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Article — Published Version

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Baltic Journal of Economics

Provided in Cooperation with:

German Institute for Economic Research (DIW Berlin)

Suggested Citation: Kholodilin, Konstantin A.; Netšunajev, Aleksei (2019) : Crimea and punishment: the impact of sanctions on Russian economy and economies of the euro area, Baltic Journal of Economics, ISSN 2334-4385, Taylor & Francis, London, Vol. 19, Iss. 1, pp. 39-51, <https://doi.org/10.1080/1406099X.2018.1547566>

This Version is available at:

<https://hdl.handle.net/10419/200147>

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To cite this article: Konstantin A. Kholodilin & Aleksei Netšunajev (2019) Crimea and punishment: the impact of sanctions on Russian economy and economies of the euro area, *Baltic Journal of Economics*, 19:1, 39-51, DOI: [10.1080/1406099X.2018.1547566](https://doi.org/10.1080/1406099X.2018.1547566)

To link to this article: <https://doi.org/10.1080/1406099X.2018.1547566>



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Published online: 07 Dec 2018.



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Crimea and punishment: the impact of sanctions on Russian economy and economies of the euro area

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ABSTRACT

The conflict between Russia and Ukraine that started in March 2014 led Western countries and Russia to impose economic sanctions on each other, including the euro zone members. The paper investigates the impact of the sanctions on the real side of the economies of Russia and the euro area. The effects of sanctions are analyzed with a structural vector autoregression. To pin down the effect we are interested in, we include an index that measures the intensity of the sanctions in the model. The sanction shock is identified and separated from the oil price shock by narrative sign restrictions. We find weak evidence that Russian and euro area GDPs declined as a result of the sanctions. The effects of the sanctions are also small for the real effective exchange rate.

ARTICLE HISTORY

Received 28 March 2018
Accepted 24 October 2018

KEYWORDS

Political conflict; sanctions; economic growth; Russia; euro area; structural vector autoregression

JEL CLASSIFICATION

C32; F51

1. Introduction

The conflict between Russia and Ukraine that started in March 2014 led to economic sanctions being imposed by Western countries, including the European Union members. In reaction, Russia imposed counter-sanctions. This paper investigates the impact of the sanctions on the Russian and euro area economies at the aggregate level. The study contributes to the debate on whether sanctions imposed by the rest of the world on Russia are effective or whether some adverse effects in terms of GDP growth losses can be attributed to the imposition of sanctions and whether these effects, if any, can be separated from the decline in oil prices that occurred around the same time. European businesses, especially those exporting to Russia, fear the negative consequences of sanctions and have called for them to be removed, see Deutsch-Russische Auslandshandelskammer (2016). Their fears are perfectly well grounded, as UN Comtrade data show that the exports of EU countries to Russia were on average 14% lower in 2014 than in 2013. Out of 28 member states, 25 suffered falls in exports. Especially strong drops in exports could be observed in the drops of 78% from Malta, 42% from Cyprus, and 27% from Belgium. Large EU economies also had substantial losses of exports, as with Germany and the UK each experiencing an 18% decline, while France and Italy each had declines of about 12%. According to the Eurostat data, in 2015, the decline in exports intensified: the extra-EU28 exports to Russian

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Federation dropped from 119.4 billion euros to 73.8 billion euro, that is, by almost 40%.¹ The exports from the UK to the Russian Federation declined by 51% between 2013 and 2015, for example. In 2015, German exports to Russia were down by 30% from 2014.² In 2016, the fall in the EU28 exports to Russia attained its minimum of 72.4 billion euros. However, in 2017, the exports increased to 86.2 billion euros, which represented an increase of 19% compared to 2016.

Given the decisions by the European Union (Council of the European Union, 2015), the Russian Federation (President of the Russian Federation, 2017), and the USA (President of the USA, 2018) to prolong the sanctions, it is increasingly important to understand the price that must be paid for these political decisions. We study how the sanctions influence a set of macroeconomic variables for both Russia and the euro area. The euro area contains 19 economies that share the same currency and monetary policy. As discussed above, international trade and financial ties between these countries and Russia were tight prior to the escalation of the conflict.

This is one of the first papers to evaluate the effects on economic growth of the sanctions for Russia and the euro area countries. There is very little literature on the effects of the sanctions against Russia. Oja (2015) focuses on the sectoral effect of sanctions for Baltic countries. Pestova and Mamonov (2017) focus on the effects on Russia, while this paper evaluates the effects on growth for Russia and the euro area countries. The lack of studies on the topic can be explained by the fact that sanctions were introduced relatively recently, meaning that there are only a small number of observations within the period when the sanctions have been in force. We make use of the most recent data, which allow us to quantify current effects without making any claims about the long-term perspective.

Following Dreger, Fidrmuc, Kholodilin, and Ulbricht (2016), we construct an aggregate index to measure the intensity of the economic sanctions imposed on Russia by the rest of the world. Accounting for the intensity of the sanctions requires taking into account all measures, including those targeting individuals, businesses, and entire industries. We use the trade weighted index of sanctions, where sanctions introduced by each country are weighted by the volume of its trade (exports and imports) with Russia. This paper is the first to set up a structural vector autoregression (SVAR) in the spirit of Sims (1980) to evaluate the consequences of sanctions using the sanctions index of Dreger et al. (2016). The magnitude of the index approximates the intensity of sanctions depending on the country imposing the sanctions and the sector on which the sanctions are imposed. A sanction index equal to zero implies that no sanctions are imposed. The method is very useful for analyzing the effect we are interested in, as under suitable conditions it allows for (1) assessment of how the economies respond dynamically to the sanctions; (2) understanding of how sanction shocks contribute to the variability of key macroeconomic indicators; and (3) estimation of a counterfactual time series, which in our case is GDP growth rates, under the assumption of the absence of sanctions. In our model, we consider GDP growth, oil prices, and the real effective exchange rates (REER) of the Russian ruble and the euro. Following the growth literature, we also use variables like interest rates, consumer price index, and trade openness, but these turned out to be unimportant.

We identify the sanction shock using a combination of narrative sign restrictions, as proposed by Antolin-Diaz and Rubio-Ramirez (2016). This allows us to separate the effect of

the intensified sanctions and the rapid decline in the price of oil that happened nearly simultaneously. The restrictions narrow down the effects of the sanction shocks on the price of oil, meaning that the sanction shock cannot have a strong effect on this variable. As a result, the contribution of sanctions to fluctuations in the price of oil does not exceed 10%. Although we use the most recent data, the sample size is too short to estimate models with time varying parameters and, for that reason, shifts that might have occurred in the structural parameters unfortunately cannot be taken into account.

Our results are summarized as follows. We estimate the probabilities of sanctions-driven GDP decline. This is done by comparing actual and counterfactual GDP series, where the counterfactual data are constructed under the assumption of no sanctions being imposed. The assumption is appealing from our point of view as the index of sanctions is a composite of bans and restrictions imposed on Russia by Western countries. The corresponding probability for Russia is quite high around 80% but is about 25% for the euro area. The uncertainty around the counterfactual effects is large, making it difficult to arrive at the precise losses of GDP growth that are due to sanctions. Given that trade connections between the European countries and Russia are rather tight, sanction shocks can be propagated by not just the loss of GDP growth, but also the depreciation of the real effective exchange rate. We find that the REER of the ruble tend to depreciate in response to the sanction shocks.

The rest of the paper is organized as follows. Section 2 discusses the literature on the economic impact of sanctions. Section 3 describes the data used in the study. The econometric model, main results, and discussion are presented in Section 4. Finally, Section 5 concludes.

2. Economic impact of sanctions

Empirical evidence on the effects of economic sanctions is mixed. Trade restrictions, for instance, can raise costs for the target country, but may also harm the sanctioning economy. Countries with strong economic ties are hit specifically through reduced perspectives for growth. Using a gravity regression approach, Caruso (2003) reports the negative effects of economic sanctions on trade. Sanctions can cause greater damage if they are implemented multilaterally. Where the sanctions are unilateral, the target might be able to buy or sell goods and raw materials with third, non-sanctioning countries.

Neuenkirch and Neumeier (2015) assess the impact of economic sanctions imposed by the UN and the USA. They use panel data estimation techniques and a sample contains 68 countries and covers the period 1976 through 2012. They find that UN sanctions have a relatively large and statistically significant effect in reducing the target state's real per capita GDP growth rate by 2.3–3.5 percentage points, while the effect of the US sanctions is much smaller, accounting for a 0.5–0.9 point decrease in the GDP growth rate. However, the effect from international sanctions imposed through the UN may be quite different from the effect of bilateral sanctions imposed by Western countries and by Russia in this specific case.

Hoffmann and Neuenkirch (2015), investigating the impact of sanctions on Russian stock returns, find that conflict intensification reduces Russian stock returns, with the escalation and de-escalation of the conflict in Ukraine accounting for a total variation of 6.5 percentage points in the Russian stock market.

Dreger et al. (2016) examine the effects of the sanctions related to Russia and Ukraine and the fall in the oil price on the daily exchange rate of the ruble. They find that the exchange rate is affected more by oil prices than by the economic sanctions. Pestova and Mamonov (2017) use conditional forecasts to evaluate the effects of the sanctions on the Russian economy, but once the statistical uncertainty is taken into account the end effects are quite unclear.

3. Data

Before embarking on estimation, we need to choose the variables to be included in our structural VAR model. For guidance, we use the empirical literature on the growth. Bernanke and Blinder (1992), who investigate the effects of monetary policies on various real economic variables (e.g. industrial production), employ several money supply and interest rate measures in their model. Similarly, Sims (1992), who also concentrates on the monetary policy impacts on industrial production, uses short-term interest rates, monetary aggregate, consumer price index, commodity price index, and an index of the foreign exchange value of the domestic currency. Kapetanios, Mumtaz, Stevens, and Theodoridis (2012) take advantage of the yield spread, GDP growth, CPI inflation, M4 growth, and the change in stock prices to examine the effects of quantitative easing. By contrast, Mertens and Ravn (2010), who focus on the effects of the fiscal policy, use only three variables: GDP, government consumption expenditures as well as private consumption of nondurable goods and services. Berument, Ceylan, and Dogan (2010) investigate the impact of oil shocks on the economy and, hence, include in their SVAR the following variables: world oil price, real exchange rates, inflation, and output growth. Nursini (2017), who examines the effects of both fiscal policy and openness on the growth, uses only several measures of government expenditure and openness (ratio of trade to GDP). Thus, although the choice of the core variables varies widely depending on the question setting, we can identify several variables that are most often included in the SVARs modelling economic growth in the international context: interest rates (or their spreads), CPI, commodity prices, exchange rates, and the openness of the economy. In addition, we consider oil prices, since Russian economy is heavily dependent on the exports of natural resources, especially oil and gas.

We use six variables for our analysis.³ All the variables are seasonally adjusted. The data are quarterly and run from 1997Q1 through to 2018Q1.

- s_t is the index of intensity for the sanctions imposed by the rest of the world⁴ on Russia. The index is developed and thoroughly described in Dreger et al. (2016). For the purposes of the present study, it was updated to include sanctions introduced after 2015 and covers the period between March 2014 and August 2018. Prior to March 2014, the index takes the value zero.
- Δy_t^{RU} first difference of the log of Russian quarterly real GDP ($\times 100$) obtained from the Russian Federation Federal State Statistics Service (Rosstat).⁵
- Δy_t^{EA} first difference of the log of euro area quarterly real GDP (based on 19 euro area countries, $\times 100$) obtained from Eurostat.
- Δp_t^{oil} the difference of the log of the price of oil obtained from Datastream. Given the high share of oil and gas in the total exports of Russia, the dramatic decline in oil

prices that began in summer 2014 is accounted for by this variable. The price of oil enters the model as quarter-on-quarter percentage growth.

- e_t^{RU} log of the real effective exchange rate of the Russian ruble obtained from the Bank for International Settlements.
- e_t^{EA} log of the real effective exchange rate of the euro obtained from the Bank for International Settlements.

The variables are shown in Figure 1. The corresponding descriptive statistics are reported in Table 1.

The sanctions index, s_t , varies between 0 and 9.73. The mean log real GDP of Russia is a quarter-on-quarter growth rate of 0.689% and is substantially higher than that of the euro area, where it is 0.391%. This is corroborated by Figure 1, which shows the dynamic growth of the Russian economy between 1999 and 2009. However, the growth rates of Russian GDP vary more strongly than those of the euro area with a standard deviation of 1.806 rather than 0.685. Between 1995Q1 and 2018Q1, oil prices fluctuated wildly between 11 and 121 US dollars per barrel. Finally, Russia's real effective exchange rate shows strong declines during economic downturns.

4. Econometric analysis

4.1. The model

The ultimate goal of our analysis is to identify the shock of the sanctions and trace the reaction of the Russian and European economies to it. As briefly discussed in the introduction, the structural VAR model suits our purposes well, but a plausible identification

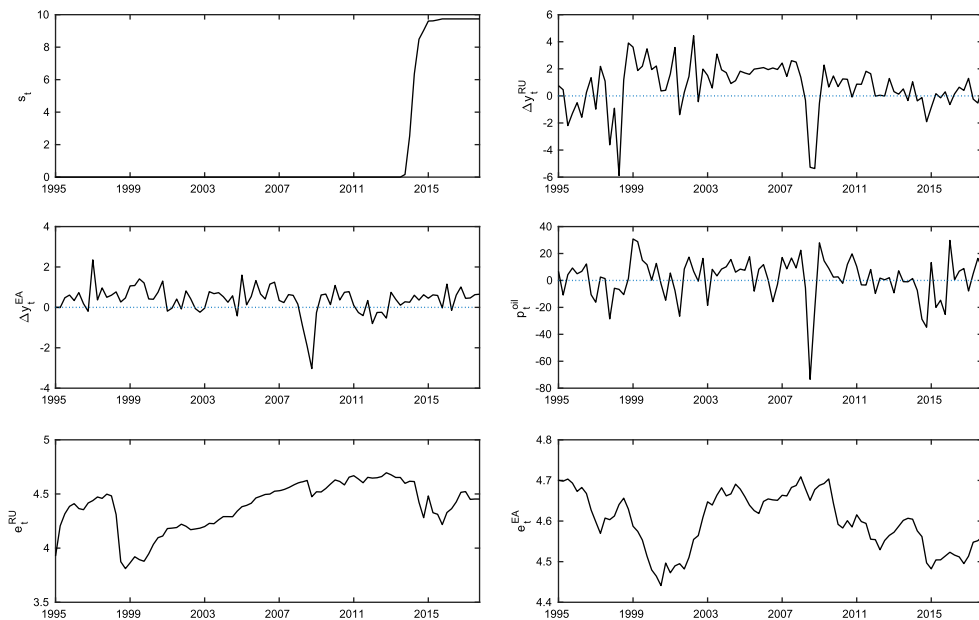


Figure 1. Variables.

Table 1. Descriptive statistics of the variables under inspection.

Statistic	N	Mean	St. Dev.	Min	Max
s_t	92	1.590	3.523	0.000	9.739
Δy_t^{RU}	92	0.689	1.806	-5.887	4.451
Δy_t^{EA}	92	0.391	0.685	-3.031	2.351
Δp_t^{oil}	92	1.574	15.531	-73.433	30.806
e_t^{RU}	92	4.393	0.219	3.810	4.696
e_t^{EA}	92	4.595	0.069	4.431	4.709

Note: N is the number of observations, while 'St.Dev.' denotes the standard deviation.

scheme is needed. To analyze the effects of the sanctions, we set up a VAR of order p :

$$y_t = \nu + A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t, \quad (1)$$

where $y_t = (y_{1t}, \dots, y_{Kt})'$ is a vector of observable variables; the A_i 's are $(K \times K)$ coefficient matrices; ν is a $(K \times 1)$ constant term; and the u_t 's are a K -dimensional serially uncorrelated vector of residuals with mean zero and non-singular covariance matrix Σ_u .

Since the reduced-form residuals, u_t , in Equation (1) are contemporaneously correlated, they do not allow for an economic interpretation. The structural shocks, ε_t , which do have economic meaning, are obtained from the reduced form residuals by a linear transformation:

$$\varepsilon_t = B^{-1} u_t \quad \text{or} \quad u_t = B \varepsilon_t. \quad (2)$$

The matrix B contains the instantaneous effects of the structural shocks on the observed variables and is the object to be identified in some way. There are several types of identifying restrictions prevalent in the empirical literature. These are short-run (Sims, 1980), long-run (Blanchard & Quah, 1989), and sign restrictions (Canova & De Nicoló, 2002). The long-run restrictions are rarely used in the Bayesian context. It may not be easy to come up with the sign pattern of impulse responses that are only for the sanction shock. For that reason, we base the analysis on a single sign restriction that is placed on the impulse response function together with a new class of sign restrictions that is based on narrative information (Antolin-Diaz & Rubio-Ramirez, 2016). These restrictions allow us to remain agnostic about the direct effects of the sanctions on variables of interest like GDP growth. Formally, these restrictions are placed on the historical decompositions implied by the set of structural parameters.

Let $\Theta = (B, \nu, A_1, \dots, A_p)$ collect the values of the structural parameters and VAR coefficients. Then, for any continuous function $F(\Theta)$ that maps the structural parameters to the space of $r \times K$ matrices, with r being a natural number, the sign restrictions take the form

$$S_j F(\Theta) e_{j,K} > 0$$

for $j \in 1, \dots, K$, where S_j is an $s_j \times r$ selection matrix of full rank with $s_j \geq 0$ indicating the number of sign restrictions to identify the j th structural shock and $e_{j,K}$ is the j th column of I_K . As shown in Antolin-Diaz and Rubio-Ramirez (2016), different definitions of S_j and $F(\Theta)$ imply several alternatives for identifying the shock of interest. These alternatives may be combined to represent the set of identifying restrictions. We apply the restrictions to impulse response functions, signs of shock, and variance decompositions. The counterfactual scenario is where we assume sanction shocks to be zero.

In our application, the set of restrictions consists of three distinct sign restrictions on different functions of the structural parameters. These restrictions are as follows.

- R1: The sanction shock is a shock that leads to an increase in the sanctions index, at least on impact. Note that by imposing this restriction, we avoid prescribing the sign patterns of the other variables.
- R2: The sanction shock of one standard deviation may induce a change in the growth rate of oil prices that is not larger than 2.5% on impact. This is approximately one quarter of the average rate of decline in the price of oil in 2014Q1–2015Q4. The restriction is meant to disentangle the effects of the sanction shock and the unexpected drop in the oil price that happened one after another in 2014.
- R3: The contribution of the sanction shock to the unexpected change in the sanctions index from 2014Q2 through to 2018Q1 is greater than the absolute value of the contribution of any other structural shock. Using this restriction, we insist that the sanction shock is the driver of the changes in the s_t index for the period when the sanctions are in place.

The model is estimated using Bayesian methods. We use Minnesota type prior on the parameters. The prior hyperparameters for the VAR coefficients are chosen to be centred around zero for the first four variables. For the other variables, they are centred around unity for lag one, and around zero for the subsequent lags. The tightness parameter is selected to be 0.2 as it is not extremely tight and allows the data to speak. The value is suggested to be as a standard benchmark for macroeconomic analysis.

4.2. Empirical analysis

We estimate VAR(2), as the information criteria suggest. The final structural model consists of restrictions R1–R3 imposed jointly. We sample 1000 draws that satisfy sign restrictions R1–R3. This amount of draws allows to analyze the moments of posterior distribution rather well.

The impulse responses to the sanction shock of one standard deviation are shown in Figure 2. After a shock, the growth rate of GDP does show some decline in both

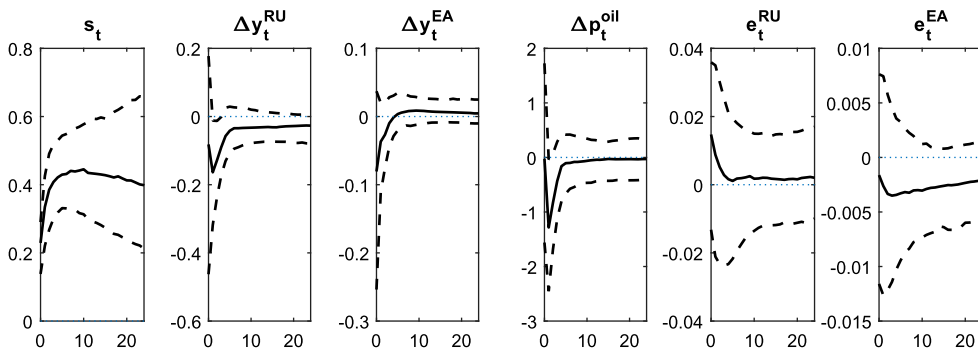


Figure 2. Impulse responses of variables to the sanction shock. Notes: The impulse responses are based on the SVAR(2) model. The solid lines represent the posterior median, while the dashed lines are 68% credible sets.

regions. There is quite a substantial probability mass on both the positive and negative sides and the credible sets cover zero for the entire response horizon.

The reaction of the other variables in the system points toward some indirect effects. To some extent, the price of oil shows reactions in early response horizons, but the reaction goes to zero quickly. The REER of the Russian ruble depreciates for up to five response horizons. This may be an indication of the diversion of trade toward remote and, perhaps, less developed partners. Possibly there is an effect from sanctions through the adjustment of the exchange rate at the beginning of the response horizon, but it is less pronounced for the euro area countries as its magnitude is approximately one-tenth that of the REER of the ruble.

Another important indicator to consider is whether the sanction shock is an important driver of the variation in GDP growth rates and other variables. The forecast error variance decomposition for several horizons is shown in Table 2. The influence of the sanction shock is quite similar for both economies. At long horizons, the shock contributes up to 28% of the variation in GDP growth in Russia and 31% in the euro area, respectively. The sanctions appear to have some effect through their influence on the REER, which results in up to 44.5% and 55.6% of the variation for Russia and the euro area. The difference is more pronounced over long horizons. The variations in the oil prices are mostly eliminated by restrictions imposed on the system.

The impulse responses and variance decomposition show that sanctions have had some effect on Russia and on the euro area. However, it may be interesting to quantify the impact of the sanctions on GDP directly. For that purpose, we deploy our SVAR to perform a counterfactual analysis in the following way. Suppose that all sanction shocks were zero for the entire time span of our data. The moving average representation of the SVAR allows us to calculate values of the time series assuming one or more shocks are set to zero. With the artificial data in hand, the difference between the true and counterfactual data shows the effect of the sanction shocks. The result of setting the sanction shocks to zero is shown in Figure 3. The shocks are eliminated for the entire duration of the sample, but for the sake of convenience, we show results from 2014Q2 onward. In the preceding period, the counterfactual GDP growth rate series is not much different from the true ones, as only the last observations differ.

The counterfactual analysis suggests that the effect of the sanctions is difficult to notice if judged using credible sets. The negative effect is largely concentrated between 2014Q2 and 2016Q1, when the differences between the actual and counterfactual GDP growth rates in Russia shift into the negative area. A similar effect is seen for the euro area between 2014Q2 and 2015Q3. The decline of the posterior probabilities of GDP is much higher for Russia than it is for the euro area, where the probability does not exceed 25% for most of the time.

Table 2. Posterior contribution of the sanction shock to forecast error variances, 90% credible sets.

Variable	Horizon		
	4	8	24
Δy_t^{RU}	[0.005,0.273]	[0.006,0.267]	[0.010,0.287]
Δy_t^{EA}	[0.003,0.322]	[0.005,0.312]	[0.008,0.312]
Δp_t^{oil}	[0.003, 0.084]	[0.005,0.091]	[0.008,0.105]
e_t^{RU}	[0.006,0.519]	[0.007,0.483]	[0.013,0.445]
e_t^{EA}	[0.004,0.579]	[0.007,0.555]	[0.016,0.556]

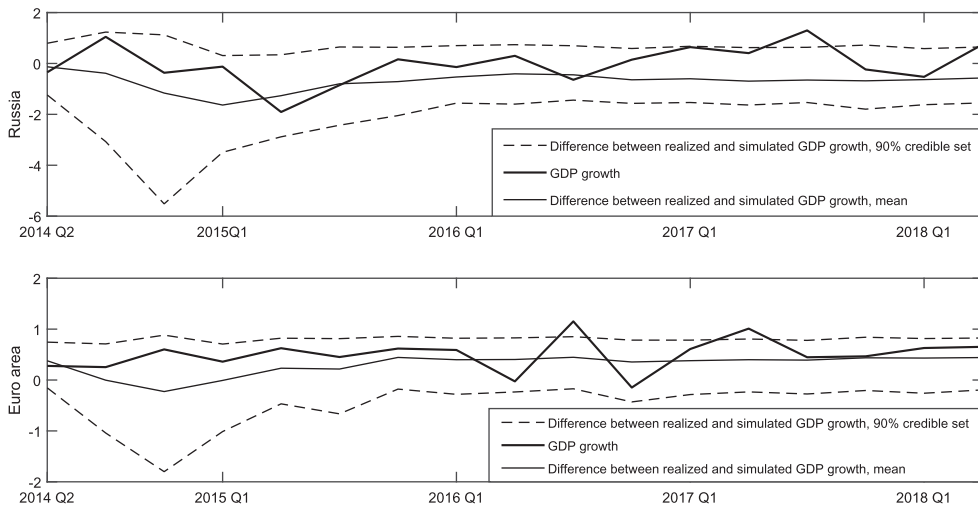


Figure 3. Realized and counterfactual median GDP growth rates.

Panel (a) of Figure 4 shows the posterior distribution and contour plot of the difference between the true and counterfactual GDP for Russia. The GDP difference is pretty much concentrated around zero. However, over 2016Q1 to 2017Q1, we observe the highest peaks of the distribution and a shift toward adverse effects. In general, there is much more probability mass on the negative side of the GDP difference. Panel (b) of Figure 4 shows the posterior distribution and contour plot of the difference between the true and counterfactual GDP for the euro area countries. The GDP difference tends to be concentrated with relatively equal probability mass above and below zero.

One possible reason why the sanctions have this quite negligible effect on the real GDP of the euro area is a change in the net exports of the euro area. In 2014, exports from the 18 euro area countries⁶ to Russia declined by 17.9 billion US dollars, while imports fell by 21.5 billion US dollars. Thus, the negative trade balance of the euro area with Russia shrank by 3.6 billion US dollars. This represents a slight increase in the GDP of the euro area, given that net exports to the Russian Federation make up about 16.1% of overall net exports and 0.6% of the GDP of the 19 euro area countries. By contrast, Russian net exports to all its trade partners fell from 212.3 to 211.2 billion US dollars between 2013 and 2014. To some extent, this is due to the fall in the price of oil, which represents a large part of Russia's exports.

5. Conclusions

In this paper, we propose using a structural VAR to assess the effects of economic sanctions for the Russian and European economies. We model the interactions between these two regions using a measure for the intensiveness of sanctions introduced in Dreger et al. (2016), real GDP growth, the price of oil, and the real effective exchange rates of Russia and a composite of 19 euro area countries.

The sanction shock is identified using a set of narrative sign restrictions. The identification is motivated by several features that the sanction shocks should possess, including a very weak effect on the price of oil to disentangle the large drop in the price of oil from the

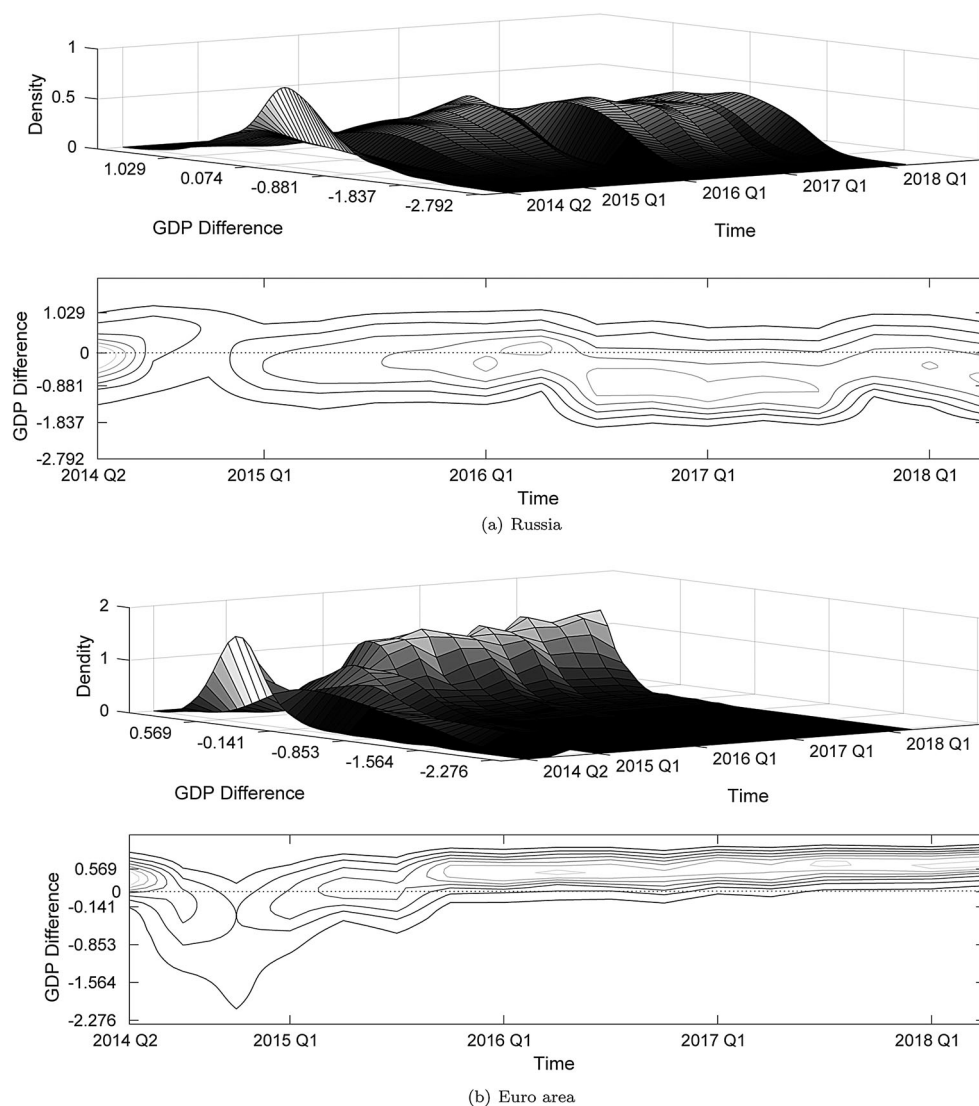


Figure 4. Simulated difference between true and counterfactual GDP growth. (a) Russia (b) Euro area.

sanctions. We do not find strong evidence in favour of the adverse effect of sanctions on the growth rate of Russian GDP or on the growth rate of euro area GDP. The real effective exchange rates are exposed to depreciation pressure following the sanction shock. The impact of the sanctions on the exchange rate is, to a large extent, expected as the sanctions analyzed are bans on foreign trade. Thus, the sanctions imposed by the Western countries on Russia since March 2014 appear to have a very small, if any, effect on the growth of the Russian economy for the period analyzed in the paper. This indicates that they may be rather inefficient as an instrument of political pressuring. The effect of the sanctions on the economy of the euro is also negligible. Therefore, Europe may gain from lifting the sanctions, as this would lead to de-escalation of tensions existing now in the political sphere.

Notes

1. <https://ec.europa.eu/eurostat/en/data/database>.
2. According to Volker Treier from DIHK (German Chamber of Commerce and Industry), <http://www.dihk.de/themenfelder/international/news?m=2016-02-18-treier-russland>.
3. Based on a reviewer's suggestion, we estimated a model that includes an openness measure, CPI, and real interest rates. However, we find that the responses of these variable are centred around zero and, for this reason, we proceed with the model incorporating only six variables.
4. In fact, not every country introduced sanctions against Russia, but as the European Union, the USA, Australia, Canada, Japan, and some smaller economies did, it seems appropriate to label these as 'the rest of the world'.
5. Due to a switch by the Russian Federal State Statistics Office from the GDP deflator with a 2008 basis to one with a 2011 basis in April 2016, we had to link the two real GDP time series (1995Q1–2015Q3 and 2011Q1–2015Q4) through their growth rates. Up to 2010Q4, the growth rates of the first time series are used, then from 2011Q1, the growth rates of the later time series.
6. Lithuania joined the area in 2015

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Estonian Research Council under Grant MOBTP11.

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Appendix: BVAR with 12 variables

Figure A1 of the [appendix](#) presents the impulse response for the model discussed in Section 3 augmented with the following variables:

- CPI_t^{RU} is the inflation rate in Russia obtained from Rosstat and based on own calculations;
- CPI_t^{EA} is the inflation rate in euro area obtained from Eurostat and based on own calculations;
- $open_t^{RU}$ is the measure of trade openness of Russia obtained from Rosstat and based on own calculations;
- $open_t^{EA}$ is the measure of trade openness of euro area obtained from Eurostat and based on own calculations;
- $RSTIR_t^{RU}$ is the real 3-month short term interest rate of Russia obtained from OECD Main Economic Indicators;
- $RSTIR_t^{EA}$ is the real 3-month short term interest rate of the euro area obtained from OECD Main Economic Indicators.

The responses of variable to shocks do not differ very much from the ones shown in Figure 2.

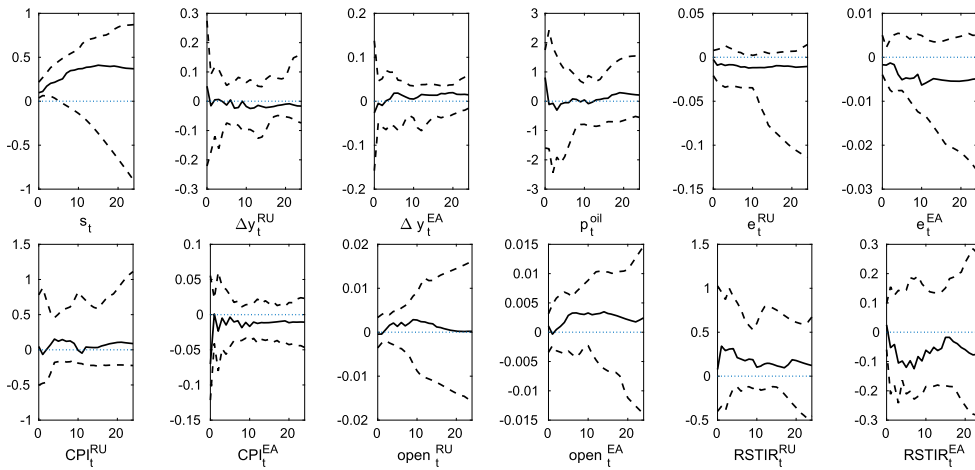


Figure A1. Impulse responses of the model with 12 variables.