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# The Impact of Economic Sanctions on Russia and its Six Greatest European Trade Partners

Morad Bali

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Morad Bali. The Impact of Economic Sanctions on Russia and its Six Greatest European Trade Partners: a Country SVAR Analysis. , 2018, Finance & Business, 14 (2), pp.45-67. 10.31085/1814-4802-2018-14-2-45-67 . halshs-01918521

**HAL Id: halshs-01918521**

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Submitted on 11 Nov 2018

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Свидетельство о регистрации  
ПИ № ФС 7718831  
выдано Федеральной службой  
по надзору за соблюдением  
законодательства  
в сфере массовых коммуникаций  
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# The Impact of Economic Sanctions on Russia and its Six Greatest European Trade Partners: A Country SVAR Analysis\*

**Morad BALI**

September 01, 2017

## **Abstract**

The Ukrainian crisis of November 2013 has led to the proclamation of independence of the Republic of Crimea in March 2014, and its attachment to Russia. This attachment, recognised by Russia and contested by a large number of Western countries, triggered an international crisis between the Russian Federation and the West (European Union, United States of America, *et cetera*). As a means of applying pressure on Russia, Western countries decided to launch a set of international sanctions. This paper's goal is to assess on sanctions effects on Russian and European economies. Thus, a country structural vector autoregressive (CSVAR) model is used in order to witness the impact of a sanction shock on considered economies. To our best knowledge, this paper is the first to use a CSVAR model to study the economic growth effects of anti-Russian sanctions on the considered economies. The economic conflict repercussions are revealed on the Euro Area (19 countries), on the six biggest trade partners of Russia as a lone entity, and finally on the six biggest trade partners of Russia separately. Results witness that the shock's effects are quite different whether a sum of GDP is used or not. In addition, results reveal that Russia is the most impacted by sanctions with a quarter-on-quarter GDP growth decrease of 3.25% after 3 quarters. Yet, European economies are also negatively impacted by sanctions, even if the impact is much weaker: -0.075% for Finland, -0.025% for France, -0.0125% for Germany, -0.012% for Italy, and -0.063% for Poland. As a consequence, we can say that the own coercive measures of European countries have a negative impact on their economies.

**Keywords:** *Russian economy, European economies, Ukrainian crisis, economic sanctions, sanctions shock, trade relations, international crisis, structural vector autoregressive models.*

\*I want to warmly thank Konstantin A. Kholodilin and Aleksei Netšunajev for providing me the data of their papers. Also, I am thankful to Nady Rapelanoro for his help regarding the econometric model.

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# 1. Introduction

The Ukrainian crisis of November 2013 has led to the proclamation of independence of the Republic of Crimea in March 2014, and its attachment to Russia. This attachment, recognised by Russia and contested by a large number of Western countries, triggered an international crisis between the Russian Federation and the West (European Union, United States of America, *et cetera.*). As a means of applying pressure on Russia, Western countries decided to launch a set of international sanctions. These sanctions concern mainly technologies related to military use, to the petroleum industry, transferable securities, and more largely to financial activities with Russian financial institutions. In response Russia announced counter-sanctions, including a large food embargo on European products.

International sanctions born of the Ukrainian crisis have transformed the structure and the intensity of economic relationships between Russia and Europe. According to Eurostat data<sup>1</sup>, the EU countries' exports decreased on average of 29.84% between 2014 and 2016. Without surprise, it is the "Food and live animals<sup>2</sup>" section of the Standard International Trade Classification (SITC) which broke all records with a negative variation of 50%. More precisely, the SITC product grouping reveals a 42.1% decline of the "Food<sup>3</sup>" group, and a 58.3% diminution of the "Fish<sup>4</sup>" group. At the same time, it is interesting to note that Russia's imports decreased of 23.57% between 2014 and 2016. The comparison between the variation of EU's exports to Russia (30,795m€<sup>5</sup>) and the variation of Russia's world imports (50,704m€), indicates that EU's exports decline accounted for 60.73% of Russia's world imports decrease.

**Table 1: EU exports to Russia by SITC**

| <b>EXPORTS EU TO RUSSIA by SITC section 2013-2016 (K€)</b>            | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>Var 2014-16</b> |
|---|-------------|-------------|-------------|--------------------|
| <b>Total</b>  | 103 203     | 73 736      | 72 408      | -29.84%            |
| <b>Food and live animals</b>  | 6 369       | 3 302       | 3 188       | -49.95%            |
| <b>by SITC product grouping (K€)</b>                                  |             |             |             |                    |
| <b>*Agricultural products (Food (incl. Fish) &amp; Raw Materials)</b> | 9 254       | 5 624       | 5 705       | -38.35%            |
| <b>**Food</b>   | 8 290       | 4 734       | 4 800       | -42.10%            |
| <b>***of which Fish</b>   | 156         | 65          | 65          | -58.33%            |

*Source Eurostat Comext - Statistical regime 4*

<sup>1</sup> Eurostat Comext - Statistical regime 4

<sup>2</sup> Section: S0

<sup>3</sup> SITC codes: 0,1,22,4

<sup>4</sup> SITC code: 03

<sup>5</sup> EU's exports to Russia.

It is nonetheless important to bear in mind that oil prices decreased at the same time, causing a strong depreciation of the Russian rouble. Indeed, according to our calculation<sup>6</sup>, there is an almost perfect linear relationship between the Russian currency and Brent oil prices during the depreciation period, as the correlation coefficient reaches 0.912. Moreover, the first-difference model reveals that when oil prices decrease of 1, the rouble depreciate of 3 (Bali, 2016, p. 3). However, even if this model suffers from a leak of explanatory variables, the paper of Dreger *et al.* (2015) is in the same vein. Their results indicate that the bulk of the depreciation is caused by the decline of oil prices (p. 26) and isn't due to sanctions.

**Table 2: Oil & Rouble econometric data**

| Source   | SS         | df        | MS         |
|----------|------------|-----------|------------|
| Model    | 58.4007687 | 1         | 58.4007687 |
| Residual | 817.761309 | 354       | 2.31006019 |
| Total    | 876.162077 | 355       | 2.46806219 |
|          |            |           |            |
| dcrs2    | Coef.      | Std. Err. | t          |
| dcrs1    | -0.331078  | 0.0658465 | -5.03      |

*From Bali (2016).*

Assuming that, it would then be logical to wonder if there isn't a share of Russia's world imports drop which can be explained by the rouble's depreciation. But as the Russian currency started to appreciate itself in February 2016, we can have a good faith into the fact that the rouble depreciation didn't cause the imports decline. Mostly because Russia's world imports remained at the almost same level in 2015 (164,402m€) and 2016 (164,459m€). However, if imports' decline was linked to the rouble's depreciation, imports would have more likely been higher in 2016 than in 2015 -as the Russian rouble started to appreciate in February. This path seems to lead to the fact that sanctions are responsible.

Besides, the fact that Russia's world imports remained at the same level between 2015 and 2016, means that before sanctions imported products –for a total value of 50,704m€- have either stopped being consumed in Russian Federation, either been homemade produced by the Russian internal market. The second possibility seems –based on the development of the Russian agriculture, which is nowadays Russia's second-biggest exporter- to be the best guess. Anyhow, the results of sanctions are politically inefficient, as neither Russia nor Europe

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<sup>6</sup> It is a try to measure the relationship between the Brent oil prices and the Russian rouble. The selected period is the rouble's collapse, from November 2013 to June 2016. The time series has been first-differenced. The test of the series' residuals shows that they aren't co-integrated, which stopped us from using an Error Correction Model. Consequently, a first-difference model has been used.

changed their position. In spite of these results, sanctions remain<sup>7</sup>. Slowly destroying a trade history of yesteryear between Europe and Russia. Moreover, it is important to remember the *raison d'être* of these coercive measures. Isn't their purpose to make a government change the positions of another government? And to this very end, isn't economic pressure the main tool in the hand of governments? This is why it is vital to have a better understanding of the impact of sanctions. As after all, sanctions that are unable to create a strong economic pressure have low chances to be efficient.

The aim of this paper is to continue the work provided by [Kholodilin and Netšunajev \(2016\)](#) in “*Crimea and Punishment: The Impact of Sanctions on Russian and European Economies*”. Their paper is the first that evaluates the economic growth effects of anti-Russian sanctions for the considered economies. They performed a quarterly analysis from 1997q1 to 2015q4 on seasonally adjusted variables. Their key finding is that Russia lost about 2 percentage points of the GDP quarter-on-quarter growth due to restrictions on international trade and financial transactions; whereas the Euro Area (EA) loss reaches only 0.02 percentage point (p. 10).

**Table 3: Actual and counterfactual GDP growth rates**

| Date           | Actual data |       | Counterfactual |       | Difference |        |
|----------------|-------------|-------|----------------|-------|------------|--------|
|                | yru         | yea   | yru            | yea   | yru        | yea    |
| 2014q2         | 0.458       | 0.096 | 1.44           | 0.394 | -0.982     | -0.298 |
| 2014q3         | 0.169       | 0.301 | 1.661          | 0.393 | -1.492     | -0.092 |
| 2014q4         | 0.055       | 0.469 | 2.138          | 0.372 | -2.084     | 0.097  |
| 2015q1         | -2.756      | 0.726 | -0.243         | 0.682 | -2.513     | 0.044  |
| 2015q2         | -2.204      | 0.424 | 0.245          | 0.372 | -2.449     | 0.052  |
| 2015q3         | 0.588       | 0.314 | 2.922          | 0.217 | -2.333     | 0.096  |
| <b>Average</b> |             |       |                |       | -1.976     | -0.017 |

*From Kholodilin and Netšunajev (2016), p. 9.*

Be that as it may, they use the EA aggregate GDP or, in other words, the sum of 19 EA countries' GDP. This method is interesting to assess the impact of sanctions on the EA as a lone entity. It is nonetheless not enough to appreciate the international restrictions' effect on the most concerned economies. As this part hasn't -to our best knowledge- been studied yet, this paper will continue their work and study the impact of sanctions on the most involved European economies. Thus, this paper is organised as follows. In Section 2, we will study the existing literature related to sanctions. The Section 3 reveals the data used for the analysis, and adjustment made. Section 4 describes the econometric analysis with a focus on the model, empirical results, and robustness checks. Finally, Section 5 concludes this paper.

<sup>7</sup> 22/06/2017: EU extends sanctions against Russia by six months until January 31, 2018.

## 2. Literature Review

First of all, it shall be noted that the definition of what is and what is not an international economic sanction is a conflict source of sanctions' literature. Starting from [Doxey \(1971\)](#), international economic sanctions are lifted measures of an international entity constitutionally authorised to send them, in order to compel a targeted country to modify its policy so that it isn't in conflict with international laws. This too limited definition can be completed by the one of [George et al. \(1971\)](#). Indeed, they define sanctions as a kind of diplomatic coercive action which impose economic pressure to a country, in order to show the will of protecting predefined interest, while exhibiting a capacity to intervene militarily if this isn't enough. This coercive measure having nonetheless a mainly alerting and negotiating nature. With that said, those who will first consider military initiatives as a kind of international economic sanction –as they often have an economic impact- are [Hufbauer et al. \(1990a, 1990b\)](#). But we finish with [Pape \(1997, 1998\)](#), who dress a heavy and vehement critic of their definition, explaining that military and economic measures must be separated. These definitions' "conflicts" are really important as they change the manner of studying international economic sanctions. As a matter of fact, data bases and econometric models differ in accordance with the adopted definition. The accepted definition of this paper is the one thoroughly described in [Dreger et al. \(2015\)](#) : “ Western Sanctions include travel bans and the freezing of assets of individuals. Sectoral sanctions like restrictions on government-owned Russian banks or trade restrictions related to the Russian energy and defence sector have been added at later stages. Russia responded with restrictions to several countries, including a ban of food imports from the USA, the EU, Canada, and Australia and travel restrictions for certain Western citizens.”, p9.

What does the literature say about sanctions? In the case of the Ukrainian crisis, [Eric Brunat \(2016\)](#) explain that: “*the escalation of mutual sanctions between Western countries and Russia and tensions are worsening the situation. In case of a long economic war or an embargo against Russia (which necessarily implies a negative spiral of penalties in both directions), the cost would be paid mainly by the Europeans (especially with tensions on the price of energy that could ultimately result as well as the measures directly affecting agricultural exports and European agrofood)*.”. Which leads to the thinking that sanctions might have a higher cost for the Europeans than for the Russians. Out of the Ukrainian crisis case, Margaret [Doxey \(1971\)](#) is the first to put forward the view that the efficiency of sanctions is a function of their intensity (economic pressure). A strong economic pressure drives to efficient sanctions. It is therefore important to note that [Eland \(1995\)](#) and [Galtung \(1967\)](#) explain that economic pressure also

leads to a favourable internal political integration. Mostly because the nation will take the pressure as an external political interference, leading people to support their government. There is, however, a major point raised by [Olson \(1975, 1979a, 1979b\)](#). He explains that hidden sanctions are stronger than announced ones. Because the hidden sanctions will counter [Eland \(1995\)](#) and [Galtung \(1967\)](#) findings and create political disintegration. In fact, if the population isn't aware of sanctions, they will consider that the bad economic situation is due to the government's choices.

On another point of view, [Morgan and Schwebach \(1979\)](#) bring an analysis which can be directly linked to the Ukrainian case. They study the influence of the number of targeted sectors, and explain that a high number of targets decrease the intensity of the economic pressure. As explained at the beginning, the number of targeted sectors of Western sanctions can be summed up to 3: military, petroleum, and financial. This could be an explanation to the little economic pressure imposed by Western measures. Moreover, [Neuenkirchn and Neumeier \(2015\)](#) demonstrate that the duration of sanctions also influences their efficiency. The longer they are, the weaker they will be. *De facto*, Ukrainian case related sanctions started now for almost 3 years, and don't stop being prolonged. This single fact could also explain their poor performance. Finally, a major finding comes from [Bonetti \(1998\)](#) with his "third-country effect". This is the fact that another country, neither the sender nor the target, plays a role into the success rate and efficiency of the punishment. This outsider can help the targeted country to decrease the effects of sanctions. Bonetti's discovery has been verified by [Askari et al. \(2004\)](#) as their results witness the third-country effect: "In some cases, we found that these sanctions have actually promoted trade between these countries and the EU or Japan. This is a clear indication of third-country effect.", p. 59. This effect could easily explain the low effectiveness of international sanctions in the Ukrainian crisis case. The thinking goes to Russia's allies whose imports appear as a substitute from European's ones.

To conclude this section, it is important to take a careful look on econometric models used in the literature. The empirical literature spearhead is more than certainly the paper of [Hufbauer et al. \(1990a, 1990b\)](#). They exploit their gigantic data base –summing up 115 cases of international sanctions from 1914 to 1990- with the help of a multiple regression model. Their key finding is that sanctions have a 33% success rate over the studied period –strongly refuted by [Pape \(1997, 1998\)](#). Later, [Clyde et al. \(2003\)](#) studied international sanctions using the Andrew Rose's gravity model ([Rose et al., 2001](#)). Their findings confirm Doxey's thesis (1971) as they show that sanctions have a real effect on trade -a 90% decrease in their case-

and, at the same time, support the idea which says that coercive measures decrease over time: « Finally, it should be recognised that the longer sanctions are in place, the greater the opportunity for both exports and imports to carve new channels. » (Clyde *et al.*, (2003), p. 13). However, papers involving gravity models as a means of measuring the impact of coercive measures are legion, see Caruso (2003), Askari *et al.* (2004), et cetera.

As explained before, the aim of this paper is to extend the work of Kholodilin and Netšunajev (2016). Their paper has been chosen as it is the first one who study the impact of sanctions by using a structural vector autoregressive model (SVAR). Moreover, it is also –at the time of this writing- a very recent paper. Thus, their goal was to investigate the impact of sanctions on Euro Area GDP and Russian GDP. They used an updated version of the sanctions index developed in Dreger *et al.* (2015) - see Table 10 - to measure the intensity of international sanctions against Russia. Also, with the help of Impulse-Response functions, they have been able to quantify the impact of sanction shocks on studied economies. It is important to note that they compare the Russian GDP to the 19 EA countries sum of GDP. Their key finding is that Russia lost about 2 percentage points of the GDP quarter-on-quarter growth due sanctions; whereas the Euro Area (EA) loss reaches only 0.02 percentage point (p. 10). Yet, we believe that these results can be nuanced in two ways. Firstly, by replacing the EA countries with the 6 strongest trade partners of Russia. Secondly, by analysing the impact of sanctions on each country individually, and not on a sum of GDP. To do so, we will use a country structural vector auto regressive model (CSVAR). In other words, we will run as many models as studied countries (see the data section). In spite of everything, international economic sanctions remain a very complex, but fascinating, matter. Mostly because it is extremely hard, if not impossible, to distinguish the pure effect of sanctions from other exogenous explanatory variables.

### 3. Data

The following data are used for the analysis. They are quarterly, seasonally adjusted -with X-13ARIMA-SEATS, direct adjustment- and run from 1997q1 to 2015q4.

- $y_t^{ea}$  : Euro Area GDP (19 countries).
- $y_t^6$ : Sum of six Russia's main partners' GDP (Germany, France, Netherland, Finland, Italia, Poland).

**Table 4: Russia's main trading partners (European)**

| Country | Imports origin (\$) | Country | Exports (\$)      |
|---------|---------------------|---------|-------------------|
| DEU     | 22 362 464 699.90   | NLD     | 32 217 555 376.70 |
| ITA     | 7 714 314 174.31    | DEU     | 18 455 594 439.10 |
| FRA     | 5 498 302 156.70    | ITA     | 15 531 259 923.40 |
| POL     | 5 121 080 966.96    | POL     | 10 658 807 955.30 |
| NLD     | 3 708 145 327.16    | FIN     | 6 227 423 980.13  |
| FIN     | 3 229 629 206.54    | FRA     | 5 240 811 405.97  |

Data for 2015, United Nations Statistical Division (COMTRADE)

**Imports origin:** The origin of Russian imports ; **Exports:** European exports to Russia/country.

- $y_t^k$ : country  $k$ 's GDP.  $k \in [fr; po; it; ge; nl; fi; ru]$
- $e_t^\varphi$ : log of real effective exchange rate of currency  $\varphi$  obtained from Bank for International Settlements.  $\varphi \in [ruble; \text{Euro}; \text{Złoty}]$
- $oil_t$ : log of oil prices obtained from Datastream.
- $s_t$ : sanctions' index of Western sanctions against Russia.

All GDP are log first-differenced. European countries' GDP are chain linked volumes (2010), million Euro, seasonally and calendar adjusted, from Eurostat. Russian GDP is from Russian Federal State Statistics Office. Three adjustments have been made:

- 1)  $y_t^{ru}$ : See [Kholodilin and Netšunajev \(2016\)](#): “Due to a switch from the GDP deflator [...] we had to link the two real GDP time series (1995q1{2015q3 and 2011q1{2015q4) through their growth rates. Through 2010q4, the growth rates of the former time series; while since 2011q1, the growth rates of the latter time series are used”.
- 2)  $y_t^{nl}$ : 1995q1 to 1995q4 values were missing and have been calculated through 1996 quarter-on-quarter growth rate.
- 3)  $y_t^{po}$ : 1995q1 to 2001q4 values were missing and have been calculated through 2002 and 2003 quarter-on-quarter growth rate.

**Table 5: Descriptive statistics of GDP**

|           | $y_t^{ru}$ | $y_t^{ge}$ | $y_t^{fr}$ | $y_t^{it}$ | $y_t^{fi}$ | $y_t^{po}$ | $y_t^{nl}$ |
|-----------|------------|------------|------------|------------|------------|------------|------------|
| Obs       | 83         | 83         | 83         | 83         | 83         | 83         | 83         |
| Mean      | 0.0072     | 0.0033     | 0.0038     | 0.0012     | 0.0053     | 0.0094     | 0.0045     |
| Std. Dev. | 0.018      | 0.008      | 0.005      | 0.007      | 0.013      | 0.006      | 0.007      |
| Variance  | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| Skewness  | -1.547     | -2.489     | -1.405     | -1.292     | -2.473     | 0.071      | -1.729     |
| Kurtosis  | 6.274      | 15.871     | 7.552      | 7.098      | 17.128     | 3.796      | 10.624     |
| Min       | -0.062     | -0.046     | -0.017     | -0.029     | -0.071     | -0.004     | -0.032     |
| Max       | 0.040      | 0.020      | 0.013      | 0.016      | 0.033      | 0.023      | 0.017      |
| Med       | 0.012      | 0.004      | 0.004      | 0.002      | 0.005      | 0.009      | 0.004      |

Here, mean is the quarter-on-quarter growth rate. We can see that Poland is first –even though this data must be interpreted with caution because of the adjustment which has been made-, then come Russia, Finland, Netherland, France, Germany, and Italy. Regarding values dispersion, Russia’s quarter-on-quarter growth is the most volatile with values varying from -6.2% to 4%, and a standard deviation of 1.8%. On the contrary, France’s quarter-on-quarter growth is the most stable one with values varying from -1.7% to 1.3%, and a standard deviation of 0.5%. In the same way, Russia’s median shows that 42 quarters had a growth above 1.2%, while Italy’s median indicates that half of the quarters had a growth below 0.2%. Skewness and Kurtosis coefficients reveal non-Gaussian<sup>8</sup> distributions, even if Poland’s distribution is close to be.

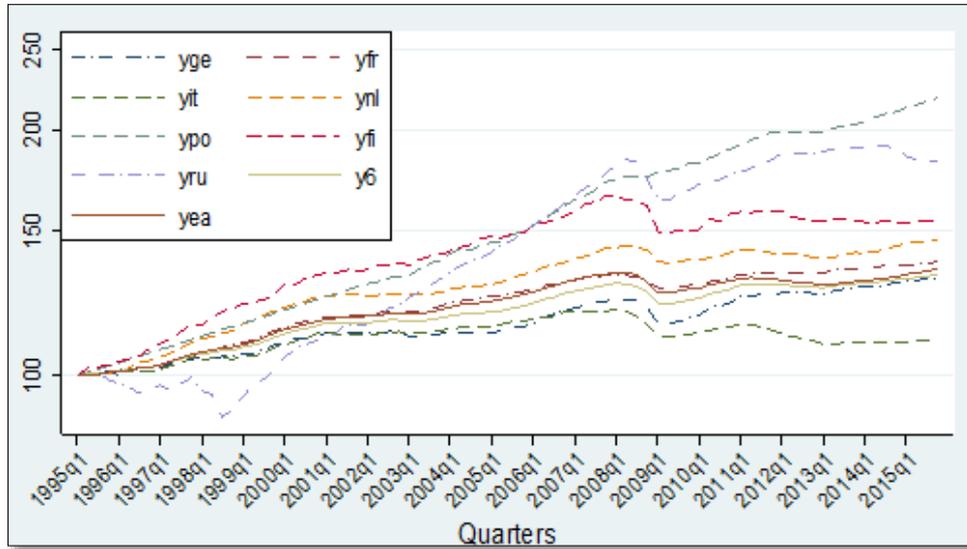
**Table 6: Descriptive statistics of remaining variables**

|                  | $y_t^{ea}$ | $y_t^6$ | $s_t$  | $e_t^{ea}$ | $e_t^{ru}$ | $e_t^{z1}$ | $oil_t$ |
|------------------|------------|---------|--------|------------|------------|------------|---------|
| <b>Obs</b>       | 83         | 83      | 84     | 84         | 84         | 83         | 84      |
| <b>Mean</b>      | 0.004      | 0.003   | 0.628  | 0.607      | 0.377      | 0.003      | 54.71   |
| <b>Std. Dev.</b> | 0.006      | 0.006   | 2.190  | 0.070      | 0.238      | 0.0397     | 35.909  |
| <b>Variance</b>  | 0.006      | 0.000   | 4.797  | 0.005      | 0.056      | 0.002      | 1289.4  |
| <b>Skewness</b>  | -2.866     | -2.651  | 3.337  | -0.518     | -0.713     | -0.965     | 0.554   |
| <b>Kurtosis</b>  | 15.968     | 15.634  | 12.409 | 2.279      | 2.599      | 5.626      | 1.962   |
| <b>Min</b>       | -0.031     | -0.031  | 0.000  | 4.435      | 3.815      | -0.144     | 10.940  |
| <b>Max</b>       | 0.014      | 0.013   | 9.140  | 4.707      | 4.697      | 0.081      | 140.32  |
| <b>Med</b>       | 0.005      | 0.004   | 0.000  | 4.612      | 4.419      | 0.007      | 46.345  |

Finally, with a lower mean and median, the quarter-on-quarter growth performance of the six countries group is below Euro Area’s. Descriptive statistics of these two distributions ( $y_t^6 ; y_t^{ea}$ ) are nonetheless very close, while the shape of these two is almost identical (see Skewness and Kurtosis values). As it stands, it seems that the 5 considered countries (without Poland) account for the largest share of the EA quarter-on-quarter performance ( $y_t^{ea}$ ).

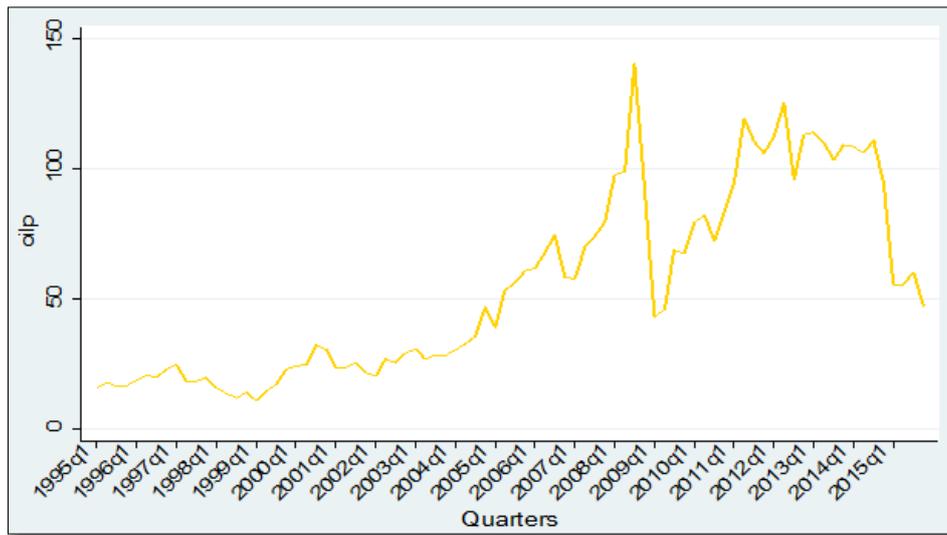
<sup>8</sup> A Gaussian distribution has a S=0 and K=3.

**Figure 1: GDP**



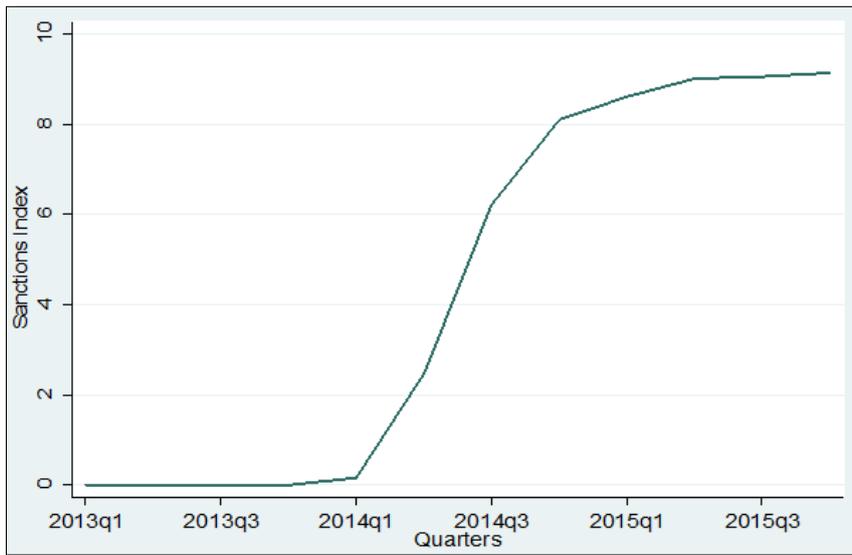
*Index1995q1 = 100*

**Figure 2 : Oil prices**

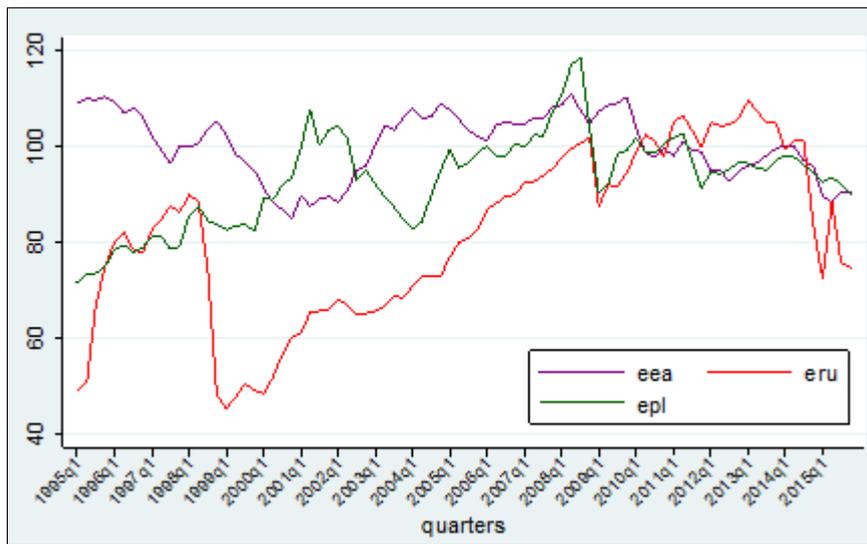


As we can see, this variable records two significant decline. Firstly, during the financial crisis, from 140.32\$ (2008q3) to 43.29\$ (2009q1). Secondly, from 110,89\$ (2014q3) to 47.38\$ (2015q4). These declines are observed on Figure 1, on all studied data except for the Polish GDP.

**Figure 3: Sanctions Index**



**Figure 4: Exchange rates**



With  $e_t^{ea}$ ,  $e_t^{ru}$  and  $e_t^{pl}$  as defined earlier

## 4. Econometric Analysis

As explained in the [introduction](#), the goal of this paper is to extend the results of [Kholodilin and Netšunajev \(2016\)](#). To do so, we will use a Country Structural Vector Autoregressive Model (CSVAR). It will allow us to identify the sanctions shock, and to study the contemporaneous effects on our variables of interest. These variables include Russian and Euro Area economies (through their GDP), but not only. Indeed, we will also study the reaction of German, Polish, Dutch, French, Finnish, and Italian, economies. Moreover, we will compare the reaction between the 19 EA countries, and the group of 6 European countries. As explained before, these six are the greatest European trade partners of Russia.

### 1.1 Model

This part will first explain the model's frame. Secondly, we will focus on the intuition which is behind.

#### 1.1.1 Model's Frame

As explained earlier, we rely on a CSVAR model and our vector of endogenous variables is defined by:

$$(i) y = (s_t, e_t^\varphi, oil_t, y_t^{k'})$$

With  $k' \in [ea, 6, ru, fi, fr, ge, it, nl, po]$

This paper follows the André-Louis Cholesky identification method. With the help of the Cholesky decomposition of the SVAR, special restrictions will be based on the contemporaneous influence of variables. This identification scheme induces to use two contemporaneous matrices,  $|A|$  and  $|B|$ .

**Figure 5: Contemporaneous Matrices A and B**

```
. matrix lis A
A[4,4]
      c1  c2  c3  c4
r1    1   0   0   0
r2    .   1   0   0
r3    .   .   1   0
r4    .   .   .   1
```

```
. matrix lis B
symmetric B[4,4]
      c1  c2  c3  c4
r1    .
r2    0   .
r3    0   0   .
r4    0   0   0   .
```

$|A|$  imposes  $n^2$  restrictions on the contemporaneous interactions among variables, while  $\frac{n(n-1)}{2}$  restrictions are placed on  $|B|$ , a lower-triangular matrix representing the given weight of the SVAR model's error terms. Numbers in matrices are restrictions, while dots are the estimated variables. In Cholesky identification, the ordering matters and depends of initial assumptions. This paper assumes that sanctions have an impact on GDP growth. Consequently, the selected causal ordering of variables through the CSVAR is the following:

$$(ii) \quad s_t \Rightarrow e_t^\varphi \Rightarrow oil_t \Rightarrow y_t^{k'}$$

In this manner, the sanction shock is ordered first and is the only one which has an impact on all other variables, without being contemporaneously affected by them. While  $e_t^\varphi$  will affect  $oil_t$  and  $y_t^{k'}$ ; and while  $oil_t$  will influence  $y_t^{k'}$  only;  $s_t$  will not be affected by  $e_t^\varphi$ ,  $oil_t$ , and  $y_t^{k'}$ . As a consequence of the above, this SVAR model will be run:

$$(iii) \quad svar \ s_t \ e_t^\varphi \ oil_t \ y_t^{k'}, lags(1\backslash 2) \ aeq(A) \ beq(B)$$

This model ensures that  $\Sigma = BB'$ , knowing that  $A = I = E(u_t, u_t')$  with  $u_t$  the structural shocks. Finally, as explain in the [Data section](#), all variables have been first differenced and are in logs. It guarantees us a stationary SVAR model and enables us to display elasticities, yielding to an easy-to-read Cholesky Decomposition.

### 1.1.2 Intuition and Analytical Sequencing

In their paper, [Kholodilin and Netšunajev \(2016\)](#) compare the sanctions' impact on the Euro Area's GDP and on the Russian's GDP. This method can be sharpening up in two ways. Firstly, the sum of 19 Euro Area GDP ( $y_t^{ea}$ ) can be replaced by the GDP's sum of the six biggest trade partners of Russia ( $y_t^6$ ). Indeed, the fact is that some countries of the EA have really small trade relationships with the Russian Federation. For example, if we look at the share<sup>9</sup> of the total exports to Russia among the Euro Area countries, we can see that Cyprus weighs only 0.02%, Luxembourg 0.2%, Greece 0.24%, Portugal 0.33%, *et cetera*. As such, their presence can only alter the analysis quality and significance. Secondly, the mere fact that the shock's effect is studied on a single GDP on the one hand, and on a sum of GDP on the other hand, is by itself disrupting. Mostly because this means comparing things which are not comparable: a large size

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<sup>9</sup> Eurostat Comext - Statistical regime 4

entity shock's effects to a small size one. This is why we believe that it makes more sense to compare each country separately, into seven different models.

## 1.2 Empirical analysis

Firstly, the empirical analysis focus on the structural VAR results using Cholesky's decomposition, and secondly on the Impulse-Response graphs.

### 1.2.1 Cholesky Decomposition

The model has been run nine times, for each studied country or group of countries, while all other variables remain equal. In this manner, it is easy to compare the impact of sanctions and other variables on each GDP separately –or group of GDP. To have a better understanding of the estimations' results, the  $y_t^{ge}$  estimation will be explained, while other estimations are displayed in the results table.

**Table 7: Cholesky Decomposition, German GDP**

```

.matrix list chol_var

chol_var[4,4]
      ds      dln_eea      dln_oil      yge
ds      .30849727      0      0      0
dln_eea -.00252942      .02228285      0      0
dln_oil -.00870616     -.02063311     .16341719      0
yge     -.00032834     -.00115129     .00215043     .00728243

```

The necessary focus of attention is on values of the last line. Thus, when the sanctions index value increase of 1%, German GDP's value decrease of 0.032% in the current quarter. Other columns will not be taken into account for our analysis, as they are contemporaneously influenced by themselves due to the ordering choice and as they don't answer to this paper's aim. Regarding the German GDP decline due to sanctions, even if it seems to be low at first sight, it would be misleading to stop there. Hence, the sanctions influence relatively to the quarter-on-quarter's average growth needs to be studied. In this case, from 1995q1 to 2015q4, the  $y_t^{ge}$  mean takes the value of 0.33%. Consequently, it seems that coercive measures have the ability to slightly reduce the German economic growth.

**Table 8: Cholesky Decomposition Results**

|               | $y_t^{ea}$ | $y_t^6$ | $y_t^{fi}$ | $y_t^{fr}$ | $y_t^{ge}$ | $y_t^{it}$ | $y_t^{nl}$ | $y_t^{po}$ | $y_t^{ru}$ |
|---------------|------------|---------|------------|------------|------------|------------|------------|------------|------------|
| $S_t$         | .007%      | -.006%  | .031%      | .019%      | -.033%     | .009%      | -.006%     | .033%      | -.151%     |
| <b>Mean</b>   | 0.362%     | 0.328%  | 0.530%     | 0.385%     | 0.332%     | 0.123%     | 0.458%     | 0.942%     | 0.724%     |
| <b>Weight</b> | 1.88%      | 1.78%   | 5.90%      | 4.97%      | 9.89%      | 6.96%      | 1.42%      | 3.52%      | 20.86%     |

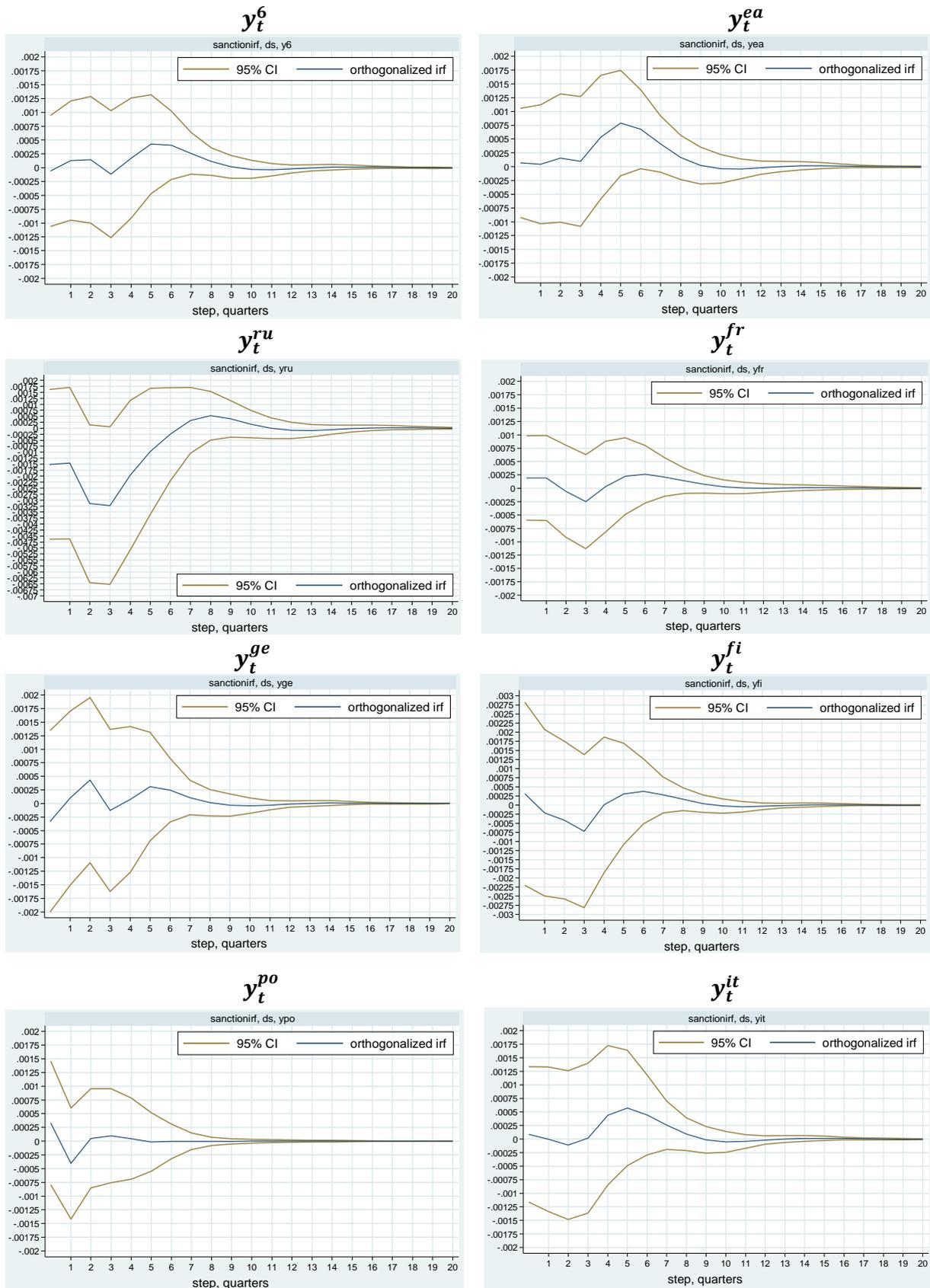
$S_t$  line provides the  $r_4$  matrix line of Cholesky decomposition, the second line provides the average quarter-on-quarter GDP growth, and the last line gives the weight of sanctions shocks on the average GDP growth.

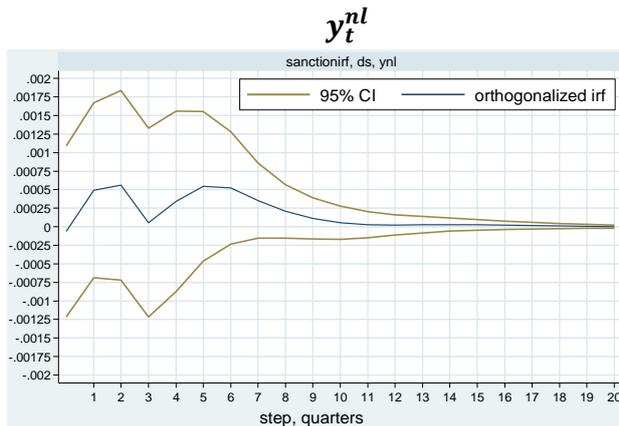
Focusing on the contemporaneous impact of sanctions, we can see that the Euro Area GDP is positively affected by the sanction shock, whereas the Group of 6 GDP is negatively impacted. By the same token, German and Russian GDP also decrease in front of a sanction shock. In value, a 1% increase of sanctions leads to a 0.151% decrease of the Russian economy in the current quarter, while the same shock leads to a 0.033% decline of German growth. Regarding the sanctions' weight, Russia is the most affected by sanctions, and Germany is on the second place. Indeed, the economic growth decline of Russia due to a 1% increase of sanctions accounts for more than 20% of the historical quarter-on-quarter average growth, while it accounts for almost 10% in the German case. Results also reveals that Finland, France, Italy, and Poland are positively affected by the sanction shocks, in the current quarter. Note that Poland, Finland and Germany suffer from the same impact in value and in absolute terms -only the weight differs. Talking about the weights, among the positively impacted countries, Italy is first, closely followed by Finland and France. Yet, these results have to be interpreted with the biggest caution and restraint as they only witness how GDP are contemporaneously affected when the sanctions shock occurs. Thus, contemporaneous relationships between our considered variables after an unexpected shock of sanctions will be captured with the Impulse-Response Functions (IRF).

### 1.2.2 Impulse-Response Functions (IRF)

In the previous section, we studied how the considered economies were affected in the short-term to a sudden and unexpected shock. This part will focus on what is happening next, once the shock has occurred and has been absorbed by the studied GDP. To describe how the shock affect our variables' relationships over time, IRF will be used.

**Figure 6 : Impulse-Response functions of GDP to sanctions shock**





The blue line reflects the IRF, and the brown lines are the 95% confidence interval. Quarters are in abscissa ( $t=3$ months) while the value of the shock is in ordinates. As expected, the IRF supports the great caution and restraint raised earlier about the short-term sanctions' shock effects.

First of all, we can see that all variables start to drive toward a normal quarter-on-quarter growth in period 5 or 6, but yet reach a normal quarter-on-quarter growth only in period 12. This indicates that the effect of a sanction shock which happens once, will possibly leave long-term economic sequelae. Secondly, whether series decreasing or increasing over  $q_1$  to  $q_3$ , all variables -except Poland- endure after all a rise from  $q_3$  to  $q_5$ . This rise can be interpreted as the beginning of return to normal. Finally, to ease the comparison between variables' behaviour, Figure 7 displays the trend of each series. Red colour indicates a decrease, green colour an increase, and yellow a stagnation.

**Figure 7: IRF behaviour of GDP after a sanction shock**

|     | 0 ><br>1 | 1 ><br>2 | 2 ><br>3 | 3 ><br>4 | 4 ><br>5 | 5 ><br>6 | 6 ><br>7 | 7 ><br>8 | 8 ><br>9 | 9 ><br>10 | 10 ><br>11 | 11 ><br>12 | 12 ><br>13 | 13 ><br>20 |
|-----|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|------------|------------|------------|------------|
| POL | Red      | Green    | Green    | Red      | Red      | Green    | Yellow   | Yellow   | Yellow   | Yellow    | Yellow     | Yellow     | Yellow     | Yellow     |
| RUS | Green    | Red      | Red      | Green    | Green    | Green    | Green    | Green    | Red      | Red       | Red        | Red        | Red        | Yellow     |
| FIN | Red      | Red      | Red      | Green    | Green    | Green    | Red      | Red      | Red      | Red       | Red        | Yellow     | Yellow     | Yellow     |
| FRA | Yellow   | Red      | Red      | Green    | Green    | Green    | Red      | Red      | Red      | Red       | Red        | Yellow     | Yellow     | Yellow     |
| NLD | Green    | Green    | Red      | Green    | Green    | Red      | Red      | Red      | Red      | Red       | Red        | Yellow     | Yellow     | Yellow     |
| Y6  | Green    | Green    | Red      | Green    | Green    | Red      | Red      | Red      | Red      | Red       | Yellow     | Yellow     | Yellow     | Yellow     |
| YEA | Red      | Green    | Red      | Green    | Green    | Red      | Red      | Red      | Red      | Red       | Yellow     | Yellow     | Yellow     | Yellow     |
| ITA | Red      | Red      | Green    | Green    | Green    | Red      | Red      | Red      | Red      | Red       | Green      | Green      | Yellow     | Yellow     |
| DEU | Green    | Green    | Red      | Green    | Green    | Red      | Red      | Red      | Red      | Red       | Green      | Green      | Yellow     | Yellow     |

The IRF's behaviour can now be read at a glance and reveals strong behavioural similarities. Finland and France have the same trends one with the other, as much as Italy and Germany, or  $y_t^6$  and  $y_t^{ea}$ . Yet, we can't rely exclusively on IRF's behaviour to construe the sanctions effects on studied variables, as it doesn't allow us to assess on intrinsic results of the shock on considered economies. This is why we need to evaluate the shock's impact in values after 3 periods -as it is the beginning of the return to normal.

**Table 9: The impact of a 1% sanctions shock after 3 periods**

|       | $y_t^{ea}$ | $y_t^6$  | $y_t^{fi}$ | $y_t^{fr}$ | $y_t^{ge}$ | $y_t^{it}$ | $y_t^{nl}$ | $y_t^{po}$ | $y_t^{ru}$ |
|-------|------------|----------|------------|------------|------------|------------|------------|------------|------------|
| $S_t$ | + .0125%   | - .0125% | - .075%    | - .025%    | - .0125%   | - .012%    | + .0025%   | - .063%    | -3.25%     |

$S_t$  value is from period 1 for Poland, and from period 2 for Italy. As the rise starts during these periods for them.

We can see that similarly to the short-term effect of sanctions,  $y_t^{ea}$  is not affected in the same way as  $y_t^6$ . When the first one is still positive 3 periods after the sanctions shock, the second is negative. Another interesting fact is that while Finland, France, Italy and Poland were reacting positively when the shock happened (in  $t = 0$ ), they after all react negatively 3 periods later. Indeed, the IRF's value of Finnish GDP is more than 3.4 times lower, French and Italian values are 2.3 times smaller, while Polish score is 2.9 times below his  $t = 0$  value. These elements highlight the fact that sanctions have a negative impact on these economies after all. On the contrary, whereas the short-term shock's impact was negative for Dutch GDP (-0.006%), it becomes positive with time and reach the value of 0.003% and thus record a +0.009 percentage point of increase. On the other hand, IRF values over time strengthen the idea that Russia and Germany are negatively impacted by sanctions. Russian value records a significant drop and is 20.5 times lower, which bring to the conclusion that a 1% increase of sanctions leads to a 3.25% decrease of the Russian growth after 3 periods.

We can naturally wonder why Russia is more impacted by sanctions than European countries. A first clue could be the dependence of Russia on oil prices. Indeed, our model allows us to see that contemporaneous effects of an oil price shock will be very different depending on the studied economy. As a matter of fact, when oil prices decrease of 1%, the Russian GDP decrease of 0.7%; whereas German GDP decrease of 0.2 % and French GDP of only 0.06%. When we know that sanctions target the petroleum industry, which is the core business of Russia, we can easily understand the Russian GDP withdrawal after shock. Moreover, [Dreger et al. \(2015\)](#) demonstrate that the Russian rouble decreasing is due to the oil prices collapsing, and not to sanctions. These different points bring strong thoughts forward which can nuance the interpretation of our results. Finally, and to conclude this econometric part, it is nevertheless important to bear in mind that these results cannot be taken at their words, as they are, however, only statistically significant clues of the impact of sanctions. Moreover, adjustments made on Polish and Russian GDP could also slightly alter the reality, even though they provide a first good impression considering the fact that data are missing.

**Table 10: Western countries sanctions against Russia**

| <b>Country</b>     | <b>Sanction description</b>  | <b>Date</b> |
|--------------------|--|-------------|
| <b>USA</b>         | blocking property and suspension of entry of not specified persons   | 06/03/2014  |
| <b>USA</b>         | blocking property and suspension of entry of specific persons  | 17/03/2014  |
| <b>EU</b>          | blocking property and suspension of entry of specific persons  | 17/03/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons  | 17/03/2014  |
| <b>Japan</b>       | 1) suspension of consultation for relaxing visa regulations and 2) freeze of certain negotiations (new investment, space co-operation, prevention of dangerous military activities)  | 17/03/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons  | 19/03/2014  |
| <b>Australia</b>   | blocking property and suspension of entry of specific persons  | 19/03/2014  |
| <b>USA</b>         | blocking property and suspension of entry of specific persons and against Rossija Bank   | 20/03/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 21/03/2014  |
| <b>EU</b>          | blocking property and suspension of entry of specific persons  | 21/03/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 28/03/2014  |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 02/04/2014  |
| <b>Albania</b>     | blocking property and suspension of entry of specific persons  | 11/04/2014  |
| <b>Iceland</b>     | blocking property and suspension of entry of specific persons  | 11/04/2014  |
| <b>Montenegro</b>  | blocking property and suspension of entry of specific persons  | 11/04/2014  |
| <b>Ukraine</b>     | blocking property and suspension of entry of specific persons  | 11/04/2014  |
| <b>USA</b>         | blocking property and suspension of entry of specific persons/entities   | 11/04/2014  |
| <b>USA</b>         | additional restrictive measures on defence exports to Russia   | 28/04/2014  |
| <b>Japan</b>       | suspension of entry of specific persons  | 29/04/2014  |
| <b>EU</b>          | blocking property and suspension of entry of specific persons/entities   | 29/04/2014  |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 02/05/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific entities   | 04/05/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 12/05/2014  |
| <b>EU</b>          | blocking property and suspension of entry of specific persons/entities   | 12/05/2014  |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 19/05/2014  |
| <b>Australia</b>   | blocking property and suspension of entry of specific persons/entities   | 21/05/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 21/06/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific entities   | 24/06/2014  |
| <b>EU</b>          | suspension of entry of specific persons  | 12/07/2014  |
| <b>USA</b>         | blocking property and suspension of entry of specific persons/entities   | 16/07/2014  |
| <b>EU</b>          | blocking property and suspension of entry of specific persons/entities   | 25/07/2014  |
| <b>USA</b>         | additional Treasury sanctions on Russian financial institutions and on a defence technology entity   | 29/07/2014  |
| <b>EU</b>          | blocking property and suspension of entry of specific entities   | 30/07/2014  |
| <b>EU</b>          | 1) restrictions on exports of certain dual-use goods and technology; 2) restrictions on the sale, supply, transfer or export, directly or indirectly, of certain technologies for the oil industry; 3) restrictions on access to the capital market for certain financial institutions | 31/07/2014  |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 04/08/2014  |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 06/08/2014  |

|                    |  |            |
|--------------------|--|------------|
| <b>Ukraine</b>     | blocking property and suspension of entry of specific persons/entities   | 14/08/2014 |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons/entities and firms  | 27/08/2014 |
| <b>USA</b>         | blocking property and suspension of entry of specific persons/entities   | 12/09/2014 |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 16/09/2014 |
| <b>EU</b>          | blocking property and suspension of entry of specific persons  | 08/09/2014 |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 12/11/2014 |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 12/04/2015 |
| <b>Canada</b>      | 1) blocking property and suspension of entry of specific persons/entities; 2) prohibition of exports of oil-related equipment  | 19/12/2014 |
| <b>EU</b>          | blocking property and suspension of entry of specific persons/entities   | 09/02/2015 |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 17/02/2015 |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 06/03/2015 |
| <b>Australia</b>   | restrictions on 1) export to or import from Russia of arms and related materiel; 2) export to Russia of certain items for use in petroleum exploration and production; 3) export to Crimea and Sevastopol of certain items for use in the energy and minerals sector; 4) commercial dealing with certain capital financial market instruments issued by certain Russian state-owned entities; and 5) Australian investment in Crimea and Sevastopol related to infrastructure, transport, telecommunications, energy, oil, gas and minerals sectors. | 31/03/2015 |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 02/04/2015 |
| <b>EU</b>          | The Council of the EU agreed to renew the EU sanctions against Russia for a further six months until 31 January 2016.  | 22/06/2015 |
| <b>Canada</b>      | blocking property and suspension of entry of specific persons/entities   | 29/06/2015 |
| <b>EU</b>          | The Council of the EU agreed to renew the EU sanctions against Russia for a further six months until 15 March 2016.  | 21/09/2015 |
| <b>EU</b>          | amendment of the arms embargo  | 09/10/2015 |
| <b>Switzerland</b> | prohibition of new business relationships for specific persons   | 06/10/2015 |
| <b>UK</b>          | Export Control (Russia, Crimea and Sevastopol Sanctions) (Amendment) Order 2015  | 16/12/2015 |

*From Dreger et al. (2015) and graciously provided by the authors.*

## 1.3 Robustness Check

The goal of this section is to validate the model's frame and results.

### 1.3.1 Variables Permuting

Thus, as explained earlier, the ordering matters in the Cholesky identification. The IRF depends of the ordering of variables. Because permuting them leads to different  $|B|$  matrices. In our model, we have decided to order sanctions first. This is why, as a sort of robustness check, an alternative ordering has been rerun. This time, sanctions are ordered last instead of first:

$$(iv) \quad svar e_t^\varphi \quad oil_t y_t^{k'} s_t, lags(1\backslash 2) aeq(A) beq(B)$$

As expected, it had an impact on contemporaneous effects of a sanction shock, and the Cholesky decomposition results change. Yet, the long-standing results of the Impulse-Response functions remain the same. Results hold. In point of fact, see the comparison displayed in [Figure 8](#) between the two different orderings. As we can see, graphs are almost identical. The confidence interval is also equivalent. Other orderings have been run, permuting either oil prices with exchange rates, or the contrary. They all witness the same IRF after a sanction shock.

### 1.3.2 Variables Replacement

Another possible method of checking the model's robustness is to replace key variables by proxy. To do so, the Industrial Production Index (IPI) -from the OECD data base-, has been used as a proxy for GDP. In consequence of that, a new SVAR model has been run (v). Here again, graphs reveal equivalent trends and effects' duration –see [Figure 9](#).

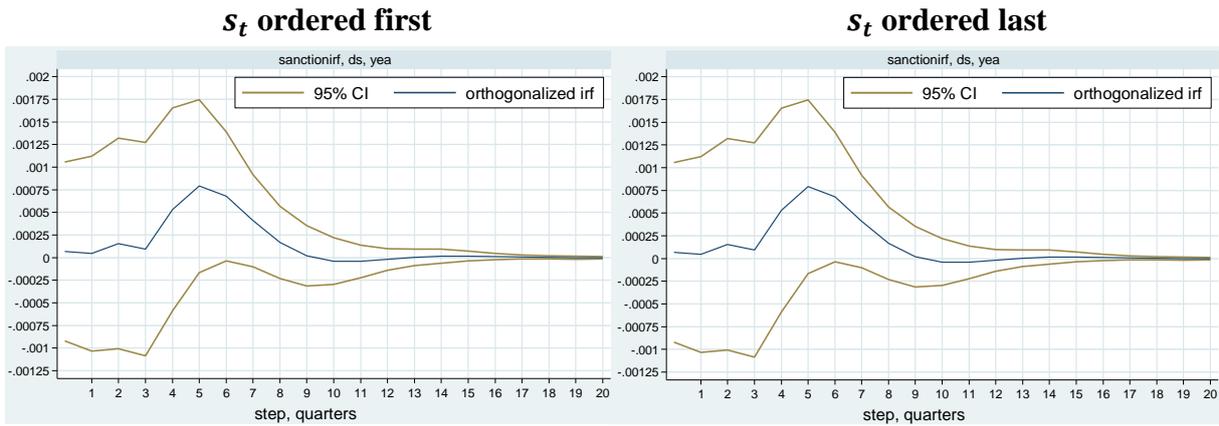
$$(v) \quad svar s_t e_t^\varphi \quad oil_t ip_t^{k'}, lags(1\backslash 2) aeq(A) beq(B)$$

Finally, and in order to be certain of the robustness of the model, a last SVAR model (vi) has been run. This time, Crude Oil Prices: West Texas Intermediate (WTI) have been used as proxy for Brent Oil Prices. Furthermore, this model has also been run with IPI instead of GDP. By doing so, all the key variables have been replaced by proxy. Except for the sanction index and for the real effective exchange rates, as these two can hardly be replaced by a viable proxy.

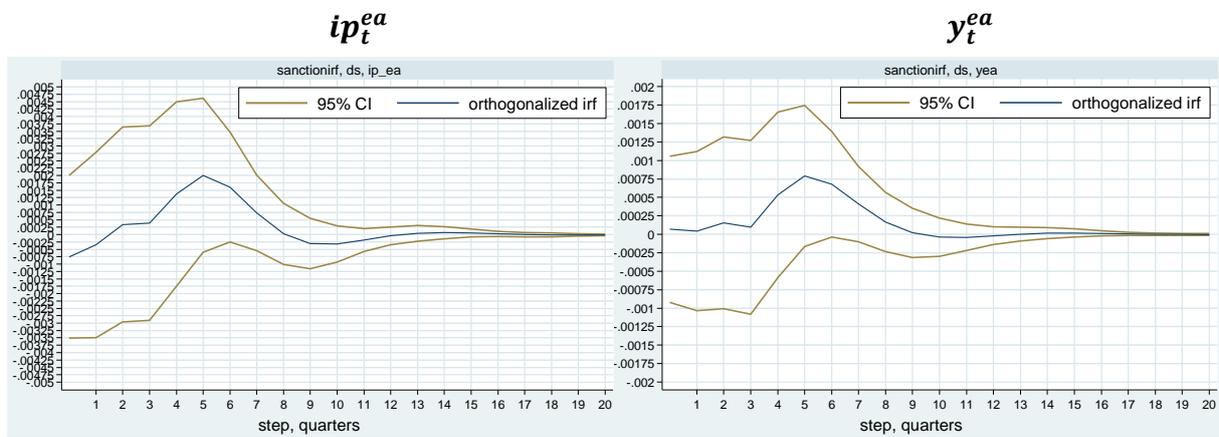
$$(vi) \quad svar s_t e_t^\varphi \quad wti_t ip_t^k, lags(1\backslash 2) aeq(A) beq(B)$$

Once again, even with a model where Brent oil prices are replaced by WTI oil prices, and where GDP is replaced by IPI, results hold. The model is robust, see [Figure 10](#).

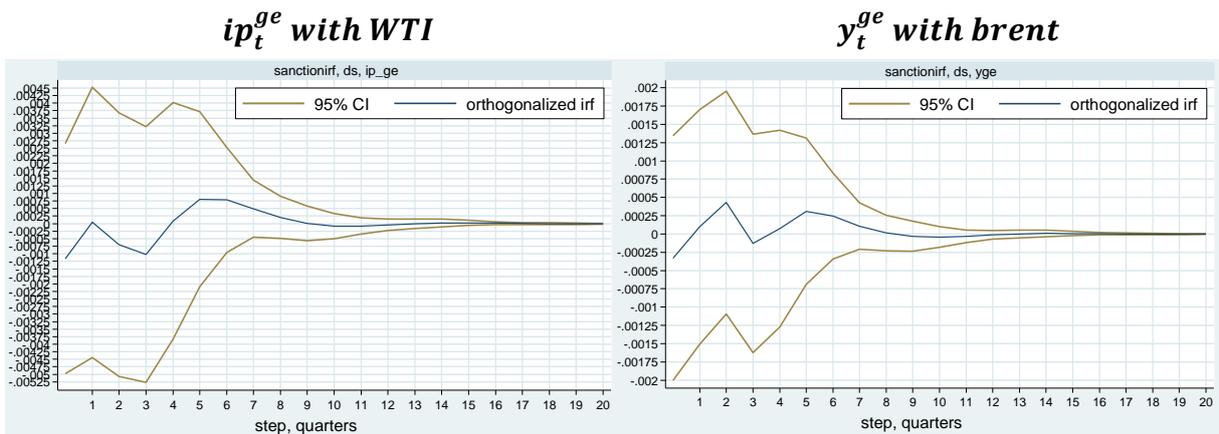
**Figure 8: IRF of EA GDP growth to sanctions, in different orderings**



**Figure 9: Impulse-Response functions of IPI and GDP to sanctions**



**Figure 10: IRF of IPI and GDP to sanctions, with WTI oil prices**



## 5. Conclusion

The econometric analysis confirms the relevance and importance of using  $y_t^6$  instead of  $y_t^{ea}$ . The closest European trading partners of Russia –as a lone entity- experience a twice stronger sanctions shock than the Euro Area countries. Yet, results also reveals that sanctions' impact differs when Russia's closest trading partners are studied separately. However, we saw that all economies are negatively impacted by a sanction shock after three periods, except Netherlands. It is like a long-lasting tremendous millstone around their neck, whereas the expected political results are non-existent. The Russian economy is by far the most influenced as the shock leads to a 3.25% decrease of economic growth after 3 quarters, when the same shock brings to a 0.0375% decrease in average for European economies' growth.

This paper used a Country Structural Vector Autoregressive model and focused on the sanctions impact on gross domestic product. It allows readers to have a better understanding of the global economic impact of sanctions. Be that as it may, the next step is to study the effect of sanctions on separated sectors. By the use of the Standard International Trade Classification, it shall be possible to quantify sanctions effects on agricultural products, fuels and mining products, machinery, or even commodities and transactions. From another point of view, the usage of spatial econometrics and gravity models is also relevant in this case. Mostly in order to have a broader understanding of sanctions impacts on trade relationships. For instance, it would allow us to measure both the import substitution trends and trade resettlement, due to sanctions. Indeed, some sectors of the Russian economy (agricultural mostly) have been developed in order to replace the import of European products.

To conclude, there is an important nuance that needs to be reminded. It is true that our analysis reveals that Russia is significantly impacted by sanctions. Yet, this paper study the effects of the rest of the world sanctions against Russia, and exclude the effects of Russian sanctions against the rest of the world. In this manner, this work stages the fact that sender countries are victims of their own coercive measures –through their GDP growth-. This is an important conclusion to bear in mind, even though this negative backlash isn't as significant as for the target. Furthermore, the very recent paper of [Giumelli \(2017\)](#) also assess on the redistributed impact of sanctions across the EU. The key finding is that all EU countries have experienced a reduction of exports to Russia due to sanctions. Moreover, he explains that Germany, Finland, and Italy have been hit hard by sanctions, which is entirely verified by the findings of this paper.

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