the Ukrainian outcome is not an exception. The peak periods of her paper coincides with mine. Jimenez-Rodriguez and Sanchez (2005) obtain the result that only positive oil price changes affect GDP growth of oil producing countries. The impulse responses of the UK and Norway show that to one-standard-deviation shock GDP growth responds by increase of 0.15 percent and 0.23 percent in the second quarter. However, the UK's response become negative later; the drop is almost of the same magnitude. Among oil producers considered here only the Russian GDP

growth responds significantly to oil price shocks and only to negative oil price changes by a drop of 0.045 percent in the fourth quarter. For the other variables, they do report the results.

For ten CEE transition economies, Varabei (2007) finds that depending on a country, oil price shocks contribute between three percent and forty percent to GDP growth variation, about twenty percent to inflation variation and finally between six and forty percent to real exchange rate's variability. The magnitude of the oil share in variation of Ukrainian GDP growth and real exchange rate lies in the range obtained by Varabei (2007); however, oil contribution to inflation and interest rate, in the case of Ukraine, exceeds the top of the range on average by six percent for the former and thirteen percent for the latter. In the case of Norway and the UK, Jimenez-Rodriguez and Sanchez (2005) report that oil share in GDP growth variation is 4.11 percent and 8.82 percent, inflation is 2.05 percent and 8.72 percent, interest rate is 10.50 percent and 5.41 percent, and, finally, real exchange rate is 3.08 percent and 5.23 percent. Oil price change proportion in variations of variables of transition oil exporters is much larger than that of developed oil exporters. The reason of such a big difference in the results lies in the transitional nature of the Russian and Kazakh economies. It also can be noted an oil share is large in the variation of macroeconomic variables of all transition economies regardless of being an oil exporter and importer. The underlying reason for this can be the lack of the effective toolkit at monetary authorities' disposal in the majority of transition countries.

8. Conclusions and policy implications

The thesis concludes that oil price shocks really matter for transition countries. That is why policy makers of transition countries should always take into consideration oil price fluctuations when they make monetary and fiscal policies.

The Kazakh result that oil price increases granger causes inflation, have a positive effect on it and play a significant role in its variation is due to huge government expenditures during the oil boom. Such a surge of governmental expenditure is explained by state ownership of the entire oil industry of the country. It is worth mentioning that Kazakhstan National Fund was established in 2000 to manage the national wealth. However, due to the lack of transparency and probable influence of the government it does not fulfill its duties properly. Thus, an uncontrolled increase of governmental spending without adequate growth of the real sector causes the increase of inflation in the country. The fact that no effect of oil price changes on exchange rate was found is probably due to a fixed exchange rate regime employed by the National Bank of Kazakhstan although the bank officially switched to the floating one, in practice it does not correspond to the reality. The next interesting finding is that oil price changes do not affect interest rate and this can be explained by immaturity of the financial market of Kazakhstan.

The overall performance of the Kazakh monetary and fiscal authorities can be graded as poor. The policy implication for the Kazakh government is that it should restrict its spending to curb inflation. The government should also develop the financial market because it will increase the effectiveness of the monetary tools and will enable them to tackle inflation more effectively.

For Russia, oil price increases positively affect only GDP. The effect on other variables is found to be insignificant. The reason that it does not impact significantly inflation is due to the Reserve Fund which accumulates excess tax revenues. The next factor is that the Russian oil

industry is not entirely state-owned, and thus the government cannot afford too excessive spending of oil revenues. In comparison with Kazakhstan, Russia has a more developed financial market, hence the response of monetary variables have to be observed. However, probably due to open market operations carried out by the Central Bank, there is no room for them to respond significantly.

The Russian economy is more responsive to oil price decreases during which GDP growth, wage growth, inflation and interest rate decline. Such consequences of oil price declines are in line with what economic theory suggests. However, the observed domestic currency appreciation is not in line with what economic theory suggest. The likely reason for that is the difference between declines in price levels of Russia and its trading partners. It appears that the speed of the price level decline in Russia is slower than the one of its trading partners and this causes rouble appreciation. The possible explanation is the trade barriers set up by the Russian government.

The overall performance of the Russian monetary and fiscal authorities is adequate. The only policy implication for the Russian government is to remove the trade barriers which would not cause such "peculiarity" as domestic currency appreciation of an oil exporter during oil price falls.

In the Ukrainian economy, oil price increases lead to an increase of real wage growth and inflation. The first outcome is due to the spillover effect from the boom of the Russian economy during oil price surges and the second outcome is what economy theory would suggest. Additionally, no significant impact of oil price increases on interest rate was found. However, it could be assumed that to curb inflation the monetary authority should raise interest rate. Actually, the monetary authority decides not to carry out tightening monetary policy. According

to Bernarke et al (1997), during oil price increases the monetary authority can implement two policies: constrained and unconstrained. In the first case, interest rate is held constant in which case positive oil price changes lead to a real GDP increase. In the second case, interest rate increases as a response to positive oil price changes and this causes the decline of GDP. Thus, it can be implied that the Ukrainian monetary authority chooses a constrained policy.

Real exchange rate growth does no respond significantly to oil price increases. This is due to open market operations carried out by the National Bank not to let the domestic currency depreciate much. Although no effect on real GDP growth is observed, the growth of other real sector variable – real wage growth is found. During periods of oil price declines, real exchange rate growth increases and interest rate declines. The responses are in line with economic theory. The monetary authority decreases interest rate not to allow the rapid appreciation of hryvnia. However, no changes in real GDP growth and real wage growth are observed.

The performance of the Ukrainian monetary authority can be graded as good. During periods of oil price increases and decreases, its reaction is optimal.

The results of the analysis of aggregate data show that Kazakhstan should develop financial markets and restrict its spending in order to curb inflation. Russia should lift trade barriers in order to prevent rouble appreciation during periods of oil price declines. For Ukraine, no recommendation is given due to optimality of its current monetary policy. Thus, the fulfillment of the recommendations by Kazakhstan and Russia would definitely decrease the vulnerability of their economies to oil price fluctuations and, eventually, this would secure the economic stability of their countries.

REFERENCES

Ahrend, R. 2006. "Russia's Economic Expansion 1999-2005" In *Return to growth in CIS countries : monetary policy and macroeconomic framework* , ed. Lucio Vinhas de Souza and Oleh Havrylyshyn. Berlin : Springer

Atmadja, A. S. 2005. "The Granger causality tests for the five ASEAN countries' stock markets and macroeconomic variables during and post the 1997 Asian financial crisis", *Jurnal Manajemen and Kewirausahaan*, Vol. 7

Bernarke, B.S., Gertler, M. and Watson M. 1997. "Systematic monetary policy and the effects of oil price shocks". *Brookings Papers on Economic Activity*, No. 1

Bjornland, H. C. 2008. "Oil Price Shocks and Stock Market Booms in an Oil Exporting Country", Norges Bank Working Paper No. 16

Bjørnland, H.C. and Leitemo K. Forthcoming. "Identifying the Interdependence between U.S. Monetary Policy and the Stock Market," *Journal of Monetary Economics*

Clements, M.P. and Hendry, D.F. 1995. "Forecasting in cointegrated systems", *Journal of Applied Econometrics*, Vol. 10

Cunado, J. and Garcia de, F.P., 2005. "Oil prices, economic activity and inflation: evidence for some Asian countries". *The Quarterly Review of Economics and Finance*, Vol. 45

Dickey, D.A. and Fuller, W.A.1979. "Distribution of the estimators for autoregressive time series with a unit root", *Journal of the American Statistical Association* , Vol. 74

EIU. 2008a. "The country profile of Kazakhstan"

EIU. 2008b. "The country profile of Russia"

EIU. 2008c. "The country profile of Ukraine"

Enders, W. 1995. *Applied econometric time series*. New York: Wiley

Engle, R.F. and Yoo, B.S. 1987. "Forecasting and testing in co-integrated systems", *Journal of Econometrics*, Vol. 35

Farzanegan, M. R. and Markwardt, Gunther. 2009. "The effects of oil price shocks on the Iranian economy". *Energy Economics*, Vol. 31

Green, W. H. 2003. *Econometric analysis.* Upper Saddle River, NJ : Prentice Hall

Hamilton, James D. 2003. "What is an oil shocks?" *Journal of Econometrics*, Vol. 113

Hamilton, James D. 1983. "Oil and the Macroeconomy since World War II", *Journal of Political Economy*, Vol. 91

Hoffman, D.L. and Rasche, R.H. 1996. "Assessing forecast performance in a cointegrated System". *Journal of Applied Econometrics*, Vol. 11

Jbir, R and Zouari-Ghorbel, S. 2009. "Recent oil price shock and Tunisian economy." *Energy Policy*, Vol. 37

Jimenez-Rodriguez, R. and Sanchez, R.H. 2005. "Oil price shocks and real GDP growth: empirical evidence for some OECD countries", *Applied Economics*, Vol. 37

Jimenez-Rodriguez, R. 2007. "The industrial impact of oil price shocks: Evidence from the industries of six OECD countries." Working paper of the Bank of Spain No. 0731

Johansen, S. 2002. "A small sample correction for the test of cointegrating rank in the vector autoregressive model." *Econometrica*, Vol. 70

Lee, K., Ni, S. and Ratti, R. 1995. "Oil Shocks and the Macroeconomy: the Role of Price Variability." *Energy Journal*, Vol. 16

Lorde, T., Jackman, M. and Thomas, C. 2009. "The macroeconomic effects of oil price fluctuations on a small open oil-producing country: The case of Trinidad and Tobago". *Energy Policy*, doi: 10, 1016/j.enpol.2009.03.2004

Lutkepohl, H**.** 2004**. "**Vector Autoregressive and Vector Error Correction Models" In *Applied time series econometrics* , ed. by Lutkepohl, H. and Kratzig, M**.** New York: Cambridge University Press

Mork, K. A., 1989. "Oil and the Macroeconomy when prices go up and down: an extension of Hamilton's results". *Journal of Political Economy*, Vol. 97

Naka, A. and Tufte, D. 1997. "Examining impulse response functions in cointegrated systems", *Applied Economics*, Vol. 29

Phillips, P.C.B. and Perron, P.1988. "Testing for a unit root in time series regression", *Biometrika*, Vol. 75

Rautava, J. 2004. "The role of oil prices and the real exchange rate in Russia's economy—a cointegration approach", *Journal of Comparative Economics*, Vol. 32

Starcheva, R. 2006. "The Effects of Exogenous Oil Supply Shocks on Transition Economies: Evidence from Central and Eastern Europe". MA thesis. CEU

Varabei, I. 2007. "Macroeconomic Effects Of the Recent Oil Price Shocks In CEE Net Oil Importing Countries". MA thesis. CEU

Vinhas de Souza, L. and Havrylyshyn, O. 2006. "Introduction: Growth Resumption in the CIS Countries." In *Return to growth in CIS countries : monetary policy and macroeconomic framework* , ed. Lucio Vinhas de Souza and Oleh Havrylyshyn. Berlin : Springer

Vinhas de Souza, L. et al. 2006. "Now So Near, and Yet Still So Far: Relations Between Ukraine and the European Union." In *Return to growth in CIS countries : monetary policy and macroeconomic framework* , ed. Lucio Vinhas de Souza and Oleh Havrylyshyn. Berlin : Springer

Yudaeva K. et al. 2004. "Down and up the stairs: paradoxes of Russian economic growth." In *The economic prospects of the CIS : sources of long term growth*, ed. Gur Ofer and Richard Pomfret. Northhampton, MA : Edward Elgar Pub

Zellner, A.1962. "An efficient method of estimating seemingly unrelated regressions and tests of aggregation bias", *Journal of the American Statistical Association*, Vol. 57

Appendix I – Results of unit root tests

Oil price shocks

Variable	ADF Test (p values in cells)								
	H0: a variable has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	Level	1st dif	2nd dif	level	1st dif	2nd dif
Oil price shock	0.0001	0.0000	0.0000	0.0003	0.0000	0.0000	0.0009	0.0000	0.0000
Oil price shock^{+}	0.0069	0.0000	0.0000	0.0010	0.0000	0.0000	0.0032	0.0000	0.0000
Oil price shock^{-}	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NOPI	0.0069	0.0000	0.0000	0.0042	0.0000	0.0000	0.0125	0.0000	0.0000
NOPD	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0009	0.0000	0.0000
SOPI	0.0124	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOPD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Variable	PP Test (p values in cells)								
	H0: a variables has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	Level	1st dif	2nd dif	level	1st dif	2nd dif
Oil price shock	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0007	0.0000	0.0000
Oil price shock^{+}	0.0077	0.0000	0.0000	0.0007	0.0000	0.0001	0.0023	0.0000	0.0001
Oil price shock^{-}	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001
NOPI	0.0065	0.0000	0.0000	0.0035	0.0000	0.0001	0.0105	0.0000	0.0001
NOPD	0.0000	0.0000	0.0000	0.0002	0.0000	0.0001	0.0008	0.0000	0.0001
SOPI	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0001	0.0001
SOPD	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0000

Macroeconomic variables of Kazakhstan

Variable	ADF Test (p values in cells)								
	H0: a variable has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	Level	1st dif	2nd dif	level	1st dif	2nd dif
Inflation	0.0040	0.0000	0.0000	0.0058	0.0002	0.0000	0.0530	0.0001	0.0000
Real GDP	1.0000	0.0105	0.0000	0.6546	0.0000	0.0000	0.0160	0.0000	0.0000
Interest rate	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0001	0.0001
Real wage	1.0000	0.0074	0.0000	0.0202	0.0007	0.0000	0.0071	0.0067	0.0000
Real effective exchange rate	0.7667	0.0000	0.0000	0.0524	0.0000	0.0000	0.1838	0.0003	0.0000

Variable	PP Test (p values in cells)								
	H0: a variables has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	Level	1st dif	2nd dif	level	1st dif	2nd dif
Inflation	0.0025	0.0000	0.0000	0.0044	0.0000	0.0001	0.0723	0.0000	0.0001
Real GDP	1.0000	0.0001	0.0000	0.6861	0.0000	0.0001	0.0131	0.0000	0.0001
Interest rate	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0001	0.0001
Real wage	1.0000	0.0068	0.0000	0.1823	0.0006	0.0000	0.0000	0.0090	0.0000
Real effective exchange rate	0.7769	0.0000	0.0000	0.2353	0.0001	0.0001	0.5192	0.0006	0.0001

Macroeconomic variables of Russia

Variable	ADF Test (p values in cells)								
	H0: a variable has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	Level	1st dif	2nd dif	level	1st dif	2nd dif
Inflation	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0029	0.0001	0.0000
Real GDP	0.9970	0.0012	0.0000	0.8351	0.0005	0.0000	0.7609	0.0063	0.0000
Interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0489	0.0000	0.0000
Real wage	0.9988	0.0010	0.0000	0.7710	0.0002	0.0000	0.8477	0.0024	0.0000
Real effective exchange rate	0.8634	0.0000	0.0000	0.2084	0.0005	0.0000	0.3199	0.0035	0.0000

Variable	PP Test (p values in cells)								
	H0: a variables has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	Level	1st dif	2nd dif	level	1st dif	2nd dif
Inflation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0001
Real GDP	1.0000	0.0012	0.0000	0.1253	0.0005	0.0000	0.4071	0.0050	0.0000
Interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001
Real wage	1.0000	0.0011	0.0000	0.0493	0.0002	0.0000	0.2558	0.0025	0.0000
Real effective exchange rate	0.9080	0.0000	0.0000	0.4377	0.0008	0.0000	0.6158	0.0050	0.0000

Macroeconomic variables of Ukraine

Variable	ADF Test (p values in cells)								
	H0: a variable has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	level	1st dif	2nd dif	level	1st dif	2nd dif
Inflation	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0002
Real GDP	1.0000	0.0030	0.0000	0.0230	0.0013	0.0002	0.0000	0.0191	0.0006
Interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0152
Real wage	1.0000	0.0005	0.0000	0.9998	0.0003	0.0000	0.0030	0.0083	0.0000
Real effective exchange rate	0.7659	0.0000	0.0000	0.2884	0.0001	0.0000	0.6330	0.0005	0.0000

Variable	PP Test (p values in cells)								
	H0: a variables has a unit root								
	None			Constant			Constant&Trend		
	level	1st dif	2nd dif	level	1st dif	2nd dif	level	1st dif	2nd dif
Inflation	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0001	0.0001
Real GDP	0.9994	0.0027	0.0000	0.1995	0.0002	0.0000	0.0001	0.0115	0.0000
Interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
Real wage	0.9997	0.0002	0.0000	0.2066	0.0004	0.0000	0.0000	0.0046	0.0000
Real effective exchange rate	0.7767	0.0000	0.0000	0.2707	0.0000	0.0000	0.5761	0.0003	0.0000

Appendix II – Relative performance of the models

Schwarz information criterion (SC)

Country	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
Kazakhstan	-2.053	-3.336	-3.051	**-3.484**	**-3.759**	-3.015	1.702
Russia	0.812	**-0.436**	-0.322	0.152	**-1.232**	4.540	4.902
Ukraine	1.244	0.091	0.686	**-0.424**	**-0.453**	5.139	5.906

Appendix III – VAR Granger Causality/Block Exogeneity Wald Tests

H0: an oil price shock does not granger cause a dependent variable

Kazakhstan

Dependent variable	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
	P value						
Real GDP Growth	0.4022	0.3222	0.7424	0.1636	0.7606	0.7703	0.6214
Real wage growth	0.7871	0.7552	0.4238	0.6938	0.0869	0.9546	0.7759
Inflation	0.4924	0.6223	0.0815	0.2871	0.0368	0.7696	0.1368
Real effective exchange rate growth	0.2930	0.7346	0.1592	0.9344	0.2589	0.9850	0.1411
Interest rate	0.3965	0.7953	0.2508	0.5087	0.0906	0.3751	0.2996

Russia

Dependent variable	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
	P value						
Real GDP Growth	0.0527	0.3542	0.0338	0.9929	0.1688	0.6115	0.0089
Real wage growth	0.4278	0.6323	0.1974	0.7796	0.6927	0.8203	0.3163
Inflation	0.9304	0.9827	0.9053	0.7556	0.1111	0.8645	0.6692
Real effective exchange rate growth	0.6412	0.6741	0.7783	0.7296	0.0480	0.1693	0.6592
Interest rate	0.4454	0.9866	0.0130	0.4781	0.0851	0.8868	0.4643

Ukraine

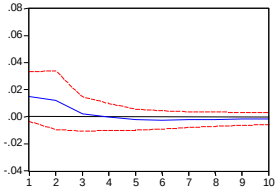
Dependent Variable	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
	P values						
Real GDP Growth	0.0874	0.0342	0.4746	0.0271	0.3466	0.0069	0.3824
Real wage growth	0.0052	0.0001	0.0580	0.0008	0.0713	0.1416	0.0744
Inflation	0.0077	0.0023	0.3002	0.0001	0.0337	0.2541	0.1499
Real effective exchange rate growth	0.0995	0.4228	0.4387	0.0798	0.0283	0.4365	0.7272
Interest rate	0.6509	0.6385	0.6226	0.5645	0.1315	0.9187	0.7877

Appendix IV – Impulse responses

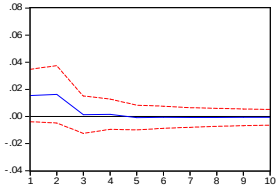
Kazakhstan

Response to Cholesky One S.D. Innovations ± 2 S.E.

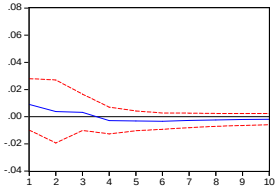
Response of Real GDP growth to Oil price shock



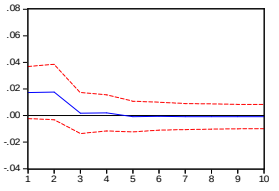
Response of Real GDP growth to Oil price shock+



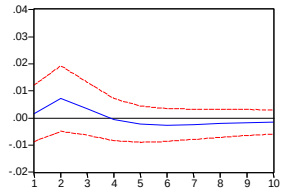
Response of Real GDP growth to Oil price shock -



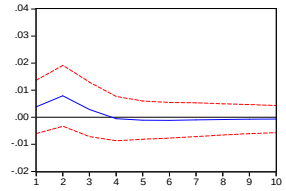
Response of Real GDP growth to NOPI



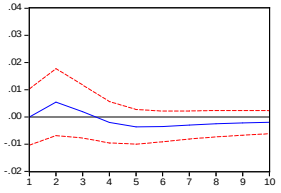
Response of Real wage growth to Oil price shock



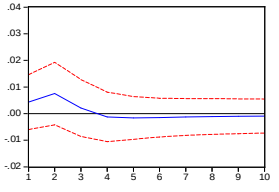
Response of Real wage growth to Oil price shock+



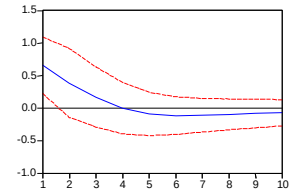
Response of Real wage growth to Oil price shock -



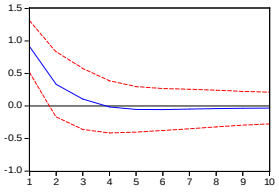
Response of Real wage growth to NOPI



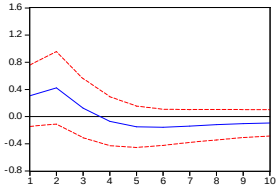
Response of Inflation to Oil price shock



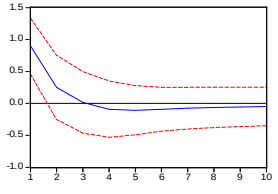
Response of Inflation to Oil price shock+



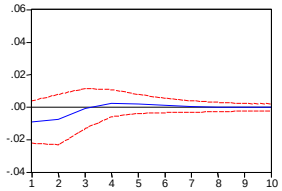
Response of Inflation to Oil price shock -



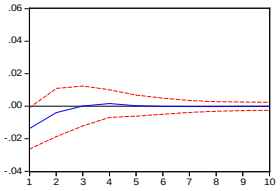
Response of Inflation to NOPI



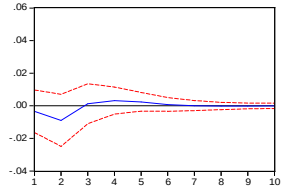
Response of Real effective exchange rate growth to Oil price shock



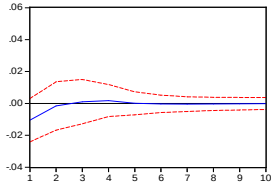
Response of Real effective exchange rate growth to Oil price shock+



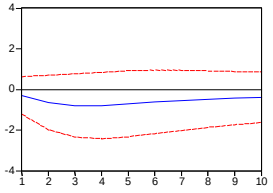
Response of Real effective exchange rate growth to Oil price shock -



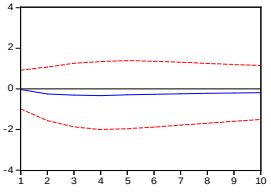
Response of Real effective exchange rate growth to NOPI



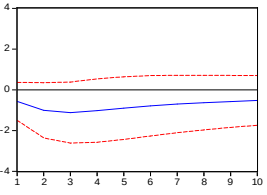
Response of Interest rate to Oil price shock



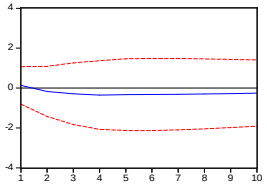
Response of Interest rate to Oil price shock+



Response of Interest rate to Oil price shock -

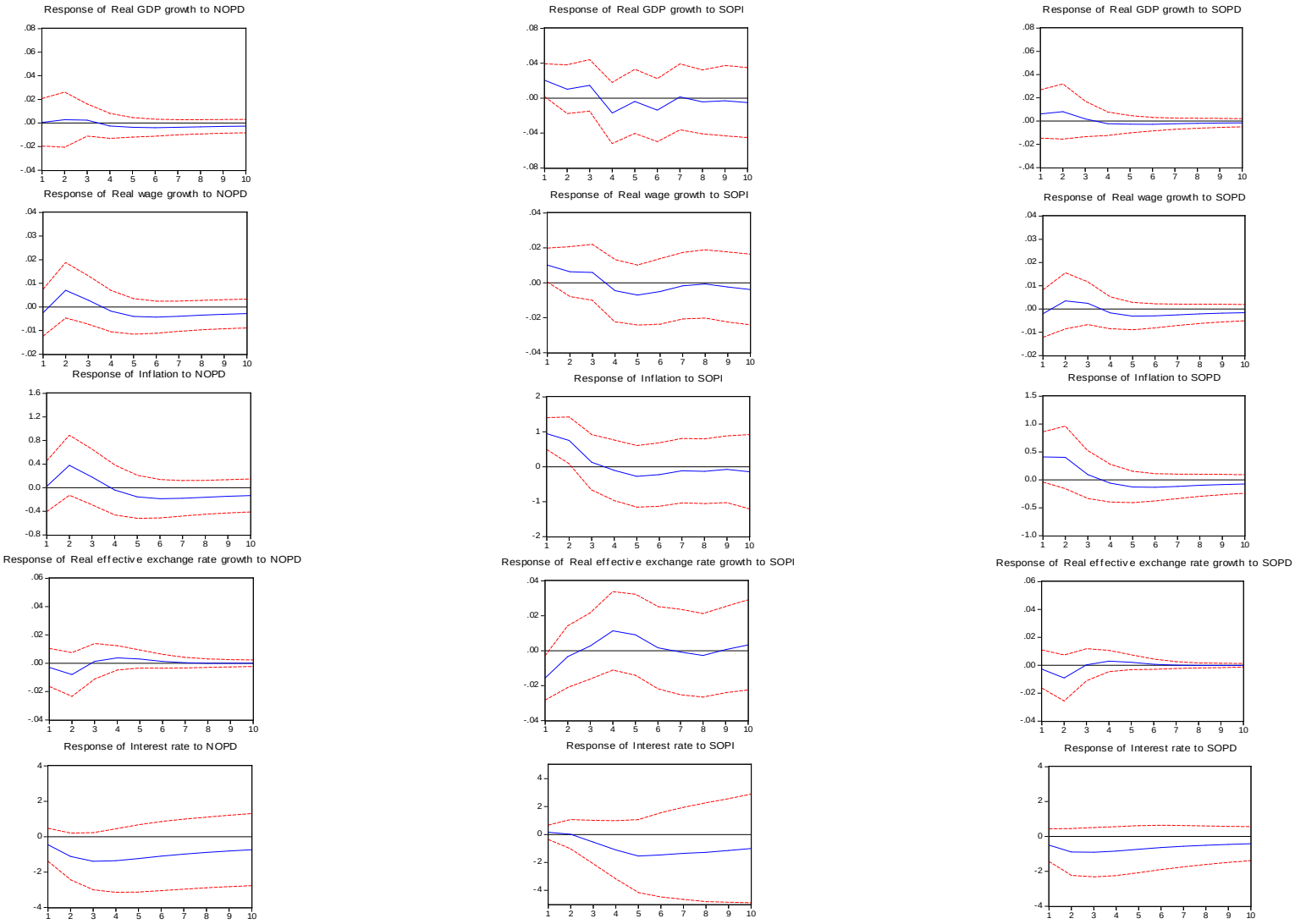


Response of Interest rate to NOPI



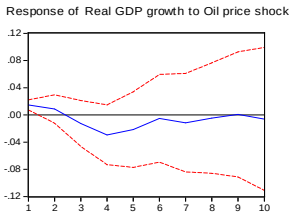
Kazakhstan (continued)

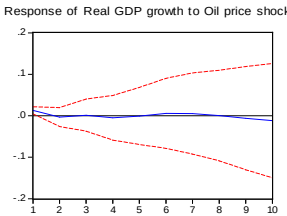
Response to Cholesky One S.D. Innovations ± 2 S.E.

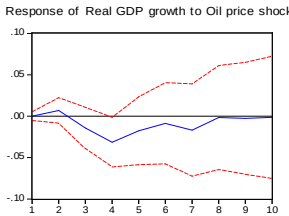


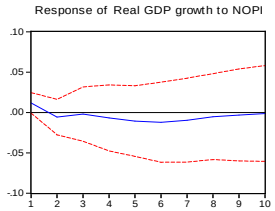
Russia

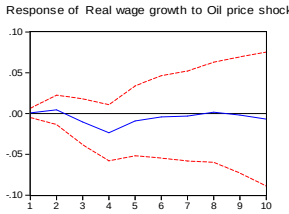
Response to Cholesky One S.D. Innovations ± 2 S.E.

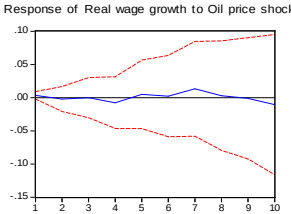


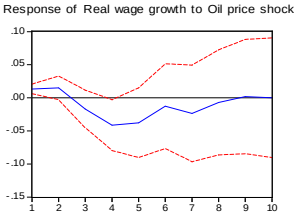


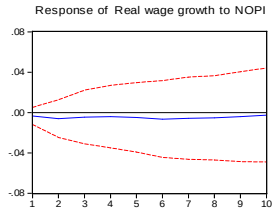


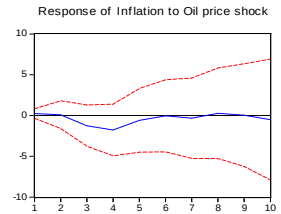


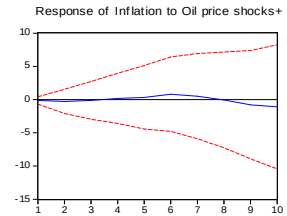


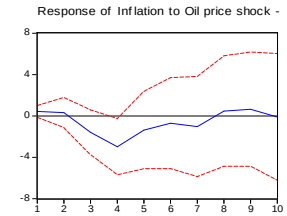


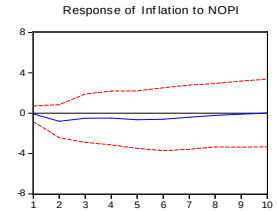


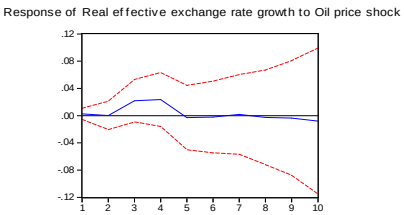


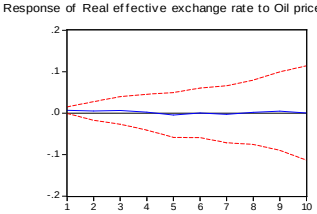


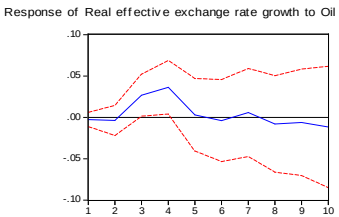


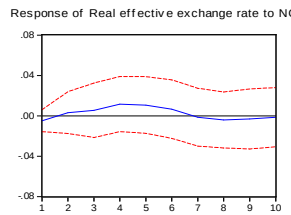


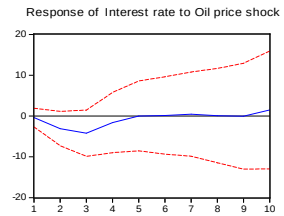


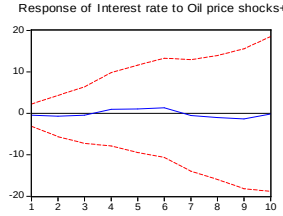


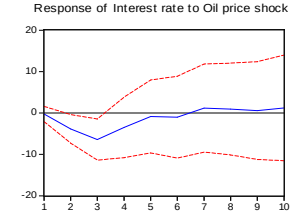


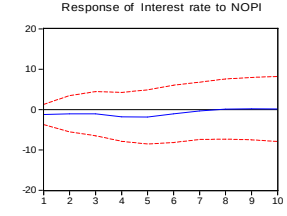






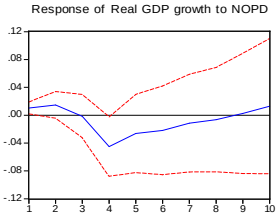


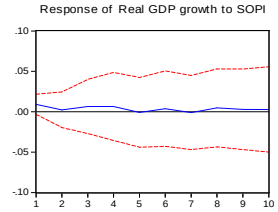


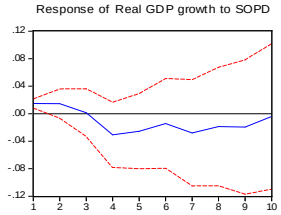


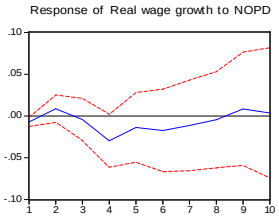
Russia (continued)

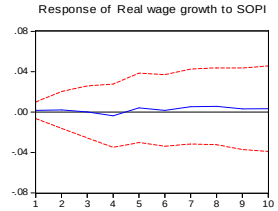
Response to Cholesky One S.D. Innovations ± 2 S.E.

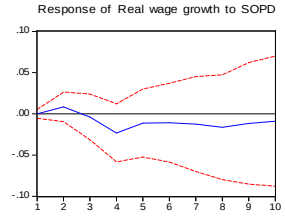


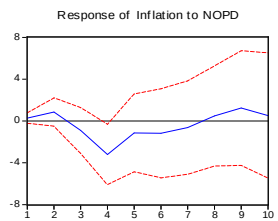


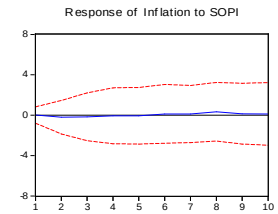


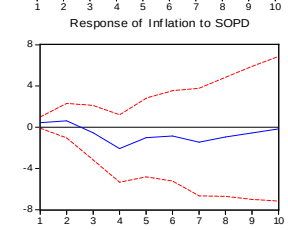


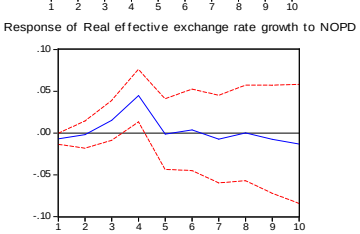


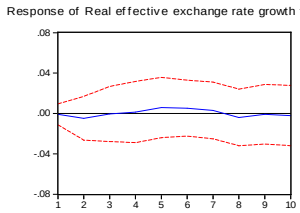


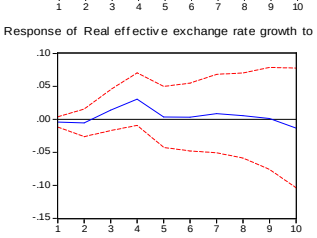


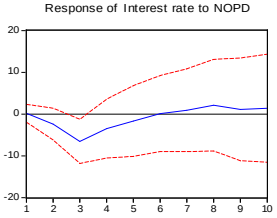


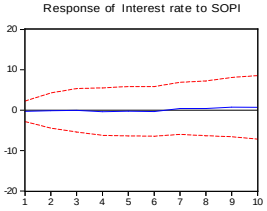


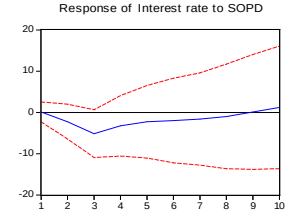








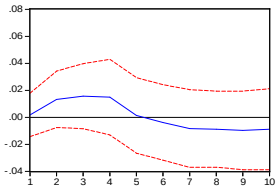




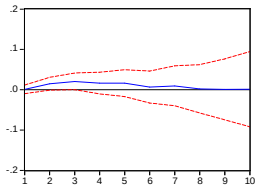
Ukraine

Response to Cholesky One S.D. Innovations ± 2 S.E.

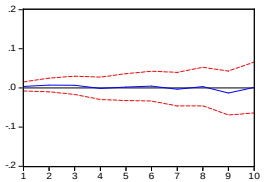
Response of Real GDP growth to Oil price shock



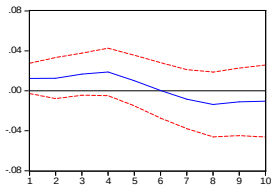
Response of Real GDP growth to Oil price shock+



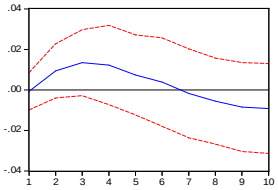
Response of Real GDP growth to Oil price shock -



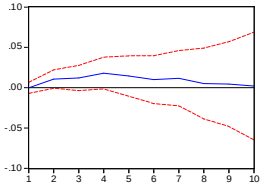
Response of Real GDP growth to NOPI



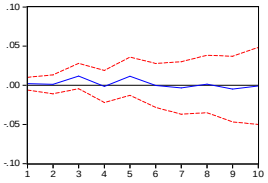
Response of Real wage growth to Oil price shock



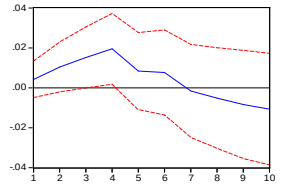
Response of Real wage growth to Oil price shock+



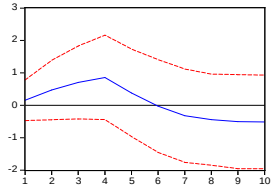
Response of Real wage growth to Oil price shock -



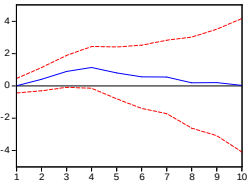
Response of Real wage growth to NOPI



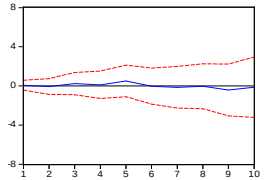
Response of Inflation to Oil price shock



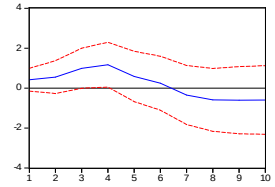
Response of Inflation to Oil price shock+



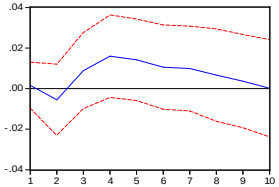
Response of Inflation to Oil price shock -



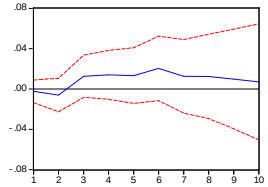
Response of inflation to NOPI



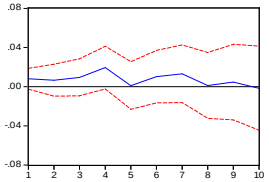
Response of Real effective exchange rate growth to Oil price shock



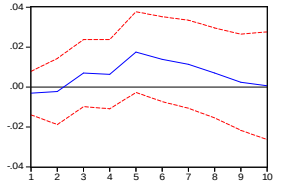
Response of Real effective exchnage rate growth to Oil price shock+



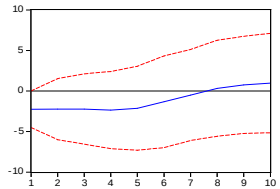
Response of Real effective exchange rate to Oil price shock -



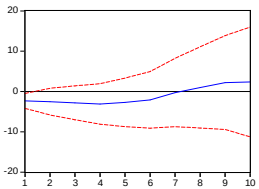
Response of Real effective exchange rate growth to NOPI



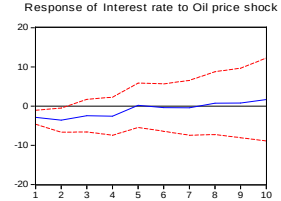
Response of Interest rate to Oil price shock



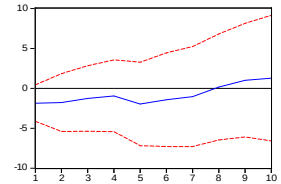
Response of Interest rate to Oil price shock+



Response of Interest rate to Oil price shock -



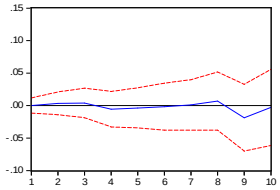
Response of Inflation to NOPI



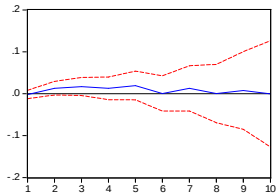
Ukraine (continued)

Response to Cholesky One S.D. Innovations ± 2 S.E.

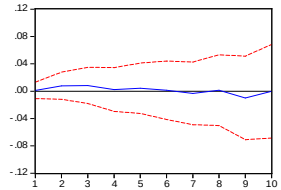
Response of Real GDP growth to NOPD



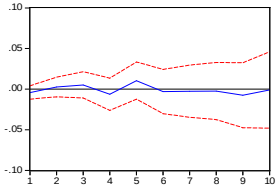
Response of Real GDP growth to SOPI



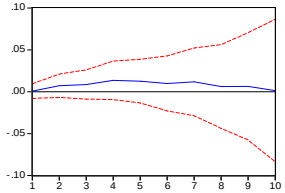
Response of Real GDP growth to SOPD



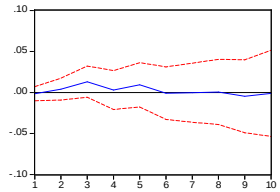
Response of Real wage growth to NOPD



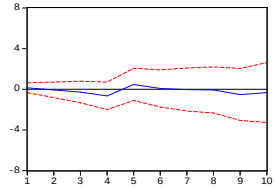
Response of Real wage growth to SOPI



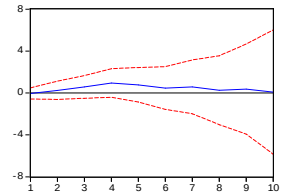
Response of Real wage growth to SOPD



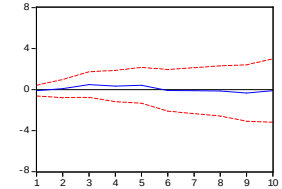
Response of Inflation to NOPD



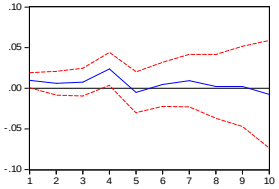
Response of Inflation to SOPI



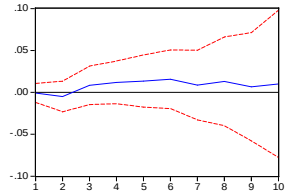
Response of Inflation to SOPD



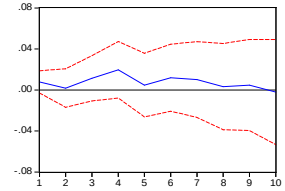
Response of Real effective exchange rate growth to NOPD



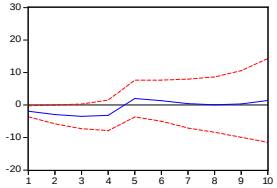
Response of Real effective exchnage rate growth to SOPI



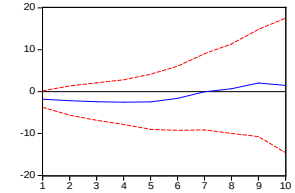
Response of Real effective exchange rate growth to SOPD



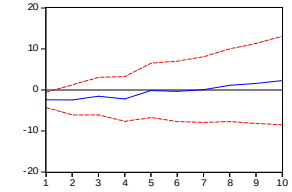
Response of Interest rate to NOPD



Response of Interest rate to SOPI



Response of Interest rate to SOPD



Appendix V – Variance decomposition

Kazakhstan

Variance Decomposition of Real GDP growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	5.765076	6.319288	2.104299	8.080664	0.006838	11.52033	0.981732
	(6.58686)	(6.62247)	(4.34028)	(6.80667)	(2.99680)	(9.09427)	(4.00566)
2	8.164288	11.20347	2.109422	13.67480	0.178366	11.27026	2.313272
	(6.87345)	(7.22891)	(4.68748)	(7.46791)	(3.91907)	(8.61942)	(5.41001)
3	7.891710	10.71080	2.240903	13.03895	0.298991	14.27830	2.290640
	(6.78289)	(7.00755)	(4.76975)	(7.34155)	(4.10157)	(9.37401)	(5.45257)
4	7.751143	10.55006	2.377766	12.85239	0.427831	17.55998	2.365500
	(6.79642)	(7.09000)	(4.79646)	(7.51287)	(4.22044)	(9.88880)	(5.40031)
5	7.753941	10.40073	2.542095	12.67594	0.702201	16.79948	2.483972
	(6.73305)	(7.02629)	(4.77678)	(7.50051)	(4.29297)	(9.82307)	(5.40543)
6	7.792516	10.29034	2.740074	12.54471	1.031497	18.74993	2.615117
	(6.70186)	(7.00408)	(4.79130)	(7.50517)	(4.37226)	(10.5805)	(5.41202)
7	7.833143	10.21317	2.869748	12.45557	1.297630	18.44243	2.700849
	(6.68267)	(6.98436)	(4.81482)	(7.48600)	(4.45395)	(10.5868)	(5.43608)
8	7.856814	10.15306	2.966160	12.38740	1.508785	18.53924	2.760430
	(6.67956)	(6.98465)	(4.86609)	(7.47377)	(4.55905)	(10.8877)	(5.45281)
9	7.870853	10.10683	3.037894	12.33709	1.675134	18.56620	2.803110
	(6.68275)	(6.99395)	(4.91720)	(7.46012)	(4.67938)	(11.0677)	(5.47313)
10	7.879466	10.07034	3.095865	12.29860	1.809564	18.70146	2.836886
	(6.69159)	(7.01271)	(4.97371)	(7.45234)	(4.81333)	(11.3974)	(5.49191)
Variance Decomposition of Real wage growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.271089	1.467095	8.31E-05	1.863496	0.647061	10.74833	0.401418
	(2.74640)	(4.21899)	(3.07847)	(4.30056)	(3.70253)	(8.43162)	(3.09404)
2	4.010435	5.732035	2.222491	5.603749	4.267542	11.60875	1.214929
	(5.94960)	(6.66009)	(5.13081)	(6.33507)	(6.09280)	(8.73828)	(4.83774)
3	4.432842	5.839798	2.300453	5.470567	4.463334	13.30035	1.518225
	(6.74675)	(7.01628)	(5.46792)	(6.55833)	(6.55417)	(9.66903)	(5.17387)
4	4.204305	5.528238	2.428400	5.270552	4.438195	13.33284	1.607759
	(6.58736)	(6.78994)	(5.37763)	(6.38000)	(6.32835)	(9.16097)	(5.05512)
5	4.344376	5.360105	3.144230	5.208162	5.258022	14.08109	2.114933
	(6.40516)	(6.60002)	(5.41762)	(6.34639)	(6.27149)	(9.25379)	(5.02137)
6	4.612403	5.259191	3.772969	5.180368	6.192317	14.34864	2.559536
	(6.37388)	(6.48103)	(5.55251)	(6.39206)	(6.39387)	(9.54583)	(5.12480)

7	4.821660	5.179290	4.192227	5.148308	6.924538	13.95687	2.850049
	(6.43448)	(6.43889)	(5.73722)	(6.49157)	(6.60422)	(9.52503)	(5.26368)
8	4.957830	5.117245	4.463651	5.124157	7.457322	13.54775	3.032643
	(6.52679)	(6.44866)	(5.93687)	(6.61990)	(6.86974)	(9.68613)	(5.39612)
9	5.045526	5.069002	4.658346	5.107777	7.857882	13.63045	3.158845
	(6.62347)	(6.49357)	(6.12564)	(6.77008)	(7.15722)	(9.94780)	(5.51229)
10	5.106777	5.031960	4.809965	5.098342	8.171042	14.06670	3.255194
	(6.71282)	(6.55878)	(6.28944)	(6.92608)	(7.44378)	(10.2460)	(5.61520)
Variance Decomposition of Inflation							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	20.82655	39.38668	4.696012	38.95885	0.030545	37.80968	8.284836
	(9.85609)	(11.0215)	(6.04528)	(10.4506)	(2.73176)	(11.2627)	(7.45357)
2	22.04698	35.34764	10.38948	33.25890	5.683627	44.97583	12.34435
	(10.1795)	(10.5908)	(8.91867)	(10.1991)	(7.16004)	(12.2312)	(9.31125)
3	21.09573	32.93326	10.01406	30.78727	6.274532	43.75444	11.57998
	(10.2962)	(10.4375)	(8.84420)	(9.85279)	(8.09750)	(11.8758)	(9.19953)
4	19.83142	31.11424	9.590987	29.36752	5.979818	39.12386	11.00543
	(9.99191)	(10.1290)	(8.47882)	(9.45719)	(7.92566)	(11.1869)	(8.80639)
5	19.11883	29.78845	9.820281	28.38345	6.455317	38.86474	10.96410
	(9.65944)	(9.85916)	(8.25915)	(9.18336)	(7.73006)	(11.0349)	(8.51974)
6	18.78872	28.82801	10.18123	27.64971	7.256161	38.80377	11.07425
	(9.42646)	(9.67171)	(8.14833)	(9.02558)	(7.69631)	(10.9823)	(8.37776)
7	18.59366	28.11337	10.44115	27.08645	7.972287	38.17514	11.14707
	(9.29135)	(9.55385)	(8.13218)	(8.94118)	(7.76330)	(10.9923)	(8.30404)
8	18.43769	27.56615	10.60251	26.64796	8.525719	37.90810	11.17049
	(9.22164)	(9.48491)	(8.16729)	(8.90773)	(7.89821)	(10.9807)	(8.25791)
9	18.30234	27.13902	10.70920	26.30290	8.948420	37.49557	11.17085
	(9.19078)	(9.45035)	(8.22238)	(8.90655)	(8.07508)	(11.1574)	(8.23035)
10	18.18734	26.80185	10.78845	26.02963	9.278703	37.35974	11.16528
	(9.18051)	(9.44041)	(8.27872)	(8.92753)	(8.27111)	(11.3573)	(8.21601)
Variance Decomposition of Real effective exchange growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	4.751432	10.30018	0.680416	6.100884	0.512706	15.11310	0.439939
	(6.01580)	(8.21014)	(3.44855)	(6.65401)	(3.65852)	(9.36741)	(3.48692)
2	6.386248	8.977787	4.117408	5.005476	3.190123	13.91638	4.037925
	(7.14584)	(7.50680)	(6.58667)	(5.83225)	(5.93729)	(9.02585)	(6.70782)
3	6.136158	8.612392	4.014746	4.847722	3.158443	12.64304	3.876812
	(7.34049)	(7.43796)	(6.52085)	(6.18976)	(5.89461)	(8.51429)	(6.57709)
4	6.291644	8.588812	4.383329	4.909920	3.721186	13.73366	4.190181

	(7.32247)	(7.41369)	(6.57853)	(6.44853)	(6.03893)	(9.12659)	(6.57172)
5	6.427075	8.563177	4.603463	4.896242	4.064477	14.85083	4.361096
	(7.36272)	(7.41286)	(6.64280)	(6.60271)	(6.20886)	(9.35032)	(6.64551)
6	6.468934	8.558613	4.626225	4.900299	4.132689	14.46409	4.381455
	(7.40759)	(7.41851)	(6.66809)	(6.69332)	(6.28710)	(9.40290)	(6.67726)
7	6.472628	8.560137	4.625920	4.909605	4.138052	13.98214	4.381093
	(7.44115)	(7.43584)	(6.68182)	(6.76221)	(6.34772)	(9.51620)	(6.68503)
8	6.472362	8.560982	4.626998	4.913536	4.138000	13.78927	4.381882
	(7.46496)	(7.45682)	(6.68787)	(6.81315)	(6.39732)	(9.73180)	(6.69183)
9	6.472499	8.561262	4.627698	4.914996	4.138181	13.70209	4.382570
	(7.48096)	(7.47819)	(6.69045)	(6.85210)	(6.43648)	(9.90909)	(6.69742)
10	6.472654	8.561278	4.627893	4.915414	4.138313	13.84810	4.382779
	(7.49235)	(7.50028)	(6.69448)	(6.88262)	(6.47564)	(10.0919)	(6.70018)
Variance Decomposition of Interest rate							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.931249	0.013945	3.638755	0.182225	2.394202	0.938448	2.788262
	(3.76515)	(2.68437)	(5.78820)	(3.15354)	(4.72280)	(4.23285)	(4.91291)
2	2.864378	0.360246	7.732057	0.268541	8.595940	0.275684	6.012453
	(5.55102)	(3.65522)	(8.41003)	(3.57951)	(8.39164)	(4.03595)	(7.36185)
3	4.617347	0.654694	10.58578	0.541835	13.78939	1.914809	7.677694
	(7.55839)	(4.93425)	(10.1988)	(4.97151)	(11.1523)	(5.58404)	(8.76011)
4	5.870555	0.910360	12.04156	0.871301	16.86888	5.998865	8.631520
	(9.05398)	(6.09776)	(11.1741)	(6.38351)	(12.7778)	(8.68085)	(9.57346)
5	6.567326	1.043145	12.79143	1.096569	18.65802	11.38132	9.101757
	(10.0353)	(6.97869)	(11.7760)	(7.56962)	(13.8192)	(11.6127)	(10.0464)
6	6.952414	1.133636	13.16362	1.285424	19.71293	14.60009	9.316830
	(10.6903)	(7.64695)	(12.1578)	(8.54841)	(14.5330)	(13.3295)	(10.3401)
7	7.173762	1.198126	13.38368	1.441381	20.39417	17.10428	9.431983
	(11.1394)	(8.15971)	(12.4223)	(9.33729)	(15.0597)	(14.3195)	(10.5385)
8	7.316043	1.248997	13.53354	1.574809	20.86805	19.04433	9.507039
	(11.4584)	(8.57165)	(12.6100)	(9.97393)	(15.4585)	(14.8452)	(10.6824)
9	7.416819	1.289342	13.64671	1.686186	21.21620	20.06660	9.564029
	(11.6905)	(8.90614)	(12.7492)	(10.4854)	(15.7681)	(15.1503)	(10.7937)
10	7.493086	1.321559	13.73461	1.778130	21.47944	20.47438	9.609325
	(11.8631)	(9.18255)	(12.8537)	(10.8978)	(16.0095)	(15.3157)	(10.8821)
Cholesky Ordering: Specification of oil price shock, Real GDP growth, Real wage growth, Inflation, Real effective exchange rate growth, Interest rate							
Standard Errors: Monte Carlo (1000 repetitions)							

Russia

Variance Decomposition of Real GDP growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	35.39965	22.27184	30.19062	8.758991	15.69778	5.616968	41.10937
	(11.5272)	(10.9736)	(11.5542)	(7.56979)	(9.73651)	(6.36770)	(10.9988)
2	9.505308	5.323142	17.69874	4.664347	13.23446	2.363215	13.55481
	(6.73643)	(5.42088)	(10.0645)	(4.99957)	(9.29629)	(4.65795)	(8.57595)
3	7.978338	2.374369	16.32298	2.170053	6.945265	1.546963	7.267342
	(7.28889)	(5.24757)	(8.51734)	(4.10501)	(6.79710)	(4.75172)	(6.81854)
4	15.09909	1.828995	31.71067	2.085555	28.13330	1.575936	15.97771
	(11.3602)	(6.80914)	(12.6916)	(5.22885)	(12.7908)	(5.83514)	(9.80005)
5	15.66695	1.538462	35.80817	2.702201	27.28327	1.399514	18.80860
	(12.3443)	(8.36374)	(14.0303)	(6.30946)	(12.3930)	(6.27419)	(11.7079)
6	13.12869	1.560606	30.66358	3.457446	26.19341	1.403649	17.47470
	(11.7628)	(9.83364)	(13.5053)	(7.36269)	(12.1110)	(6.67661)	(11.8241)
7	12.96948	1.660245	30.55034	3.819947	25.10703	1.340880	20.65225
	(11.9362)	(11.1397)	(13.6590)	(7.90762)	(11.5347)	(6.86546)	(12.3515)
8	12.23285	1.587712	28.28721	3.807708	24.01185	1.447688	20.70492
	(11.9897)	(12.0001)	(13.2528)	(8.19927)	(11.0933)	(6.95407)	(12.3598)
9	11.39887	1.709211	25.80832	3.713227	22.98962	1.457350	20.89620
	(11.8570)	(13.0080)	(12.9383)	(8.41699)	(10.8135)	(7.03931)	(12.3709)
10	11.32276	2.456387	25.11199	3.621668	23.58162	1.460223	20.53936
	(11.9077)	(13.6897)	(12.7131)	(8.56941)	(10.8235)	(7.15555)	(12.2254)
Variance Decomposition of Real wage growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.206816	4.307798	8.99E-07	1.803499	17.47814	0.421059	0.000782
	(3.52240)	(6.13070)	(3.55099)	(4.59596)	(10.0765)	(3.30804)	(3.22314)
2	0.832956	0.631233	2.359147	1.678629	6.343639	0.254748	2.791728
	(4.48115)	(3.66801)	(5.69072)	(4.65464)	(6.54255)	(3.70016)	(5.74001)
3	3.785260	0.407851	9.486200	1.475027	5.507473	0.154607	2.527343
	(7.61311)	(5.59730)	(9.31042)	(5.06207)	(7.32773)	(4.21192)	(6.29614)
4	14.10449	1.303951	28.37498	1.409025	22.67315	0.326366	13.37984
	(11.6504)	(7.10114)	(13.4100)	(5.64689)	(12.3232)	(5.14465)	(10.4784)
5	11.98435	1.387120	26.11950	1.485358	19.58095	0.509699	12.56323
	(11.3935)	(8.78776)	(12.9691)	(6.41355)	(11.3240)	(5.78198)	(10.7483)
6	10.33558	1.277590	22.25700	1.802997	20.52592	0.484017	12.36367
	(11.0332)	(9.85581)	(12.5702)	(7.11158)	(11.7857)	(6.28069)	(11.0875)
7	9.397841	3.172673	22.56470	2.025969	19.97522	0.779256	12.92790
	(11.1830)	(11.7525)	(12.9400)	(7.59942)	(11.5134)	(6.82232)	(11.3633)

8	8.503679	3.028089	19.68603	2.184525	18.66206	1.084685	13.95068
	(11.2538)	(12.4679)	(12.4637)	(8.02699)	(11.1422)	(7.10134)	(11.7348)
9	8.254903	2.977222	18.89757	2.247208	18.64904	1.143567	14.63179
	(11.4208)	(13.2450)	(12.4379)	(8.28882)	(10.9113)	(7.28738)	(11.9017)
10	8.575769	4.043437	18.61118	2.227701	18.61883	1.200533	15.19849
	(11.6514)	(13.9290)	(12.2840)	(8.46400)	(10.7554)	(7.42169)	(12.0846)
Variance Decomposition of Inflation							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	1.828469	0.509200	5.861078	0.098692	3.411219	0.001168	7.031842
	(5.24301)	(3.66039)	(7.23551)	(3.04438)	(5.49536)	(2.73055)	(7.47128)
2	0.321786	0.423933	1.867480	2.873555	5.496460	0.185224	2.867315
	(3.85062)	(4.18875)	(4.95466)	(5.43247)	(7.48942)	(3.72143)	(5.66184)
3	5.494756	0.297142	12.59926	2.293175	7.531693	0.178857	2.956847
	(8.62285)	(5.73013)	(9.89703)	(5.53371)	(7.92830)	(4.46690)	(6.27809)
4	10.91143	0.269793	29.52399	2.442129	29.33531	0.162560	12.27671
	(11.3523)	(7.11564)	(13.9288)	(6.29072)	(13.7714)	(5.42351)	(10.6313)
5	9.697124	0.419004	27.60892	3.019218	25.77175	0.157826	12.55131
	(11.3016)	(8.97573)	(13.6500)	(7.18975)	(12.5418)	(5.94635)	(11.3020)
6	8.223616	1.350076	23.64397	3.389780	24.57340	0.174408	11.78276
	(10.8051)	(10.3014)	(13.0883)	(7.72875)	(12.0285)	(6.22108)	(11.2898)
7	7.904969	1.644633	23.23820	3.510122	23.86797	0.189440	13.78304
	(11.1579)	(11.3286)	(12.9632)	(8.06297)	(11.5282)	(6.47140)	(11.7639)
8	7.706414	1.613957	22.06696	3.482324	22.94599	0.373859	14.11786
	(11.5528)	(12.1309)	(12.4459)	(8.23723)	(11.0351)	(6.55586)	(11.8650)
9	7.625075	2.408225	22.08608	3.417156	24.23885	0.397964	14.27674
	(11.6042)	(12.9570)	(12.4077)	(8.38516)	(11.0181)	(6.62829)	(11.8641)
10	7.867190	3.947697	21.60242	3.369926	24.20698	0.410325	14.14179
	(11.6235)	(13.3647)	(12.3001)	(8.49912)	(10.8457)	(6.74519)	(11.8590)
Variance Decomposition of Real effective exchange rate growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	1.037545	7.929898	1.115141	2.053404	10.99407	0.079865	2.653181
	(4.13698)	(7.76591)	(4.13677)	(4.79828)	(8.62077)	(2.87936)	(4.76718)
2	0.217805	2.164112	1.067552	0.955446	2.895809	0.631675	1.491268
	(3.89327)	(5.07660)	(5.05061)	(4.06441)	(4.82311)	(4.30420)	(4.67245)
3	12.42409	2.390389	24.26487	1.361459	11.74736	0.488075	6.204974
	(11.3000)	(6.80791)	(12.8026)	(4.96872)	(10.2868)	(4.82655)	(8.54207)
4	17.38501	1.852819	37.61893	3.831736	43.44451	0.480828	20.12286
	(11.7987)	(7.57485)	(13.3886)	(6.75525)	(14.2415)	(5.67534)	(12.0771)
5	15.90927	2.051522	33.95782	5.613527	37.13713	1.085145	18.72729

	(10.6831)	(9.25200)	(12.1479)	(7.44571)	(12.2830)	(6.22242)	(11.3589)
6	15.01673	1.887253	31.87129	6.053369	35.17515	1.492224	17.43443
	(10.4561)	(10.0008)	(11.5953)	(7.71672)	(11.4374)	(6.40038)	(10.9603)
7	14.72074	1.969615	30.91256	5.999358	33.81335	1.633863	17.94357
	(10.7115)	(11.0245)	(10.9946)	(7.76496)	(10.8723)	(6.57424)	(10.6461)
8	14.27391	1.952914	29.84352	6.212407	32.91042	1.883868	17.35178
	(10.7585)	(11.5844)	(10.8701)	(7.80451)	(10.7182)	(6.72051)	(10.6948)
9	14.00597	2.121119	29.31501	6.329115	32.04911	1.886745	16.94307
	(10.5580)	(12.1519)	(10.7775)	(7.96362)	(10.7514)	(6.83804)	(10.7847)
10	13.95305	2.037264	28.39173	6.319396	31.33255	1.946901	17.90907
	(10.6363)	(12.4949)	(11.0523)	(8.07292)	(10.8623)	(7.04433)	(11.1014)
Variance Decomposition of Interest rate							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.296320	0.345437	0.199555	2.572069	0.090466	0.127986	0.025517
	(3.39702)	(3.56260)	(3.46623)	(5.22920)	(3.38924)	(3.10728)	(2.96278)
2	10.94834	0.546355	22.28548	1.945962	8.611437	0.064468	5.788092
	(10.8553)	(5.68037)	(12.4790)	(5.31104)	(9.59106)	(4.09049)	(8.13274)
3	17.55354	0.457073	38.58293	1.957168	34.32613	0.048037	21.24122
	(12.9379)	(6.92625)	(14.3619)	(6.07845)	(14.7781)	(5.34763)	(12.9217)
4	14.29685	0.791730	33.83709	3.118793	30.44185	0.106886	21.44823
	(12.3304)	(8.78410)	(14.5298)	(7.37610)	(13.7461)	(6.06989)	(13.5639)
5	12.15885	1.145514	28.36896	4.024326	27.65853	0.124954	19.91656
	(11.6119)	(10.3706)	(13.8475)	(8.35699)	(12.9630)	(6.53941)	(13.3210)
6	11.47529	1.743610	26.54680	4.198515	26.39182	0.155065	19.55691
	(11.7519)	(11.8673)	(13.6591)	(8.83125)	(12.1012)	(6.90140)	(13.1981)
7	11.15957	1.799066	25.46401	4.052856	25.77916	0.211536	19.36970
	(12.1665)	(12.5780)	(13.1169)	(8.90419)	(11.5960)	(7.07991)	(13.1074)
8	11.04858	2.166281	25.17870	3.919121	26.57695	0.265306	19.39213
	(12.1418)	(13.3427)	(12.8924)	(8.90772)	(11.2518)	(7.27823)	(12.8860)
9	10.86767	2.756769	24.75567	3.833200	26.50763	0.428418	19.16501
	(11.9826)	(13.8172)	(12.6742)	(8.92855)	(11.0493)	(7.49026)	(12.6186)
10	11.48648	2.722088	24.96928	3.746972	26.91800	0.553008	19.26019
	(12.1819)	(14.0085)	(12.5654)	(8.97676)	(10.9087)	(7.61711)	(12.4913)
Cholesky Ordering: Specification of oil price shock, Real GDP growth, Real wage growth, Inflation, Real effective exchange rate growth, Interest rate							
Standard Errors: Monte Carlo (1000 repetitions)							

Ukraine

Variance Decomposition of Real GDP growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.133603	0.082240	1.000239	7.226986	0.000667	0.490041	0.086759
	(3.12868)	(2.97819)	(4.26776)	(7.55262)	(2.93119)	(3.70594)	(3.22385)
2	5.976131	13.31792	3.137721	11.97699	0.581710	10.90108	2.944890
	(7.48416)	(9.81243)	(6.37261)	(8.89464)	(4.66919)	(9.95764)	(7.07364)
3	11.76192	24.48481	3.555477	18.93399	0.903096	18.76403	4.166328
	(9.10331)	(11.7792)	(7.17671)	(10.3032)	(5.22533)	(11.3944)	(7.90900)
4	15.48661	26.81729	2.997762	25.22432	1.606664	20.27410	3.589372
	(9.97689)	(12.3688)	(7.34965)	(11.2843)	(6.20865)	(12.0202)	(8.17085)
5	15.27433	26.85319	2.543361	26.59175	1.593259	23.01945	3.387774
	(9.73601)	(13.0915)	(7.43480)	(11.7111)	(6.73445)	(12.5574)	(8.72352)
6	15.16186	23.68104	2.514786	25.71140	1.462813	20.22077	2.881995
	(9.45394)	(12.3384)	(7.73747)	(11.3199)	(7.37582)	(11.5114)	(9.11162)
7	16.04868	22.48843	2.615626	25.53911	1.405753	19.97152	2.951068
	(9.34588)	(12.6664)	(8.01499)	(10.8878)	(7.92993)	(11.9823)	(9.69593)
8	17.17552	20.82093	2.635817	27.03817	2.159943	18.96802	2.815903
	(9.31078)	(12.5397)	(8.55875)	(10.7120)	(8.19650)	(11.7761)	(10.1051)
9	18.60337	19.97721	5.284158	27.72836	7.716653	18.78402	4.266923
	(9.53240)	(12.6104)	(8.93487)	(11.0153)	(9.32663)	(12.1001)	(10.4484)
10	19.75163	19.42071	5.144698	28.73814	7.617709	18.42607	4.179200
	(9.77785)	(12.8837)	(9.20350)	(11.2774)	(9.42407)	(12.2228)	(10.7435)
Variance Decomposition of Real wage growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.061506	0.013647	0.643164	2.406637	2.661056	0.066491	0.384390
	(3.23201)	(3.06164)	(3.81975)	(4.98752)	(5.19487)	(3.40683)	(3.74310)
2	7.289996	12.43946	0.675071	11.66174	2.869486	5.014102	2.021926
	(8.24409)	(10.0639)	(5.01315)	(9.30070)	(6.24261)	(7.68510)	(6.61700)
3	14.73604	17.80829	8.784634	22.52632	3.148323	7.892935	10.84530
	(9.83841)	(9.67798)	(8.86917)	(10.8147)	(5.76076)	(8.19179)	(9.34244)
4	20.31806	28.26958	7.668569	35.82325	4.593918	15.05377	9.593742
	(11.5370)	(11.9713)	(8.53916)	(12.2209)	(6.95599)	(10.9222)	(9.21491)
5	21.15365	31.56327	10.97391	37.35048	7.512067	18.74248	10.98707
	(11.7589)	(13.0346)	(9.90400)	(12.6874)	(8.64671)	(12.0744)	(10.5041)
6	20.38631	28.89843	9.292570	35.62589	6.860821	18.96535	9.262421
	(11.5729)	(13.1967)	(9.48632)	(12.9149)	(9.02007)	(12.3175)	(10.1119)
7	19.54846	28.46265	8.819910	33.91909	6.289829	20.11586	8.421382
	(11.1239)	(13.9318)	(9.34742)	(12.5502)	(9.07870)	(13.0061)	(10.3587)

8	20.23252	26.67390	8.199126	32.98652	6.050474	19.85141	7.945060
	(10.8646)	(14.0243)	(9.52886)	(12.2247)	(9.26861)	(12.8898)	(10.6913)
9	22.16081	25.65949	8.618343	33.41778	7.333006	19.58089	8.307514
	(10.8666)	(14.0793)	(9.87323)	(12.2037)	(9.75765)	(13.1148)	(11.0441)
10	24.38759	24.92290	8.464109	35.25071	7.182469	19.04409	8.210381
	(10.9781)	(14.1542)	(10.1485)	(12.2914)	(9.81231)	(13.0987)	(11.4247)
Variance Decomposition of Inflation							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.647560	0.008174	0.213070	5.813035	0.926617	0.084258	0.469905
	(3.68713)	(2.98854)	(3.06844)	(7.17292)	(3.78077)	(3.18752)	(3.97978)
2	4.161627	4.580618	0.237447	9.813209	0.677299	1.496681	0.454633
	(6.92788)	(7.19112)	(4.73407)	(8.71572)	(4.47213)	(6.02574)	(4.87583)
3	8.928100	14.52934	0.808081	20.50800	1.278234	5.573383	3.114002
	(9.01811)	(10.3066)	(5.61265)	(11.3132)	(5.00477)	(7.78833)	(6.93121)
4	15.76696	25.59226	0.851431	32.28410	5.441271	14.85305	3.948656
	(11.5241)	(12.8984)	(6.94153)	(12.8728)	(8.31398)	(11.1930)	(8.33987)
5	16.62008	27.73259	3.000419	34.48408	6.183838	18.13775	4.960716
	(11.7478)	(13.6446)	(7.82857)	(13.2310)	(7.73215)	(12.1939)	(9.51865)
6	15.98653	26.05033	2.593724	32.83637	5.479252	17.43158	4.351852
	(11.1704)	(13.5379)	(7.84086)	(12.9517)	(8.31997)	(12.0831)	(9.44428)
7	16.32204	25.38499	2.568296	31.95025	5.101664	18.06241	4.134630
	(10.6507)	(13.9704)	(8.28659)	(12.1894)	(8.90100)	(12.4959)	(9.90856)
8	17.59057	23.22659	2.385671	32.08599	4.893596	17.17083	3.984932
	(10.4861)	(13.9011)	(8.72650)	(11.7457)	(9.18301)	(12.4508)	(10.2368)
9	19.20282	21.75637	3.432740	32.50122	6.354564	16.59457	4.592381
	(10.6178)	(13.9326)	(9.19745)	(11.7694)	(9.78426)	(12.6978)	(10.4847)
10	20.84236	21.03767	3.465255	33.72323	6.827700	16.07064	4.549254
	(10.8171)	(14.0545)	(9.56792)	(12.0067)	(10.0296)	(12.7513)	(10.8499)
Variance Decomposition of Real effective exchange rate growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.224345	0.490306	5.736612	0.809212	10.85138	0.052779	5.058093
	(3.49356)	(3.61096)	(7.02197)	(3.78192)	(8.36272)	(2.98746)	(6.50957)
2	1.762583	2.282497	6.559104	0.766205	10.09941	1.252700	3.523015
	(5.22250)	(5.88649)	(7.58666)	(4.82978)	(7.81756)	(5.63886)	(6.10917)
3	5.573021	9.694930	10.42340	3.145257	12.81061	4.279441	9.343509
	(7.56367)	(8.89866)	(9.25155)	(5.98810)	(8.97744)	(7.79649)	(9.59928)
4	16.10592	16.69939	24.33876	4.811180	34.60259	9.244703	22.80101
	(9.80669)	(9.90672)	(11.6941)	(6.25241)	(12.5630)	(9.14321)	(12.1850)
5	22.41351	21.68143	23.51263	16.25833	33.60555	14.41134	22.50078

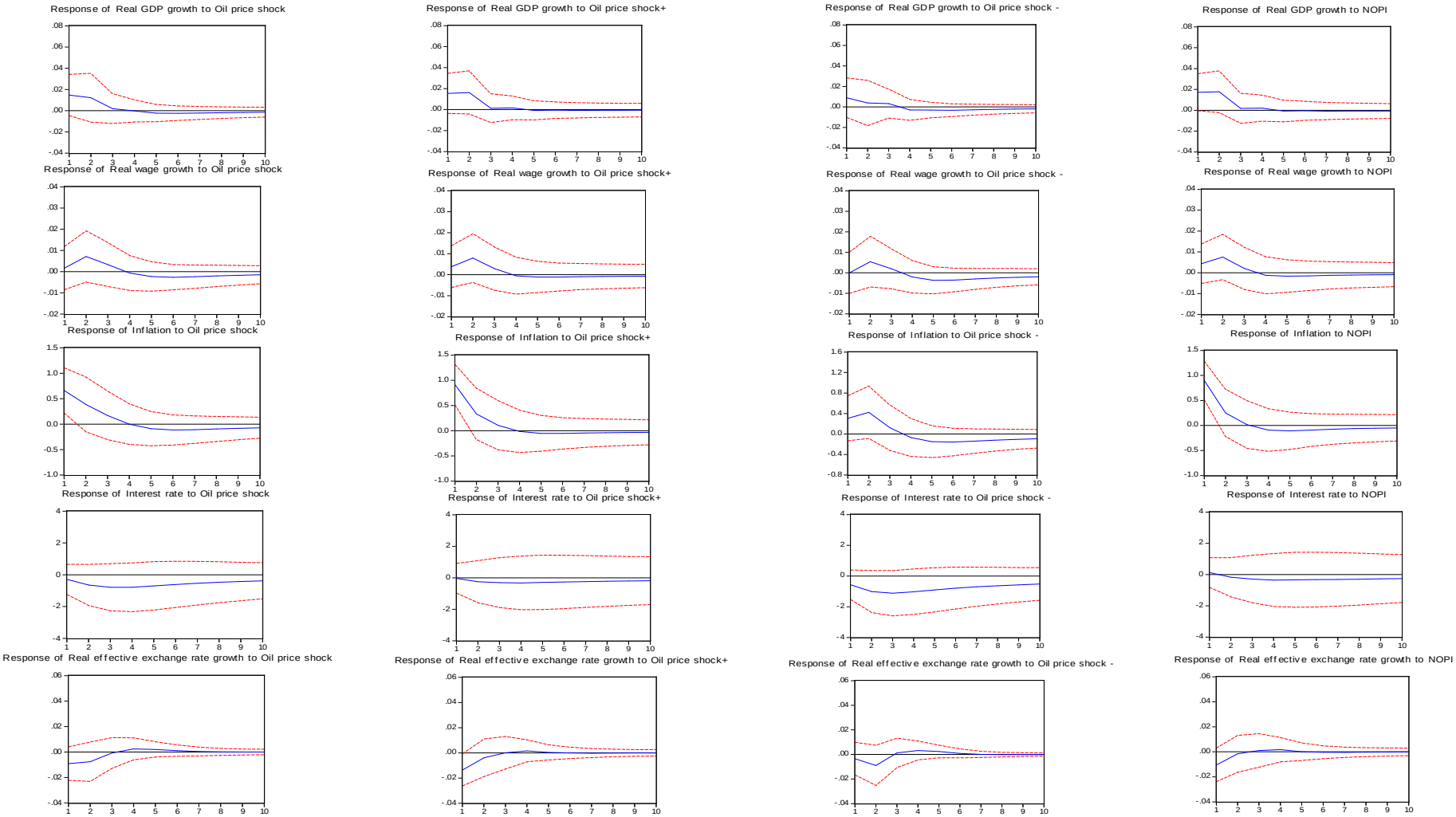
	(10.5491)	(10.7920)	(11.0282)	(9.17721)	(11.5615)	(10.2858)	(11.6066)
6	25.20069	30.15007	23.24473	21.55599	28.73153	19.34291	24.03388
	(10.6424)	(12.1792)	(10.5448)	(10.3309)	(10.8516)	(11.2388)	(11.6700)
7	26.99145	30.68813	24.41666	24.24366	27.98377	19.12521	23.34827
	(10.8626)	(12.3493)	(10.3539)	(11.1858)	(10.8680)	(11.3353)	(11.5395)
8	27.22897	31.55702	23.42253	24.82165	26.59819	21.01577	22.33569
	(10.9284)	(12.6183)	(10.2716)	(11.3554)	(10.8829)	(11.7667)	(11.6410)
9	26.72108	30.78747	21.55817	24.13351	23.91849	20.64429	20.89556
	(11.0719)	(12.8527)	(10.2955)	(11.3230)	(10.6923)	(11.6652)	(11.7699)
10	26.20520	29.92172	20.93217	23.38035	24.21579	21.30775	20.42498
	(11.1481)	(12.9066)	(10.3239)	(11.2178)	(10.6955)	(11.6828)	(11.8915)
Variance Decomposition of Interest rate							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	9.979567	15.86062	23.71331	6.945869	12.57156	8.748865	16.26913
	(8.36679)	(9.80235)	(10.8700)	(7.18304)	(8.96951)	(7.86260)	(9.76034)
2	10.89859	15.34598	27.99236	6.902053	20.11249	9.692184	14.54553
	(9.15834)	(9.95820)	(12.3168)	(7.44059)	(11.8302)	(9.41716)	(10.5759)
3	13.46761	21.07045	29.06989	7.171149	29.46200	13.54447	14.59056
	(10.8432)	(11.6946)	(12.8432)	(8.07846)	(13.9038)	(11.1365)	(11.3865)
4	16.44012	26.91589	29.55415	7.372589	32.61634	17.17748	16.42075
	(12.0383)	(12.5577)	(12.9283)	(8.62768)	(14.8504)	(12.3590)	(12.5173)
5	18.47950	29.29136	25.97181	9.760955	29.49859	19.70764	14.67476
	(12.9420)	(13.4554)	(11.8093)	(10.0362)	(12.2203)	(13.0787)	(11.9243)
6	18.57849	29.01172	22.12938	10.70295	24.77302	19.27678	13.02329
	(13.1429)	(13.7775)	(11.0287)	(10.8857)	(10.9033)	(12.9659)	(11.4229)
7	17.91347	27.62143	20.22449	10.88443	22.85643	18.17701	11.88128
	(13.0334)	(13.5660)	(10.7191)	(11.3818)	(10.7745)	(12.6682)	(11.3009)
8	17.49514	27.32406	19.48336	10.57777	22.16349	17.56078	11.91124
	(12.7571)	(13.2239)	(10.5216)	(11.2342)	(10.7926)	(12.4785)	(11.4859)
9	17.49775	28.20396	19.09106	10.87948	21.64021	18.86438	12.58083
	(12.5880)	(13.0228)	(10.4860)	(11.1565)	(10.8062)	(12.2518)	(11.6213)
10	17.75805	28.86004	19.27024	11.53189	21.48162	18.85278	14.19949
	(12.5160)	(13.1606)	(10.5755)	(11.2673)	(10.9316)	(12.3334)	(11.7330)
Cholesky Ordering: Specification of oil price shock, Real GDP growth, Real wage growth, Inflation, Real effective exchange rate growth, Interest rate							
Standard Errors: Monte Carlo (1000 repetitions)							

Appendix VI – Robustness check

Impulse responses

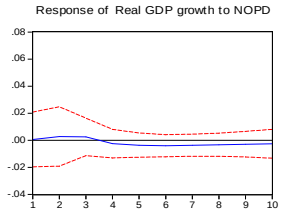
Kazakhstan

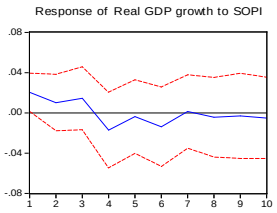
Response to Cholesky One S.D. Innovations ± 2 S.E.

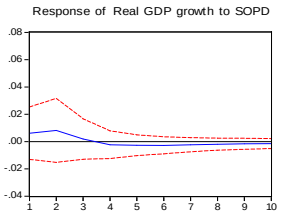


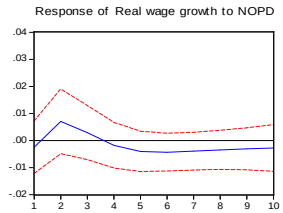
Kazakhstan (continued)

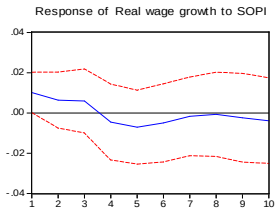
Response to Cholesky One S.D. Innovations ± 2 S.E.

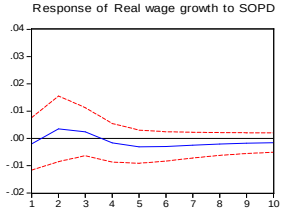


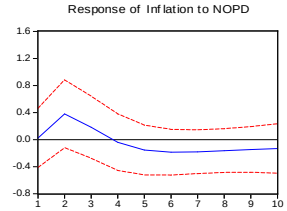


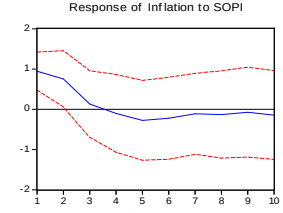


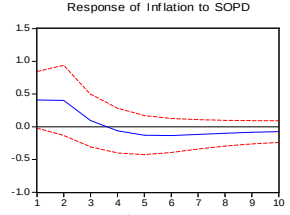


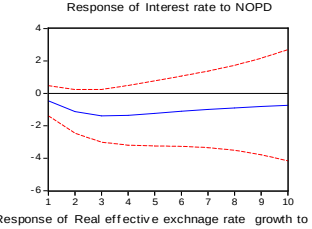


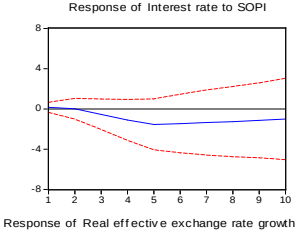


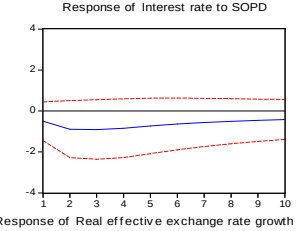


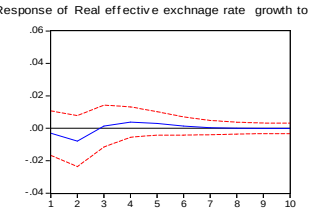


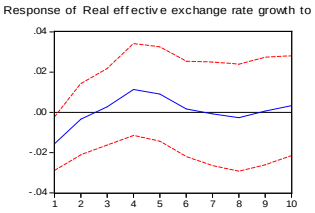


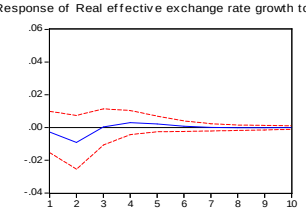








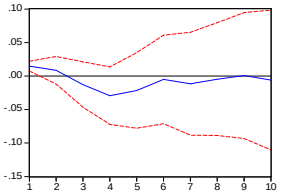




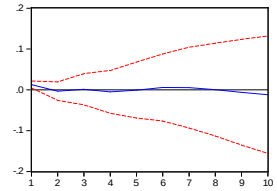
Russia

Response to Cholesky One S.D. Innovations ± 2 S.E.

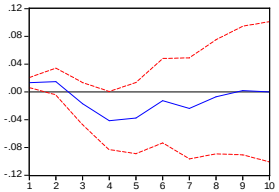
Response of Real GDP growth to Oil price shock



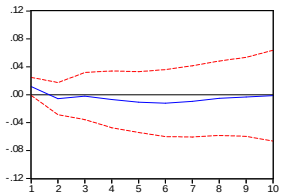
Response of Real GDP growth to Oil price shock+



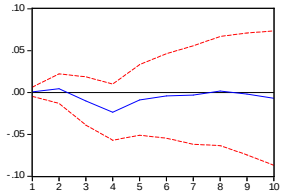
Response of Real GDP growth to Oil price shock -



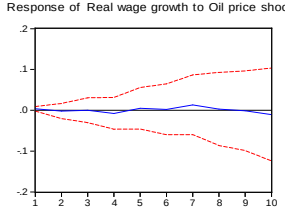
Response of Real GDP growth to NOPI



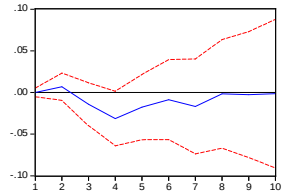
Response of Real wage growth to Oil price shock



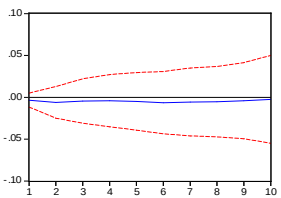
Response of Real wage growth to Oil price shock+



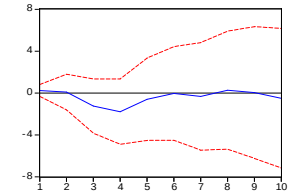
Response of Real wage growth to Oil price shock -



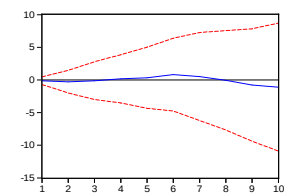
Response of Real wage growth to NOPI



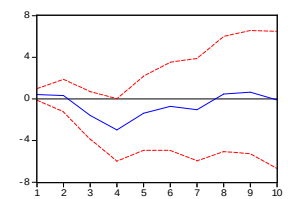
Response of Inflation to Oil price shock



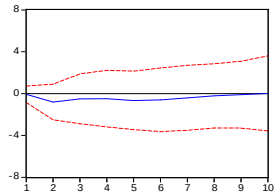
Response of Inflation to Oil price shock+



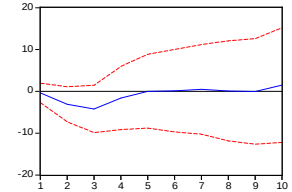
Response of Inflation to Oil price shock -



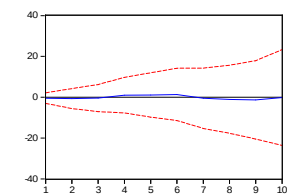
Response of Inflation to NOPI



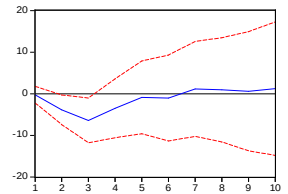
Response of Interest rate to Oil price shock



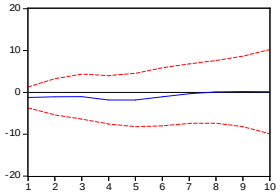
Response of Interest rate to Oil price shock+



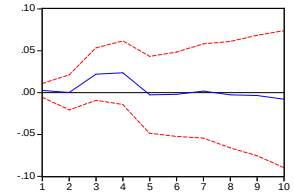
Response of Interest rate to Oil price shock -



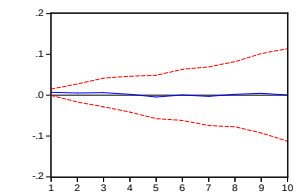
Response of Interest rate to NOPI



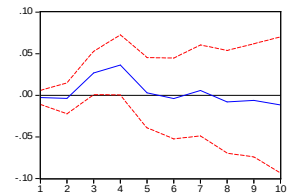
Response of Real effective exchange rate growth to Oil price shock



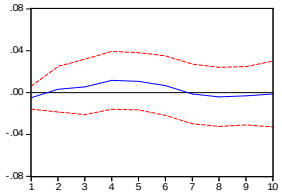
Response of Real effective exchange rate growth to Oil price shock+



Response of Real effective exchange rate growth to Oil price shock -

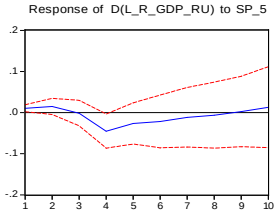


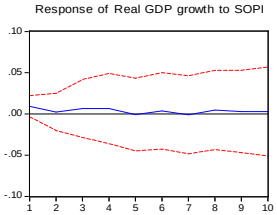
Response of Real effective exchange rate growth to NOPI

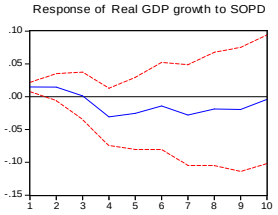


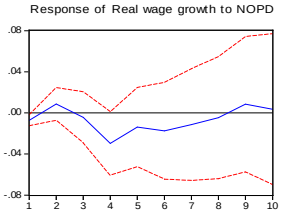
Russia (continued)

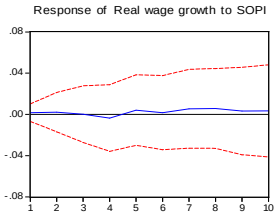
Response to Cholesky One S.D. Innovations ± 2 S.E.

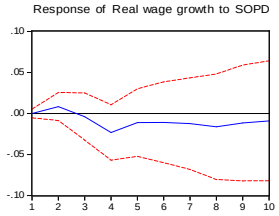


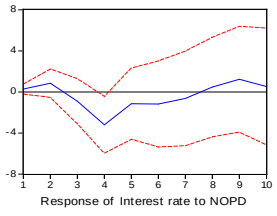


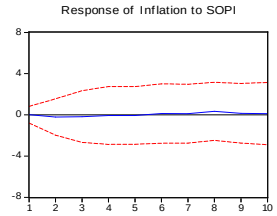


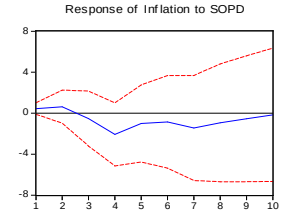


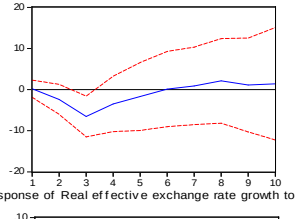


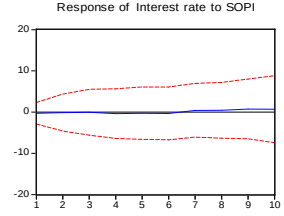


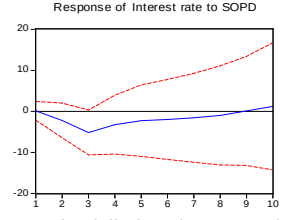


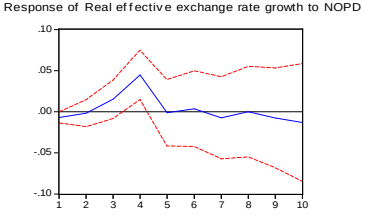


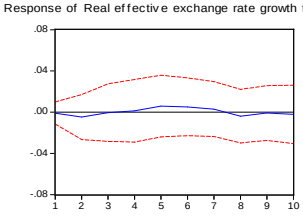


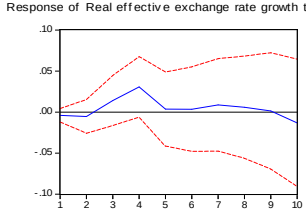








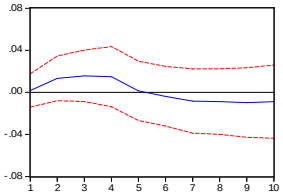




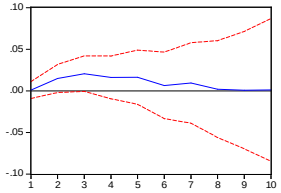
Ukraine

Response to Cholesky One S.D. Innovations ± 2 S.E.

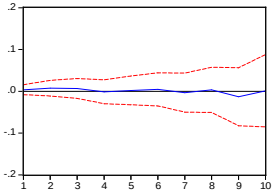
Response of Real GDP growth to Oil price shock



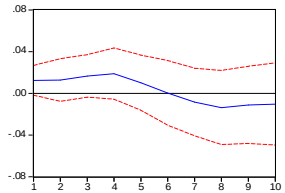
Response of Real GDP growth to Oil price shock+



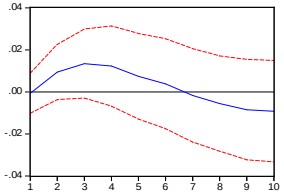
Response of Real GDP growth to Oil price shock -



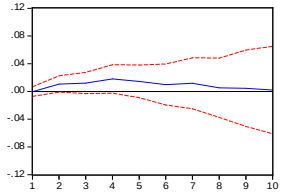
Response of Real GDP growth to NOPI



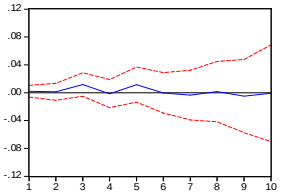
Response of Real wage growth to Oil price shock



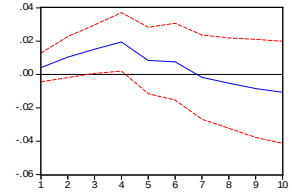
Response of Real wage growth to Oil price shock+



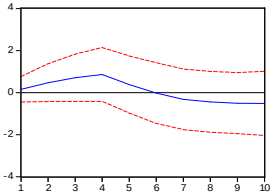
Response of Real wage growth to Oil price shock -



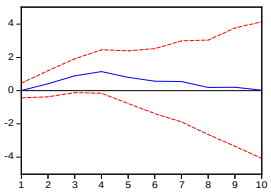
Response of Real wage growth to NOPI



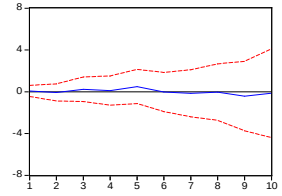
Response of Inflation to Oil price shock



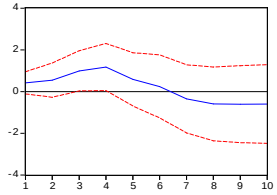
Response of Inflation to Oil price shock+



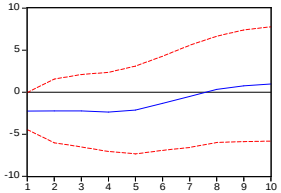
Response of Inflation to Oil price shock -



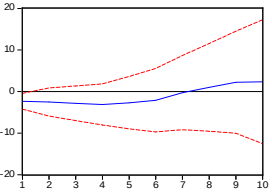
Response of Inflation to NOPI



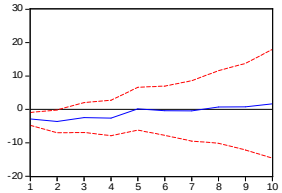
Response of Interest rate to Oil price shock



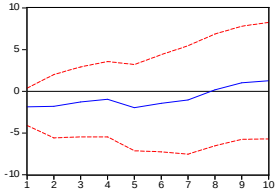
Response of Interest rate to Oil price shock+



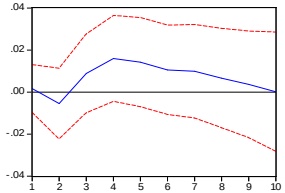
Response of Interest rate to Oil price shock -



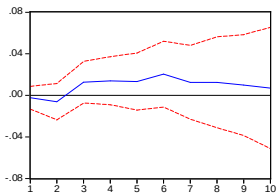
Response of Interest rate to NOPI



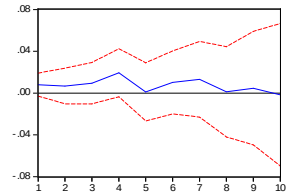
Response of Real effective exchange rate growth to Oil price shock



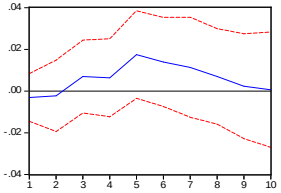
Response of Real effective exchnage rate growth to Oil price shock+



Response of Real effective exchange rate growth to Oil price shock -

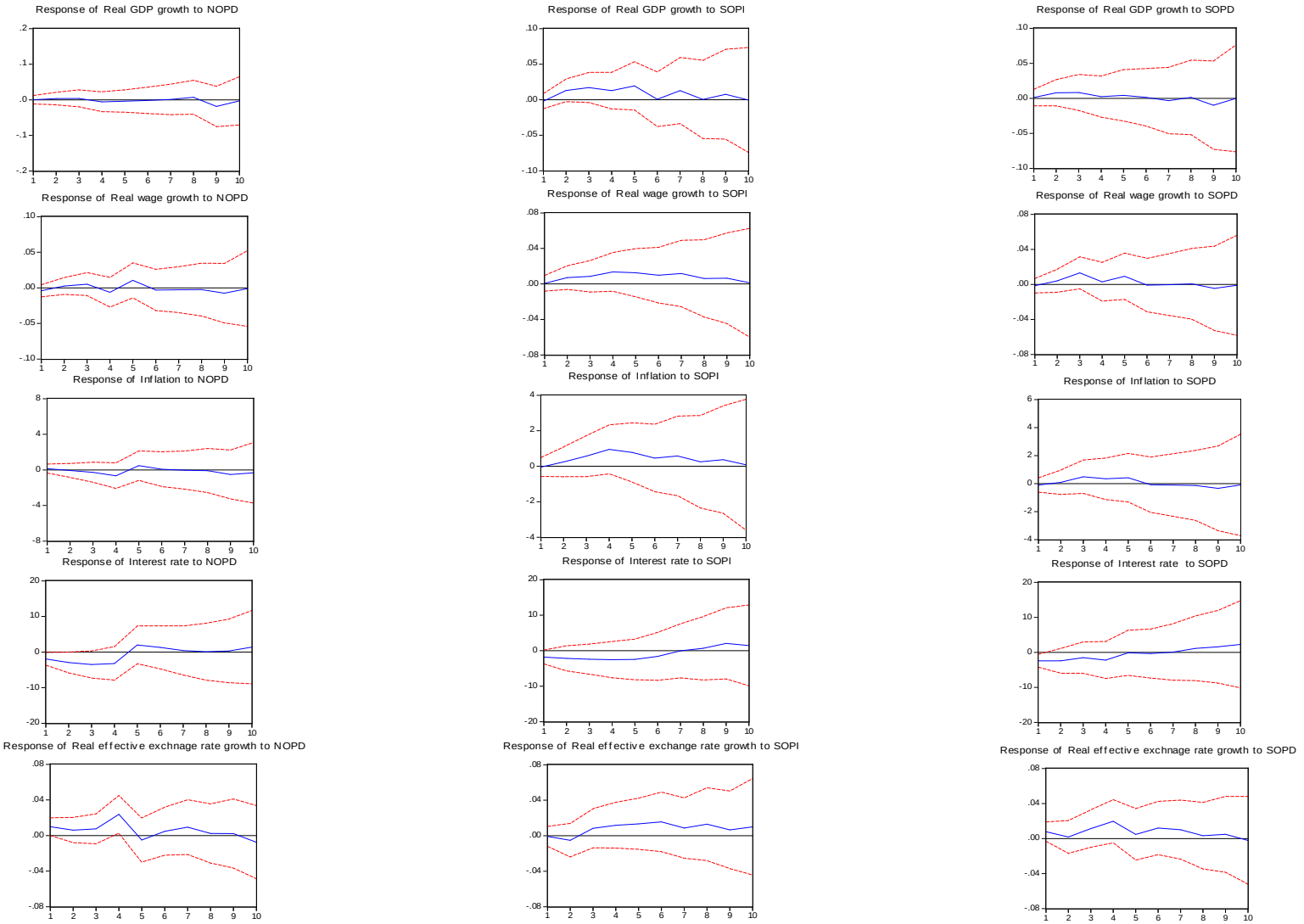


Response of Real effective exchnage rate growth to NOPI



Ukraine (continued)

Response to Cholesky One S.D. Innovations ± 2 S.E.



Variance decomposition

Kazakhstan

Variance Decomposition of Real GDP growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	5.765076	6.319288	2.104299	8.080664	0.006838	11.52033	0.981732
	(6.64830)	(6.64992)	(4.67025)	(7.36753)	(2.63158)	(8.30170)	(4.07946)
2	8.164288	11.20347	2.109422	13.67480	0.178366	11.27026	2.313272
	(6.81549)	(7.19934)	(4.94145)	(7.83278)	(3.61752)	(8.27743)	(5.31701)
3	7.891710	10.71080	2.240903	13.03895	0.298991	14.27830	2.290640
	(6.77383)	(7.05534)	(4.99916)	(7.70450)	(3.74580)	(9.20111)	(5.34294)
4	7.751143	10.55006	2.377766	12.85239	0.427831	17.55998	2.365500
	(6.77568)	(7.20107)	(4.97641)	(7.94094)	(3.88454)	(9.99216)	(5.32682)
5	7.753941	10.40073	2.542095	12.67594	0.702201	16.79948	2.483972
	(6.70517)	(7.16526)	(4.92300)	(7.96872)	(4.00433)	(9.60804)	(5.32110)
6	7.792516	10.29034	2.740074	12.54471	1.031497	18.74993	2.615117
	(6.65991)	(7.17324)	(4.93490)	(8.02215)	(4.15156)	(10.1244)	(5.29016)
7	7.833143	10.21317	2.869748	12.45557	1.297630	18.44243	2.700849
	(6.63095)	(7.17358)	(4.94288)	(8.04800)	(4.27742)	(10.1719)	(5.27655)
8	7.856814	10.15306	2.966160	12.38740	1.508785	18.53924	2.760430
	(6.61951)	(7.18465)	(4.97388)	(8.07367)	(4.39981)	(10.3527)	(5.26798)
9	7.870853	10.10683	3.037894	12.33709	1.675134	18.56620	2.803110
	(6.61924)	(7.19594)	(5.00452)	(8.09171)	(4.51745)	(10.4446)	(5.26777)
10	7.879466	10.07034	3.095865	12.29860	1.809564	18.70146	2.836886
	(6.62534)	(7.20844)	(5.04236)	(8.10799)	(4.64097)	(10.7131)	(5.26884)
Variance Decomposition of Real wage growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.271089	1.467095	8.31E-05	1.863496	0.647061	10.74833	0.401418
	(3.14900)	(4.22487)	(2.68070)	(4.78590)	(3.73555)	(8.47875)	(3.41593)
2	4.010435	5.732035	2.222491	5.603749	4.267542	11.60875	1.214929
	(6.29364)	(6.53735)	(5.18442)	(6.76812)	(5.81685)	(8.89505)	(4.68451)
3	4.432842	5.839798	2.300453	5.470567	4.463334	13.30035	1.518225
	(6.89891)	(6.85832)	(5.52491)	(7.24466)	(6.17403)	(9.78259)	(4.87601)
4	4.204305	5.528238	2.428400	5.270552	4.438195	13.33284	1.607759
	(6.72509)	(6.68321)	(5.35449)	(7.21720)	(5.96010)	(9.44279)	(4.68292)
5	4.344376	5.360105	3.144230	5.208162	5.258022	14.08109	2.114933
	(6.55479)	(6.55424)	(5.33436)	(7.24698)	(5.96134)	(9.23815)	(4.63594)
6	4.612403	5.259191	3.772969	5.180368	6.192317	14.34864	2.559536
	(6.52418)	(6.49523)	(5.43020)	(7.28963)	(6.14174)	(9.49276)	(4.67942)

7	4.821660	5.179290	4.192227	5.148308	6.924538	13.95687	2.850049
	(6.57159)	(6.48792)	(5.55751)	(7.36273)	(6.37709)	(9.41547)	(4.75751)
8	4.957830	5.117245	4.463651	5.124157	7.457322	13.54775	3.032643
	(6.64953)	(6.51055)	(5.68877)	(7.45980)	(6.63111)	(9.54906)	(4.83549)
9	5.045526	5.069002	4.658346	5.107777	7.857882	13.63045	3.158845
	(6.74456)	(6.55222)	(5.81552)	(7.57104)	(6.89160)	(9.72093)	(4.91329)
10	5.106777	5.031960	4.809965	5.098342	8.171042	14.06670	3.255194
	(6.84169)	(6.60378)	(5.93303)	(7.68347)	(7.14603)	(10.0348)	(4.98636)
Variance Decomposition of Inflation							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	20.82655	39.38668	4.696012	38.95885	0.030545	37.80968	8.284836
	(10.3880)	(10.5984)	(6.28168)	(10.3942)	(3.06600)	(11.1662)	(7.61521)
2	22.04698	35.34764	10.38948	33.25890	5.683627	44.97583	12.34435
	(10.7293)	(10.3684)	(8.85015)	(10.1352)	(6.74045)	(12.1802)	(9.17307)
3	21.09573	32.93326	10.01406	30.78727	6.274532	43.75444	11.57998
	(10.8171)	(10.2704)	(8.95792)	(9.88845)	(7.54266)	(12.0081)	(9.04578)
4	19.83142	31.11424	9.590987	29.36752	5.979818	39.12386	11.00543
	(10.4728)	(9.96618)	(8.52199)	(9.51893)	(7.31479)	(11.3064)	(8.70014)
5	19.11883	29.78845	9.820281	28.38345	6.455317	38.86474	10.96410
	(10.1227)	(9.70656)	(8.18755)	(9.28085)	(7.08177)	(11.0776)	(8.43518)
6	18.78872	28.82801	10.18123	27.64971	7.256161	38.80377	11.07425
	(9.89282)	(9.52230)	(8.01014)	(9.13622)	(7.05778)	(10.9846)	(8.26073)
7	18.59366	28.11337	10.44115	27.08645	7.972287	38.17514	11.14707
	(9.76541)	(9.40521)	(7.92091)	(9.06117)	(7.15640)	(10.9115)	(8.14752)
8	18.43769	27.56615	10.60251	26.64796	8.525719	37.90810	11.17049
	(9.69854)	(9.34018)	(7.88155)	(9.03176)	(7.31023)	(10.9886)	(8.07761)
9	18.30234	27.13902	10.70920	26.30290	8.948420	37.49557	11.17085
	(9.66898)	(9.31039)	(7.87494)	(9.03297)	(7.49521)	(11.0316)	(8.03712)
10	18.18734	26.80185	10.78845	26.02963	9.278703	37.35974	11.16528
	(9.66064)	(9.30283)	(7.88915)	(9.05053)	(7.69481)	(11.1473)	(8.01275)
Variance Decomposition of Interest rate							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.931249	0.013945	3.638755	0.182225	2.394202	0.938448	2.788262
	(4.06542)	(2.76717)	(5.77365)	(2.48947)	(4.85664)	(3.85323)	(5.00615)
2	2.864378	0.360246	7.732057	0.268541	8.595940	0.275684	6.012453
	(6.14226)	(3.57028)	(8.22654)	(3.15115)	(8.30341)	(4.11209)	(7.23429)
3	4.617347	0.654694	10.58578	0.541835	13.78939	1.914809	7.677694
	(8.18559)	(4.71204)	(9.88993)	(4.63612)	(10.9963)	(5.96838)	(8.54940)

4	5.870555	0.910360	12.04156	0.871301	16.86888	5.998865	8.631520
	(9.62264)	(5.79130)	(10.8417)	(6.05190)	(12.5926)	(8.99487)	(9.31656)
5	6.567326	1.043145	12.79143	1.096569	18.65802	11.38132	9.101757
	(10.5331)	(6.62177)	(11.4077)	(7.17086)	(13.5855)	(11.8419)	(9.76996)
6	6.952414	1.133636	13.16362	1.285424	19.71293	14.60009	9.316830
	(11.1208)	(7.26305)	(11.7624)	(8.05784)	(14.2591)	(13.5456)	(10.0533)
7	7.173762	1.198126	13.38368	1.441381	20.39417	17.10428	9.431983
	(11.5139)	(7.75713)	(12.0028)	(8.76414)	(14.7515)	(14.4931)	(10.2464)
8	7.316043	1.248997	13.53354	1.574809	20.86805	19.04433	9.507039
	(11.7901)	(8.14626)	(12.1753)	(9.33996)	(15.1249)	(15.0397)	(10.3885)
9	7.416819	1.289342	13.64671	1.686186	21.21620	20.06660	9.564029
	(11.9927)	(8.45713)	(12.3045)	(9.81238)	(15.4140)	(15.3266)	(10.4975)
10	7.493086	1.321559	13.73461	1.778130	21.47944	20.47438	9.609325
	(12.1459)	(8.70902)	(12.4039)	(10.2032)	(15.6406)	(15.4968)	(10.5833)
Variance Decomposition of Real effective exchange rate growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	4.751432	10.30018	0.680416	6.100884	0.512706	15.11310	0.439939
	(5.87197)	(7.79629)	(3.52154)	(6.42000)	(3.40566)	(9.69939)	(3.59727)
2	6.386248	8.977787	4.117408	5.005476	3.190123	13.91638	4.037925
	(6.82744)	(7.14107)	(6.47081)	(5.72619)	(5.87562)	(9.21620)	(6.41767)
3	6.136158	8.612392	4.014746	4.847722	3.158443	12.64304	3.876812
	(6.89971)	(7.12110)	(6.18504)	(5.81490)	(5.73855)	(8.41871)	(6.47880)
4	6.291644	8.588812	4.383329	4.909920	3.721186	13.73366	4.190181
	(6.85596)	(7.12973)	(6.21791)	(5.95655)	(5.83991)	(8.96559)	(6.47847)
5	6.427075	8.563177	4.603463	4.896242	4.064477	14.85083	4.361096
	(6.90572)	(7.17451)	(6.32750)	(6.06796)	(5.99370)	(9.15623)	(6.53371)
6	6.468934	8.558613	4.626225	4.900299	4.132689	14.46409	4.381455
	(6.93248)	(7.22067)	(6.35851)	(6.14604)	(6.06666)	(8.96879)	(6.55026)
7	6.472628	8.560137	4.625920	4.909605	4.138052	13.98214	4.381093
	(6.94822)	(7.26299)	(6.37031)	(6.21155)	(6.10977)	(9.02756)	(6.55455)
8	6.472362	8.560982	4.626998	4.913536	4.138000	13.78927	4.381882
	(6.96315)	(7.29789)	(6.37481)	(6.26204)	(6.13768)	(9.25614)	(6.55914)
9	6.472499	8.561262	4.627698	4.914996	4.138181	13.70209	4.382570
	(6.97197)	(7.32754)	(6.37494)	(6.30307)	(6.16400)	(9.35624)	(6.56398)
10	6.472654	8.561278	4.627893	4.915414	4.138313	13.84810	4.382779
	(6.97443)	(7.35260)	(6.37644)	(6.33670)	(6.18758)	(9.53530)	(6.56650)
Cholesky Ordering: Specification of oil price shock, Real GDP growth, Real wage growth, Inflation, Interest rate, Real effective exchange rate growth							
Standard Errors: Monte Carlo (1000 repetitions)							

Russia

Variance Decomposition of Real GDP growth:							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	35.39965	22.27184	30.19062	8.758991	15.69778	5.616968	41.10937
	(11.6919)	(10.7918)	(11.3597)	(8.10238)	(9.64852)	(7.20425)	(11.4368)
2	9.505308	5.323142	17.69874	4.664347	13.23446	2.363215	13.55481
	(6.81757)	(5.35419)	(10.1781)	(5.48617)	(9.38511)	(5.03268)	(8.68268)
3	7.978338	2.374369	16.32298	2.170053	6.945265	1.546963	7.267342
	(7.16469)	(5.27322)	(8.48598)	(4.63483)	(6.75420)	(5.08386)	(7.39838)
4	15.09909	1.828995	31.71067	2.085555	28.13330	1.575936	15.97771
	(10.5693)	(6.73420)	(12.8728)	(5.61666)	(12.8168)	(5.75246)	(10.4735)
5	15.66695	1.538462	35.80817	2.702201	27.28327	1.399514	18.80860
	(11.1809)	(8.27952)	(14.2742)	(6.54935)	(12.4028)	(6.09261)	(11.8479)
6	13.12869	1.560606	30.66358	3.457446	26.19341	1.403649	17.47470
	(10.9076)	(9.84202)	(13.9259)	(7.75545)	(12.2262)	(6.71813)	(12.2267)
7	12.96948	1.660245	30.55034	3.819947	25.10703	1.340880	20.65225
	(11.1949)	(11.4194)	(13.8975)	(8.39534)	(11.8390)	(7.11031)	(12.9894)
8	12.23285	1.587712	28.28721	3.807708	24.01185	1.447688	20.70492
	(11.1195)	(12.5281)	(13.5128)	(8.73490)	(11.7055)	(7.42496)	(13.1550)
9	11.39887	1.709211	25.80832	3.713227	22.98962	1.457350	20.89620
	(10.7081)	(13.1706)	(13.0262)	(8.84912)	(11.3647)	(7.60358)	(13.3163)
10	11.32276	2.456387	25.11199	3.621668	23.58162	1.460223	20.53936
	(10.9095)	(13.7258)	(12.7033)	(8.92006)	(11.1535)	(7.75337)	(13.1942)
Variance Decomposition of Real wage growth:							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.206816	4.307798	8.99E-07	1.803499	17.47814	0.421059	0.000782
	(3.28740)	(6.36700)	(3.08616)	(4.62822)	(10.4704)	(3.76918)	(3.18598)
2	0.832956	0.631233	2.359147	1.678629	6.343639	0.254748	2.791728
	(4.05663)	(3.87602)	(5.39948)	(4.54784)	(6.33086)	(3.78641)	(5.90833)
3	3.785260	0.407851	9.486200	1.475027	5.507473	0.154607	2.527343
	(7.38596)	(5.81451)	(9.39433)	(5.15001)	(7.10994)	(4.70656)	(6.60216)
4	14.10449	1.303951	28.37498	1.409025	22.67315	0.326366	13.37984
	(10.8880)	(7.46076)	(13.3639)	(5.80394)	(12.3816)	(5.22886)	(10.7701)
5	11.98435	1.387120	26.11950	1.485358	19.58095	0.509699	12.56323
	(10.4526)	(8.73066)	(13.2148)	(6.43241)	(11.5380)	(5.71035)	(10.6999)
6	10.33558	1.277590	22.25700	1.802997	20.52592	0.484017	12.36367
	(10.4383)	(10.0894)	(12.8723)	(7.34286)	(11.6584)	(6.19122)	(11.4068)
7	9.397841	3.172673	22.56470	2.025969	19.97522	0.779256	12.92790

	(10.6042)	(11.7343)	(13.2437)	(7.91402)	(11.6916)	(6.73158)	(11.9171)
8	8.503679	3.028089	19.68603	2.184525	18.66206	1.084685	13.95068
	(10.6224)	(12.6285)	(12.6420)	(8.30367)	(11.4991)	(7.15543)	(12.4005)
9	8.254903	2.977222	18.89757	2.247208	18.64904	1.143567	14.63179
	(10.6230)	(13.2979)	(12.5903)	(8.52042)	(10.9861)	(7.44576)	(12.8908)
10	8.575769	4.043437	18.61118	2.227701	18.61883	1.200533	15.19849
	(10.9587)	(13.9024)	(12.4576)	(8.64432)	(11.0383)	(7.59929)	(12.9041)
Variance Decomposition of Inflation:							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	1.828469	0.509200	5.861078	0.098692	3.411219	0.001168	7.031842
	(4.58638)	(3.74723)	(6.86441)	(3.14210)	(5.61940)	(3.37004)	(7.58774)
2	0.321786	0.423933	1.867480	2.873555	5.496460	0.185224	2.867315
	(3.83201)	(4.30954)	(5.00784)	(5.28889)	(7.27985)	(3.68262)	(6.11283)
3	5.494756	0.297142	12.59926	2.293175	7.531693	0.178857	2.956847
	(8.41190)	(5.71749)	(10.2299)	(5.58006)	(8.18855)	(4.53514)	(6.76791)
4	10.91143	0.269793	29.52399	2.442129	29.33531	0.162560	12.27671
	(10.5736)	(6.96337)	(14.0807)	(6.42540)	(13.8843)	(5.33747)	(11.0853)
5	9.697124	0.419004	27.60892	3.019218	25.77175	0.157826	12.55131
	(10.4183)	(8.67564)	(13.8914)	(7.23207)	(12.7059)	(5.90421)	(11.5839)
6	8.223616	1.350076	23.64397	3.389780	24.57340	0.174408	11.78276
	(10.2188)	(10.3258)	(13.3445)	(8.01547)	(12.2771)	(6.36695)	(11.9457)
7	7.904969	1.644633	23.23820	3.510122	23.86797	0.189440	13.78304
	(10.7207)	(11.3843)	(13.1240)	(8.39623)	(11.9172)	(6.69337)	(12.5798)
8	7.706414	1.613957	22.06696	3.482324	22.94599	0.373859	14.11786
	(10.7795)	(12.2195)	(12.6007)	(8.54179)	(11.4913)	(6.90597)	(12.7251)
9	7.625075	2.408225	22.08608	3.417156	24.23885	0.397964	14.27674
	(10.8542)	(12.7537)	(12.3192)	(8.58850)	(11.2633)	(7.08550)	(12.8608)
10	7.867190	3.947697	21.60242	3.369926	24.20698	0.410325	14.14179
	(11.1178)	(13.3507)	(12.2218)	(8.61221)	(11.1961)	(7.24367)	(12.6515)
Variance Decomposition of Interest rate:							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.296320	0.345437	0.199555	2.572069	0.090466	0.127986	0.025517
	(3.27837)	(3.49938)	(3.39577)	(5.06687)	(3.09135)	(3.06421)	(3.08647)
2	10.94834	0.546355	22.28548	1.945962	8.611437	0.064468	5.788092
	(10.4558)	(5.45497)	(12.7708)	(5.40299)	(10.0124)	(4.16298)	(8.23656)
3	17.55354	0.457073	38.58293	1.957168	34.32613	0.048037	21.24122
	(12.1205)	(6.77583)	(14.5795)	(6.44069)	(14.9583)	(5.05421)	(13.2028)
4	14.29685	0.791730	33.83709	3.118793	30.44185	0.106886	21.44823
	(11.5728)	(8.51729)	(14.9025)	(7.74141)	(13.9360)	(5.91855)	(13.6191)

5	12.15885	1.145514	28.36896	4.024326	27.65853	0.124954	19.91656
	(11.0662)	(10.2786)	(14.3679)	(8.77813)	(13.3146)	(6.51673)	(13.7530)
6	11.47529	1.743610	26.54680	4.198515	26.39182	0.155065	19.55691
	(11.1532)	(11.6315)	(13.9837)	(9.24462)	(12.5701)	(6.92083)	(13.9040)
7	11.15957	1.799066	25.46401	4.052856	25.77916	0.211536	19.36970
	(11.0857)	(12.3492)	(13.3633)	(9.26817)	(12.1286)	(7.08594)	(14.0571)
8	11.04858	2.166281	25.17870	3.919121	26.57695	0.265306	19.39213
	(11.0872)	(12.9374)	(12.9618)	(9.23089)	(11.7110)	(7.25832)	(14.0306)
9	10.86767	2.756769	24.75567	3.833200	26.50763	0.428418	19.16501
	(11.4204)	(13.6754)	(12.6860)	(9.23959)	(11.6417)	(7.53649)	(13.6936)
10	11.48648	2.722088	24.96928	3.746972	26.91800	0.553008	19.26019
	(11.4819)	(14.0586)	(12.6825)	(9.24362)	(11.7987)	(7.75017)	(13.5895)
Variance Decomposition of Real effective exchange rate growth:							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	1.037545	7.929898	1.115141	2.053404	10.99407	0.079865	2.653181
	(3.85184)	(7.84538)	(4.00935)	(4.78998)	(8.44369)	(3.08283)	(5.19374)
2	0.217805	2.164112	1.067552	0.955446	2.895809	0.631675	1.491268
	(3.83001)	(4.92957)	(4.87432)	(4.01222)	(4.60540)	(4.19855)	(4.76983)
3	12.42409	2.390389	24.26487	1.361459	11.74736	0.488075	6.204974
	(10.5898)	(6.56836)	(12.8643)	(4.96601)	(10.6283)	(4.91324)	(8.25546)
4	17.38501	1.852819	37.61893	3.831736	43.44451	0.480828	20.12286
	(11.2312)	(7.38767)	(13.2917)	(6.77924)	(14.3100)	(5.59378)	(12.5328)
5	15.90927	2.051522	33.95782	5.613527	37.13713	1.085145	18.72729
	(10.5002)	(8.97560)	(12.4034)	(7.46075)	(12.4164)	(6.26073)	(11.7580)
6	15.01673	1.887253	31.87129	6.053369	35.17515	1.492224	17.43443
	(10.3035)	(9.88713)	(11.8892)	(7.92252)	(11.6584)	(6.53463)	(11.6434)
7	14.72074	1.969615	30.91256	5.999358	33.81335	1.633863	17.94357
	(10.4152)	(10.8857)	(11.1675)	(7.94584)	(11.2708)	(6.76077)	(11.2953)
8	14.27391	1.952914	29.84352	6.212407	32.91042	1.883868	17.35178
	(10.4556)	(11.5167)	(10.9148)	(7.96764)	(10.9421)	(6.86550)	(11.4482)
9	14.00597	2.121119	29.31501	6.329115	32.04911	1.886745	16.94307
	(10.5147)	(12.1207)	(10.9603)	(8.15769)	(10.9628)	(7.03869)	(11.5186)
10	13.95305	2.037264	28.39173	6.319396	31.33255	1.946901	17.90907
	(10.8341)	(12.6460)	(10.9681)	(8.19083)	(11.0738)	(7.25285)	(11.4780)
Cholesky Ordering: Specification of oil price shock, Real GDP growth, Real wage growth, Inflation, Interest rate, Real effective exchange rate growth							
Standard Errors: Monte Carlo (1000 repetitions)							

Ukraine

Variance Decomposition of Real GDP growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.133603	0.082240	1.000239	7.226986	0.000667	0.490041	0.086759
	(2.96517)	(3.05371)	(3.89957)	(7.11924)	(2.99729)	(3.64966)	(3.15776)
2	5.976131	13.31792	3.137721	11.97699	0.581710	10.90108	2.944890
	(7.92522)	(10.2699)	(6.50572)	(9.14558)	(4.78639)	(9.41494)	(6.76716)
3	11.76192	24.48481	3.555477	18.93399	0.903096	18.76403	4.166328
	(9.49358)	(11.9816)	(7.24002)	(10.5410)	(5.88274)	(11.2087)	(8.01369)
4	15.48661	26.81729	2.997762	25.22432	1.606664	20.27410	3.589372
	(10.2745)	(12.5439)	(7.23238)	(11.6514)	(6.53907)	(11.7217)	(8.21518)
5	15.27433	26.85319	2.543361	26.59175	1.593259	23.01945	3.387774
	(10.0384)	(13.0987)	(7.49453)	(11.9518)	(6.64088)	(12.9593)	(8.55768)
6	15.16186	23.68104	2.514786	25.71140	1.462813	20.22077	2.881995
	(9.79618)	(12.3252)	(7.84123)	(11.7800)	(7.18099)	(11.8476)	(8.54935)
7	16.04868	22.48843	2.615626	25.53911	1.405753	19.97152	2.951068
	(9.90906)	(12.9365)	(8.31107)	(11.1812)	(7.68501)	(12.3499)	(9.05390)
8	17.17552	20.82093	2.635817	27.03817	2.159943	18.96802	2.815903
	(10.1096)	(12.8921)	(8.70801)	(11.0412)	(8.32716)	(12.1297)	(9.45909)
9	18.60337	19.97721	5.284158	27.72836	7.716653	18.78402	4.266923
	(10.3881)	(13.2017)	(9.36325)	(11.0753)	(9.31040)	(12.4424)	(9.76729)
10	19.75163	19.42071	5.144698	28.73814	7.617709	18.42607	4.179200
	(10.6542)	(13.4571)	(9.63347)	(11.2538)	(9.53068)	(12.3857)	(10.2879)
Variance Decomposition of Real wage growth							
Period	SP_1	SP_2	SP_3	SP_4	SP_5	SP_6	SP_7
1	0.061506	0.013647	0.643164	2.406637	2.661056	0.066491	0.384390
	(3.07408)	(3.03807)	(3.82056)	(5.05695)	(5.07097)	(3.01488)	(3.78569)
2	7.289996	12.43946	0.675071	11.66174	2.869486	5.014102	2.021926
	(8.51204)	(10.3517)	(4.99032)	(9.53727)	(5.98577)	(7.72721)	(6.63202)
3	14.73604	17.80829	8.784634	22.52632	3.148323	7.892935	10.84530
	(9.70714)	(9.98657)	(9.02090)	(10.9348)	(6.01377)	(7.98558)	(9.72991)
4	20.31806	28.26958	7.668569	35.82325	4.593918	15.05377	9.593742
	(11.0418)	(12.2434)	(8.35088)	(12.3782)	(6.79669)	(10.3722)	(9.51194)
5	21.15365	31.56327	10.97391	37.35048	7.512067	18.74248	10.98707
	(11.3492)	(12.8798)	(10.1113)	(12.5062)	(8.70434)	(11.6496)	(10.9844)
6	20.38631	28.89843	9.292570	35.62589	6.860821	18.96535	9.262421
	(11.3956)	(13.2332)	(9.65815)	(12.7889)	(8.88646)	(12.1000)	(10.5168)
7	19.54846	28.46265	8.819910	33.91909	6.289829	20.11586	8.421382
	(11.2443)	(13.9251)	(9.65266)	(12.4525)	(8.89314)	(12.7883)	(10.8290)
8	20.23252	26.67390	8.199126	32.98652	6.050474	19.85141	7.945060

	(11.1698)	(13.9558)	(10.0446)	(12.2800)	(9.24260)	(12.9616)	(11.0942)
9	22.16081	25.65949	8.618343	33.41778	7.333006	19.58089	8.307514
	(11.3144)	(14.2721)	(10.5321)	(12.1783)	(9.88635)	(13.1893)	(11.4861)
10	24.38759	24.92290	8.464109	35.25071	7.182469	19.04409	8.210381
	(11.5313)	(14.3667)	(10.8414)	(12.1683)	(10.0965)	(13.2594)	(11.8138)
Variance Decomposition of Inflation							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.647560	0.008174	0.213070	5.813035	0.926617	0.084258	0.469905
	(3.68082)	(3.02518)	(3.54599)	(6.86459)	(4.17930)	(3.03185)	(3.68665)
2	4.161627	4.580618	0.237447	9.813209	0.677299	1.496681	0.454633
	(7.23550)	(7.35185)	(4.71034)	(9.12366)	(4.72061)	(5.43571)	(5.08412)
3	8.928100	14.52934	0.808081	20.50800	1.278234	5.573383	3.114002
	(9.41788)	(10.5391)	(5.50370)	(11.6548)	(5.22086)	(7.62212)	(7.43747)
4	15.76696	25.59226	0.851431	32.28410	5.441271	14.85305	3.948656
	(11.2939)	(12.8132)	(6.73576)	(13.2110)	(8.05846)	(11.0608)	(8.90873)
5	16.62008	27.73259	3.000419	34.48408	6.183838	18.13775	4.960716
	(11.4926)	(13.3713)	(8.12241)	(13.5593)	(7.55286)	(12.4617)	(10.0777)
6	15.98653	26.05033	2.593724	32.83637	5.479252	17.43158	4.351852
	(11.2580)	(13.4753)	(8.21567)	(13.2624)	(8.03926)	(12.3410)	(9.90750)
7	16.32204	25.38499	2.568296	31.95025	5.101664	18.06241	4.134630
	(11.1430)	(13.8949)	(8.79115)	(12.4580)	(8.39736)	(12.6181)	(10.4216)
8	17.59057	23.22659	2.385671	32.08599	4.893596	17.17083	3.984932
	(11.2724)	(13.8753)	(9.28873)	(12.1035)	(8.93537)	(12.6292)	(10.7266)
9	19.20282	21.75637	3.432740	32.50122	6.354564	16.59457	4.592381
	(11.5119)	(14.2766)	(9.90705)	(11.9783)	(9.67333)	(12.8619)	(11.0689)
10	20.84236	21.03767	3.465255	33.72323	6.827700	16.07064	4.549254
	(11.7367)	(14.3650)	(10.2544)	(12.0833)	(10.1388)	(12.8889)	(11.4763)
Variance Decomposition of Interest rate							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	9.979567	15.86062	23.71331	6.945869	12.57156	8.748865	16.26913
	(8.33468)	(9.54896)	(10.9033)	(7.05744)	(8.63938)	(8.50059)	(9.68701)
2	10.89859	15.34598	27.99236	6.902053	20.11249	9.692184	14.54553
	(9.33492)	(10.3664)	(12.1579)	(7.65054)	(11.3073)	(9.37460)	(10.3175)
3	13.46761	21.07045	29.06989	7.171149	29.46200	13.54447	14.59056
	(10.8202)	(12.2204)	(12.7395)	(8.15352)	(13.6980)	(11.2255)	(11.5534)
4	16.44012	26.91589	29.55415	7.372589	32.61634	17.17748	16.42075
	(11.8641)	(13.3520)	(13.0178)	(8.80539)	(14.5702)	(12.3888)	(12.5425)
5	18.47950	29.29136	25.97181	9.760955	29.49859	19.70764	14.67476
	(12.8117)	(14.0180)	(11.9365)	(10.3531)	(11.9416)	(13.0826)	(11.8368)

6	18.57849	29.01172	22.12938	10.70295	24.77302	19.27678	13.02329
	(13.1064)	(14.3957)	(11.2304)	(11.4343)	(10.7375)	(13.0625)	(11.3344)
7	17.91347	27.62143	20.22449	10.88443	22.85643	18.17701	11.88128
	(13.1142)	(14.2679)	(11.0695)	(11.7802)	(10.2568)	(12.7918)	(10.8064)
8	17.49514	27.32406	19.48336	10.57777	22.16349	17.56078	11.91124
	(13.0174)	(13.8571)	(10.9747)	(11.6507)	(10.2566)	(12.4667)	(10.7498)
9	17.49775	28.20396	19.09106	10.87948	21.64021	18.86438	12.58083
	(13.0066)	(13.5486)	(10.9496)	(11.4132)	(10.3398)	(12.3595)	(10.8760)
10	17.75805	28.86004	19.27024	11.53189	21.48162	18.85278	14.19949
	(13.0400)	(13.8065)	(11.0208)	(11.4233)	(10.5145)	(12.5649)	(11.1247)
Variance Decomposition of Real effective exchange rate growth							
Period	Oil price shock	Oil price shock^{+}	Oil price shock^{-}	NOPI	NOPD	SOPI	SOPD
1	0.224345	0.490306	5.736612	0.809212	10.85138	0.052779	5.058093
	(3.28328)	(4.26569)	(7.17087)	(3.94679)	(8.34436)	(2.89021)	(6.43438)
2	1.762583	2.282497	6.559104	0.766205	10.09941	1.252700	3.523015
	(5.34193)	(6.50984)	(7.54037)	(4.73936)	(7.63241)	(4.92220)	(6.13078)
3	5.573021	9.694930	10.42340	3.145257	12.81061	4.279441	9.343509
	(8.00807)	(9.11481)	(8.98002)	(6.09809)	(8.73951)	(7.41728)	(9.43322)
4	16.10592	16.69939	24.33876	4.811180	34.60259	9.244703	22.80101
	(10.0848)	(10.1141)	(11.5926)	(6.91995)	(12.3597)	(9.11071)	(11.7958)
5	22.41351	21.68143	23.51263	16.25833	33.60555	14.41134	22.50078
	(10.9029)	(11.1470)	(10.8991)	(9.63735)	(11.1302)	(10.0855)	(11.3575)
6	25.20069	30.15007	23.24473	21.55599	28.73153	19.34291	24.03388
	(11.3633)	(12.2724)	(10.8075)	(10.6746)	(10.3542)	(11.2249)	(11.4469)
7	26.99145	30.68813	24.41666	24.24366	27.98377	19.12521	23.34827
	(11.6560)	(12.1808)	(10.8288)	(11.2679)	(10.1760)	(11.7007)	(11.3465)
8	27.22897	31.55702	23.42253	24.82165	26.59819	21.01577	22.33569
	(11.7470)	(12.1912)	(10.7549)	(11.3759)	(10.3027)	(12.1618)	(11.5251)
9	26.72108	30.78747	21.55817	24.13351	23.91849	20.64429	20.89556
	(11.7073)	(12.3374)	(10.9484)	(11.4508)	(10.1956)	(12.3751)	(11.7226)
10	26.20520	29.92172	20.93217	23.38035	24.21579	21.30775	20.42498
	(11.7055)	(12.5475)	(10.9974)	(11.5370)	(10.3562)	(12.4865)	(11.7781)
Cholesky Ordering: Specification of oil price shock, Real GDP growth, Real wage growth, Inflation, Interest rate, Real effective exchange rate growth							
Standard Errors: Monte Carlo (1000 repetitions)							