MASTER OF SCIENCE IN FINANCE

MASTERS FINAL WORK

DISSERTATION

IMPACT OF THE EU AND US SANCTIONS ON THE FOREIGN EXCHANGE RATE OF RUSSIA

Dmytro Butuzov

Supervisor:

Paula Cristina Albuquerque

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Abstract

International economic sanctions became a regular tool to achieve foreign policy objectives regarding target nation. The sanctions literature mostly focuses on question whether sanctions succeed their foreign policy goals or not, but not on the damage caused to the sanctioned economy. The following study attempts to fill this gap by presenting a theoretical overview of the literature concerning the impact of sanctions on a target country's economy. Several studies consider different consequences of sanctions on a target country, such as reduction of investments and international trade. However, this study seeks to go forward and explore impact on currency exchange rate, which is more substantial macroeconomic measure of economy than investments and international trade. To be more precise, the study empirically analyzes the connection between EU and US sanctions and the foreign exchange rate of Russia, using its monthly data over the period of time from January 2009 to June 2015.

The findings suggest that implementation of sanctions have a significant negative impact on the domestic currency value. Moreover, since Ruble is substantially connected with the oil's price, the paper tests and confirms the hypothesis that sanctions weaken domestic currency, thus making it more dependent on the price of the oil.

Table of Contents

1. Introduction

Sanctions became popular instrument of foreign policy over the last decade, especially by United States. Nevertheless, the efficiency of sanctions still remains out of scope.

While plenty of studies that evaluated effects of sanctions focus on the efficiency of achieving chosen policy goals on a target nation, it was a small number of studies that analyzed the impact on a target nation economy. The main and most used type of sanctions are economic sanctions. They are supposed to lead to deterioration of an economic situation in the target nation, thereby forcing its government to change certain policy or actions. Hence, the first thing on which sanction should have an impact is country's state of economy, which includes exchange rate, international trade and international investments.

This work seeks to study an impact of sanctions on exchange rate as one of the most important macro determinants of country's economy, which is tightly interrelated with other economic variables.

The paper is organized as follows. Section 2 provides literature review of sanctions and their impact on economy. Section 3 investigates literature of exchange rate models and its connection with sanctions. Section 4 lays out the empirical model and specifies the data used. Section 5 summarizes main findings of the empirical part.

2. Economic Impact of Sanctions

Economic sanctions are the well-known instruments of diplomacy used to decrease economic welfare of a target nation, thereby forcing it to follow the interests of international communities.

Sanctions have never been as popular tools of the foreign policy as nowadays. Apparently it has led to increase of the scholars' attention to whether sanctions are effective or not (Hufbauer et al. 1990; Elliot 1998; Drezner 1999). Even though, the effectiveness is still questionable. It always depends on the particular cases and circumstances. It could be reasonable to remember such well-known cases from the last decade as success with the issue of apartheid in South Africa or fails with nuclear policies of Iran and North Korea.

According to the Hufbauer et al. (2009) most sanctions do not reach their goals. They appear to be successful only at 34% of cases. It turns out that most successful are sanctions that are focused on moderate changes of the target country policy. They are successful in 51% of all cases. And most unsuccessful sanctions are those that try to stop military intervention. According to the study, only 21% of sanctions' episodes reached their goals. Attempts to change regime or increase level of democracy were successful in 31% of cases.

O'Sullivan (2003) finds that sanctions have bigger chances to be effective if they are multilateral, and they are most likely to fail if sanctions implemented unilaterally. Drezner (2000), on the other hand, concludes that the chances of success are not statistically significant between multilateral and unilateral sanctions.

Some scientist, such as Hufbauer et al. (1990), Shagabutdinova and Berejikian (2007), based on pre-1990 episodes, found that financial sanctions appear to be successful more often than trade sanctions.

Though each case is very particular, there are some unavoidable consequences. For example, sanctions can lead to an uncertainty that in the meantime increases the risk taken by the domestic and foreign investors. Thus investment attractiveness of a sanctioned country is decreasing, that leads to increase of the capital outflow.

Another quite popular topic related to sanctions is so-called "smart sanctions", which includes financial sanctions, trade restrictions on particular goods, and travel bans on key individuals and organizations. The main idea of "smart sanctions" is to harm elite supporters of the targeted regime, while mass public would not be negatively affected. Thereby, the elite supporters suppose to suffer from the imposed sanctions and put pressure upon the targeted government to compromise. According to Drezner (2011), comprehensive sanctions are more effective than selective measures, however the superiority of "smart sanctions" is that they minimize humanitarian and human rights issues. Besides, they do not hamper bilateral trade flows, thereby have minimal cost.

While most of the scholars were paying attention to the efficiency of sanctions only as success or failure of achieving foreign policy goals, there were some attempts to breakthrough this tendency.

Hufbauer et al. (1997) were pioneers in researching economic impact of sanctions. They empirically measured the impact of economic sanctions on bilateral trade flows using gravity model. They found that economic sanctions have a huge negative impact on bilateral trade flows between target and sender nations. At the further study Hufbauer et al.

(2009) specified that sanctions reduce not only trade between target and sender countries, but also with all trading partners of a target country. Later on, these findings have been verified by other scholars such as Yang et al. (2004) and Caruso (2003).

Another important determinant of the country's economic health that has been studied in connection with sanctions is foreign investment. Foreign investment is very powerful tool for economy growth, especially for the developing countries, as they have low liquidity, and foreign investments are crucial to implement their goals of development.

Biglaiser & Lektzian (2011) studied effect of sanction on Foreign Direct Investment as the biggest source of foreign capital, using panel data for 171 countries from 1971 to 2000. They found robust evidence that US sanctions significantly decrease US FDI into target nation due to the high risk and uncertainty.

One more important economic variable is foreign exchange rate which unfortunately was not studied extensively enough. Foreign exchange rate of the domestic currency is one of the most crucial macroeconomic determinants that have an influence on current and future situation of a whole domestic economy's development and particular economy's agents. Foreign exchange rate movements have direct impact on the international trade, capital flows, volume of production and consumption, and other economic and social determinants.

This indicator is more ambiguous than all mentioned above, because the depreciation of the currency has not only negative consequences, and also the appreciation has not only positive effects. Increase of a relative currency value makes export less profitable and more expensive for the international markets, while import turn to be less expensive, therefore more attractive. On the other hand, decrease of a currency value

relative to other currencies makes its export more valuable and potentially makes it cheaper for the international markets, while import becomes less attractive due to its price growth.

In spite of the fact that cheap currency relative to main trading partners can be economically profitable, quick exchange rate movements may lead to its high volatility which according to Arize et al. (2000) would have significant negative effect on the export flows.

The study from Piana (2001) suggests that devaluation of the domestic currency increases the country burden of an international debt and provokes large outflows of interest payments, which can lead to recession effect.

In general, sanctions should harm targeted economy by decreasing foreign investments and trade, increasing an uncertainty of the country's political future, which will cause domestic currency depreciation (Sobel, 1998).

3. Exchange Rate and Sanctions

Since Bretton Woods system collapsed and floating exchange rate system was generalized, variety of models were invented trying to explain exchange rate dynamic, as well as predict its short- and long-term movements.

The most prominent study on structural exchange rate models was made by Meese and Rogoff (1983). They matched most popular structural models of 1970s against random walk model on the basis of their out-of-sample forecasting accuracy. The analyzed models are: the flexible price monetary (Frenkel-Bilson) model, the sticky-price monetary (Dornbusch-Frankel) model, and the sticky-price asset (Hooper-Morton) model. Respectively, first model includes money supply, industrial production index and interest rate. Second model consist all of the mentioned variables plus inflation rate. The third model includes all of the mentioned variables plus trade balance.

By testing these three models, Meese and Rogoff found that none of these models can outperform a random walk model at one- to twelve-month horizon for the dollar/pound, dollar/mark, dollar/yen and the trade-weighted dollar exchange rate. Moreover, after a number of attempts to argue this statement, evidence to disprove these results were not found (Rapach and Wohar, 2001; Mark and Sul, 2001).

Nevertheless, Engel et al. (2007) claim that the test based on whether model beats random walk, is too strong criteria for the model evaluation, because under general conditions exchange rate movement simulate random walk.

Evans and Lyons (1999) test microstructure model for exchange rate that includes order flow and interest rate. The model explains more than 50% of JPY/USD and DM/USD exchange rate changes in 4 months. Wright et al. (2007) test hybrid models that combine

macroeconomic fundamentals and microstructure variables to explain US/Jamaica exchange rate's movement. The study applies several models and eventually suggests that including micro-based variables improves explanation power for all the models. The paper finds four statistically significant variables with correct a priori sign for all the models. These variables are relative money, relative prices, USD purchases and interventions.

Smith (2014) wrote the first paper that seeks to analyze effect of sanction on the foreign exchange rate using data of 40 countries that were sanctioned by US for some period between 1976 and 2000. The study considers several models, from which the most robust one includes gross domestic product, trade balance, foreign reserves, inflation rate and a dummy for the type of sanctions imposed. Eventually, the model suggests that comprehensive and financial sanctions have a negative impact on the year changes in nominal exchange rate.

Another recent paper that is trying to explain the foreign exchange rate was written by Dreger et al. (2015) studies the case of Russia. The paper is using daily frequency data of the period from January 2014 to March 2015. The model used in this study includes nominal exchange rate, oil price, interest rates for overnight loans, sanction indices and media indices. Sanction index is the composite indicator of sanctions on and from Russia, which is determined from the cumulative sum of sanction dummies. Media index denotes of how frequently international media mentions topic related to Russia's sanctions. The results of the model conclude that major portion of the Ruble depreciation was caused by the fall of oil prices, while sanctions have minor positive effect, significant only at the margin.

Given the lack of a widely accepted model for nominal exchange rate, especially with sanctions effect accounted, neither of invented models is likely to be universally applicable. Therefore, the most reasonable approach is to empirically test various models and variables for each particular case.

4. Case Study Sanctions on Russia

Due to the conflict in Ukraine started in 2014, United States, European Union and some other countries imposed various sanctions on Russia. The first two rounds of sanctions were travel bans, freezing of assets located in sender countries imposed upon certain individuals and officials from Russia. It did not have significant effect, neither on Russia's policy nor on economy, but definitely caused state of uncertainty, thus making it more vulnerable for the external shocks.

The most crucial package of sanctions was implemented in July 2014, which imposed restrictions against certain sectors of Russia's economy. It included restrictions in financial sector, ban on export of military, mining technologies and some engineering equipment.

Moreover, at the III quarter of 2014 oil price has fallen by 50%, which turns to be a big loss for the Russia's economy. According to the U.S. Energy Information Administration, crude oil and petroleum products export accounted for 54% of Russia's total export in 2013. Hence, the assessment of the sanctions' effect is complicated by the fact that there are two external shocks happened in the short period of time, thus increasing harmful impact of each other.

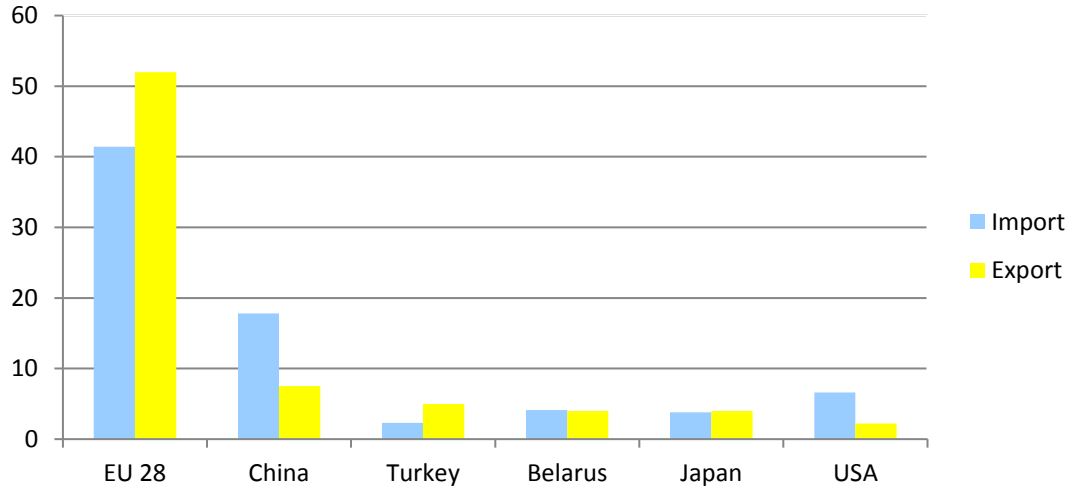
As a result, sanctions and the fall of oil price caused huge outflow of the capital, which led to boost of the volatility on exchange market, depreciation of the Russian currency by more than 50%, and increase of inflation.

The literature of sanctions mentions several conditions that significantly increase likelihood of sanctions to be successful. One of the main conditions of successful sanctions is for them to be imposed by the major economic partners (McLean and Whang, 2010). For

instance, sanctions from U.S. on Russia are apparently not as impactful as sanctions from Europe, given that some of Europe countries are one of the main partners of Russia.

According to the Federal State Statistics Service the major trade partners of Russia at 2013 were EU countries (27.6% of whole import and 54.7% of whole export), when U.S. had only 2.3% of export and 3.4% of import. Chart 1 displays import and export with particular countries in % to whole import and export (based on data from 2014).

Chart 1 – Main trading partners of Russia, %



Source: European Commission Directorate-General Trade's Statistics

It is important to note that some of the banned U.S. products such as mining technologies and engineering equipment are unique and licensed, which makes them not replaceable. And even though, there are no visible consequences for Russia at this point of time, it may slow down development of new oil and gas fields.

Another condition is that economy of a sender country should be significantly bigger than economy of a target country, otherwise sanctions will not be successful and may hurt economy of the sender more than economy of the target (Hufbauer et al., 1990).

According to the International Monetary Fund World Economic Outlook from April 2015, Russia holds only 3.1% of the world GDP based on PPP Valuation, whereas U.S. holds 16.1% and Europe 16.9%. Hence it follows that the economy of Russia significantly smaller than economy of U.S. or Europe, which increase likelihood of the sanctions to be successful.

Another measure of partnership importance is the size of its investments. Based on the Federal State Statistics Service major international investments come from European Union members. More precisely, in 2013, 46% of import to Russia was from EU countries, and more than 50% of its export Russia transferred to EU countries. In the meantime, investments from U.S. accounted for only 5.1%. Table 2 represents inflows of the foreign investments in Russia at 2012 and 2013.

Table 2 – Inflows of the foreign investments in Russia at 2012 and 2013

	2012		2013	
	USD Million	% of total	USD Million	% of total
Foreign investments - total	154570	100	170180	100
By countries:				
Switzerland	46790	30.3	24602	14.4
Cyprus	16455	10.6	22683	13.3
UK	13490	8.7	18862	11.1
Luxemburg	11523	7.5	16996	10.0
Netherlands	21126	13.7	14779	8.7
France	4193	2.7	10309	6.1
Germany	7202	4.7	9157	5.4
US	3384	2.2	8656	5.1

Source: Federal State Statistics Service

Although US investments are quite small, some sectors of Russia's economy significantly rely on U.S. investments such as production of oil products (12% of all foreign investments in the production of oil products) and production of machines and equipment (28.1%). Furthermore, several US companies are substantial players in Russia. For instance, PepsiCo is the largest producer in Russian beverage and food market. Other examples represent Ford Motor Co., General Electric, Visa and Master Card (Congressional Research Service).

Paper from Hufbauer et al. (2009) finds level of a target country democracy to be significant among other explanatory variables. The study finds that the higher the democracy level, the higher probability of sanctions to achieve stated goals. In accordance to Polity IV data, Russian Federation has moderately high and stable level of democracy. The index of Russia is 5 for the scale of indexes from -10 to +10. On the other side, The Economist Intelligence Unit's Democracy Index 2015 denotes the Russia's index as 3.31 for the range from 0 to 10, which puts Russia on 132nd place among 165 countries and defines its regime as authoritarian.

Since this study focuses on exchange rate, it is relevant to briefly consider current exchange rate regime of Russia. In 2005, the Bank of Russia implemented a dual-currency basket as main indicator for exchange rate. Then, in 2009 the mechanism of automatic correction of the allowed boundaries was introduced, according to the amount of intervention. In 2013, the Bank of Russia started to switch the main tool of managing exchange rate from interventions to interest rate. In November 2014, the interval of allowed values of dual-currency basket was finally abolished, as well as necessity for intervention in case of reaching these values. However, The Bank of Russia left the right to intervene in

case of the risk to financial stability. Hence, when the Ruble started to fall in 2014, significant interventions were made in order to prevent this drop or at least stabilize the currency. According to the statistics in 2013 the Central bank sold only $24.26 in the foreign exchange market, but in 2014 CB sold $76.13 billion, from which $11.9 billion during December (CBR Statistics).

5. Methodology and data

The paper investigates the effect of sanction on exchange rate, moreover it seeks to go further and test the assumption that sanction could interfere relation of exchange rate and oil price. Hence, the hypotheses that will be tested in this paper are as follows:

H1: The imposition of sanctions on Russia has a negative effect on its domestic currency versus foreign currencies.

H2: The imposition of sanctions on Russia makes its currency more vulnerable to external shocks, particularly to the sharp fall of oil price.

Hypothesis 2 assumes that the relation between exchange rate and oil price may vary due to presence of sanctions, in other words, that sanctions make exchange rate of Russia more vulnerable to the fall of oil price. Hence, if the hypothesis is true, the relation between exchange rate and oil price with implemented sanctions is different from when there are no sanctions. Thus, the study seeks to find weather sanctions made Russia more vulnerable to external shocks or not. The hypothesis based on the fact that both events occurred simultaneously, hence it would be misleading not to take into account possible interference of these two events.

As it is discussed above, there is no widely accepted model for exchange rate. Thereby, empirical studies use various sets of variables to analyze exchange rate according to particular characteristics of country. By following this approach, particular structural model was constructed and adjusted to the economy of Russia. There is a wide range of economic indicators which have an impact on domestic currency. Thus, the number of main

economic indicators was tested for the relevance, statistically significant impact and multicollinearity among them. Eventually, the variables chosen for the final model are money supply, oil price, government interventions, interest rate and sanctions. Apparently, it is possible to include more variables which will increase the fit of the model, but then it would decrease the degrees of freedom and statistical power of the regression.

The chosen model specification is denoted as follows:

$$exr_t = f\,(m_t, interv_t, oil_t, i_t, dummy) \qquad (1)$$

Money supply (m). Money supply is used as the variable in the most of the models that seeks to explain exchange rate movements. According to the Flexible Price model (Frankel, 1976), an increase of money supply leads to depreciation of the national currency. Sticky Price model (Dornbusch, 1976), also known as Overshooting Model, suggests that an increase in a country's money supply reduces domestic interest rate, and then the drop of interest rate leads to a short-run depreciation of the domestic currency, that is larger than the long run equilibrium.

Interventions (interv). The purpose of interventions is to stop the drop, or at least to abate it. In case of Russia, interventions were also used as a tool to keep exchange rate between determined boundaries.

There have been many controversial results from the impact of interventions on exchange rate. Nevertheless, Marcel Fratzscher (2005), based on the wide sample of the major currencies, finds robust evidences of the long-run effect of sterilized interventions on exchange rate. Moreover, Taylor and Sarno (2001) point out that interventions may have an impact on foreign exchange markets for a long period as such actions alert other market participants, thus altering their expectations and behavior.

Oil price (oil). Variety of scholars has studied connection between exchange rates of commodity-exporting countries to the price of those commodities. Most of them indicate strong connection between exchange rate and commodities, which in most of the cases is oil. As reported by Habib and Kalamova (2007) and some other papers, Russian ruble is the "oil currency", meaning that world oil price has a strong positive relation with ruble.

According to Jouko Rautava (2004), oil price has a strong impact on GDP of Russia. Moreover, simple correlation and variance inflation tests were conducted to check for the presence of correlation between these two time series. The results indicate strong correlation, which means that they are highly collinear. Finally, GDP of Russia is presented only in quarterly frequency, when the rest of the data has monthly frequency. Everything mentioned above makes GDP inapplicable to use in this study, but fully replaceable by oil price variable. (Nearly perfect correlation between logarithm of the Brent oil prices and Russia's GDP changes in percentage according to the previous period are presented in the attachments section – Figure 1).

Interest rate (i). Raise of interest rate increases potential earnings from investments in domestic currency, its demand is increasing and thus the currency relative value is also growing. Central banks widely use interest rate as a tool to stop or relax currency depreciation. Interest rate is included in all structural and hybrid models.

Descriptive Statistics

Data set is taken from the Data Stream and Federal State Statistic Service. It has monthly frequency and covers the period from January 2009 to June 2015. The Figures of all variables are presented in Appendix. The exchange rate is defined as nominal bilateral exchange rate of the Ruble against the US Dollar, more accurately it is a price of US Dollar

in terms of Ruble (Figure 2). For the money supply variable the M2 measure is used (Figure 3). Interventions are Russia Central Bank sales of USD (Figure 4). Interest rate is taken as Russian Interbank middle rate for 31 to 90 days (Figure 5). The oil price variable is the price of Brent oil in US Dollars per barrel (Figure 6). Sanctions are expressed through the dummy variable which is equal to 0 until August 2014, when the most substantial package of sanctions was imposed. The rest of the period dummy is equal to 1, indicating the presence of sanctions. All the variables are presented in logarithmic form, except the oil price and dummy variable.

Exchange rate, money supply, interest rate and interventions are taken as endogenous variables, when oil price, dummy of sanctions and interaction of sanctions with oil price are taken as exogenous.

Empirical Analysis

The econometric software which is used for employing the tests and constructing the model is Eviews 8 program.

First of all, Augmented Dickey-Fuller (ADF) Unit Root test was conducted for all of the variables to check whether they are stationary or not, and if not, what are the orders of integration. All of the time series appear to be integrated of order one or I(1).

Table 3. Unit root test.

Time series	Level	1st difference
	t-Statistics	
exr	1.25	-3.77*
m	-2.23	-4.83*
interv	-1.82	-8.74*
i	-2.9	-6.73*
oil	-1.83	-9.06*

Note: The test performed by Augmented Dickey-Fuller (ADF) unit root test. Null hypothesis of the test is presence of a unit root. * denotes rejection of null hypothesis at the 1% significance level. Lag lengths are indicated through Akaike information criterion. Test is performed with a constant.

The paper from Engle and Granger (1987) states, that the linear regression of non-stationary variables may be stationary in case the variables are cointegrated. Vector Autoregression (VAR) with all endogenous variables is constructed in order to determine optimal lag length for the Vector Error Correction (VEC) model. On the basis of Schwarz information criterion two lags are identified as the optimal lag length. Then Johansen Cointegration test, proposed by Johansen (1988), was performed in order to check for the presence of long-term relationships among them. Oil price series and dummy are not included since they are assumed as exogenous variables. Test allows for intercept in cointegrating equation and VAR. Both versions of the test (Trace and Maximum Eigenvalue) reject the null hypothesis of no cointegration and indicate presence of 1 cointegrating equations at 5% significance level (Table 4).

Table 4. Johansen Cointegration test.

Rank	Trace Statistic	*ME Statistic*
0	54.79* (0.0097)	28.28* (0.0407)
1	26.52 (0.114)	19.79 (0.0761)
2	6.72 (0.6102)	6.56 (0.5422)
3	0.002 (0.6893)	0.16 (0.6893)

* denotes rejection of null hypothesis of no cointegration at the 5% significance level.
P-values are presented in parentheses.

According to the Lütkepohl et al. (2005), if there are cointegrating relations among variables, the application of the VAR model will lead to the spurious regression problem. On the other hand, so-called Vector Error Correction model can be used for the cointegrating systems. It is restricted version of the VAR model with error correction features. VEC model enables to describe long- and short-term relationships among nonstationary time series that are cointegrated in the same order and eliminates the problem of spurious regression which appears in case of Vector Autoregressive. Hence, Vector Error Correction model is applied in this study. VEC model estimates cointegration relationship using Johansen procedure, it also represents speed of adjustment of variables towards long-run equilibrium along with parameters of short-run effect.

Simple form of the VEC model with two cointegrated variables and one lag length can be presented as follows:

$$\Delta x_t = \lambda_2 (y_{t-1} - \beta x_{t-1} - \alpha) + \lambda_1 \Delta x_{t-1} + \lambda_2 \Delta y_{t-1} + \varepsilon_t \qquad (2)$$

Where $e_{t-1} = (y_{t-1} - \beta x_{t-1} - \alpha)$ is so-called error correction term that indicates long-run relationship between y_t and x_t, λ_1 and λ_2 represent speed of adjustment in case

of disequilibrium, in other words they indicate the response of *y* and *x* to deflections from long-run equilibrium, Δx_{t-1} *and* Δy_{t-1} are the parameters of short-run effect, ε_t is independent and identically-distributed error term.

Since specified model has only one cointegrating equation it is also applicable to run Dynamic Least Squares (DOLS) and Fully Modified Least Squares (FMOLS) models. As stated in Lyhagen et al. (2007), this restriction occurs since those methods are residual based. FMOLS and DOLS models correct for endogeneity bias and serial correlation in cointegrated regression, thus allowing for the standard normal inference.

FMOLS is applying semi-parametric autocorrelation correction using estimated residuals from cointegrating regressions and differenced explanatory variables. Thus, FMOLS method adjusts endogeneity and short-term dynamics of the errors (Philips and Hanson, 1990).

DOLS approach was developed by Saikkonen (1992) and Stock and Watson (1993). It involves parametric correction for endogeneity by adding lagged values of the first difference.

$$x_t = \lambda_0 + \lambda_1 Z_t + \sum_{j=-p}^{p} \lambda_j \Delta Z_{t-1} + \eta_t \qquad (3)$$

Where Z_t is a vector of explanatory variables, p is number of lags and Δ is a lag operator.

At this point, specified regression in VEC, DOLS and FMOLS representations can be constructed (Table 4). Those models require variables to be first difference stationary, therefore the variables are taken on the level. All models assume constant as the trend specification.

All of the methods indicate stationary long-run relations among exchange rate (*exr*), money supply (*m*), interest rate (*i*), interventions (*interv*), price of the oil (*oil*), dummy of sanctions (*D*) and interaction variable (*oil*D*) with high explanatory power of each variable and of the whole model. According to the t-statistics, all of the variables are significant at 1% level of significance.

Table 5. VEC, DOLS and FMOLS models.

Variables	VEC	DOLS	FMOLS
	Endogenous Variables		
m	0.3078 (0.0379) [8.1176]	0.2795 (0.047) [5.9482]	0.3333 (0.0570) [5.841]
interv	0.000017 (0.000002) [8.1809]	0.000012 (0.0000027) [4.3372]	0.0000039 (0.0000014) [2.721]
i	0.0115 (0.0047) [2.4383]	0.0259 (0.0056) [4.6575]	0.0265 (0.0057) [4.6244]
	Exogenous Variables		
oil	-0.1632 (0.0194) [-8.4333]	-0.2419 (0.0577) [-4.1896]	-0.3209 (0.0711) [-4.514]
D	0.9754 (0.173) [5.6401]	2.3145 (0.3918) [5.9073]	2.1185 (0.4521) [4.6862]
*oil*D*	-0.2006 (0.0386) [-5.1949]	-0.4887 (0.088) [-5.5528]	-0.4453 (0.1005) [-4.4302]
R^2	0.8687	0.9841	0.9539
Sum sq. residue	0.02	0.1953	0.1953
S.E. equation	0.018	0.0275	0.0437

The numbers in ( ) indicate standard errors. T-statistics are presented in [ ].

Test for the inverse roots of the characteristic AR polynomial suggests that the estimated VEC model is stable (or stationary). The stability condition of the test requires

that the number of unit roots has to be equal to the number of endogenous variables minus the number of cointegrating relationships. At the same time the moduli of the remaining roots have to be less than unity. Autocorrelation LM test proposed by Johansen (1995) indicates rejection of serial correlation among residuals since all the p-values are higher than 0.05.

6. Results and Conclusion

The coefficients vary considerably between each model. However, VEC, DOLS and FMOLS approaches denote negative and statistically significant coefficients of the sanctions variable, which equal to 0.98, 2.31 and 2.12 respectively. Thus, all models confirm the presence of strong impact of sanctions on exchange rate in the long-run perspective.

The second hypothesis is that sanctions have substantial influence on the connection between exchange rate and oil price. VEC, DOLS and FMOLS methods indicate negative and statistically significant coefficients of 0.2, 0.48 and 0.45 respectively. The results suggest that the sanctions increase the impact of the world oil price on exchange rate of the Russian currency.

This paper makes its contribution into a quite unexplored, but very important field by testing the influence of exchange rate on the relative value of Russia's domestic currency and its interference to the relation between the currency and price of the oil. The study applies exchange rate model based on the literature analysis, but also adjusts it to the particular case of Russia's economy. The model is stable and has substantially high explanatory power of the exchange rate movements.

The findings suggest that sanctions are indeed play significant role in exchange rate value, thus the imposition of sanctions has strong negative effect on the currency's value. Moreover, the model finds that sanctions make Ruble more dependent on the oil price.

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Appendix

Figure 1 – Russia GDP change in percentage according to the previous period and logarithm of the Brent oil price.

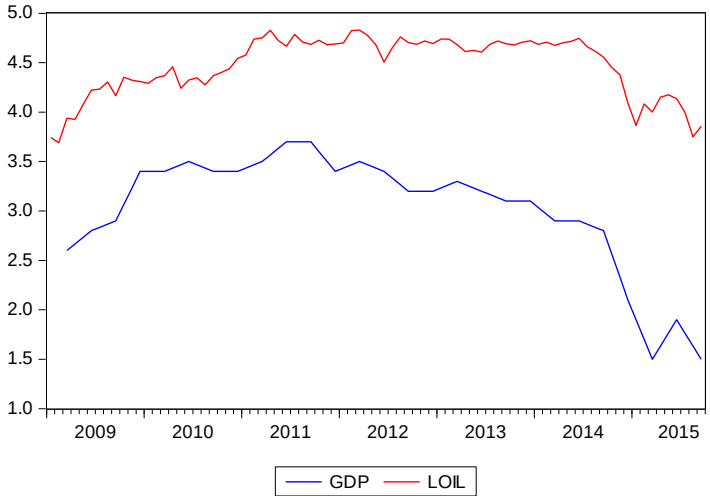

Figure 2 – Log-transformed time series of the exchange rate variable

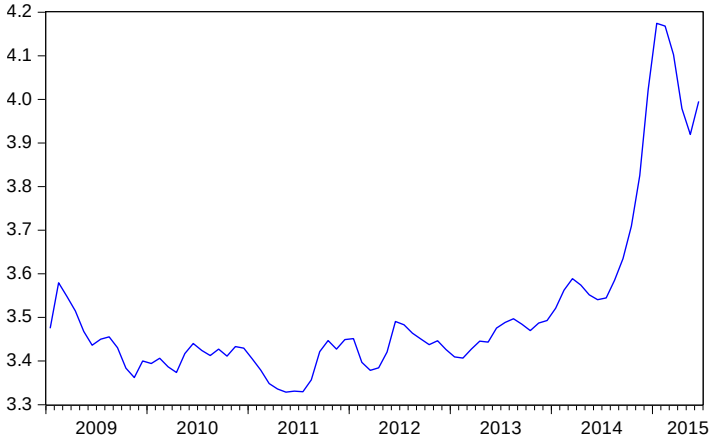

Figure 3 – Log-transformed time series of the money supply variable

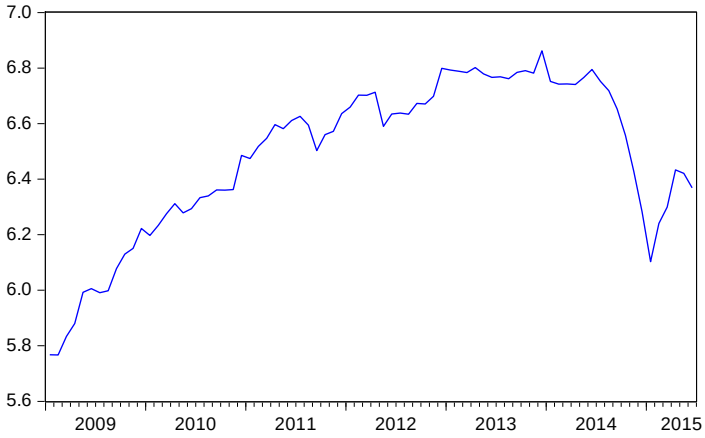

Figure 4 – Log-transformed time series of the intervention variable

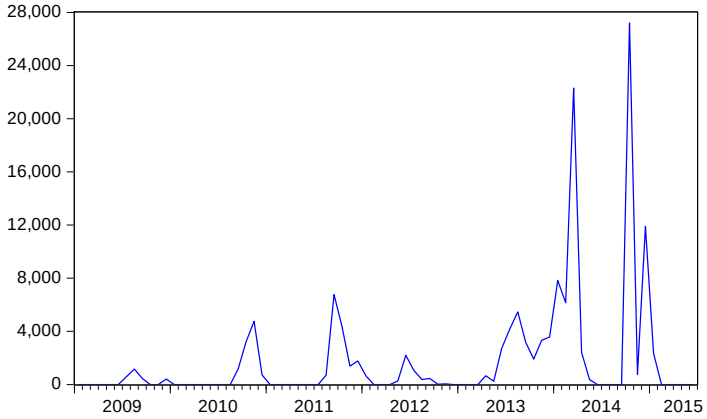

Figure 5 – Log-transformed time series of the interest rate variable

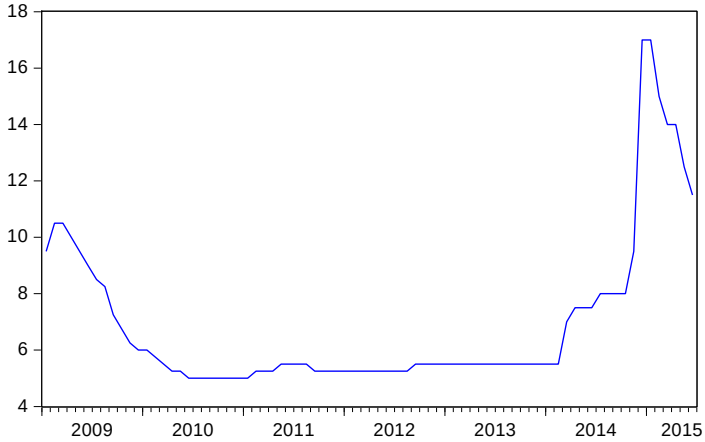

Figure 6 – Log-transformed time series of the oil price variable