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Does nominal exchange rate have a predictive power for oil and gas prices? The case of Russia

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DOES NOMINAL EXCHANGE RATE HAVE A PREDICTIVE POWER FOR OIL AND GAS PRICES? THE CASE OF RUSSIA

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RESEARCH PAPER APPROVAL

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TITLE: DOES NOMINAL EXCHANGE RATE HAVE A PREDICTIVE POWER FOR OIL AND GAS PRICES? THE CASE OF RUSSIA

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Since Russian economy heavily depends on the export of primary commodities, and fluctuations in the exchange rate between ruble and dollar have a significant impact on the country's GDP, Russia can be considered a commodity economy for which the nominal exchange rate can have predictive power for commodity prices. Followed Chen et al (2009) approach, we found very limited evidence that nominal exchange rate can help to predict oil and gas prices in Russia. The reverse relationship does not hold as well: Furthermore, the result appeared to be robust to using real CPI-based and real effective exchange rates as well as alternative currency benchmark. The possible explanation of the result can be the fact the oil and gas markets are more volatile than exchange rate market, thus the exchange rate cannot be used as a proper predictive instrument for Russia.

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CHAPTER 1

INTRODUCTION

The relationship between nominal exchange rate and its fundamentals is a subject to frequent discussions in the economic literature with most recent researches focused on the relationship between exchange rate and primary commodity prices[1]. The fluctuations in the word prices of primary commodities can be considered a proxy of terms of trade effect, and fundamental determinant of the nominal exchange rate. Furthermore, since the nominal exchange rate is treated as an asset price in exchange rate literature, it incorporates the expectations about future commodity prices for a country and helps to forecast them.

Commodity prices have an advantage over the traditional measure of terms of trade effect - export-to-import price ratio, since there are certain cases which make it meaningful to use the standard measure of terms of trade effect. For example, if prices are sticky and there is a perfect pass-through, the exchange rate will automatically exhibit co-movements with terms of trade effect without any causality between them. In the present research we focus on the commodity prices as a measure of terms of trade effect.

A recent paper, Yu-chin Chen and Kenneth Rogoff (2003) showed that export prices of commodities can predict real exchange rates in the countries which can be considered a “commodity economies”: small open economies with

floating exchange rate regime and dependence on export of primary commodities. They considered three OECD countries New Zealand, Australia and Canada to show that result holds for New Zealand and Australia and doesn't hold for Canada. Yu-chin Chen, Kenneth Rogoff and Barbara Rossi (2009) explored the forecasting ability of nominal exchange rate over commodity prices and showed that in New Zealand, Australia, Canada and South Africa the nominal exchange rate can forecast global commodity prices once controlled for the parameter instabilities in the model[2].

Exchange rate volatility and fluctuations in energy prices have a significant impact on Russian economy. Any shocks to the oil and gas prices affect the Russian export's revenue and put the pressure on the value of domestic currency. Rautava (2004) reports that for a 10% permanent increase in international oil prices results in a 2.2% increase in Russian GDP. Also a 10% real appreciation of the domestic currency corresponds to 2.7% decrease in GDP.

The ability to forecast the export prices is particularly important for Russia. It will give policy makers a useful tool for planning oil and gas production and forecasting future export earnings. Moreover, since inflation targeting has always been a top priority for Russian Central Bank[3], it will be a part of the toolkit for

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[1] See for example, Chen and Rogoff (2003) and Chen (2005)

[2] At the same time they failed to confirm the same result for Chile.

[3] Fetisov, Gleb, 'Monetary policy in Russia: targets, instruments, rules', Economics issues, 2008, pp. 4-24.

Russian monetary policy in designing anti-inflation policy to deal with the volatile situation in the energy markets.

The paper is structured in the following way. Chapter 2 describes economic situation in Russia since the period of transition and talks why the country can be considered a commodities economy. Chapter 3 describes approaches used to carry out the empirical analysis and data. Chapter 4 presents the empirical analysis and its main results. Chapter 5 presents the robustness check of the results. Chapter 6 summarizes.

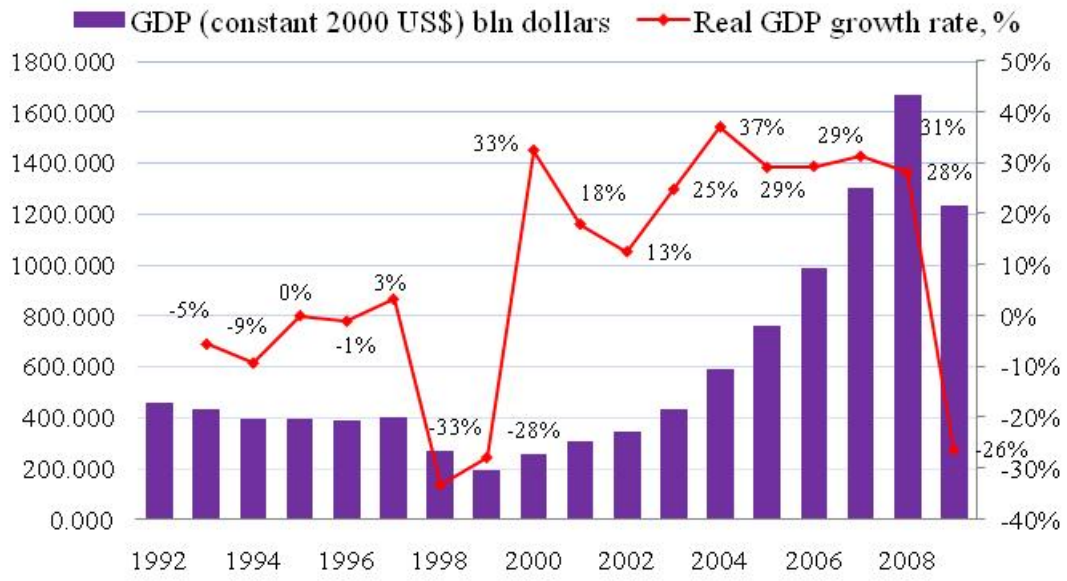
CHAPTER 2

RUSSIAN ECONOMIC POLICY SINCE THE TRANSITION PERIOD

I. Monetary Policy and Exchange Rate Regime

There are several periods of different monetary policy strategies in the history of Russia. The beginning of the transition period in early 90s put the country in a deep recession. As shown in the Figure 2.1., the real GDP growth was negative for the whole period 1992-1996.

Figure 2.1 Russian Real GDP and Economic Growth for the period 1992-2009



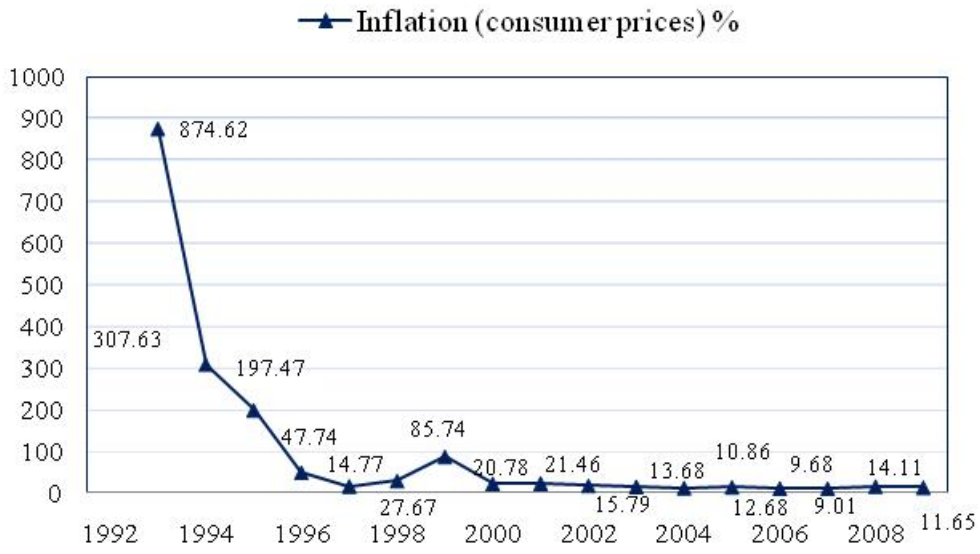
Source: IMF, IFS

The dramatic swing in the output was due to the favorable policy towards the contracts with foreign investors after Russia opened the border, which hurt domestic producers. The other reason was the privatization process, started

under Gorbachev's Cabinet. The prices for the most state plants were underestimated. Furthermore, the government sold a lot of strategic assets abroad.

During the first years after the crush of the Soviet Union Russia suffered from hyperinflation and deep ruble depreciation. As shown in the Figure 2.2., in 1993 the inflation was about 875%, 308% - in 1994, and 198% - in 1995.

Figure 2.2 Inflation in Russia for the period 1992-2009



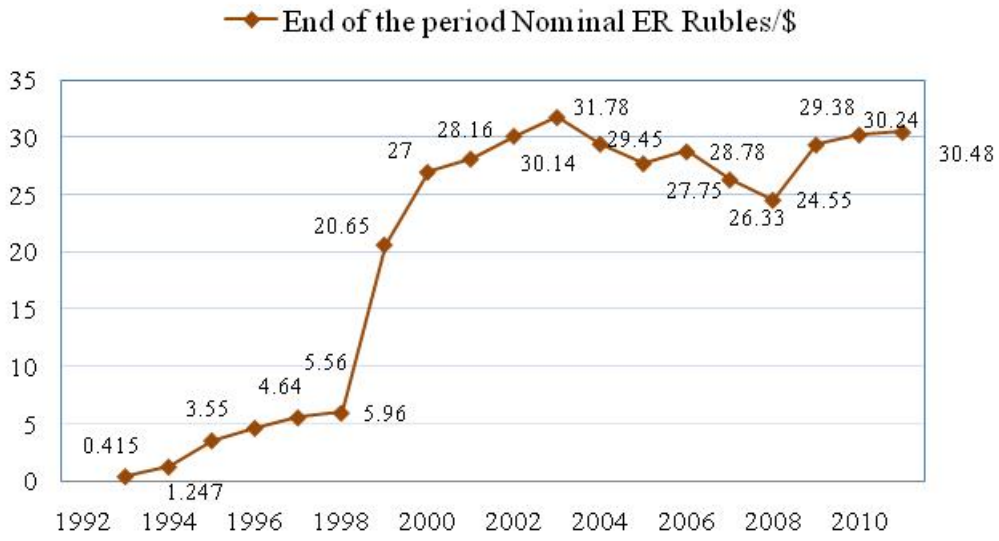
Source: IMF

As a part of stabilization policy at that period, the government reduced the government deficit by cutting the government expenditure and introducing new taxes and tightened the monetary policy. It helped to bring inflation down to the 47.74% in 1996 and achieve a positive real GDP growth of 3%.

In 1991 in order to stabilize the ruble the Central Bank of Russia (CBR) adopted the fixed exchange rate regime. But the value of domestic currency was

overestimated. As a result, in 1994 the CB failed to maintain the fixed exchange rate and it appreciated from 1.24 rubles per dollar in 1993 to 3.55 rubles per dollar in 1994 (Figure 2.3.). In 1995 in response to the further ruble appreciation the CBR had to loosen the fixed exchange rate and announce the band within which the currency was allowed to fluctuate.

Figure 2.3 Russian Nominal Exchange Rate for the period 1992-2010



Source: IFS

The consequence of Asian crisis 1997 was the collapse of ruble followed by the rapid increase in the inflation and the decline in the output by more than 50%[4]. In August 1998 the Russian government ended its attempt to maintain exchange rate band and within the month ruble skyrocketed by more than 300% to US dollar. Since then the country has been operating under managing floating

exchange rate regime.

Depreciation of the ruble made the domestic producers more competitive in the international market and along with the boom in the energy commodity prices contributed to the fast recovery of the country. The average economic growth of Russia for the period 2000-2009 was 22%.

There exist debates about the appropriate monetary policy regime for Russia[5]. An increase in energy-commodities prices in 2006 showed that dual targeting (price stability and exchange rate) creates a tradeoff between inflation and loss of export revenue. Since Russian economy is affected by fluctuations in word energy prices, this is essential to restrain the appreciation of domestic currency to keep domestic processing industries competitive in the world market. At the same time, in case of free capital movement this policy makes the quantity of money endogenous and, furthermore, makes it impossible to control the inflation[6].

Empirical evidence shows that targeting both inflation and exchange rate is becoming increasingly ineffective for achieving the ultimate monetary policy goal of price stability and, moreover, it makes an economy vulnerable to speculative attacks, which may result in a currency crisis. Russian economists argue that instead of targeting the reduction in inflation from 10% to 5% the

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[4] Oomes and Ohnsorgei (2005), Rautava (2004).

[5] Peter Voigt (2006), Korhonen and Mehrotra (2010).

[6] Dobrynskaya Valeria, 'Pass-through effect and monetary policy in Russia: what has changed since the crisis of 1998? Economic Journal of Higher School of Economics, Moscow, 2006, #1

government should adopt the policy aimed at economical stability and full employment[7].

II. Is Russia a Commodity Economy?

Russia is a very resource rich country. It holds 5.6% of world proved oil reserves and largest proved natural gas reserves – 23.7% of total world capacity[8]. Russian oil stock is the seventh-largest oil stock in the world after Saudi Arabia, Venezuela, Iran, Iraq, Kuwait, and United Arab Emirates.

As shown in Figure 2.4., Russian oil reserves have been steadily growing over 1998-2004 time period. Since 2005 country's oil stock remains constant at 74.2 thousand million barrels, although the share of Russia in the total proved oil reserves declined.

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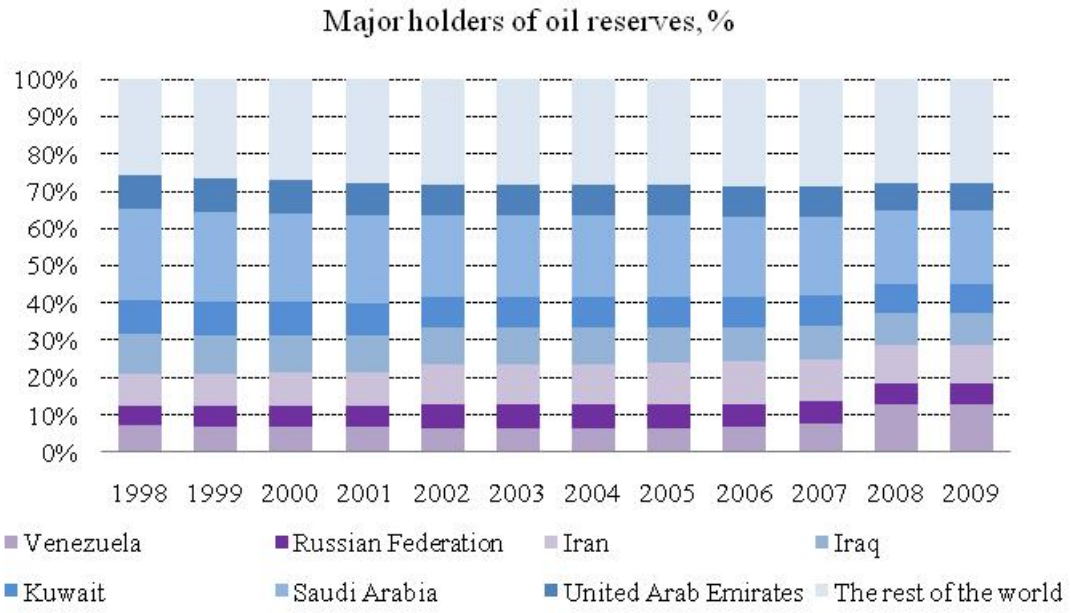
[7] Polterovich, Vladimir, 'Inflation is not a main target for economics policy in Russia', Economics, Moscow, 2007.

[8] BP, Statistical Review of World Energy 2010.

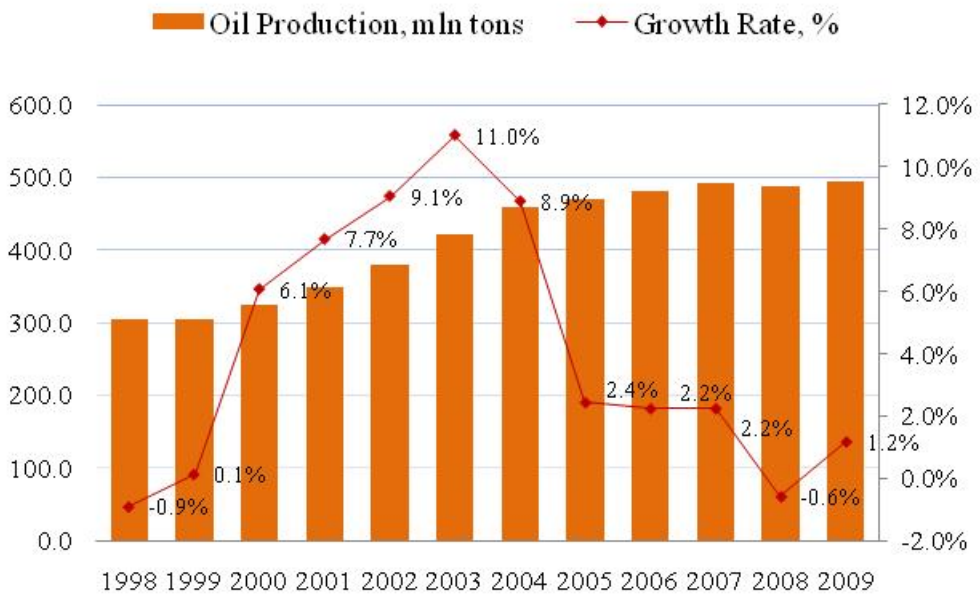
Figure 2.4 World Structure of Oil Reserves in 2009



Source: BP Statistical Review of World Energy, 2010

Russian oil industry experienced a rapid growth during the post crisis period followed by the significant slowdown in the subsequent years and negative growth in 2009 (Figure 2.5.). Nevertheless, in 2009 the volume of the oil and NGLs (the liquid content of natural gas) recovery in Russia was the largest in the world - 494.247 million tons.

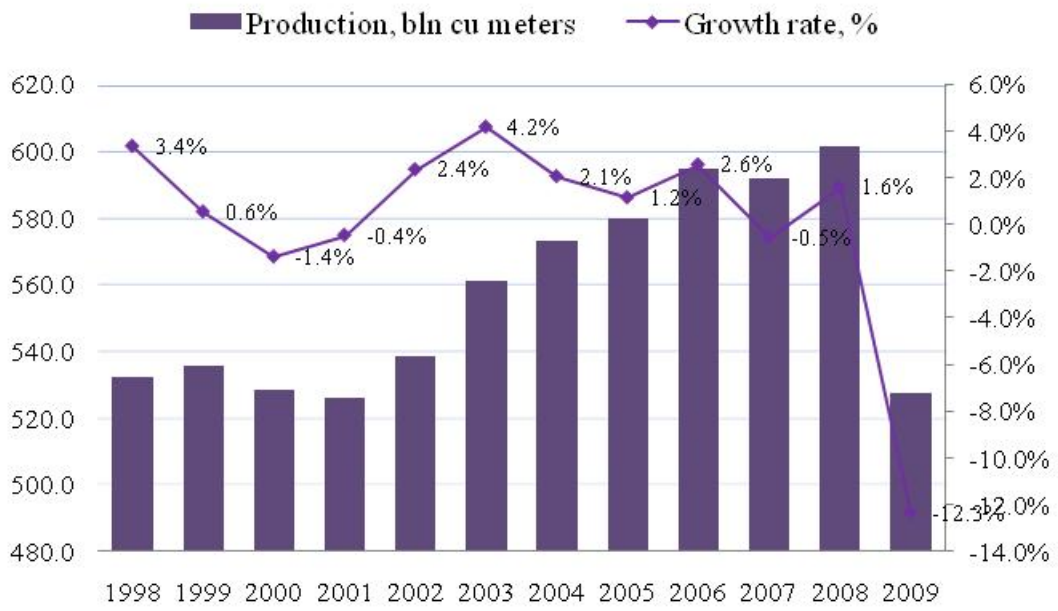
Figure 2.5 Oil Production and Oil Recovery Growth Rate in Russia for the period 1998-2009



Source: BP Statistical Review of World Energy, 2010

There is a less obvious trend in the production of natural gas in Russia (Figure 2.6.). Growth rates for gas recovery remained negative during 2000-2001 and then started to fluctuate between 4.2% in 2003 and -0.5% in 2007. In 2009 Russia produced 527.511 billion cubic meters of natural gas which is by 12.5% less than in 2008 and 17.6% of total word extraction.

Figure 2.6 Gas Production and Gas Recovery Growth Rate in Russia for the period 1998-2009



Source: BP Statistical Review of World Energy, 2010

The main reasons for the decrease in oil and gas production in Russia includes the critical level of equipment amortization, the lack of investment, and recent reduction in tax benefits within domestic processing industries.

Oil and gas processing industries are the key industries in the economy of Russia. Shares of oil and gas production in Russia GDP are 12.9 % for oil and

5.6% for gas sector[9]. In 2010 the oil and gas industries accounted for 44% of total fiscal revenue and accommodated 16% of total labor force in the country[10].

The export of crude oil and gas account for the approximately 40% of total country's export earnings (25% is the share of oil and 15% is the share of gas)[11]. At the same time Russia is a price taker for these commodities in the international market and gas and oil prices can be considered as exogenous terms of trade effect to country's nominal exchange rate.

Heavily dependence on the export of energy commodities and floating exchange rate regime over the decade together contributes to the fact that Russia can be considered a commodity economy. The following analysis based on this assumption.

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[9] As Rautava (2004), Oomes and Kalcheva (2007) showed, Russian Statistical Committee (Goskomstat Rossii) underestimates the share of oil and gas sector in Russian GDP due to the transfer pricing. According to the Journal of Eurasian Geography and Economics, 46, 1:68-76, 2005, Russian Statistical Committee reports the share of oil and gas sector in Russian GDP of 7.6% (6.8% for oil extraction and processing and 0.8% for gas).

[10] Survey: Oil industry in Russia, 2011, Analytical Agency INFOLINE

[11] Nienke Oomes and Katerina Kalcheva (2007) report the share of 60%.

CHAPTER 3

DATA DESCRIPTION AND METHODOLOGY

I. Methodology

We applied the present value approach to model nominal exchange rate behavior based on MacDonald and Taylor (2003). The main idea of this model is similar that exchange rate embodies the information about future value of its fundamentals in the same fashion as current price of an asset contains information about its future return.

In accordance with this approach we estimate the regression equation where a change in the commodity prices is a dependent variable and lagged value of exchange rate and commodity prices are independent variables:

$$E_t \Delta cp_{t-1} = \beta_0 + \beta_1 \Delta exrate_t + \beta_2 \Delta cp_t \qquad (1)$$

We choose four different commodity prices - trade weighted commodity price index, production weighted commodity price index, oil prices and gas prices.

Since Chen et al (2009) and others argue that under certain circumstances commodity prices have some predictive power for the nominal exchange rate; we also estimate the reverse equation:

$$E_t \Delta exrate_t = \beta_0 + \beta_1 \Delta exrate_{t-1} + \beta_2 \Delta cp_t \qquad (2)$$

Chen et al (2009) chose not to include food and energy prices in their analysis as these prices fluctuate more in response to many political and non-

economic events. Still we chose to examine whether the most important commodity prices for Russia (oil and gas prices) have any predictive power for nominal exchange rate or nominal exchange rate can help to predict commodity prices.

Recently, Chen at el (2011) examined the relationship between exchange rate and world food prices. They showed that information from exchange rates and equity markets can help to forecast world food and agricultural commodity prices for the major exporters of commodities – Australia, New Zealand and Canada.

II. Data

Quarterly data for the period 1998Q3-2007Q4 have been used in this paper. The data span is chosen to eliminate the existence of outliers due to the huge fluctuations in the nominal exchange rate at the beginning of transition in Russia in early 90-s, during the 1997 Asian crisis and 2008 global crisis.

The nominal exchange rate (*ner*), defined as a dollar value per one unit of ruble, is the end of period nominal exchange rate. It is collected from International Financial Statistics (IFS) from the IMF.

The real exchange rate (*rer*) is the end of the period nominal exchange rates deflated by the relative CPI's. Russian and US CPI are taken from IFS.

The real effective exchange rate (*reer*) is an index taken from IFS.

Nominal trade weighted commodity price index is a weighted average of

nominal oil and gas prices. The weights are shares of oil and gas export in total export earnings. Average shares of oil and gas export in total export earnings are calculated from the total export data and data for oil and gas export for the period 1992-2009 from Russian Statistical Committee (Goskomstat Rossii).

Nominal production weighted commodity price index is a weighted average of nominal oil and gas prices. The weights are shares of oil and gas production in total GDP. Average shares of oil and gas production in total GDP are calculated from the data for oil and gas production and GDP for the period 1992-2009 from Russian Statistical Committee (Goskomstat Rossii).

The nominal oil price is an average world crude oil price ($/barrel) from IFS. Nominal gas price is the Russian natural gas index (US $/000 M^3) from IFS.

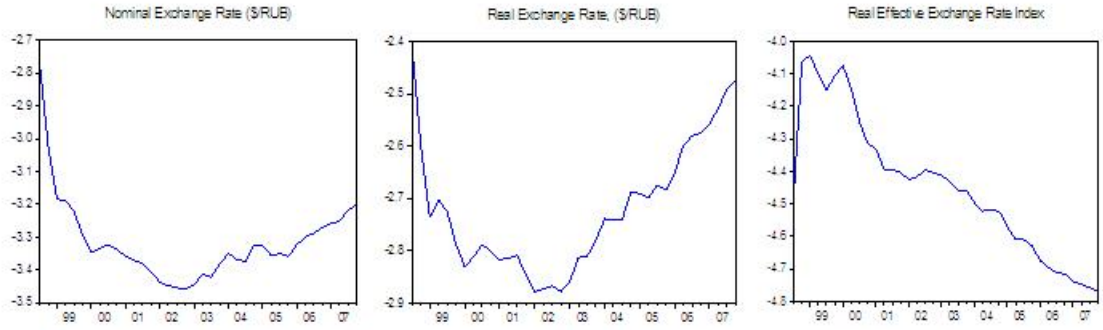
Real trade weighted commodity price index is weighted average of real oil and gas prices. Real oil and gas prices are nominal oil and gas prices deflated by the US CPI.

CHAPTER 4

EMPIRICAL ANALYSIS

We examined the exchange rate series for the probability of having a unit root using Augmented Dickey-Fuller test. As shown at the Figure 4.1 and Table 4.1 a (Appendix 1), exchange rate and real effective exchange rate are unit root processes.

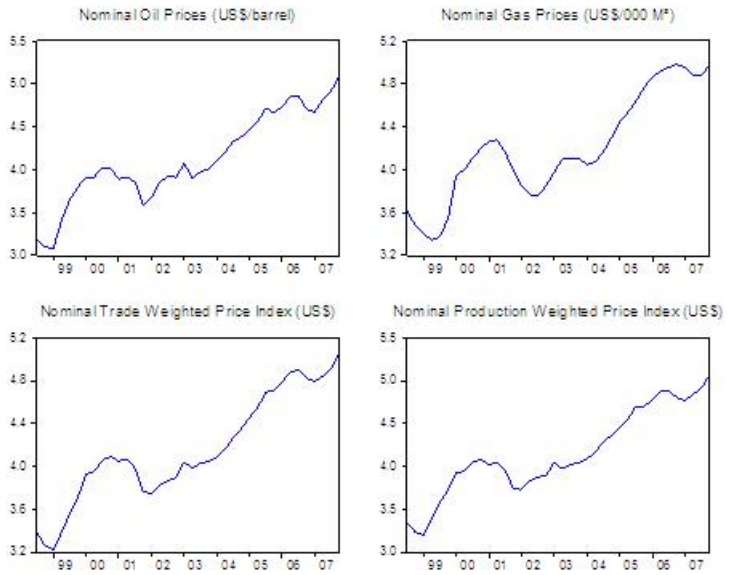
Figure 4.1 Russian Nominal, Real and Real Effective Exchange Rate for the period 1998Q3-2007Q4.



Source: IFS

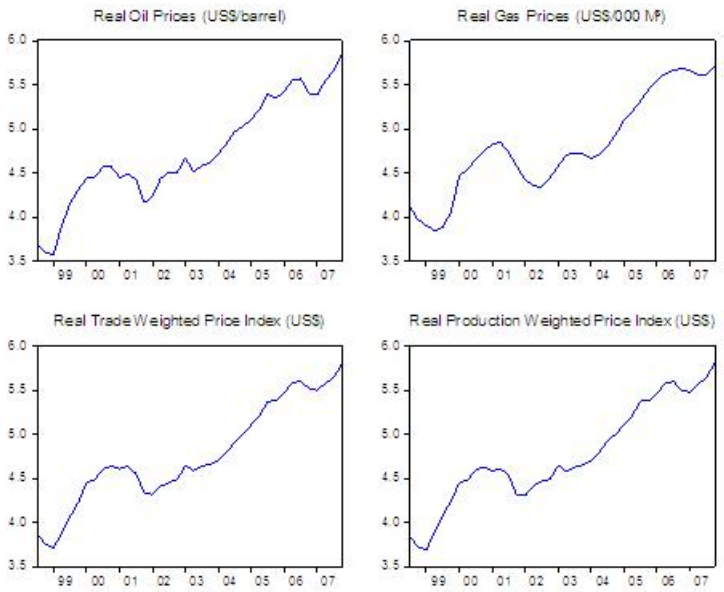
According to Augmented Dickey-Fuller test, trade weighted and production weighted price indices have unit roots as well as oil and gas prices. The results are reported at Figure 4.2-4.3 and Table 4.1 (b) and (c) in Appendix A.

Figure 4.2 Russian Nominal Commodity Prices for the period 1998Q3-2007Q4.



Source: IFS

Figure 4.3 Russian Real Commodity Prices for the period 1998Q3-2007Q4.



Source: IFS

Based on these results further analyses have to be done using the first differences of the series.

I. Does nominal exchange rate have a predictive power for oil and gas prices?

Results of the estimates of the regression equation (1) with nominal exchange rate and nominal commodity prices are reported in Table 4.2. A-B. Estimates from the equation (1) suggest that there is a positive relationship between nominal exchange rate and nominal commodity prices – trade and production weighted price indices and oil and gas prices. But the coefficients are not statistically significant.

However, when change in the nominal exchange rate is the only independent variable in the equation (1), for nominal trade weighted commodity price index and nominal gas prices we found positive significant coefficients.

Granger-Causality test failed to reject the null hypothesis of no Granger-Causality at 10% significance level for all four cases. The results from Table 4.3 A suggest that nominal exchange rate can only weakly predict the commodity prices in Russia.

Since Russia follows managing floating exchange rate regime and thus nominal exchange rate includes a bit of noise, it is not able to capture the movements in the commodity prices. Moreover, our commodity prices are energy commodity prices which are prone to sudden change even due to the political shocks.

II. Does real exchange rate have a predictive power for oil and gas prices?

Results of the estimates of the regression equation (1) with real exchange rate and real commodity prices are reported in Table 4.4. A-B. Estimates from the equation (1) suggest that there is a positive relationship between real exchange rate and real commodity prices – trade and production weighted price indices and oil and gas prices. But the coefficients are not statistically significant.

However, when change in the real exchange rate is the only independent variable in the equation (1), for real trade weighted commodity price index and real gas prices we found positive significant coefficients.

Granger-Causality test failed to reject the null hypothesis of no Granger-Causality at 10% significance level for all four cases. The results from Table 4.5 A suggest that real exchange rate can only weakly predict the commodity prices in Russia.

Results of the estimates of the regression equation (1) with real effective exchange rate and real commodity prices are reported in Table 4.6. A-B. Estimates from the equation (1) suggest that there is a positive relationship between real effective exchange rate and real commodity prices – trade and production weighted price indices and oil and gas prices. But the coefficients are not statistically significant.

However, Granger-Causality test rejected the null hypothesis of no Granger-Causality at 5% significance level for the real trade weighted and production weighted commodity price indices and at 1% significant level for real oil prices. The results from Table 4.7 A suggest that real effective exchange rate

has some predictive power for the commodity prices.

III. Do oil and gas prices have a predictive power for exchange rates?

Results of the estimates of the regression equation (2) with nominal commodity prices and nominal exchange rate are reported in Table 4.2 D. Estimates from the equation (2) suggest that there is a positive relationship between nominal commodity prices and nominal exchange rate. But the coefficients are not statistically significant.

However, Granger-Causality test rejected the null hypothesis of no Granger-Causality at 10% significance level for oil prices. The results from Table 4.3 B suggest that nominal oil prices have some predictive ability for Russian nominal exchange rate.

Results of the estimates of the regression equation (2) with real exchange rate and real commodity prices are reported in Table 4.4 C. Estimates from the equation (2) suggest that there is a positive relationship between real commodity prices and real exchange rate. But the coefficients are not statistically significant.

However, Granger-Causality test rejected the null hypothesis of no Granger-Causality at 10% significance level for oil prices. The results from Table 4.5 B suggest that real oil prices have some predictive ability for Russian real exchange rate.

Results of the estimates of the regression equation (2) with real effective exchange rate and real commodity prices are reported in Table 4.6 D. Estimates from the equation (2) suggest that there is a positive relationship between real

commodity prices and real effective exchange rate with statistically significant coefficients for the real gas prices.

However, Granger-Causality test failed to reject the null hypothesis of no Granger-Causality at 10% significance level for real commodity prices. Thus real commodity prices have only limited ability to predict real effective exchange rate in Russia.

CHAPTER 5

ROBUSTNESS ANALYSIS

I. Does alternative currency benchmark have a predictive power for oil and gas prices?

As a historical fact, Russia carries out all operations in domestic and international markets in two common foreign currencies – dollar and euro. Furthermore, according to Goskomstat, European countries consume about 55% of total Russian export. Based on these facts, we estimated the regression equation (1) using alternative currency benchmark – euro value of ruble.

Results of the estimates of the regression equation (1) with nominal exchange rate and nominal commodity prices are reported in Table 4.8 A-B. Estimates from the equation (1) suggest that there is a positive relationship between nominal exchange rate and nominal commodity prices – trade and production weighted price indices and oil and gas prices. But the coefficients are not statistically significant.

However, when change in the nominal exchange rate is the only independent variable in the equation (1), for nominal trade weighted commodity price index we found positive significant coefficients.

Alternatively, the results of the estimates of the regression equation (1) with real exchange rate and real commodity prices are reported in Table 4.9 A-B. Estimates from the equation (1) suggest that there is a positive relationship between real exchange rate and real commodity prices – trade and production weighted price indices and oil and gas prices. But the coefficients are not

statistically significant.

However, when change in the real exchange rate is the only independent variable in the equation (1), for real trade and production weighted commodity price indices and gas prices we found positive significant coefficients.

Thus the result from using alternative currency benchmark is consistent with our finding that exchange rate can only weakly predict commodity prices in Russia.

II. Does aggregate exchange rate have a predictive power for the gas prices?

Russia and Canada are the biggest players in the world gas market. The share of Canada and Russia in the total production of the natural gas is 23% (5.4% and 17.6% respectively)[12]. In this section we showed that aggregate Russian and Canadian exchange rate does not help to predict world gas prices.

Results of the estimates of the regression equation (1) with aggregate nominal exchange rate defined as dollar value of ruble and nominal gas prices are reported in Table 4.2 C. Estimates from the equation (1) suggest that there is a positive relationship between nominal exchange rate and nominal gas prices. But the coefficients are not statistically significant.

Table 4.6 C reports the results of the estimates of the regression equation (1) with aggregate real effective exchange rate defined as dollar value of ruble and real gas prices. Estimates from the equation (1) suggest that there is a

positive relationship between real effective exchange rate and real gas prices. But the coefficients are not statistically significant.

Similarly, results of the estimates of the regression equation (1) for the nominal exchange rate defined as euro value of the domestic currency and nominal gas prices are reported in Table 4.8 C. Estimates from the equation (1) suggest that there is a positive relationship between nominal exchange rate and real gas prices. But the coefficients are not statistically significant.

Thus the result from using aggregate exchange rate is consistent with our finding that exchange rate has only limited ability for predicting commodity prices in Russia.

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[12] BP Statistical Review of World Energy, 2010

CHAPTER 6

CONCLUSION

We have conducted econometric analysis to explore the relationship between nominal exchange rate and prices for energy commodities - oil and gas for Russia. We have used quarterly data for the period 1998Q3-2007Q4. Following Chen et al (2009) we have estimated the regression equation with commodity prices as a dependent variable and nominal exchange rate as independent variable. We have found a little evidence for Russia to support Chen et al (2009) hypothesis that nominal exchange rate can predict commodity prices. Following Chen et al (2009) we have also estimated the reverse relationship. Also, there exists no strong relationship between them. The possible explanation of the result can be the fact the oil and gas markets are more volatile than exchange rate market, thus the exchange rate cannot be used as a proper predictive instrument for Russia.

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APPENDICIES

APPENDIX A

Table 4.1(a). Augmented Dickey-Fuller test for the exchange rates

Nominal exchange rate ($US/RUB)	Real exchange rate ($US/RUB)	Real effective exchange rate Index
P – values of H_0: the time series has a unit root in Dickey-Fuller test		
0.0001	0.4187***	0.4835***

Asterisks mark the failure to reject the null hypothesis at 1% (*), 5% (**) and 10% (***) level.

Table 4.1(b). Augmented Dickey-Fuller test for the nominal commodities prices

Nominal trade weighted commodity price index	Nominal production weighted commodity price index	Nominal oil price	Nominal gas price
P – values of H_0: the time series has a unit root in Dickey-Fuller test			
0.7173***	0.9248***	0.8630***	0.7477***

Asterisks mark the failure to reject the null hypothesis at 1% (*), 5% (**) and 10% (***) level.

Table 4.1(c). Augmented Dickey-Fuller test for the real commodities prices

Real trade weighted commodity price index	Real production weighted commodity price index	Real oil price	Real gas price
P – values of H_0: the time series has a unit root in Dickey-Fuller test			
0.9422***	0.9349***	0.8824***	0.7919***

Asterisks mark the failure to reject the null hypothesis at 1% (*), 5% (**) and 10% (***) level.

Table 4.2. The relationship between nominal exchange rate (US dollar value of domestic currency) and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: $\beta_1 = 0$ in $\Delta cp_t = \beta_0 + \beta_1 \Delta ner_t + \beta_2 \Delta cp_t$			
0.2384***	0.2646***	0.4580***	0.2103***
B: P – values of H_0: $\beta_1 = 0$ in $\Delta cp_t = \beta_0 + \beta_1 \Delta ner_t$			
0.0949**	0.1254***	0.3610***	0.0702**
C: P – values of H_0: $\beta_0 = \beta_1 = \beta_2 = 0$ in $\Delta gasprice_t = \beta_0 + \beta_1 \Delta ner_t^{Russia} + \beta_2 \Delta ner_t^{Canada}$			
			0.1496***
D: P – values of H_0: $\beta_1 = 0$ in $\Delta ner_t = \beta_0 + \beta_1 \Delta cp_t$			
0.1298***	0.1466***	0.2644***	0.1872***

Asterisks mark rejection at 1% (*), 5% (**) and 10% (***) level.

Table 4.3. Granger-Causality test for the nominal exchange rate (US dollar value of domestic currency) and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: the nominal exchange rate does not cause the commodity prices			
0.4031***	0.4416***	0.6107***	0.3824***
B: P – values of H_0: the commodity prices do not cause the nominal exchange rate			
0.1733***	0.1366***	0.0731**	0.6208***

Asterisks mark the rejection at 1% (*), 5% (**) and 10% (***) level.

Table 4.4. The relationship between real exchange rate (US dollar value of domestic currency) and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: $\beta_1 = 0$ in $\Delta cp_t = \beta_0 + \beta_1 \Delta er_t + \beta_2 \Delta cp_t$			
0.2319***	0.2575***	0.2195***	0.1834***
B: P – values of H_0: $\beta_1 = 0$ in $\Delta cp_t = \beta_0 + \beta_1 \Delta er_t$			
0.0910**	0.1186***	0.3314***	0.0711**
C: P – values of H_0: $\beta_1 = 0$ in $\Delta er_t = \beta_0 + \beta_1 \Delta cp_t$			
0.1570***	0.1722***	0.2772***	0.2277***

Asterisks mark rejection at 1% (*), 5% (**) and 10% (***) level.

Table 4.5. Granger-Causality test for the real exchange rate (US dollar value of domestic currency) and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: the real exchange rate does not cause the commodity price			
0.4659***	0.5034***	0.6773***	0.3584***
B: P – values of H_0: the commodity price does not cause the real exchange rate			
0.1956***	0.1582***	0.0891**	0.6362***

Asterisks mark the rejection at 1% (*), 5% (**) and 10% (***) level.

Table 4.6 The relationship between real effective exchange rate (US dollar value of domestic currency) and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: $\beta_1 = 0$ in $cp_t = \beta_0 + \beta_1 reer_t + \beta_2 cp_t$			
0.5156***	0.4773***	0.4802***	0.8134***
B: P – values of H_0: $\beta_1 = 0$ in $cp_t = \beta_0 + \beta_1 reer_t$			
0.1406***	0.1277***	0.3148***	0.2160***
C: P – values of H_0: $\beta_0 = \beta_1 = \beta_2 = 0$ in $gasprice_t = \beta_0 + \beta_1 reer_t^{Russia} + \beta_2 reer_t^{Canada}$			
			0.1714***
D: P – values of H_0: $\beta_1 = 0$ in $reer_t = \beta_0 + \beta_1 cp_t$			
0.2503***	0.3203***	0.7002***	0.0733**

Asterisks mark rejection at 1% (*), 5% (**) and 10% (***) level.

Table 4.7. Granger-Causality test for the real effective exchange rate index and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: the real effective exchange rate does not cause the commodity price			
0.0265*	0.0144*	0.0030	0.6481***
B: P – values of H_0: the commodity price does not cause the real effective exchange rate			
0.1278***	0.1426***	0.2295**	0.2300***

Asterisks mark the rejection at 1% (*), 5% (**) and 10% (***) level.

Table 4.8 The relationship between nominal exchange rate (Euro value of domestic currency) and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: $\beta_1 = 0$ in $cp_t = \beta_0 + \beta_1 ner_t + \beta_2 cp_t$			
0.1960***	0.3179***	0.4403***	0.2139***
B: P – values of H_0: $\beta_1 = 0$ in $cp_t = \beta_0 + \beta_1 ner_t$			
0.0946**	0.1254***	0.3653***	0.1103***
C: P – values of H_0: $\beta_0 = \beta_1 = \beta_2 = 0$ in $gasprice_t = \beta_0 + \beta_1 ner_t^{Russia} + \beta_2 ner_t^{Canada}$			
			0.1496***
D: P – values of H_0: $\beta_1 = 0$ in $ner_t = \beta_0 + \beta_1 cp_t$			
0.1918***	0.1466***	0.2986***	0.2547***

Asterisks mark rejection at 1% (*), 5% (**) and 10% (***) level.

Table 4.9 The relationship between real exchange rate (Euro value of domestic currency) and commodity prices

Trade weighted commodity price index	Production weighted commodity price index	Oil price	Gas price
A: P – values of H_0: $\beta_1 = 0$ in $cp_t = \beta_0 + \beta_1 rer_t + \beta_2 cp_t$			
0.2597***	0.2155***	0.2735***	0.3487***
B: P – values of H_0: $\beta_1 = 0$ in $cp_t = \beta_0 + \beta_1 rer_t$			
0.0479*	0.0706**	0.1654***	0.0785**
C: P – values of H_0: $\beta_1 = 0$ in $rer_t = \beta_0 + \beta_1 cp_t$			
0.2411***	0.3103***	0.4552***	0.2608***

Asterisks mark rejection at 1% (*), 5% (**) and 10% (***) level.

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