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Oil Price, Exhange Rate and Economic Growth in Russia: A Multiple Structural Break Approach

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Abstract

This study aims to investigate the relation between oil prices, exchange rate and economic growth in Russia from a multiple structural break approach. For this reason, quarterly series have been used for the period 1995:q1-2014:q3. In the study, first of all, the series have been subject to multiple structural break unit root test and multiple structural break cointegration test, and the effect of oil prices and exchange rate on economic growth has been estimated with dynamic least squares method. Two significant findings have been identified as a result. First of all, it has been observed that there are structural breaks in the series, and despite this, series move together in the long run. Secondly, it has been observed that increasing oil prices are an important factor for economic growth and that depreciation of rouble against dollar will have a limited effect on economic growth in the long run..

JEL classification numbers: C22, F31, Q43
Keywords: Oil Price, Exchange rate, Economic Growth, Unit Root Test, Cointegration Test

1 Introduction

Oil is an indispensable energy source for world economy. With the increasing energy demand, countries become more and more dependant on oil every passing year, and the oil price fluctuations following this dependency may affect country economies (Delavari, Alikhani and Esmaeil, 2013). In this respect, the oil price fluctuations have a different effect on oil exporting and on oil importing countries. Increasing oil prices increase both manufacturing costs and inflation rate for oil importing countries (the reverse should be expected when the oil price decreases). Increasing inflation rate affects economic growth by affecting real economy and financial markets at the same time. Increasing oil prices

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leads to a transfer of income from importing to exporting countries, and affects exchange rate (Amano and Norden, 1998; Turhan, Hacihasanoğlu and Soytas, 2012). The oil prices fluctuations are more important for oil exporting countries.

For an oil exporting countries, decreasing oil prices will decrease export revenue (the opposite applies for increasing prices), decreasing oil prices pressure on balance of payments, affect economic growth negatively. While public expenditures decrease with the decline in income, interests rates will raise in financial markets which will have liquidity problems (Jiménez-Rodríguez and Sánchez, 2005; Rickne, 2009). As it is in oil importing countries, oil price fluctuations affect both real economy and financial markets, and ultimately it affects economic growth. While the most significant effect of the oil price fluctuations are inflation for oil importing countries, its most significant effect is on exchange rate and economic growth for oil exporting countries (Bernanke, Gertler and Watson, 1997; Jiménez-Rodríguez and Sánchez, 2005; Lescaroux and Mignon, 2008; Rickne, 2009).

Amano and Norden (1998) investigate for USA and find that a stable link exists between oil price shocks and the US real effective exchange rate in the period 1972-1993, and there was a one-way causality relation between oil prices and exchange rate. Chen and Chen (2007) investigate the long-run relationship between real oil prices and real exchange rates for G7 countries, and that real oil prices may have been the dominant source of real exchange rate movements. Besides, Habib and Kalamova (2007) made an analysis by using Russia's annual data for 1995-2006, and Norway and Saudi Arabia's annual data for 1980-2006. And with this analysis, they found that while there was a relation between real oil prices and real exchange rate in Russia, this was not the case for Norway and Saudi Arabia. While Chaudhuri and Daniel (1998), Kutan and Wyzan (2005), Zalduendo (2006), Korhonen and Juurikkala (2009), Issa, Lafrance and Murray (2008) found that oil prices have a strong effect on exchange rate, Akram (2004) and Bjornland and Hungnes (2008), and Huang and Guo (2008) found that the relation between oil prices and exchange rate is highly weak respectively on Norway and China.

Hamilton (1983) investigate on the USA, which is one of the early studies on the relation between oil prices and economic growth, that increasing oil prices had a share in the depression between 1948-1972, and that there was a negative relation between economic growth and oil prices. Also, Burbidge and Harrison (1984), Gisser and Goodwin (1986) found that there was a negative relation between oil prices and economic growth. Jiménez-Rodríguez and Sánchez (2005), oil price increases are found to have a negative impact on economic activity in almost cases among oil importing countries. Moreover, the effect of oil shocks on GDP growth, with oil price increases affecting the oil exporting UK negatively and oil exporting Norway positively.

The aim of this study is to investigate the relation between oil prices, exchange rate and economic growth in oil exporting Russia. In previous studies, it was found that oil price is a very important factor for Russian economy, and Russia is dependent upon oil revenues (Rautava, 2004; Merlevede, Aarle and Schoors, 2004; Beck, Kamps and Mileva, 2007). Several studies have researched the claims that Russia might get "Dutch Disease (DD)" (Beck, Kamps and Mileva, 2007; Benedictow, Fjærtoft and Løfsnæs, 2013). However, this study has a number of points which differentiates from previous studies. First of all, most of the previous studies did not consider multi structural breaks, and some of them considered only one or two structural break. In this respect, short and long run movements were reviewed in these studies by considering the existence of multiple structural breaks in the series. Secondly, direct effect of structural breaks, real exchange rate and oil prices on

economic growth was researched by using techniques which allow structural breaks. The rest of the paper is structured as follows. In Section 2 we present an overview of oil prices, exchange and economic growth in Russia, followed in Section 3 previous studies on this subject. Section 4 presents the description of the data and method. In Section 5 the empirical evidence is presented. In Section 6 a general assessment, and recommendations about the results and politics have been introduced.

2 Oil Price, Exchange Rate and Economic Growth in Russia

Even if it is not a member country of OPEC, Russia has increased its oil production constantly in recent years. Oil production has a significant place in export activities of Russia which ranks among top three in world ranking in terms of daily barrel of oil production. Looking back at history, it can be seen that international oil demand has increased with the countries entering into recession in 1997 Asian financial crisis. Russia, whose oil export has an important share in its budget revenue, had a financial crisis in 1998. Oil prices increased with rising political risks after 11 September 2001, this affected Russian economy positively, and paved way to a rapid economic growth which continued until 2008 (Ghalayini, 2011). In 2008, Russian economy had its share from global financial crisis with declining oil prices. In this respect, Russian economy grew 6.89 % between 1999-2008, and 1.82% between 2008-2013. In the first two quarters of 2014, Russian economy grew 0.006% and 0.24% respectively.

Undergoing a high inflation problem between 1995-1998, Russian economy has changed from fixed exchange rate system to exchange rate corridor system in 1995 following Soviet regime. The exchange rate depreciated following the Russian transition to a market economy. While exchange rate was determined by Russian Central Bank after 1998 crisis and in subsequent years in accordance with market dynamics, a strict exchange rate policy was applied for the period between 2002-2005 (Gędek, 2013; Shigeki, 2014). In 2004, Russian Central Bank passed regulations facilitating capital inflow and made some interventions to exchange rate appreciations. In 2005, it intended to reduce exchange rate volatilities against other currencies by using dual exchange rate basket. However, 2008 was a tough year for rouble. Rouble was appreciated by 80% in the period between 1998 Russian financial crisis and 2009 global financial crisis. Between 2009–2012, Russian Central Bank identified a more flexible exchange rate system. And between 2013-2014, Russian Central Bank sustained a more flexible rouble policy to pass to free floating exchange rate system in the future (Bank for International Settlements, 2013).

Oil price[2] was 14 dollars in average in 1998, it became 30 dollars in average in 2000. Oil price increased constantly and reached 145 dollars per barrel in 2008, while it was 36 dollars per barrel in February 2003. However, it started to decrease rapidly following global financial crisis and dropped to 39 dollars per barrel in February 2009. Oil prices increased rapidly in March 2009, and reached 62 dollars and 80 dollars in average in 2009 and 2010 respectively.

[2]Brent-type crude oil.

Having reached 110 dollars in April 2011, oil prices were around 95 dollars in average in 2011 and 2012.[3]

3 Literature Review

In literature, there are a number of studies investigating for the relation between oil prices, exchange rate and economic growth in Russia. These studies can be categorized under two titles: studies in which macroeconomic relations are addressed, and studies in which DD is discussed. In the initial studies in which macroeconomic relations are addressed, computable general equilibrium models (CGEM) was frequently used. Since limited data was available in the studies where general equilibrium models were used, similar results were obtained (Benedictow, Fjærtoft and Løfsnæs, 2013). However, in the studies where other estimation methods were used , different results were obtained. In the studies where the relations between oil prices, exchange rate and economic growth were addressed within the scope of DD, mostly, it was researched whether or not oil prices caused exchange rate to increase, and how this affected economic growth.

Merlevede, Aarle and Schoors (2004), one of the studies on general equilibrium models, made estimations on eight different scenarios in which exchange rate depreciated and oil prices changed between 12 and 43.4 dollars. Their estimation results show that depreciation in exchange rate and increase in oil prices trigger economic growth to a great extent. An also Suni (2007) got similar results from two scenarios. In the first scenario, oil price was fixed at its value in 2001 and oil prices for 2002-2006 period were estimated. In the second scenario, it was estimated how a 20-dollar increase in the oil price per barrel would affect Russian economy for the period 2007-2028.

Lescaroux and Mignon (2008), one of the studies where causality relation was investigated, researched the relationship between oil prices, economic growth and some macroeconomic variables in a group of countries including Russia. It was found that there was not a relation between oil prices and economic growth for Russia. A similar result was observed in Ghalayini's (2011) study too. While Spatafora and Stavrev (2003) state that there is a relation between equilibrium exchange rate and oil prices in their study where the relation between oil prices and exchange rate is investigated, Sosunov and Zamulin (2006) has found that rouble will be appreciated even if oil prices don't increase, and appreciation of exchange rate is permanent. Habib and Kalamova (2007) examined the effect of real crude oil prices on real exchange rate based on the sample group of three big oil exporting countries: Russia, Norway and Saudi Arabia. This study shows that there is a relation between real crude oil prices and real exchange rate in Russia, whereas this is not the case for other countries in question. Ito (2010) investigated the relation between the oil prices fluctuations and exchange rate. The oil prices fluctuations make Russian economy quiet vulnerable against increasing oil prices, and decrease exchange rate value in the long run. Shigeki (2014) made a research on the relation between future's international oil prices and

[3]The oil prices were 100 dollars per barrel around the middle of 2014, it decreased rapidly to 66 dollars at the end of the year. Rapid depreciation of oil prices created a pressure on rouble and rouble went down by 7% in a day on 15 December 2014. Russian Central Bank increased interests by 650 basis points, from 10.5% to 17% with an emergency decision. This step alleviated the pressure on rouble to a certain extent.

exchange rate. This study shows that future's international oil prices affect rouble to a significant extent.
While Algieri (2004), Kuboniwa (2010) and Gędek (2013) show in their studies on DD that increasing oil prices increase exchange rate and economic growth. Rautava (2004) shows that increasing oil prices increase exchange rate, but this increase affects economic growth negatively in the long run. Desai (2006), Oomes and Kalcheva (2007), Beck, Kamps and Mileva (2007) and Benedictow, Fjærtoft and Løfsnæs (2013) have found that increase in oil prices increases only exchange rate, and identified the effect of this increase on economic growth with the help of various macroeconomic variables.

4 Model, Data and Method

Following Rautava (2004), Beck et al. (2007) and previous studies, the relationship between GDP, the oil price and the exchange rate is estimated. The analysis is based on quarterly data, spanning from the first quarter of 1995 to the last quarter of 2014. The model specifies the oil price, exchange rate and dummy variables are as a function of GDP.
In log-linear form the model (Equation 1) is specified as follows:

$$Y_t = \beta_0 + \beta_1 OIL_t + \beta_2 RUB_t + \beta_3 D_1 1998_t + \beta_4 D_2 2008_t + u_t \quad (1)$$

where Y is representing the GDP, OIL is the value of the crude oil price, RUB is the dollar/rouble exchange rate, D_1 and D_2 are the dummy variable(s) is the impact of the economic crises. The expected signs for parameters are such that $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 < 0$ and $\beta_4 < 0$. Scope of the study was restricted to 1995 since it was hard to find data on previous years.
The oil price (OIL) is defined as the price of Brent crude oil expressed in US dollars.[4] These series were taken from US Department of Energy database.[5] Rouble/dollar exchange rate was used to represent exchange rate variable (RUB). Daily average exchange rate for dollar was used to build up series. GDP series was used to represent economic growth (Y). Series of both variables were taken from OECD's database.[6] Logarithms were taken of all series.
Main purpose of economic method is to make estimations within the scope of economic theory by using all the information on series. In this respect, stationary analysis should be applied on series to make the right estimations. This is because stationary series carry too little information about the past (Enders, 1995). This will ensure that estimations will be more accurate and future forecasts will be more reliable.
Some of the unit root tests used in stationary analysis does not take into account extraordinary events that happened in the period under review (economic crisis, political crisis, natural disasters etc.). These extraordinary events may result in structural breaks in series. For this reason, unit root tests that consider structural breaks should be preferred. Perron (1989), Zivot-Andrews (1992), Lumsdaine-Papell (1997), Perron (1997), Ng-Perron (2001) and Lee-Strazicich (2003) allow for one or two structural breaks at most in structural

[4]Dollar price per barrel was taken into account while series for variable was set.
[5]http://www.eia.gov/
[6]http://stats.oecd.org/

break unit root tests. Besides, the test recommended by Carrion-i-Sylvestre, Kim and Perron (2009) allows up to five structural breaks. Multiple structural break unit root tests should be run on the series used in the study since many economic and political crisis occurred in the relevant period. So, the test recommended by Carrion-i-Sylvestre et al. (2009) was used. The test recommended by Carrion-i-Sylvestre et al. (2009) is as follows:

$$P_T(\lambda^0) = \{S(\bar{\alpha}, \lambda^0) - \bar{\alpha}S(1, \lambda^0)\}/s^2(\lambda^0) \tag{2}$$

$$MP_T(\lambda^0) = \left[c^{-2}T^{-2}\sum_{t=1}^{T}\tilde{y}_{t-1}^2 + (1-\bar{c})T^{-1}\tilde{y}_T^2\right]/s(\lambda^0)^2 \tag{3}$$

$$MZ_\alpha(\lambda^0) = T^{-1}\tilde{y}_T^2 - s(\lambda^0)^2)\left(2T^{-2}\sum_{t=1}^{T}\tilde{y}_{t-1}^2\right)^{-1} \tag{4}$$

$$MSB(\lambda^0) = \left(s(\lambda^0)^{-2}T^{-2}\sum_{t=1}^{T}\tilde{y}_{t-1}^2\right)^{\frac{1}{2}} \tag{5}$$

$$MZ_t(\lambda^0) = T^{-1}\tilde{y}_T^2 - s(\lambda^0)^2)\left(4s(\lambda^0)^2T^{-2}\sum_{t=1}^{T}\tilde{y}_{t-1}^2\right)^{-\frac{1}{2}} \tag{6}$$

In this test, Bai and Perron's (2003) algorithm was used for the calculation of structural break dates, and the total number of error squares is minimized through dynamic process of data production. While the presence of unit root under structural breaks is tested, asymptotic critical values of test statistics were produced with bootstrap.

One possible reason for the failure to reject the null hypothesis of nonstationarity of the series are that there may be macroeconomic disturbances (Cashin, Ce´spedes and Sahay, 2004). After it was found all series are nonstationary in levels values, unit root test was applied to series, whose first difference was taken, and they were observed to be stationarity. In this respect, either series differences should be considered and a long run estimation should be made, or series should be estimated by their level values in the event that series tend to move together in the long run.

It was decided that long run movements between series should be reviewed before proceeding with model estimation. According to Gregory and Hansen (1996), at the using the standard cointegration test, breaks may cause spurious unit root behavior in the cointegrating relationship. So, cointegration tests that take multiple structural breaks into account must be run. Maki (2012) developed a cointegrtion test which take multiple structural breaks into account for this reason. Maki (2012) recommended four models to identify long run relations between series. These models are as follows: model without trend in which there is a break in the constant term (Model 0); model without trend in which there are breaks both in constant term and slope (Model 1), model with trend in which there are breaks in constant term and slope (Model 2) and the model with breaks in constant term, slope and trend (Model 3).

Model 0;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta X_t + u_t \quad (7)$$

Model 1;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta X_t + \sum_{i=1}^{k} \beta_i x_t K_{i,t} + u_t \quad (8)$$

Model 2;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma t + \beta X_t + \sum_{i=1}^{k} \beta_i x_t K_{i,t} + u_t \quad (9)$$

Model 3;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma t + \sum_{i=1}^{k} \gamma_i t K_{i,t} + \beta X_t + \sum_{i=1}^{k} \beta_i x_t K_{i,t} + u_t \quad (10)$$

Dynamic Least Squares Method (DOLS) estimation employed for the relation between oil prices, exchange rate and economic growth. DOLS developed by Stock and Watson (1993), can estimate the coefficients more accurately compared to Ordinary Least Squares Method (OLS) and Maximum Likelihood Method.

$$Q_t = \boldsymbol{B}'\boldsymbol{X}_t + \sum_{p=-P}^{p=P} \eta_k \Delta Y_{t-k} + \sum_{p=-L}^{p=L} \lambda_k \Delta \mathrm{PR}_{t-k} + u_t \quad (11)$$

In the model $\boldsymbol{B} = [c, \alpha, \beta]$ and $\boldsymbol{X} = [1, Y_t, PR_t]$ refer to matrices, P and L refer to lag and lead transactions. DOLS method allows some of the variables to be I(1) and some of them to be I(0) (Masiha and Masih, 1996).

5 Results

Determining the stationary of the variables is a crucial step for an empirical analysis to avoid spurious regressions. In this respect, the multiple breaks test suggested by Carrion-i-Silvestre et al. (2009) is utilised to test stationary. The results of break unit root test for series are given in the Table 2.

Table 2: Unit Root Test with Multiple Breaks

Breaks in level and slope of time trend at level						
Variables	PT	MPT	MZA	MSB	MZT	Breaks Dates
Y	13.127	12.714	-32.146	0.124	-4.006	1997:q1 1998:q2 2001:q3
	(8.809)	(8.809)	(-46.222)	(0.103)	(-4.795)	2007:q1 2009:q1
OIL	14.281	12.776	-31.979	0.123	-3.960	2003:q2 2007:q3 2009:q3
	(8.763)	(8.763)	(-44.904)	(0.105)	(-4.732)	2011:q3 2014:q2
RUB	16.492	15.418	-24.704	0.142	-3.512	1999:q4 2001:q4 2009:q4
	(8.595)	(8.595)	(-44.137)	(0.106)	(-4.693)	2012:q1 2014:q2
Breaks in level and slope of time trend at first difference						
ΔY	6.444 **	6.268 **	-38.316 **	0.114 **	-4.376 **	
	(7.387)	(7.387)	(-33.364)	(0.121)	(-4.049)	
ΔOIL	5.992	5.578 **	-32.829 **	0.123 **	-4.043 **	
	(5.770)	(5.770)	(-30.260)	(0.130)	(-3.883)	
ΔRUB	4.848	4.753 **	-32.423 **	0.119 **	-3.889 **	
	(4.844)	(4.844)	(-25.864)	(0.145)	(-3.518)	

Note: Values inside the parentheses are statistical significance at 5% level of significance via estimated boostrap. **, denote statistically significant at 5%. Critical values are taken from Carrion-i-Sylvestre et al. (2009) .

According to results of structural break unit root test, the series are nonstationarity in their level values. Identified dates of structural breaks correspond to Asia's Economic Crisis in 1997, Russia's Economic Crisis in 1998, Global Economic Crisis in 2009, Syria's Political Crisis in 2011, Ukraine's Political Crisis in 2014 and subsequent periods. With regard to the period under review, structural breaks have been identified successfully.

To analyze the existence of the long-run relationship among the series, cointegration test was applied. In Maki (2012) test, structural breaks that are determined endogenously. In the test applied, critical values are calculated by t statistics, and the points where t statistics are minimum are considered as structural break points. Table 3 presents the results of cointegration test.

Table 3: Cointegration Tests Results

	Statistic	%1	%5	%10	Break dates
Model 0	-5.983***	−5.943	−5.392	−5.125	1998:3 2007:2 1997:3 2009:1 2000:2
Model 1	-6.255***	−6.169	−5.691	−5.408	1998:3 2008:1 2009:2 2004:4 2002:2
Model 2	-8.581***	−7.031	−6.516	−6.210	2000:1 1996:4 1998:1 2009:1 2008:1
Model 3	-9.182***	−7.673	−7.145	−6.873	1999:3 1998:2 1997:1 2007:3 2009:1

Note: Critical values are taken from Maki (2012), ***, denote statistically significant at 10%

In the cointegration analysis, in which up to five structural breaks are allowed, it was observed that series move together in the long run. The dates identified with the analysis are similar to the ones found in unit root tests. Also, with the observation that series move together in the long run, no spurious regression relation will turn out in the long run analysis to be conducted with level values of series. In the long run analysis, 1998 and 2009, which are the most commonly detected structural break dates in the models, were included in the analysis for the estimation of cointegration coefficients by forming dummy variables.

DOLS method was used to estimate long run coefficients. Table 4 presents DOLS Estimation results for the full sample period.

Table 4: DOLS Estimation Results

Variables	Coefficient	SE	t statistic	Prob.
Constant	0.959672	0.247245	3.881455	0.0003
OIL	0.120901	0.050046	2.415798	0.0189
RUB	0.055671	0.032608	1.707304	0.0931
D1998	-4.526939	1.474107	-3.070970	0.0032
D2009	-1.959583	0.925878	-2.116459	0.0386
R^2 0.64				

Note: The number of leads and lags was determined by the AIC. The bandwidth was selected by Newey-West estimator using the Bartlett kernel.

According to the results in Table 4, all of the variables are in line with the expectations and comply with economic theory. 1% increase in oil prices raises economic growth at a rate of 0.12%. 1% depreciation of rouble against dollar raises economic growth at a rate of 0.05%. However, it is observed that this is a weak relation considering probability values. D1998 and D2009 dummy variables which represent structural breaks have a strong relation with economic growth and affects the magnitude of economic growth (respectively at -4.5% and -1.9% rates). Also, in line with the expectations, Russian economic crisis in 1998 had a bigger effect compared to the global crisis in 2008.

6 Conclusion

In this study where the relation between oil prices, exchange rate and economic growth was researched, a multiple structural break analysis was applied by using quarterly data on the period 1995:q2-2014:q3, and the impact of oil prices and rouble/dollar exchange rate on economic growth was estimated with dynamic least squares method. Two significant findings have been identified as a result. First of all, it has been observed that there are structural breaks in the series, and despite this, series move together in the long run. Secondly, it has been observed that increasing oil prices are an important factor for economic growth and that depreciation of rouble against dollar will have a limited effect on economic growth in the long run. Besides, it has been observed that economic growth is affected by economic crisis, and 1998 crisis had a greater effect on economy than 2009 crisis.

As a result of the analysis, it was found that international oil prices are a more important factor for Russian economic growth even if rouble/dollar exchange rate is appreciated or not. In this respect, the impact of decrease in international oil prices on Russian economy can be interpreted as both negative and positive. Firstly, low oil prices will definitely reduce Russia's budget income as negatively. On the other hand, low oil prices are as positively, pressure would increase to restructure budget spending so as to cut or reschedule less productive spending in favor of spending which might boost economic activity.

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Appendix

Table A1: Literature Review

Authors	Period	Methodology	Relevant Variables	Conclusion
Algieri (2004)	1994:m1-2002:m5	ECM	Oil Price Exchange Rate Economic Growth	A 7% real appreciation is caused by a 10% oil price shock. A 10% increase in oil prices leads to a 2% GDP growth.
Rautava (2004)	1995:q1 – 2001:q3	VAR	Oil Price Exchange Rate Economic Growth	In the long run a 10% permanent increase (decrease) in international oil prices is associated with a 2.2% growth (fall) in the level of GDP. Respectively, a 10% real appreciation (depreciation) of the rouble is associated with a 2.4% decline (increase) in the level of output.
Merlevede, et al. (2004)	2000:q1-2007q4	Gauss-Seidel Algorithm	Oil Price Exchange Rate Economic Growth	They considered eight oil price and exchange rate depreciation scenarios. Real GDP is strongly affected by oil price shocks and exchange rate depreciation
Sosunov and Zamulin (2006),	1998-2005	General Equilibrium Analysis	Oil Price Exchange Rate	The increase of the oil price alone, however, cannot explain the appreciation, unless one is willing to accept the increase as permanent,
Beck et al. (2007)	1995:q1–2006:q1	VAR	Oil Price Exchange Rate Economic Growth	An increase in the oil price leads to a stronger rouble. But evidence of significant economic growth capabilities in the absence of oil price growth.
Habib and Kalamova (2007	1995-2006	VAR	Oil Price Exchange Rate	There is a positive long-run relationship between the real oil price and the real exchange rate.
Oomes and Kalcheva (2007)	1997:m4-2005:m12	VAR	Oil Price Exchange Rate	A one percent increase in the oil price leads to a 0.50 percent appreciation of the real exchange rate.
Suni (2007)	2001:q1-2006:q4	NIGEM	Oil Price Exchange Rate Economic Growth	The average GDP growth in 2001-6 would have been around 4 per cent, around 2.5 percentage points lower than in the actual case. The lower oil prices could justify a weaker rouble.
Lescaroux and Mignon (2008)	1960 – 2005	Causality	Oil Price Economic Growth	There is no causality between oil price and economic growth.
Benedictow et al. (2013)	1995q1-2008q1	OLS	Oil Price Exchange Rate Economic Growth	The positive impact of rising oil prices on Russia's GDP growth has increased in recent years, but tends to be buffered by an appreciation of the real effective exchange rate which is stimulating imports.
Ito (2010)	1994:Q1 - 2009:Q3	VAR	Oil Price Exchange Rate Economic Growth	A 1% increase (decrease) in oil prices contributes to the depreciation (appreciation) of the exchange rate by 0.17% in the long run, whereas it leads to a 0.46% GDP growth (decline).

Kuboniwa (2010)	2003q1-2010q2	OLS	Oil Price Exchange Rate Economic Growth	10 per cent increase in oil prices leads to about a 1.8 per cent increase in the growth of Russia's GDP. A 10% increase in oil prices contributes to the depreciation of the exchange rate by 4.5%.
Ghalayini (2011)	2003q1: 2010q3	Causality	Oil Price Economic Growth	There is no causality between oil price and economic growth.
Gędek (2013)	2004.w01.01 - 2013w.07.09	VECM	Oil Price Exchange Rate	Rouble exchange rate was influenced by oil price – rouble appreciated as oil price was rising. The relation was stronger after 2008 world financial crisis.
Shafi and Hua (2014)	1971:2012	VECM	Oil Price Exchange Rate Economic Growth	Oil prices and exchange rate has positive relation with economic growth of the Russia.
Shigeki (2014)	1997w01.01-2012.w04.12	VAR	Oil Price Exchange Rate	The oil price leads the exchange rate from the beginning of 2002 through the end of 2012, which indicates that the rouble exchange rate is affected by international oil futures.