Kazakhstan - The Real Currency and Growth Challenge for Commodity Producing Countries

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As burgeoning Chinese and Indian demand for commodities affects established global supply and demand curves, host producer countries are increasingly finding it necessary to manage domestic currency and growth dependencies on volatile commodity market dynamics. We use Kazakhstan's primary dependence on oil sector revenues to isolate and illustrate the extent to which that economy's GDP growth is vulnerable to exogenous commodity price fluctuations. The specific focus of this paper is on the relationship between real Kazakh GDP, real exchange rates and oil prices - using time series data for the period 2000–2010. Multivariate VAR analysis and Granger causality tests are carried out using both linear and non-linear specifications to capture oil price change effects.

Our work finds evidence of both linear and non-linear impact of oil price shocks on real GDP and real exchange rate. We also find that one of the key effects of oil prices on real economic activity relates to the real effective exchange rate. Though, oil price changes do not have a measurable direct impact on real GDP of Kazakhstan, they are shown to clearly indirectly affect it through their effect on real exchange rates. Indeed, results of the Wald, Granger multivariate causality, and Likelihood Ratio tests indicate that linear price change (and all other oil price transformations) is significant for the Kazakh system as a whole. In particular, asymmetric oil price increases in non-linear models are found to have positive impact on real GDP growth of a far larger magnitude than asymmetric oil price decreases adverse affects on real GDP. In an important learning for commodity dependent countries - we posit a real need for structural policy management of exchange dependencies in commodity price volatility.

Keywords: GDP; Real Exchange Rate; Oil prices

JEL codes: E58, F31, F43, Q43

Introduction

There is now a burgeoning body of empirical literature which examines central Asian economic development. However, one issue that remains unclear is the extent of the regional primacy of the relationship between commodity prices, GDP and economic growth. In order to provide insights into this important relationship – we apply a vector autoregression approach to this issue, using the country of Kazakhstan. Kazakhstan is selected as it possesses extensive natural resources and relies heavily on revenues from the export of primary commodities, in particular petroleum and natural gas.

Kazakhstan's dependence on revenues from the oil sector raises the possibility that the economy is vulnerable to external commodity price fluctuations – something which we *ex ante* expected would be clearly observable using our analytical approach. The relationship is important in the region since a drop in oil revenue levels, affected by the plummeting of world oil prices in the late 2008 has the capability of destabilizing the entire region of Central Asia and Russia. Specifically we expect that the volatility in oil prices would be expected to have a direct effect on Kazakhstan´s balance of payments and directly impact Kazakhstan´s foreign reserves for the period 2000 – 2010. It is the nature and the extent of this relationship that is the focus of this paper.

Researching the nature and extent of GDP/ commodity dependence is extremely important, since, as the Russian Rouble devaluation in 1998 showed - concentrated commodity dependence (especially in countries with emerging banking systems) will have a considerable impact on GDP of the country. There are three models that offer explanation of the oil price - macroeconomy relationship. Each presumes a symmetric relationship between oil price changes and output growth. These are: the model of real balances (supposes that oil price increases lead to inflation which lowers the quantity of real balances in the systems), the income transfer model (describing income transfer between oil exporting and oil importing countries) and finally the potential output model (suggesting that oil and capital are complements, so that an increasing oil price decreases the economy's productive capacity).

This oil price - macroeconomy relationship is expected to be different in oil importing and in oil exporting countries. Bernanke et al. (1997), Hamilton (2003), Hamilton and Herrera (2004), Lee et al. (1995), Jimenez-Rodriguez and Sanchez (2005), Hsing (2009), Abeysinghe (2001), Raymond and Rich (1997), Ghosh et al. (2009) have all conducted studies in different time series and concluded that there is a negative correlation between increases in oil prices and the subsequent economic downturns in oil importing countries. Gurvich et al. (2009), Tabata (2009), Ito (2008, 2009, 2010), Rautava (2004), Bjornland (2009), Korhonen, Mehrotra (2009), Aliyu (2009) have, conversely, found that there is a positive relationship between increases in oil prices followed by higher economic activity for oil exporting countries.

Bjornland (2009) provides the transmission channels of oil prices for macroeconomic behavior of oil exporting countries. She argues that for oil producing countries, higher oil prices may affect the economy in two ways: (1) through positive income and wealth effects and (2) through negative trade effects. Regarding the first channel, higher oil prices represent an immediate transfer of wealth from oil importers to oil exporters.

As for the second channel, since the oil importing trading partners will suffer an oil induced recession, they will demand less export of traditional goods and services from the oil exporting countries which might have a negative effect on the oil exporting countries. The net effect of the two channels, positive wealth effect and negative trade effect trade effect, therefore, is ambigiuous. As a consequence, there are mixed results on the effect of oil prices in oil exporting countries.

Bjornland (2009), Jimenez-Rodrıguez and Sanchez (2005), Korhonen, Mehrotra (2009) find a positive effect of higher oil prices on the growth rate of Norway, Russia, Kazakhstan, Iran, and Venezuela. And at the same time oil exporting countries like the United Kingdom and Canada have behaved more like oil importing countries, showing declining growth rates as a result of higher oil prices. Additionally, Tazhibayeva et al. (2008) conclude that in countries where the oil sector is large in relation to the economy, oil price changes affect the economic cycle only through their impact on fiscal policy. Once fiscal policy changes are removed, oil price shocks do not have a significant independent effect on the economic performance of the country. Indeed, Gurvich et al. (2009) showed that the price of oil has a significant effect on the economy of four out of the five oil producing countries (Norway, Russia, Iran, and Venezuela). However, they have not found evidence of oil price importance for Kazakhstani output.

Furthermore, the relationship between oil prices and growth rate seems to lose significance when the declines in oil prices occur. Mork (1989), Hamilton (2003), Jimenez-Rodriguez and Sanchez (2005), Jimenez-Rodriguez (2009), Lardic and Mignon (2008), Yang and Lam (2008), Cologni and Manera (2009) find asymmetry between the responses to oil-price increases and decreases by the GDP growth, concluding that the decreases are not statistically significant. Moreover, asymmetric effect of oil prices on GDP growth is commonly found for oil-importing countries. Bjornland (2009), Aliyu (2009), and Korhonen, Mehrotra (2009) contribute to this literature by finding asymmetric effects of oil price movements on GDP growth in oil-exporting countries, Norway, Nigeria, and Venezuela, respectively. Korhonen and Mehrotra (2009), however, were not able to reject the null hypothesis of linearity for Iran, Kazakhstan, and Russia.

The macroeconomic literature has identified several primary routes to the asymmetry between oil price changes and GDP responses. That includes the sectoral shifts hypothesis (costly rearrangement of factors across sectors that are affected differently by the oil price change); the demand composition route; and the investment pause effect (along the lines of the irreversible investment model, in which households and firms defer major purchases in the face of uncertainty). Ferderer (1996), Bernanke et al. (1997) have also found a significant relationship between oil price increases and counterinflationary policy responses.

As for the effect of oil prices on real exchange rate, Amano and Norden (1998), Huang and Guo (2007), Kutan and Wyzan (2005), Olomola and Adejumo (2006), Korhonen and Juurikkala (2009), Narayan et al. (2008) have found that an increase in oil prices leads to an appreciation of the domestic currency. However, Chen and Chen (2007) estimates suggest an opposite relationship, that a rise in real oil prices leads to a depreciation of the real exchange rate in the long-run. Korhonen, Mehrotra (2009) have found that a positive shock to real oil prices leads to an appreciation of the real exchange rate only in Iran and Venezuela. In case of Kazakhstan and Russia, the role of oil price shocks in explaining movement of real exchange rate is found to be negligible.

Kutan and Wyzan (2005) examine the vulnerability of Kazakhstan to the Dutch disease by estimating a real exchange rate equation that incorporates oil prices. Their results indicate that changes in oil prices have significant effects on movements in the real exchange rate, particularly, oil price increase leads to appreciation of the real exchange rate. They also provide a plausible explanation of this result. According to Kutan and Wyzan (2005) an increase in the price of oil, which improves oil exporting country's terms-of-trade, would imply an increase in export revenues. This leads to an increased spending of all goods, which increases domestic prices relative to foreign prices, causing an increase in the RER.

Closer to our analysis, there are a number of papers looking at the effects of oil price on oil-producing countries. Rautava (2004) develops a VAR model to examine dynamics of Russian economy and shows that oil has played a significant role in movements of Russian GDP. Higher oil price leads to higher GDP, in both the short and long run. On the other hand, in the model, a higher oil price does not lead to a stronger real exchange rate, although the author conjectures that this may be because of the estimation strategy. For another major oil producer, Norway, Bjornland (2004), using a structural vector autoregressive framework, shows that an oil price shock stimulates the economy temporarily but has no significant long-run impact. The author finds no evidence to support the proposition that a major part of real exchange rate appreciation in Norway was driven by oil price shocks. Aliyu (2009) assesses the effects of oil price shocks on the real macroeconomic activity in Nigeria. He finds evidence of both linear and non-linear impact of oil price shocks on real GDP. In particular, asymmetric oil price increases in the non-linear models are found to have positive impact on real GDP growth of a larger magnitude than asymmetric oil price decreases adversely affects real GDP. Korhonen, Mehrotra (2009) assess the effects of oil price shocks on real exchange rates and output in four major energy-producing countries: Iran, Kazakhstan, Russia, and Venezuela. Using structural vector autoregressive models, they find that higher real oil prices are associated with higher output, however, they also find that supply shocks are the most important driver of real output in all four countries, possibly due to ongoing transition and catching-up. Authors find that oil shocks do not account for a large share of movements in the real exchange rate. They investigate possible non-linearity in the system by testing a smooth transition regression (STR) model and find no evidence of non-linearity.

As for the effect of oil prices on the economy of Kazakhstan, there are few papers that address the issue. Korhonen, Mehrotra (2009) assess the effects of oil price shocks on real GDP and real exchange rate. They find a positive effect of oil prices on real GDP of Kazakhstan. Gurvich et al. (2009), on the other hand, have not found a significant effect of oil prices on real GDP of Kazakhstan. Regarding the influence of oil prices on real exchange rate, again results are not unanimous. Korhonen, Mehrotra (2009) have found that oil shocks do not account for a large share of movements in the real exchange rate. At the same time, Kutan and Wyzan (2005) results indicate that changes in oil prices have significant effects on movements in the real exchange rate. This heterogeneity of results raises a need for more empirical evidence of effect of oil prices on economic performance of Kazakhstan.

Period Of Analysis

Our analysis is conducted using quarterly data from 2000 to 2010, which is generally assumed to be a relative stable monetary policy regime in Kazakhstan. Using an earlier starting period would have made it difficult to identify one policy regime. Before their respective financial crises - in August 1998 for Russia and April 1999 for Kazakhstan - both Russia and Kazakhstan used the nominal exchange rate as the nominal anchor - a common practice in transition economies (Korhonen and Mehrotra, 2009). However, fiscal policy in Russia was not compatible with a fixed exchange rate, and eventually the rouble was allowed to float. To keep export competitiveness, Kazakhstan was forced to follow the same practice.

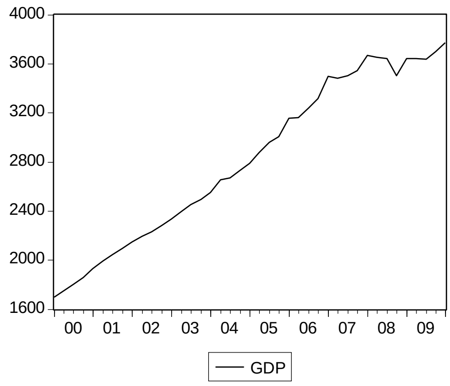
After abandoning the fixed exchange rate regime, Kazakhstan have chosen a policy where the central bank and government agree on inflation targets (Monetary Policy Guidelines, National Bank of Kazakhstan) but there is also a publicly announced ceiling for appreciation of the real exchange rate. In addition, since interbank markets do not yet function very efficiently, the Central Bank of Kazakhstan´s main policy tool continues to be foreign currency intervention. The exchange rate against the US dollar was very stable between 2000 and 2004, after which it has been allowed to appreciate slightly.

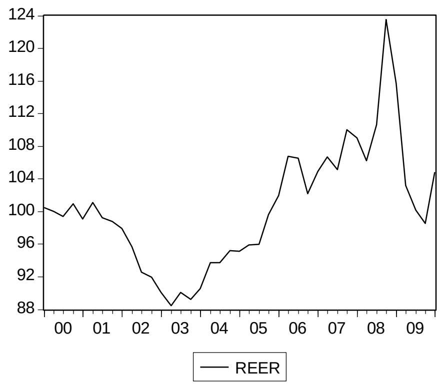
Recent efforts by the Kazakhstan Central Bank to manage the Tenge to a trading band and restore fiscal probity have begun to redress the flawed approach of providing unconstrained and expensive downside structural support, to the extent that there is 2009/10 evidence that the government is buying up USD in the domestic market in an attempt to prevent Tenge appreciation and volatility. These factors have led to a situation where the Tenge’s exchange rate has sometimes been rather tightly managed. Therefore, Kazakhstan can be said to manage its exchange rate fairly tightly, even though it is not officially pursuing a policy of fixed exchange rates.

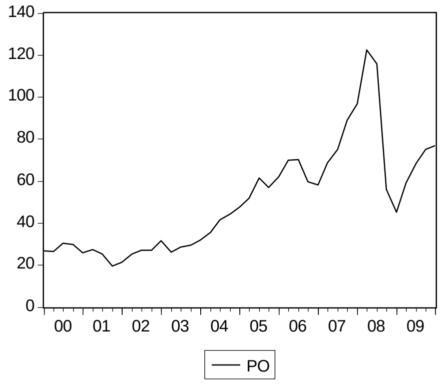
Data

We use quarterly data from the first quarter of 2000 to the first quarter of 2010 to estimate a VAR model that includes Kazakhstani GDP, the exchange rate, and international oil prices as endogenous variables. The data for Kazakhstan is based on IHS Global Insight information and oil prices are taken as Dated Brent Monthly Price Crude Oil (petroleum).

We observe a steady rise in oil prices from the 2000; with oil price hikes in 2008 up to $150 per barrel. Since then the oil price has declined with a slight rise recently.







We notice a steady rising trend in real GDP. The average annual growth rate over the period 2000–2010 has been 9.5 per cent. The growth rate has been more alarming the last year: the annual economic growth rate was around negative 2 per cent.

Methodology

Consistent with most recent VAR studies, the variables are specified in levels.
Sims et al. (1990) argue for using VAR in levels as a modelling strategy, as one avoids the danger of inconsistency in the parameters caused by imposing incorrect cointegrating restrictions; though at the cost of reducing efficiency. However, since monetary policy responds to deviations from the potential level of output rather than the level itself, we have included a linear trend in the VAR. The inclusion of a trend also serves as a good approximation for ensuring that the VAR is invertible if the variables are non-stationary, in particular given the short time span of data used.
We consider the following vector autoregression model of order *p* (or simply, VAR (*p*)):

$$y_t = c + \sum_{i=1}^{p} \Phi_i y_{t-i} + \varepsilon_t \qquad (1)$$

where y_t is a (n × 1) vector of endogenous variables, $c = (c_1\ldots, c_3)'$ is the (3 × 1) intercept vector of the VAR, Φ_i is the ith (3 × 3) matrix of autoregressive coefficients, and $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t})'$ is the (3 × 1) generalization of a white noise process.

In order to assess the impact of shocks on endogenous variables, we examine both the orthogonalized and accumulated impulse-response functions, using Cholesky decomposition. The paper assumes the following ordering of the three variables used in the VAR: real oil price, real GDP, real exchange rate. We choose an ordering for the variables in the system so that we only allow for a contemporaneous correlation between certain series. Recursive (Cholesky) ordering implies that the first variable in the system will not react contemporaneously to any shocks in the remaining variables, but all other variables can react to shocks in the first variable, and so forth. This restriction concerns contemporaneous relations only. After one period (one quarter in the present analysis), all variables can react to all shocks.

In addition to estimating the impulse response and variance decomposition, the bivariate and multivariate Granger causality tests were also carried out in order to ascertain whether there is a statistically significant relationship between oil prices and the important macroeconomic variables.

We conduct tests for stationarity of the series using Augmented Dickey Fuller (ADF) and Phillips and Perron (PP) tests as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2\, trend + \sum \beta_j \Delta y_{t-j} + \mu_t \qquad (2)$$

The models estimated employ both the linear and non-linear oil price transformations to examine various short run impacts. The two non-linear price measures utilized in the paper follow Mork's (1989) asymmetric specification, in which increases and decreases in the price of oil are considered as separate variables, and Hamilton's (1996) net specification, where the relevant oil price variable is defined to be the net amount by which these prices in quarter *t* exceed the maximum value reached in the previous four quarters.

Mork´s (1989) asymmetric specification models the positive and negative oil price changes separately. That is, the oil price shock variable is included in the regression framework as follows, where o_t is the rate of change of oil price in period *t*:

$$o_t^- = \begin{cases} o_t \; if \; o_t \succ 0 \\ 0 \; otherwise \end{cases} \qquad (2a)$$

$$o_t^- = \begin{cases} o_t \; if \; o_t \prec 0 \\ 0 \; otherwise \end{cases} \qquad (2b)$$

Lee et al. (1995), and Hamilton (1996), observe that oil-price increases after a long period of price stability have more dramatic consequences than those that are merely corrections to greater oil-price decreases during the previous quarter. The Hamilton's (1996) non-linear transformation, which he calls net oil price increase (NOPI) is defined as following:

NOPI = max {0, o_t – max {o_{t-1}, o_{t-2}, o_{t-3}, o_{t-4}}} (3)

Hamilton's definition is also asymmetric in the specific sense because it captures oil price increase-type shocks while neglecting the impact of oil price declines. Lee et al. (1995) model the conditional volatility of oil prices using Generalized Autoregressive Conditional Heteroscedasticity, i.e. AR(4)-GARCH(1,1) process as follows:

$$o_t^r = \alpha_0 + \alpha_1 o_{t-1}^r + \alpha_2 o_{t-2}^r + \alpha_3 o_{t-3}^r + \alpha_4 o_{t-4}^r + e_t \qquad (4)$$

$$e_t | I_{t-1} \sim N(0, h_t)$$

$$h_t = \gamma_0 + \gamma_1 e_{t-1}^2 + \gamma_2 h_{t-1} \qquad (5)$$

$$SOPI = \max\left(0, \, e_t / \sqrt{h_t}\right) \qquad (6a)$$

$$SOPD = \min\left(0, \, e_t / \sqrt{h_t}\right) \qquad (6b)$$

where o_t^r is the real oil-price change and SOPI stands for scaled oil price increases, while SOPD for scaled oil price decreases. The scaled oil price measure is, however, not used in the paper.

Empirical Results

In this section we analyze the empirical results for the linear and the two non-linear models described in the previous section. Firstly, we run the unit root tests using the ADF and the PP techniques as specified in equation (2). Then we carry out the Wald tests for the joint significance of the oil price coefficients in the VAR model. Finally, we analyse the impulse functions and the accumulated responses and error variance decompositions.

Unit Root Test

The main motivation behind tests for unit roots is to see whether shocks to a series have permanent or transitory effects. A unit root in a time series variable implies that the mean and the variance are not constant over time, and the covariance between any two values of the series depends on the actual times at which the variables are observed. This implies that a shock to the variable takes it away from its equilibrium and the series, thus, establishes a new equilibrium. This means that a shock to the variable has a permanent effect on it. When the mean, variance and covariance of a variable are constant, shocks will not lead to a permanent change in equilibrium. Following a shock, the variable will change course; however, after a short period of time it will return to its pre-shock equilibrium.

The estimation results are presented in Table 1. The appropriate lag level applied in the unit root test follows the SIC criterion. Results show that all variables except for nonlinear oil prices are nonstationary at level. Meaning, the hypothesis of unit root could not be rejected at some percent level. The real oil price, real GDP, real effective exchange rate are only stationary at the first difference level. Three nonlinear oil price measures, NOPI, asymmetric oil price increase and asymmetric oil price decrease, are stationary at levels.

Table 1
Unit Root Tests

	Level		First Difference	
Variable	ADF	PP	ADF	PP
GDP	-0.53	-0.44	-7.48***	-7.56***
exrate	-1.73	-1.19	-4.13**	-4.05**
po	-1.17	-1.05	-5.4***	-5.01***
popos	-22.36***	-21.35***	-18.99***	-74.46***
poneg	-39.88***	-53.56***	-5.72***	-85.39***
nopi	-4.50***	-4.42***	-9.42***	-11.48***

* (**,***) indicate significance at 10, 5, and 1 percent respectively.
Note: Lag length was chosen in line with the Schwarz information criterion.

Testing For Significance And Granger-Causality

The paper investigates the relationship between oil prices and the macroeconomic variables of the model with emphasis on the impact of oil prices on real activity. We run tests for both linear and non-linear specifications of oil price models. First, the Wald test statistic is calculated which tests the null hypothesis that all of the oil price coefficients are jointly zero in the GDP and Exchange rate equations of the VAR model. Table 2 reports the results of the Wald, multivariate and bivariate Granger causality test statistics and the corresponding p-values. The Wald test statistic for GDP equation indicates that we reject the hypothesis that the different oil prices variables in the linear and non-linear models are statistically significant at the 5 percent level. This implies that oil prices do not have a significant direct impact on real activity in the Kazakhstan economy. However, the Wald test statistics indicate that we accept the hypothesis that the different oil prices variables in the linear and non-linear models are statistically significant at the 5 or better percent level in the real exchange rate equation. This implies that oil prices have a significant direct impact on the real exchange rate of Kazakhstan.

Jimenez-Rodriguez and Sanchez point out that it could well be the case that oil prices do not affect GDP directly, but through third variables in the system. To examine this possibility, the significance of the oil price variable under consideration for the VAR system as a whole is tested, the null hypothesis being that all of the oil price coefficients are jointly zero in all equations of the

VAR system but its own equation. The Likelihood Ratio test is used in order to test this hypothesis. Let the VAR model be rewritten as follows:

$$y_{1t} = c_1 + D_1' x_{1t} + D_2' x_{2t} + \varepsilon_{1t}$$
$$o_t = c_2 + C_1' x_{1t} + C_2' x_{2t} + \varepsilon_{2t}$$

where y_{lt} is the vector of variables other than oil price, x_{1t} contains lags of y_{1t}, o_t represents the real oil price, and x_{2t} contains lags of o_t. Then the null hypothesis would be the following:

H0: All oil price coefficients are jointly zero in all equations of the system but its own equation, i.e. D_2=0. The statistic is as follows:

$$2 \times [L(\theta_1) - L(\theta_2)] \overset{a}{\sim} \chi^2 (rows(y_{1t}) \times p)$$

where $L(\theta_1)$ and $L(\theta_2)$denote the value of the log likelihood function of the unrestricted and restricted models, respectively. p-values of the asymptotic distribution are reported for the different specifications considered.

It is found that the all oil price variable: in the linear model, the positive and negative changes in the asymmetric model, and net oil price specification are significant for the whole model. This result confirms that though there is no direct impact of oil prices on real GDP of Kazakhstan, they still affect the real activity of the country through their effect on other variable in the system, real exchange rate.

Table 2

	Model			
Test	Linear	Oil Price+	Oil Price-	NOPI
Wald (GDP)	2.19 (0.33)	3.86 (0.14)	2.53 (0.28)	1.39 (0.49)
Wald (REER)	24.56 (0.00)	9.66 (0.008)	6.41 (0.04)	5.97 (0.05)
Likelihood Ratio	0.032 (0.0005)	3.45E-04 (1.2E-0.6)	4.1E-04 (8.7E-08)	9.2E-03 (3.3E-05)
Block Granger causality	30.98 (0.00)	15.00 (0.02)	15.00 (0.02)	10.26 (0.03)

Finally, some so-called tests of block exogeneity are performed, including two multivariate Granger causality tests. First, the null hypothesis that the oil price variable under consideration is Granger-caused by the remaining variables of the system is tested. Results – though not reported, tell us to reject the null hypothesis except in the linear and NOPI specifications. Second, it is tested whether a given oil price variable Granger-causes the remaining variables of the system, obtaining that oil price variables generally Granger-cause the remaining variables of the system at the 5% significance level. In sum, the results show that the interaction between oil prices and macroeconomic variables is generally significant, with the direction of causality going in at least one direction.

Impulse Response Functions And Accumulated Responses

Now we examine the effects of oil prices on real GDP growth using both the orthogonalised impulse-response functions and accumulated responses for the linear, net and the non-linear specifications of the model. We can derive the specification for the impulse response function that describes the response of $y_{i,t+s}$ to a one-time impulse in y_{jt}, where all other variables are held constant.

The matrix φ in Equation (7) can be described as follows:

$$\frac{\partial y_{i,t+s}}{\varepsilon_t'} = \varphi \qquad (9)$$

Equation (9) shows that the row *i* column *j* element of φ gives the outcome of a one-unit increase in the *j*th variable's innovation at date *t* (ε_{jt}) for the value of the *i*th variable at time *t*+*s* ($y_{i,t+s}$), holding all other innovations, at all time periods, constant. A plot of the row *i*, column *j* element of φ, $\partial y_{i,t+s}/\partial \varepsilon_{jt}$ as a function of *s* is the impulse response function. In essence, the impulse response function describes the response of $y_{i,t+s}$ to a one-time impulse in y_{jt} with all other variables held constant.

We also examine the effect of oil price shock on the level of real exchange rate. Since Kazakhstan is the oil producing country, Kazakhstani real exchange rate appreciates when higher oil prices lead to higher inflow of foreign exchange into the economy. Although this may sound good for the economy, it, however, has serious implications on real economic activities and the foreign scene due to the heavy reliance of the economy on foreign inputs. Figures 1, 2 and 3 present the orthogonalized impulse responses functions and the accumulated responses of GDP growth and real exchange rate to one standard deviation oil price shock across the three oil price specifications, respectively.

The level of GDP increases as a result of an oil price shock for linear and asymmetric oil price specifications. This is expected, as a positive shock to oil price represents a positive supply shock for a major oil-producing economy. It induces an increase in incomes and wealth and supports consumption, given a constant propensity to consumption from income and wealth.

The responses of real GDP to oil price innovations from the orthogonalized impulse response functions are strong across all the time horizons. Starting with the linear specification, the impulse responses from the orthogonalized functions as presented in Figure 1 reveal that real GDP in Kazakhstan is positively affected by oil price shocks reaching about 0.5 percent in one year following the oil price shock. However, in the long run the effect of oil price innovation on real GDP of Kazakhstan diminishes and asymptotically gets to zero after three years following the shock.

The asymmetric specification´s orthogonalized and accumulated impulse responses functions are presented in Figure 2. In all, the negative and positive impact of asymmetric oil price shocks to real GDP is less than 1 percent across the time horizons. As for the accumulated responses, Figure 2 shows that the accumulated responses of an asymmetric oil price innovations is positive for asymmetric price increase and negative for price decrease throughout the time horizons. While the linear model supposes that the effects of an oil price increase and those of a decline are totally symmetric, nonlinear specifications allow for differential impacts of oil shocks. With respect to the magnitude of the accumulated response, as expected, the impact of the oil price increase on real GDP outweighs the impact of the oil price decrease. The result shows that Kazakhstan benefits more from asymmetric oil price increases than it suffers from asymmetric price decreases. This result is consistent with a finding by Jimenez-Rodriguez and Sanchez (2005) for UK and Norway, two net oil exporting countries.

As for the net oil price specification, the impulse responses from the orthogonalized functions as presented in Figure 3 reveal that real GDP in Kazakhstan responds positively to oil price innovations by up to 0.05 percent in the first six months following the shock. This, however, turns then into negative and persists throughout the time horizon. The accumulated responses were however, more robust. It reaches up to 4.66E-04 percent in first six months, and remains negative thereafter reaching -0.1 percent two years after the oil price shock. This result is consistent with a finding by Jimenez-Rodriguez and Sanchez (2005) for UK, net oil exporting country, which exhibited a loss of GDP growth rate of more than 1% in the first year after an oil price increase of 100% in all their specifications.

Assessing the real exchange rate responses to oil price innovations is another important channel for understanding the impact of oil price shock on the overall macroeconomy. The results for all oil price specifications show that the real exchange rate responds negatively first 6-8 months after oil price shock, turning then into positive and remaining that way throughout the time horizon. As for accumulated response, results show that the increase in oil price leads to appreciation of a real exchange rate after 6 months following the shock. In case of oil price decrease, the effect on real exchange rate will be depreciation of it with lesser magnitude than with oil price increase. Generally, there is a consensus across the models – in the medium and long terms that oil price innovations in Kazakhstan result in real exchange rate appreciation which is consistent with the theory.

Variance Decomposition Analysis

Under this section, the forecast error variance decomposition tells us exactly how much of the unanticipated changes of the variables are explained by different shocks. The variance decomposition generally suggests that oil price shocks, except the net oil price specification, are considerable source of volatility for most of variables. Tables 4 through 6 present the results of the forecast error variance decomposition of the real GDP. Table 4 shows that the linear oil price accounts for less than 20 percent of real GDP's variability. Contemporaneously and over the time horizon, real GDP drives its own variance by over 70 percent. In the NOPI specification, oil price innovations, for instance, account for less than 2 percent of the variance of the real GDP. Lastly, the combined share of the asymmetric oil price increase and decrease account for more than 40 percent of the variance of the real GDP. These results are consistent with findings of Jimenez-Rodriguez and Sanchez (2005), whose estimates from the decomposition of the forecast error variance show that oil price shock account for 8 percent of Germany's output variability, 9 percent in the UK, and 5 percent in Norway, and of Aliyu (2009) for Nigeria who obtained from 8.8 to 18.9 percent for different oil price specifications. The finding on the contribution of oil shocks to output variability seems to lie within the range of estimates computed in more recent studies. However, Brown and Yucel (1999) found that that oil price shocks explain little of the variation in output.

Besides, oil price innovations significantly drive the variance of the real exchange rate. This result contradicts finding of Korhonen, Mehrotra (2009) who have found that oil shocks do not account for a large share of movements in the real exchange rate. On this basis, even though we find strong evidence for a relationship between GDP and commodity prices, we suggest that monetary policies often mask the rue extent of this relationship.

Conclusion

There is one active strand of literature that examines the relationship between real GDP and oil prices. Recent hikes and drops in oil prices have made this topic attractive for policy making. The existent literature, while in large part on developed countries, has established a strong influence of oil prices on the macroeconomy. One branch of this research states that oil prices are positively related to economic growth. As for the effect of oil prices on the economy of Kazakhstan, few papers that address the issue obtained heterogeneous results. In this paper, we examined the effect of oil prices on real GDP and real exchange rate for an oil producing country, Kazakhstan.

We find evidence of more significant positive effect of asymmetric oil price increase in Kazakhstan than adverse effect of asymmetric oil price decrease on the level of real GDP. Equally, the results from linear and net specification fall within the bound reported by similar studies in the area. Tests confirm the significance of the linear oil price coefficients in the VAR and those of asymmetric specification.

It is found that one of the key channels playing a role in the effect of oil prices on real activity is related to the real effective exchange rate. Though, oil price changes do not have a direct impact on real GDP of Kazakhstan, they indirectly affect it through their effect on real exchange rate. Our finding that an increase in oil prices leads to appreciation of real exchange rate is consistent with the literature on oil exporting countries. We feel that the institutional support and interference of the Central Bank is somewhat masking the affect of oil on GDP. As result we believe that as more data become available - our study opens up an interesting avenue for future work on the connectivity between monetary policy, oil price and economic growth in emerging commodity dependent economies.

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Figure 1

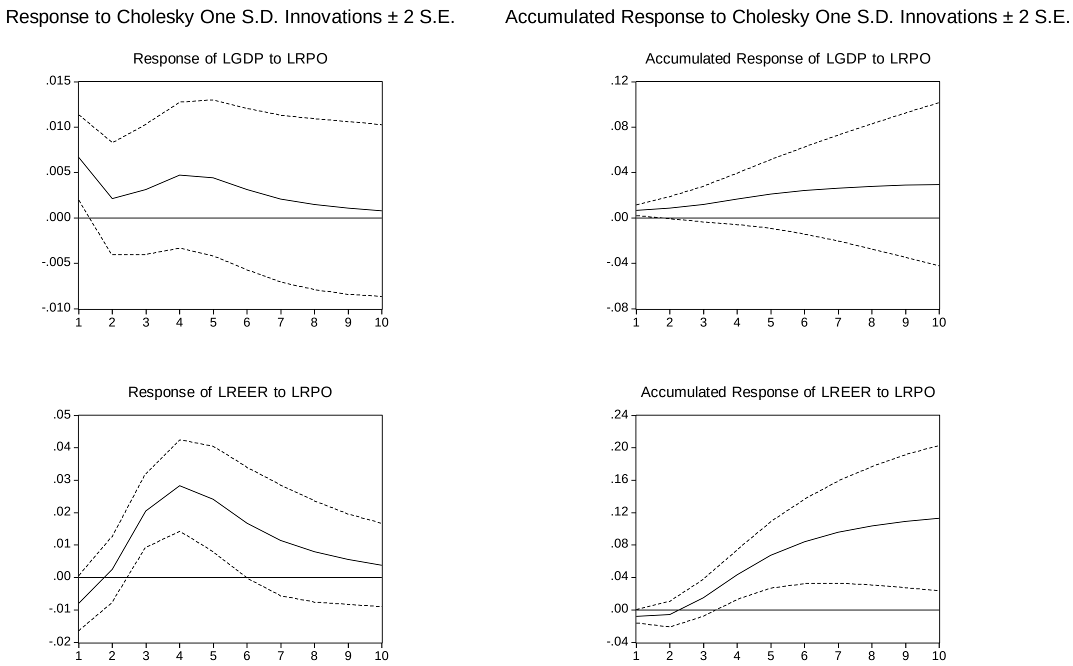
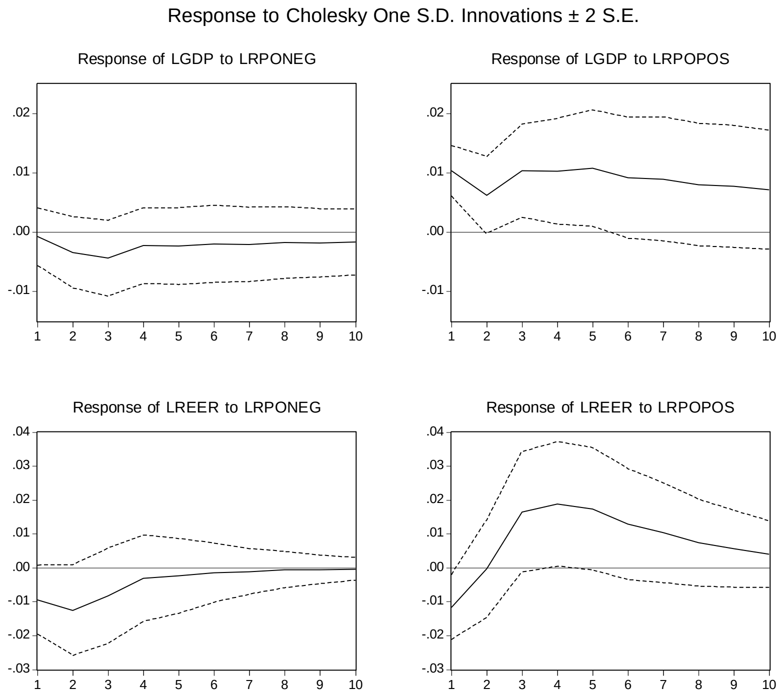


Figure 2



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

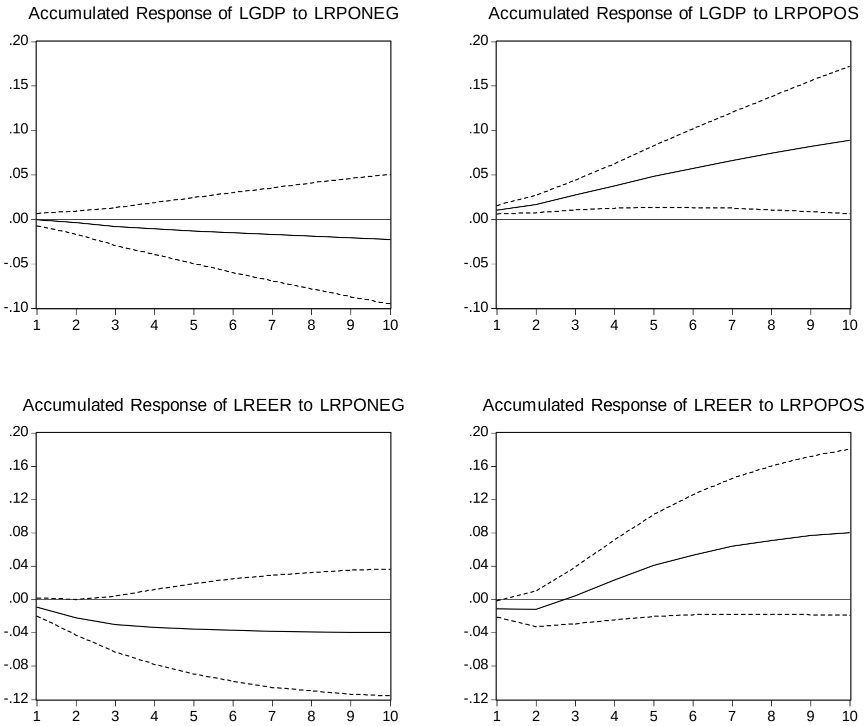
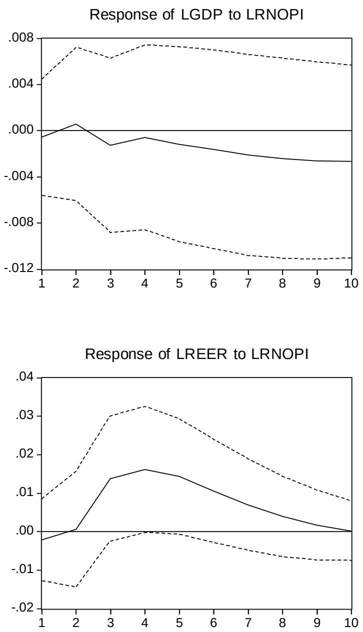


Figure 3

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



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

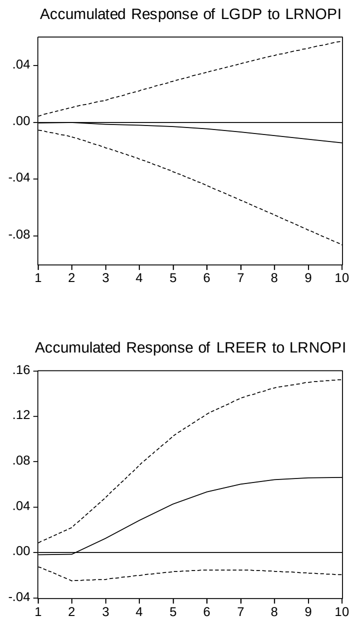


Table 4.

Variance Decomposition of LGDP:

Period	S.E.	LGDP	LREER	LRPO
1	0.015352	75.14418	6.006443	18.84938
2	0.019323	78.77728	8.115505	13.10722
3	0.022385	76.92474	11.37021	11.70504
4	0.025529	73.89607	13.72708	12.37685
5	0.028363	72.22363	15.34454	12.43182
6	0.030664	71.54948	16.76143	11.68909
7	0.032554	71.13193	18.08351	10.78456
8	0.034174	70.76175	19.26750	9.970751
9	0.035600	70.43149	20.28962	9.278887
10	0.036872	70.14267	21.16243	8.694900

Variance Decomposition of LREER:

Period	S.E.	LGDP	LREER	LRPO
1	0.027258	0.000000	91.48019	8.519807
2	0.031770	0.166845	92.95344	6.879717
3	0.038980	0.188318	67.42789	32.38379
4	0.048925	1.833945	44.09650	54.06956
5	0.055267	3.618230	34.95841	61.42336
6	0.058219	4.696868	31.61189	63.69124
7	0.059566	5.295729	30.20975	64.49452
8	0.060252	5.685621	29.52674	64.78764
9	0.060624	5.979181	29.17913	64.84169
10	0.060828	6.206852	29.00947	64.78368

Table 5.

Variance Decomposition of LGDP:

Period	S.E.	LGDP	LREER	LRPONEG	LRPOPOS
1	0.015198	49.80259	3.720522	0.250975	46.22591
2	0.019796	53.00974	6.691608	3.175732	37.12292
3	0.024305	45.09263	6.777821	5.416303	42.71325
4	0.028095	42.42773	7.670748	4.710200	45.19132
5	0.031800	40.38632	8.698886	4.232780	46.68202
6	0.034615	39.71318	10.05801	3.910074	46.31874
7	0.037095	38.96108	11.19338	3.734168	46.11137
8	0.039157	38.60822	12.28700	3.563519	45.54126
9	0.040998	38.28153	13.20415	3.450573	45.06374
10	0.042587	38.09678	14.02626	3.354897	44.52206

Variance Decomposition of LREER:

Period	S.E.	LGDP	LREER	LRPONEG	LRPOPOS
1	0.032245	0.000000	78.38368	8.563998	13.05232
2	0.044403	0.253990	80.36164	12.49371	6.890662
3	0.053041	0.178958	74.22582	11.22402	14.37120
4	0.058358	0.670305	67.55925	9.555828	22.21462
5	0.061717	1.329942	62.30813	8.702031	27.65990
6	0.063377	1.783031	59.57926	8.310632	30.32708
7	0.064362	2.095057	57.85577	8.090892	31.95828
8	0.064869	2.343866	56.95617	7.973183	32.72678
9	0.065179	2.529560	56.43102	7.905361	33.13406
10	0.065362	2.670758	56.15689	7.865452	33.30690

Table 6.

Variance Decomposition of LGDP:

Period	S.E.	LGDP	LREER	LRNOPI
1	0.015711	93.07627	6.798164	0.125567
2	0.019986	95.02479	4.818716	0.156489
3	0.023804	94.80628	4.793987	0.399731
4	0.026818	93.92683	5.710627	0.362547
5	0.029589	92.56897	6.972519	0.458515
6	0.031997	91.18201	8.169785	0.648202
7	0.034140	89.83424	9.212471	0.953290
8	0.036037	88.63241	10.06409	1.303496
9	0.037728	87.59905	10.73656	1.664387
10	0.039236	86.73978	11.25792	2.002292

Variance Decomposition of LREER:

Period	S.E.	LGDP	LREER	LRNOPI
1	0.033272	0.000000	99.58542	0.414582
2	0.045389	0.014340	99.74523	0.240430
3	0.051902	0.175965	92.61794	7.206091
4	0.055993	1.035625	84.43479	14.52959
5	0.058438	1.905849	78.75127	19.34288
6	0.059681	2.675645	75.65016	21.67420
7	0.060285	3.265802	74.14571	22.58848
8	0.060585	3.708176	73.50469	22.78714
9	0.060761	4.027961	73.24021	22.73183
10	0.060888	4.261927	73.10073	22.63734