The Effect of Sanctions on EU-Russia Trade: The Study for 2015 – 2019[1]

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Abstract

We analyze the influence of sanctions on bilateral trade flows between the European Union and the Russian Federation during 2015 – 2019. Despite trade sanctions and counter-sanctions being imposed against particular groups of commodities, their influence affected trade flows between Russia and the EU in all sectors. The proposed methodology of estimating the effect of sanctions on EU-Russia trade is based on the idea of calculating trade potentials and comparing them with actual values. The augmented gravity approach is used to construct an econometric model, while the Poisson pseudo maximum likelihood method is applied to derive unbiased estimates. It is shown that during 2015 – 2019, due to EU sanctions Russia lost USD 41.3 billion in export revenues annually, comprising 2.5 percent of its GDP. Russian exports to Europe declined in all basic industries, but the petroleum industry took 91.2 percent of the total losses. European aggregate exports to Russia have not suffered from mutual sanctions: although the European food industry lost USD 2.7 billion annually, these losses were compensated for by export growth in other industries.

Keywords: *Russia-EU trade, sanctions, counter-sanctions, trade potential, effect of sanctions, PPML*

JEL Classification: F14, F51

DOI: https://doi.org/10.31577/ekoncas.2022.09-10.04

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[1] This research was supported by Russian Science Foundation grant *Empirical modelling of balanced technological and socioeconomic development in the Russian regions* (Project No. 19-18-00262).

Introduction

In April 2014, the United States of America and the European Union disagreed with the actions of the Russian authorities during the Ukrainian crisis and introduced sanctions against high-level Russian policy-makers responsible for undermining the territorial integrity of Ukraine. In July 2014, the sanction list was supplemented with a number of Russian enterprises belonging to the military-industrial complex, extraction companies, and banks. US and EU sanctions have been continuously broadened (as have been the reasons of introducing them); by December 2021, the list included 448 Russian individuals and 557 legal entities.[2]

Besides individuals and entities, sectoral sanctions against the Russian Federation (RF) were implemented. They include: import and export bans on the arms trade, an export ban on dual-use goods for military use or military-end users in Russia and restrictions on Russian access to certain sensitive technologies and services that can be used for oil production and exploration (fixed in Regulation (EU) 833/2014).[3]

The Russian response to sectoral sanctions (so-called 'counter-sanctions') took place in August 2014, and included a ban on the import of agricultural products whose countries of origin had either 'adopted a decision on the introduction of economic sanctions in respect to Russian legal and (or) physical entities, or joined same'. The list of products included fruits, vegetables, meat, fish, milk and dairy imports.[4]

Before the implementation of sanctions, in 2013 EU member states accounted for 57 percent of Russian exports and 46.5 percent of Russian imports, making the Union Russia's most significant trading partner by far. In turn, Russia was the EU's third largest trading partner, accounting for 9.5 percent of EU trade.[5]

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[2] <https://www.rbc.ru/politics/18/04/2021/5bffb0f09a79470ff5378627>, in Russian, date of access: 15. 12. 2021.

[3] <https://europa.eu/newsroom/sites/default/files/docs/body/1_act_part1_v2_en.pdf>, date of access: 15. 12. 2021.

[4] Presidential decree of 6 August 2014 No. 560 *On the application of certain special economic measures to ensure the security of the Russian Federation* <http://www.garant.ru/hotlaw/federal/558039/>, in Russian, date of access: 15. 12. 2021;

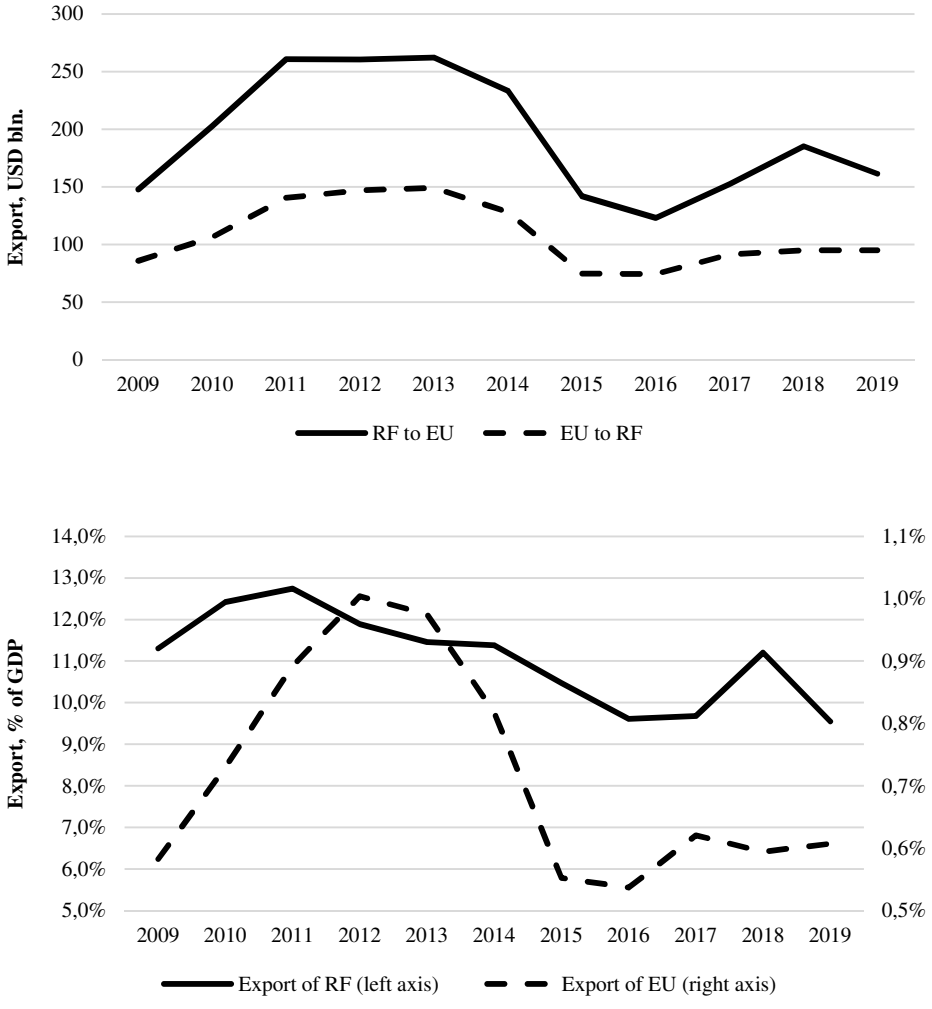
Government decree of 7 August No. 778 On measures to implement the Decree of the President of Russia *On the application of certain special economic measures in order to ensure the security of the Russian Federation* <https://web.archive.org/web/20140903212819/>; <http://government.ru/docs/14195>, in Russian, date of access: 15. 12. 2021.

[5] <https://publications.parliament.uk/pa/ld201415/ldselect/ldeucom/115/11505.htm#note4>, date of access: 15. 12. 2021.

When political relations between countries worsen, economic relations suffer. The trade effect of sanctions went beyond the industries under ban. The total volume of EU exports to Russia declined by 25.4 percent in 2019 compared to 2014. For the same period, the volume of Russian exports to EU declined by 30.5 percent (here and after in this section, trade flows are estimated in nominal values). This significant downturn in trade flows is observed not only in absolute levels, but also as a share of GDP (see Figure 1).

Figure 1

Trade between EU and Russia 2009 – 2019, in Nominal Values and as a Share of GDP



Source: UNCTAD, World Bank, authors' calculations.

Comparing 2019 and 2014, in absolute values the loss of export in the European economies comprised USD 25.2 billion, while the losses in Russian exports were equal to USD 56 billion (Figure 1, upper graph). However, taking into account the size of the economies in question, the "price" of sanctions for both parties becomes starker: Russian losses are estimated at 1.8 percent of GDP, while the losses of the EU are "only" 0.2 percent (Figure 1, lower graph).

Country-pair analysis shows a decline in export flows from all European countries to Russia, and vice-versa. Comparing 2014 and 2019, the largest decline in EU-to-RF flows was in Austria (–38.1 percent) and Finland (–33.8 percent), while the smallest was in Belgium (–13.4 percent) and the Netherlands (–15.6 percent). The sharpest decrease in export flows from Russia to the EU was observed in the Czech Republic (–47.1 percent), while moderate declines were observed in Finland (–8.4 percent) and Austria (–10.8 percent). Table 1 presents the trade flows between the RF and its largest European partners in 2014 and 2019.

T a b l e 1

RF Trade with 10 Major EU Partners, 2019 and 2014

Country	Export from EU, mil. USD			Export from RF, mil. USD		
	2014	2019	Δ, %	2014	2019	Δ, %
Germany	38 088.7	29 714.6	–22.0	36 843.1	25 119.9	–31.8
Italy	12 592.0	8 844.8	–29.8	22 936.2	16 021.0	–30.1
Poland	9 408.4	7 863.7	–16.4	20 015.9	13 709.8	–31.5
Netherlands	7 806.4	6 592.0	–15.6	47 292.4	31 992.0	–32.4
France	8 750.6	6 102.8	–30.3	13 671.4	9 155.1	–33.0
Lithuania	6 755.0	4 632.1	–31.4	7 620.5	5 189.6	–31.9
Belgium	5 336.8	4 623.6	–13.4	14 003.3	9 093.3	–35.1
Czech Republic	5 452.1	4 224.8	–22.5	6 248.1	3 303.8	–47.1
Finland	5 915.7	3 913.4	–33.8	10 046.5	9 204.0	–8.4
Austria	4 132.3	2 559.2	–38.1	1 070.0	954.4	–10.8
Hungary	2 799.4	1 973.5	–29.5	7 289.1	4 468.2	–38.7
Total	104 238.0	79 071.0	–24.1	179 747.4	123 742.9	–31.2

Source: UNCTAD, authors' calculations.

Analysis of the commodity structure of EU exports to the RF shows that all industries declined with one exception: oilseeds, fats and oils increased by 21.0 percent. The foodstuffs industries under Russian sanctions faced the largest decline, –70.4 percent. The dynamics of Russian exports to EU are less homogeneous. The main decline in export volumes was observed for petroleum (by 37.6 percent).[6] However, taken together, the exports of 14 other industries did not

[6] Although green energy was developing in European Union between 2015 and 2019, the demand for oil and gas increased due to industrial development and the rejection of nuclear and coal generation. *Source*: Eurostat,
<https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Final_energy_consumption_by_fuel_EU_1990 – 2019.png>,
date of access: 15. 12. 2021.

change significantly. The industries that showed largest growth in exports to the EU were the food industry (+72.2 percent), coffee and tea (+52.6 percent), beverages and tobacco (+36.0 percent) and electrical machinery (+27.6 percent). Table A.1 in the appendix presents a comparison of trade flows between the EU and the RF at the industry level.

The aim of this paper is to estimate the effect of sanctions on trade between the European Union and the Russian Federation. Russian trade with the European Union is chosen as an object of analysis because the EU has been Russia's largest trading partner since the 2000s and is the Russian extraction sector's main market.[7]

As the levels of bilateral trade flows are influenced by different factors, it is very important to separate the influence of sanctions from all other factors, such as exchange rates, import tariffs, level of demand, and different industry/country specific factors. The methodology used in this paper is based on the calculation of trade potentials (Egger, 2002; Shepotylo, 2009; Mariev et al., 2016; Greaney and Kiyota, 2020). The procedure includes 4 steps.

1. Formulate a model of bilateral RF – EU trade flows for the period 2009 – 2014 (before sanctions) in constant prices.
2. Using the estimation coefficients derived in step 1, calculate the predicted values of RF – EU trade flows for the period 2015 – 2019 (expected, or *potential*, volumes of trade in the case of no sanctions).
3. Adjust the potential values for the period 2015 – 2019 to price changes.
4. Compare actual trade levels (in the case of sanctions) with potential ones. The difference between the potential and actual trade volumes can be interpreted as an effect of imposed sanctions on bilateral trade.

A distinctive feature of this approach is the possibility to calculate trade potentials (and compare them with actual values) across different trade partners and commodity groups. The research's main finding is that Russian exports to Europe suffered much more than European exports to Russia. While total losses in Russian exports are estimated at USD 41.7 billion per year during 2015 – 2019, European exports increased to USD 5.3 billion on average. The petroleum (USD 38.1 billion per year) and chemical (USD 2.3 billion per year) industries in Russia and the foodstuff industry in Europe (USD 2.7 billion per year) suffered larger losses. The largest decline in Russian exports was associated with Russia's main trading partners – the Netherlands, Germany, France and Italy (USD 9.6, 8.8, 5.4 and 4.6 billion, respectively). The largest decrease in export sales to Russia occurred in Central East European countries – Hungary and the Czech Republic (USD 1.2 and 0.6 billion) – and northern European countries – Sweden and Denmark (USD 0.6 billion each).

[7] Based on statistics provided by UN Comtrade <https://comtrade.un.org/data>.

The paper contributes to the existing literature in the following directions. First, to the best of our knowledge, this is the first paper that seeks to calculate trade potentials when estimating the effect of sanctions. Second, compared to the existing research, this paper estimates the effects of sanctions against Russia and Russia's counter-sanctions over a continuous (5 year) period. Third, using industry-level data allows us to identify the sectors that faced losses due to sanctions and the sectors where trade volume increased despite sanctions. Finally, the derived results are consistent with the existing literature, showing that the trade effect of sanctions is negative, but in general rather weak.

The rest of paper is structured as follows. Section 1 conducts a literature review on the effects of sanctions and an analysis of the sanctions imposed on Russia since 2014. Section 2 presents a gravity-based model of EU-Russia trade and discusses the methodology used to derive unbiased estimates. In Section 3, the results of econometric estimation are presented and the determinants of EU-Russia trade are analyzed. Next, trade potentials are calculated and the effect of sanctions on both the industry and country level is assessed. In concluding Section, the paper's contribution to the existing literature is discussed, the main results are summed up and the potential directions of further research are outlined.

1. Literature Overview

The main aim of imposing sanctions is to cause economic damage and force the object of the sanctions to change its political behavior (Pape, 1997). The effectiveness of sanctions is widely discussed in the literature. Although targeted against political elites, sanctions often cause humanitarian damage in the target society, leaving the richest and most influential groups unaffected. Hufbauer et al. (2007) and Bapat and Morgan (2009) state that the effect of sanctions depends on the number of countries imposing sanctions and the engagement of international institutions in the process. Kirshner (1997) calls into question the reasonability of sanctions as a pressure instrument. Marinov (2005) argues that imposing sanctions on political elites is useless. Weiss (1999) and Allen (2008) point out that sanctions destabilize the political environment and cause society to clash with the political elite; however, the expected transformations do not occur, meaning that sanctions do not achieve their desired effect.

Many researchers state that sanctions have destructive effects in the economic, social and politic spheres in sanctioned countries. Sanctions empower the discrimination of democracy and human rights (Peksen and Drury, 2010) and worsen public health and humanitarian systems, affecting child morality rate (Peksen, 2011) and access to essential goods, such as medicine, clean water and food

(Allen and Lektzian, 2013). Wood (2008) argues that sanctions strengthen state repression and worsen population welfare in general. Mariev et al. (2020) show that economic and financial sanctions are detrimental to low-income segments of the population and do not facilitate policies aimed at reducing income inequality. Moreover, sanctions do not harm the most affluent people in a given society, as they are able to shift the burden of sanctions onto the rest of the population. The post-sanctions period causes criminalization in the economy and society, stimulating underground economy activity in collaboration with clandestine transnational economic agents (Andreas, 2005). However, compared to military operations, sanctions cause less damage (Allen and Lektzian, 2013).

Regardless of the humanitarian and political effects of sanctions on societies and political elites, numerous studies have explored the impact of economic restrictions on macroeconomic performance indicators, such as the inflation and unemployment rates (Dizaji and van Bergeijk, 2013; Hufbauer et al., 2007). Analyzing 67 countries that experienced UN economic sanctions from 1976 to 2012, Neuenkirch and Neumeier (2015) show that over a 10-year period, sanctions lead to a decline in GDP per capita growth of 2.3 – 2.5 percent.

Investment, trade and finance are sensitive spheres in the context of sanctions. US sanctions from 1969 to 2000 have led to the US disinvesting in these countries, although they have not caused global disinvesting by third parties (Lektzian and Biglaiser, 2013). Using a gravity trade model, Caruso (2003) demonstrates that unilateral US sanctions diminished trade flows by 59 percent, while multilateral ones (in cooperation with the G7) caused a fall in trade flows by 81 – 82 percent. Hatipoglu and Peksen (2018) show that financial sanctions are more detrimental to the stability of banking systems than trade sanctions. Financial sanctions significantly increase the likelihood of systematic banking crises by deteriorating the target economy's macroeconomic conditions and limiting its access to international capital.

A series of research papers have studied the effects of sanctions (counter-sanctions) imposed against (by) Russia after 2014. Using a structural gravity framework, Crozet and Hinz (2016) quantify these trade losses in a general equilibrium counterfactual analysis. The estimated losses comprise USD 60.2 billion from 2014 to mid-2015. Fritz (2017) argues that the decline in trade volumes between the EU and Russia was not only due to sanctions, but also due to other economic factors, such as the downturn of the Russian economy, largely caused by the falling oil price and the ensuing depreciation of the ruble. Korhonen (2018), analyzing Russian trade during 2014 and 2016, shows that the sanctions reduced Russia's market share in EU markets. Russian counter-sanctions also lowered the consumption of affected goods in Russia. Skvarciany et al. (2020),

using a gravity trade model, analyzed the effects of Russian counter-sanctions on EU exports, showing that their effect was quite moderate for EU economies. Borisov et al. (2020), employing a gravity 2012 – 2016 panel dataset, show that Russia's conflicts with Turkey and Ukraine led to a decrease in exports and imports between 9% and 34%, depending on the sector and the direction of trade. Examining bilateral trade data, Bělín and Hanousek (2021) study the effectiveness of narrow (European sanctions against Russia) versus broad (Russian sanctions against Europe) sanctions, and the differences in the effectiveness of sanctions imposed on exports and imports. It was shown that the Russian sanctions imposed on European and American food imports resulted in a decline in trade flows that was about 8 times stronger than the decline caused by EU and US sanctions on the export of extraction equipment.

Ahn and Ludema (2016), using firm-level data, demonstrate that the average sanctioned Russian company or associated company lost about a third of its operating revenue, over half of its asset value and about a third of its employees relative to non-sanctioned peers. At the same time, sanctions have had a relatively smaller impact on Russia's macroeconomy compared to the effect of changing oil prices. Dreger et al. (2016) studied the role of sanctions in the 50-percent ruble depreciation in 2014, revealing that the bulk of the depreciation was caused by the decline in oil prices. The authors conclude that in the long run sanctions may weaken the Russia's economy due to their negative effect on investments by domestic and (especially) foreign firms in Russia.

The existing literature on post-2014 sanctions against Russia leaves space for further research. On the one hand, few papers go beyond the industries and companies directly affected by sanctions. On the other, most studies are limited to examining only one or two years after the first sanctions were implemented (often due to the year of research). This study aims to contribute to the existing research by filling these gaps.

2. Model and Methodology

Our econometric model of bilateral trade flows between the European Union and the Russian Federation is based on the gravity approach, implying that the trade flows between each pair of countries are positively correlated with the economic size of the countries involved (measured as each country's GDP) and negatively correlated with the distance between them. First applied by Tinbergen (1962) and later provided theoretical foundations by Anderson (1979), this approach is widely used to model international trade. In this study, the gravity model is applied on the industry level.

A set of additional variables is used to heighten the quality of this econometric model. First, the macroeconomic situation in each trading country should influence the volume of trade flows. On the one hand, macroeconomic stability in the home country decreases the discount rate for exporting firms and helps them expand. On the other, a stable macroeconomic situation in the host economy increases the solvency of partner firms and thus also stimulates bilateral trade. Following Ho (2013) and Lin et al. (2017), we use inflation rate as a measure of macroeconomic stability. Second, exchange rate dynamics are an important factor for trade flows because currency depreciation (appreciation) in the host economy makes both foreign commodities more (less) expensive and local goods more (less) competitive on foreign markets (Kang and Dagli, 2018; Bussière et al., 2020). Third, the level of import tariffs is expected to have a negative impact on bilateral trade levels (Wilson et al., 2003; Lee and Park, 2007). Finally, common historical ties are expected to be significant for trade flows between a pair of countries (Henderson and Millimet, 2008; Melitz, 2007). For this reason, a dummy variable indicating whether an EU country belonged to the Soviet bloc in the past is included.

The following model is used to estimate bilateral EU-Russia trade flows:

$$TRADE_{reit} = exp\begin{pmatrix} \alpha_1 \ln GDP_{rt} + \alpha_2 \ln GDP_{et} + \alpha_3 \ln Dist_{re} + \alpha_4 ER_{ret} + \\ + \alpha_5 INFL_{et} + \alpha_6 ImpTariff_{reit} + \alpha_7 SB_e \end{pmatrix} e_{reit}$$

where

$Trade_{reit}$ – trade flow (export or import) between Russia (r) and the EU country e in industry i in year t (USD mln.);
$\ln GDP_{rt}$ – logarithm of Russia's GDP in year t (USD mln.);
$\ln GDP_{et}$ – logarithm of the EU country's GDP in year t (USD mln.);
$\ln Dist_{re}$ – logarithm of the distance between Moscow and the capital of the EU country e (km);
ER_{ret} – average exchange rate between the Russian ruble and the currency of the EU country e in year t (rubles paid for 1 unit of the currency of the EU country e);
$INFL_{et}$ – inflation rate in the EU country e in year t (fraction of unity);
$ImpTariff_{reit}$ – import tariff for commodities i in year t, charged in country r (or e, depending on the direction of trade flow and fraction of unity);
SB_e – a dummy variable indicating the belonging of the EU country e to the Soviet bloc in the second half of the twentieth century;
$\alpha_1 - \alpha_7$ – estimated coefficients before regressors;
e_{reit} – error term.

The data has been collected from open sources. The data sources, together with the expected influence of the explaining variables, are presented in Table A.2 in the appendix.

Choosing the appropriate estimation technique is an important element in the research. The standard OLS method leads to biased results when employing gravity model estimation. The first reason for this is the number of zeros in bilateral trade flows. Taking away the logs removes these observations from the analysis (the logarithmic function is not defined as zero). Substituting zero with a small constant (say, 1 + *Trade*) also leads to biased results when OLS is applied (Silva and Tenreyro, 2006). The second reason is the presence of hereroskedastisity and serial correlations in the gravity data.

In many research papers, different estimation approaches are used to derive unbiased results: the Hausman-Taylor approach (Carrere, 2006), the two-step Heckman procedure (Rubinstein et al., 2008), Tobit regression (Soloaga and Winters, 2001) and others. The Poisson pseudo maximum likelihood method (PPML), first applied by Silva and Tenreyro (2006), is considered one of the best methods for gravity-type models. PPML is an interpretation of the generalized method of moments from a variety of maximum likelihood methods. In turn, the generalized method of moments is often used to correct for the bias caused by the endogenous nature of explanatory variables. The main feature of PPML is the use of a constant-elasticity model instead of a model utilizing logarithms. As shown by Silva and Tenreyro, the estimation of a log-linearized form changes the properties of the error term, which is correlated with explanatory variables in the presence of heteroskedasticity.

To correctly specify the gravity model of bilateral trade flows, the costs of trading with third countries must be taken into account (the so-called "multilateral resistance term", which was first introduced and theoretically justified by Anderson and Van Wincoop, 2003). Following Baldwin and Taglioni (2006) and Nowak-Lehmann et al. (2013), we include country-pair fixed effects to control for multilateral resistance and avoid omitted variable bias.

3. Econometric Estimation, the Calculation of Potentials and Discussion

Our database includes bilateral trade flows (export and import) between Russia and 27 EU countries for 2009 – 2019 (the list of countries with their official 3-digit ISO code is presented in Table A.3 in the appendix). We do not consider 2020 in the analysis to exclude the effect of COVID-19. All trade flows are initially disaggregated into 65 subindustries, but when presenting the results we amalgamated 65 subindustries into 15 industries using the 2-digit MTN classification employed by the WTO (industries are listed in Table A.4 in the appendix). The database is a strictly balanced panel with $272 \times 65 \times 11 = 38610$

observations. There are 5827 (15.1 percent) zero trade flows in the database. Descriptive statistics of the variables in the model are presented in Table A.5 in the appendix.

T a b l e 2

Estimation of the Model of EU-Russia Bilateral Trade

Variable	Model 1 (PPML)	Model 2 (PPML)
GDP importer, log	0.999*** (0.005)	0.980*** (0.005)
GDP exporter, log	0.109*** (0.004)	0.337*** (0.004)
Distance, log	1.479*** (0.027)	0.744*** (0.027)
Exchange rate	–0.005*** (0.000)	0.000*** (0.000)
Inflation importer	–0.926*** (0.026)	–0.405*** (0.025)
Import tariff	–0.251*** (0.000)	0.030*** (0.004)
Soviet bloc dummy	–1.102*** (0.015)	–0.506*** (0.016)
Country-pair dummy	Yes	Yes
Industry dummy	No	Yes
Pseudo R-sq.	0.324	0.702
Number of obs.	38610	38610

Notation: Hereinafter, the robust standard errors are in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; constant term not reported.

Source: Authors' calculations using the Stata program.

In the first step of the analysis, we checked the relevance of the econometric model using the constructed database. In Table 2, two model specifications are reported: with country-pair dummies and with industry dummies. The results show that all regressors are significant at 99-percent confidence level. At the same time, not all regressors influence the dependent variable in the expected way. First, large distance positively affects trade flows between Russia and EU countries. Second, the Soviet bloc dummy has a negative sign, indicating the negative influence of Soviet ties between Russia and CEE countries. Import tariffs, being negative in model 1, become positive after including industry dummies. However, the size of the partner countries (GDP) and inflation rate have the expected influence on the dependent variable (positive and negative, respectively). We do not interpret the influence of the exchange rate on trade flows at this stage because it has bidirectional influence on trade flows: the devaluation of the national currency both decreases imports and increases exports.

To increase the accuracy of the further analysis, we estimate the trade flows from the EU to Russia and from Russia to the EU separately. The results presented in Table 3 show several important differences in the factors explaining the levels of EU-Russia trade when the different directions of trade are taken into account.

An increase in distance decreases exports from Russia to an EU country, but increases the exports of EU countries to Russia. At the same time, we find that the Soviet bloc dummy has a different influence: all other things being equal,

Russian companies export larger volumes to former socialist countries, while former socialist countries export smaller volumes to Russia. We explain these results by the generally negative perception of Russia in the countries of the former Soviet bloc: when the Iron Curtain fell, Baltic and Central East European Countries (CEEC) turned to the West and became deeply integrated in the European Common Market. However, it was quite difficult to replace Russia as the supplier of raw materials (such as gas, oil and metal). This is why we observed relatively low exports from former socialist countries to Russia and relatively high Russian exports to former socialist countries.

Table 3

Estimation of the Model of EU – Russia Bilateral Import and Export Flows

Variable	EU-to-Russia trade (PPML)	Russia-to-EU trade (PPML)
GDP (Russia), log	0.842*** (0.007)	0.796*** (0.006)
GDP (EU), log	0.243*** (0.016)	0.095*** (0.011)
Distance, log	2.121*** (0.036)	–6.560*** (0.040)
Exchange rate	–0.009*** (0.000)	0.006*** (0.000)
Inflation (EU)	–0.717*** (0.098)	–3.759*** (0.074)
Import tariff	–0.014*** (0.001)	–0.189*** (0.008)
Soviet bloc dummy	–0.911*** (0.033)	0.426*** (0.031)
Country-pair dummy	Yes	Yes
Industry dummy	Yes	Yes
Pseudo R-sq.	0.813	0.908
Number of obs.	19305	19305

Source: Authors' calculations using the Stata program.

When EU-to-Russia and Russia-to-EU trade flows are considered separately, the exchange rate has the expected influence on the dependent variable in the model. Since the exchange rate is considered in terms of the Russian rubles exchanged for one unit of an EU country's currency, we observe a negative sign before the exchange rate regressor for the case of EU exports to Russia (exporting becomes more expensive when the exchange rate increases) and a positive sign otherwise (Russian products become cheaper for European customers).

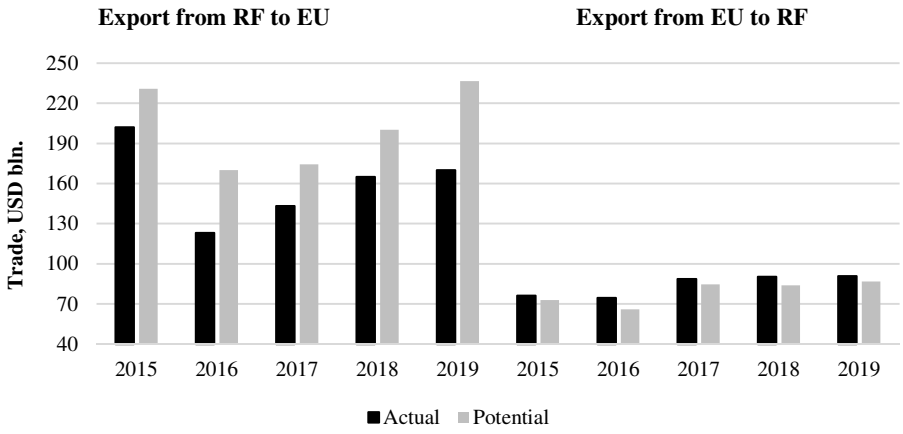
Figure A.1 in the appendix shows how adequate our econometric model is. On the horizontal axis, the average actual trade levels are plotted, while the vertical axis plots are predicted by the model average trade levels for 2009 – 2014. The graphs are constructed separately for trade flows in each direction (to the European Union and to the Russian Federation) and separately for each industry (the two upper graphs) and each country (the two lower graphs). As seen from Figure A.1, all points lie along the 45-degree line, meaning that the average annual predicted values of trade equal the actual ones on both country and industry levels.[8]

[8] Technically this result is achieved by including country-pair and industry dummies. Otherwise, we would always observe differences between the actual and potential trade levels.

Using the constructed model, we can estimate the regression coefficients for the pre-sanctions period and calculate the predicted trade levels had sanctions not been imposed. After adjusting the predicted (potential) trade levels to price changes using annual production price indices, we compare potential trade levels with the actual ones. In Tables 4 and 5, the calculations for actual and potential values on industry and country levels are presented. All the data are averaged within the considered period and presented in constant prices. The annual actual and potential values of EU exports to the RF and RF exports to the EU for 2015 – 2019 are presented in Figure 2.

F i g u r e 2

Actual and Potential Levels of EU – RF Trade, 2015 – 2019



Source: Authors' calculations.

Comparing potential and actual values of trade shows the uneven effects of sanctions and counter-sanctions. The overall losses in Russian exports to EU countries for the 5-year period are estimated at USD 41.7 billion annually. The petroleum industry suffered major export losses, estimated at USD 38.1 billion (24.0 percent) per year. Although officially European sanctions were not imposed on Russian oil and gas, processes of supply diversification in natural resources were triggered in Europe. Together with the chemical industry, the fall in the trade of petroleum products comprises 96.7 percent of the total fall in Russian exports to the EU. The booming Russian agricultural sector exported to Europe USD 50 percent (USD 0.3 billion annual) more compared to its potential level. Less politicized sectors (wood, machinery and other manufacturing products) show relatively small declines in actual values compared with the potential ones – within the 1 – 2 percent interval.

Table 4

Potential and Actual Levels of EU – Russia Trade on an Industry Level (average within each period, in constant prices)

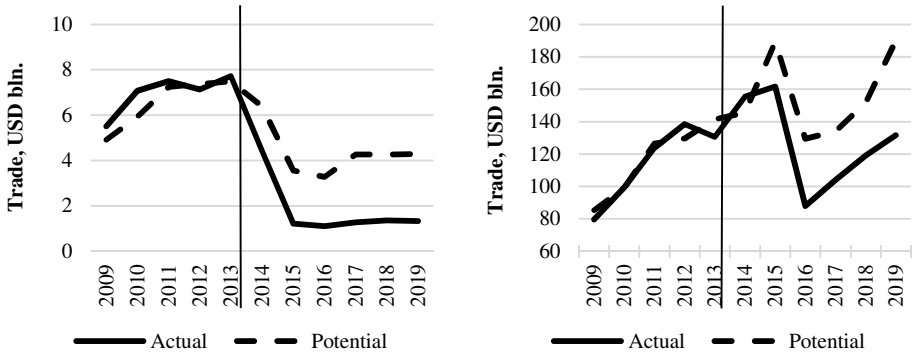
Industry	Export from EU to Russia, USD mln.				Export from Russia to EU, USD mln.			
	Actual, 2009 – 2014	*Potential, 2015 – 2019*	*Actual, 2015 – 2019*	Δ, *2015 – 2019*, %	*Actual, 2009– 2014*	*Potential, 2015– 2019*	*Actual, 2015– 2019*	Δ, *2015– 2019*, %
Food	6558	3934	1263	+211.5	557	660	991	–33.4
Coffee, tea	1010	619	921	–32.8	26	31	39	–20.5
Cereals and preparations	2474	1551	1803	–14.0	709	834	788	+5.8
Oilseeds, fats and oils	558	380	559	–32.0	414	542	374	+44.9
Beverages and tobacco	1827	1192	1450	–17.8	97	117	104	+12.5
Other agricultural products	1167	692	888	–22.1	2887	3298	2773	+18.9
Textile and clothes	7292	4230	4518	–6.4	355	419	263	+59.3
Minerals and metals	5690	3419	4237	–19.3	18924	21090	20557	+2.6
Petroleum	754	525	758	–30.7	121201	158978	120898	+31.5
Chemicals	18424	11556	15008	–23.0	5422	6361	4053	+56.9
Wood, paper, etc.	3330	2156	2245	–4.0	2313	2656	2611	+1.7
Non-electrical machinery	3623	2328	2947	–21.0	710	828	742	+11.6
Electrical machinery	40091	25481	27134	–6.1	992	1172	1142	+2.6
Transport equipment	19472	12168	10818	12.5	852	1018	1000	+1.8
Manufactures n.e.s.	13612	8614	9598	–10.3	3780	4442	4377	+1.5
Total	125882	78843	84166	–6.3	159238	202447	160714	+26.0

Source: Authors' calculations based on estimation results.

The total volume of European exports to Russia was not negatively affected by counter-sanctions: the average actual trade flows in 2015 – 2019 exceed the potential ones at USD 5.32 billion. Although there was a sharp fall in the food industry export, it was compensated by increases in most sectors, mainly in chemicals, minerals and metals. The decline in transport equipment exports was substituted by the increase in electrical and non-electrical machinery, as well as in the export of other manufacturing products. Figure 3 demonstrates the annual actual and potential trade levels in the two industries that faced the largest decrease due to mutual sanctions: foodstuffs (European exports to Russia) and petroleum (Russian exports to the EU).

F i g u r e 3

Actual and Potential Levels of Trade for Food Industry Exports from the EU to Russia (left graph, in constant prices) **and Petroleum Industry Exports from Russia to the EU** (right graph, in constant prices)



Source: Authors' calculations.

The country-level analysis is presented in Table 5. Russian exports to its major EU partners (the Netherlands, Germany, France and Italy) indicates that the actual values are significantly lower than the potential ones. In the meantime, we can see that these countries did not suffer a decline in their exports to Russia: indeed, their actual export level to Russia is higher than the potential one.

Russian exports to former socialist countries demonstrated mixed results: the actual level was lower than the potential level for Lithuania and Slovakia, but higher for Poland and Romania. The only country whose actual values of export to Russia were higher than the potential ones was Lithuania. Slovakia, Poland and Romania's exports to Russia were very close to their potential level. To additionally illustrate the results on the country level, Figures A.2 and A.3 in the appendix present the actual and potential levels of trade in both directions between Russia and 8 major European partners for each year between 2015 and 2019. The graphs confirm the result that Russian exports to Europe were lower

than their potential, while European exports to Russia were higher than the potential. The estimation results derived in this section help outline some specific features of EU-Russia trade.

The European export to Russia is very diversified and sustainable against external shocks. Technologically intensive European machinery, equipment and different intermediate products have strong positions on the Russian market and are difficult to substitute. Most European TNCs have been working in the Russian market since mid-1990s and have made substantial direct investment in Russia: as a result, they are deeply integrated into the production chains of the Russian economy. The Russian economy has no locally produced equivalents for a wide range of complex products and equipment, which makes its demand for European exports inelastic. The import substitution incentives announced in Russia since 2014 have been focused on agricultural products and foodstuffs, a sector that makes up less than 10% of European exports to Russia. Thus, the industrial policy for decreasing the Russian economy's crucial dependency on foreign technologies has been inefficient (if it ever existed).

The structure of Russian exports to Europe is mainly limited to extractive and primary products. Although Russia has been exporting energy products to Europe since the mid-1970s and has a diversified infrastructure that allows for the cheap delivery of oil and gas to European countries, Russia's position in the European market is not unshakable. The development of liquified natural gas infrastructure development, sea logistic opportunities and the challenges of energy turnaround makes Russian exports to Europe vulnerable. The political shock caused by sanctions showed that Russia is not an irreplaceable supplier on the European energy market.

The other weakness of Russian exports to Europe is that it is mostly made up of a dozen giant Russian companies either with government participation or associated with the Russian authorities. When the political background changes, partnership with these Russian companies is vulnerable. On the other hand, European products exported to Russia are produced by hundreds of large, medium, and small TNCs that are barely linked to any government.

The results in this paper can also be justified in the context of the positions of Europe and Russia in global value chains. Russia is the supplier of resource-intensive, low-margin products located close to the starting point of global value chains. There are very limited opportunities for market positioning and increasing mark-up for these products. In case of shock, these products are relatively easily substituted because they are standardized. Russian incentives to push off the primary stages of value chains and increase the value added in exported goods have not led to visible export diversification.

Table 5

Potential and Actual Levels of EU – Russia Trade on a Country Level (average within each period, in constant prices)

Country	Export from EU to Russia, USD mln.				Export from Russia to EU, USD mln.			
	Actual, 2009 – 2014	*Potential, 2015 – 2019*	*Actual, 2015 – 2019*	Δ, *2015 – 2019, %*	*Actual, 2009– 2014*	*Potential, 2015– 2019*	*Actual, 2015– 2019*	Δ, *2015– 2019, %*
Austria	3721	2156	2221	–2.9	863	1191	857	+39.0
Belgium	5539	3174	3956	–19.8	8782	12090	9977	+21.2
Bulgaria	645	486	533	–8.8	3566	3964	3666	+8.1
Croatia	313	247	191	+29.3	1023	905	413	+119.1
Cyprus	31	17	35	–51.4	47	63	135	–53.3
Czech Republic	4815	4186	3557	+17.7	4913	4270	4540	–5.9
Denmark	1645	1339	785	+70.6	750	673	1595	–57.8
Estonia	2559	1681	1415	+18.8	1549	2227	1782	+25.0
Finland	6302	3592	3489	+3.0	8626	11748	8113	+44.8
France	9394	5191	5542	–6.3	10549	14318	8937	+60.2
Germany	40552	23609	26486	–10.9	25171	34817	26044	+33.7
Greece	487	229	244	–6.1	4482	5742	4336	+32.4
Hungary	3207	2929	1763	+66.1	4868	4183	4067	+2.9
Ireland	675	518	514	+0.8	183	280	420	–33.3
Italy	11979	6452	8192	–21.2	15406	20635	16070	+28.4
Latvia	1237	754	1100	–31.5	1007	1424	1291	+10.3
Lithuania	4803	3014	4013	–24.9	5575	8209	4900	+67.5
Luxembourg	185	117	146	–19.9	13	18	32	–43.8
Malta	13	10	9	+11.1	385	573	946	–39.4
Netherlands	7645	4307	5496	–21.6	29489	40290	30686	+31.3
Poland	8282	6864	6667	+3.0	12833	12255	13663	–10.3
Portugal	216	121	197	–38.6	601	818	1369	–40.2
Romania	1393	1282	1144	+12.1	1972	1911	3003	–36.4
Slovakia	2889	1687	1606	+5.0	4501	6223	4856	+28.2
Slovenia	1076	623	889	–29.9	391	538	463	+16.2
Spain	3168	1752	2030	–13.7	6278	8504	3860	+120.3
Sweden	3108	2506	1942	+29.0	5213	4579	4693	–2.4
Total	125882	78843	84165	–6.3	159238	202447	160714	+26.0

Source: Authors' calculations.

At the same time, European exports to Russia are knowledge intensive and technologically advanced. These goods are deeply integrated into Russian production networks: European TNCs work in tight cooperation with their customers in Russia. The absence of equivalent technologies in Russia makes it very difficult to substitute European suppliers in case of external shocks. In general, the positions of European companies in Russia are more stable than those of Russian companies in Europe, as was illustrated by the results of this research.

Conclusion

In this paper, the effects of European sanctions and Russian counter-sanctions on countries' bilateral trade are estimated. To the best of our knowledge, this is the first paper to estimate the effect of sanctions (i) using trade potentials, (ii) on the sectoral level, and (iii) during the period of 2014 – 2019.

The main problem that must be solved in research like this is how to separate the effect of sanctions from the influence of all other factors affecting bilateral trade. The proposed and applied methodology is based on constructing a reliable econometric model explaining EU – RF trade volumes, calculating potential trade volumes (trade in a world without sanctions against Russia), and finally comparing them with actual values.

Using a bilateral trade database (exports and imports) between Russia and 27 European countries in 65 industries for 2009 – 2019 and applying the Poisson pseudo maximum likelihood method with country-pair and industry fixed effects to derive unbiased estimates, we identify a set of determinants in EU – RF trade. Estimating the suitability of the gravity model trade, we found that the level of trade flow is positively associated with the economic size (the GDP) of the countries concerned. Testing the role of distance in explaining trade flows between the EU and the RF, we observed statistically significant negative influence for distance travelled by Russian exports to the EU and the positive influence of distance travelled for European exports to the RF. We also tested the significance of European countries having previously belonged to the Soviet bloc and find a significant positive influence for the Soviet bloc dummy for RF-to-EU trade and a negative influence for EU-to-RF trade. Together with the unexpected influence of distance on European exports to Russia, we explain this by the negative attitude of Central East European Countries to Russia as the former center of the Soviet bloc. After the fall of the Iron Curtain, the CEE countries became deeply integrated into the economy of Western Europe. At the same time, Russia remained an important supplier of primary resources for these countries. The influence of import tariffs, inflation in European countries and exchange rate on EU – RF bilateral trade is significant.

Analyzing trade potentials indicate that Russian exports suffered much more than European exports. The total losses sustained by Russian exports during 2015 – 2019 are estimated at USD 41.7 billion on average, with the petroleum industry having faced 91.2 percent of the total losses. On the contrary, European exports to Russia have not suffered much from sanctions and counter-sanctions: after controlling for all export determinants, we observe that the actual EU export level was USD 5.3 billion higher than its potential level (average per year). We can state that the imposed European sanctions led to significant damage to the Russian economy in term of the loss of export revenues, estimated at 2.5 percent of Russian GDP annually. European countries, facing decline in the food industry due to counter-sanctions, managed to compensate for their losses by increasing exports to Russia in other sectors.

The dramatic events of 2022 showed that 2015 – 2019 was only the first episode of destroying trade relations between the European Union and the Russian Federation. To the moment it is impossible to give a proper evaluation to the scale and the consequences of these striking transformations because the statistical data are lagging and the Russia-Ukrainian conflict is still in its hot stage. At the same time the methodology proposed and applied in this paper is universal and could be used for the analysis of EU-Russia bilateral trade in the later periods. Future studies of the EU-Russia trade should include not only calculations of the losses for both parties due to the sanctions introduced, but also the analysis of re-orientation of the EU's and Russian import and export flows to the third countries.

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Appendix

Table A.1

RF – EU Trade by Commodities, 2019 and 2014

Industry	Import to RF, mil. USD			Export from RF, mil. USD		
	2014	*2019*	Δ, %	*2014*	*2019*	Δ, %
Food	4 722.1	1 398.0	–70.4	725.8	1 249.8	72.2
Coffee, tea	1 212.9	950.2	–21.7	34.4	52.5	52.6
Cereals and preparations	2 789.9	1 905.9	–31.7	1 078.3	813.0	–24.6
Oilseeds, fats and oils	508.7	615.4	+21.0	370.1	432.9	17.0
Beverages and tobacco	1 956.3	1 747.6	–10.7	99.8	135.7	36.0
Other agricultural products	1 166.1	1 008.8	–13.5	3 147.1	3 093.6	–1.7
Textile and clothing	7 326.8	4 708.3	–35.7	398.0	246.0	–38.2
Minerals and metals	6 552.9	5 382.4	–17.9	22 151.4	23 287.8	5.1
Petroleum	952.3	688.0	–27.8	188 308.2	117 507.4	–37.6
Chemicals	19 894.2	18 414.3	–7.4	6 449.3	4 571.5	–29.1
Wood, paper, etc.	3 467.4	2 345.4	–32.4	2 689.0	2 975.0	10.6
Non-electrical machinery	4 183.3	3 350.8	–19.9	785.9	786.4	0.1
Electrical machinery	41 238.5	30 136.3	–26.9	1 040.7	1 327.7	27.6
Transport equipment	17 098.0	11 950.8	–30.1	1 015.0	831.9	–18.0
Manufactures n.e.s.	14 870.6	10 347.0	–30.4	4 849.8	4 047.0	–16.6
Total	129 954.0	96 968.2	–25.4	235 156.8	163 377.2	–30.5

Source: UNCTAD, authors' calculations.

Table A.2

Data Sources and Expected Influence of Explaining Variables

Variable	Source	Expected influence
Trade	UNCTAD	
GDP importer	UNCTAD	+
GDP exporter	UNCTAD	+
Distance	CEPII	–
Inflation	IMF	–
Import tariff	WTO	–
Exchange rate	UNCTAD	+ for export, – for import
Soviet bloc dummy	CEPII	+

Source: Compiled by the authors.

Table A.3

Countries' 3-Digit ISO Codes Used in the Research

Country	ISO code	Country	ISO code	Country	ISO code
Austria	AUT	France	FRA	Netherlands	NLD
Belgium	BEL	Greece	GRC	Poland	POL
Bulgaria	BGR	Croatia	HRV	Portugal	PRT
Cyprus	CYP	Hungary	HUN	Romania	ROU
Czech Republic	CZE	Ireland	IRL	Slovakia	SVK
Germany	DEU	Italy	ITA	Slovenia	SVN
Denmark	DNK	Lithuania	LTU	Sweden	SWE
Spain	ESP	Luxembourg	LUX	Russian Federation	RUS
Estonia	EST	Latvia	LVA		
Finland	FIN	Malta	MLT		

Source: Compiled by the authors.

Table A.4

Groups of Commodities Used in the Analysis

MTN 2-digit code(s)	Group of commodities
MT2 – 01, 02, 03, 07, 11	Foodstuffs (including fruit, vegetables, meat, fish, milk and dairy imports)
MT2 – 04	Coffee, tea
MT2 – 05	Cereals and preparations
MT2 – 06	Oilseeds, fats and oils
MT2 – 10	Other agricultural products
MT2 – 08	Beverages and tobacco
MT2 – 16, 17, 18	Textile and clothing
MT2 – 09	Petroleum
MT2 – 12	Minerals and metals
MT2 – 14	Chemicals
MT2 – 15	Wood, paper, etc.
MT2 – 19	Non-electrical machinery
MT2 – 20	Electrical machinery
MT2 – 21	Transport equipment
MT2 – 22	Manufactures n.e.s.

Source: Compiled by the authors.

Table A.5

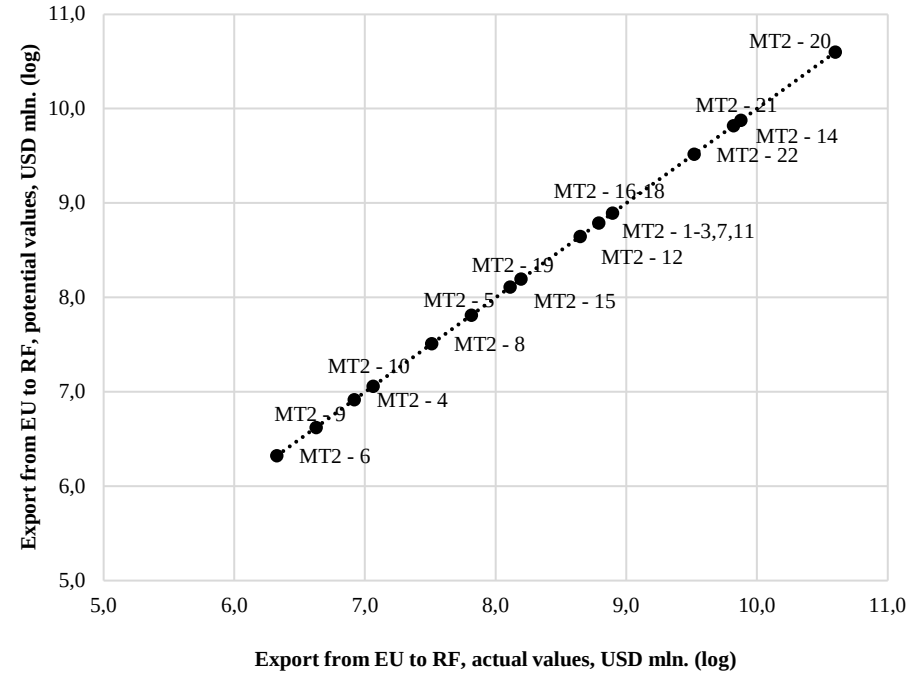
Descriptive Statistics of the Variables Included in the Model

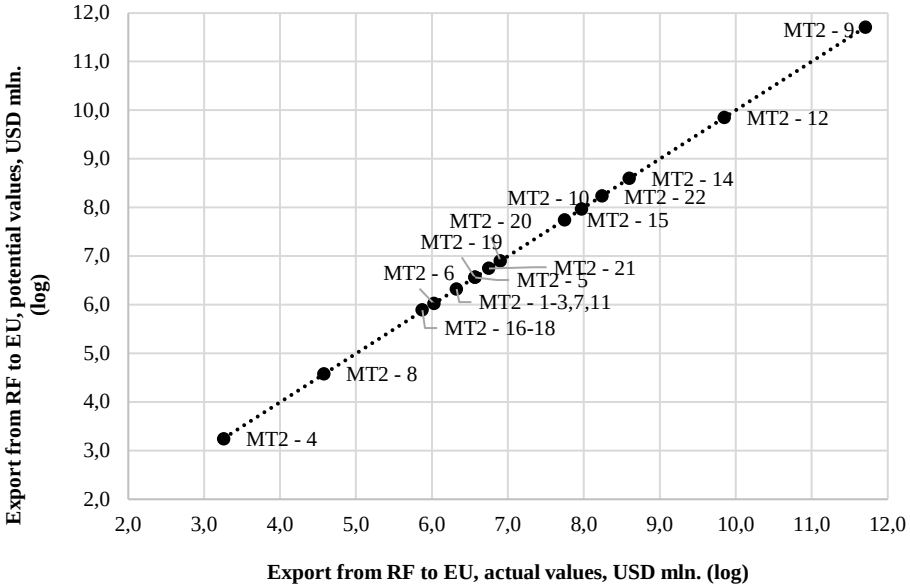
	Obs.	Mean	Std. Dev.	Min	Max
Trade	38610	76.02	653.46	0	32625.79
GDP importer (log)	38610	6.36	1.52	2.17	2.17
GDP exporter (log)	38610	6.36	1.52	2.17	2.17
Distance (log)	38610	7.49	0.41	6.68	8.27
Inflation	38610	0.038	0.038	–0.016	0.155
Import tariff	38610	5.79	5.41	0	44.7
Exchange rate	38610	42.04	24.69	0.14	74.22
Social camp dummy	38610	0.30	0.46	0	1

Source: Authors' calculations in the Stata program.

F i g u r e A.1

Actual and Potential Values of EU – RF Trade

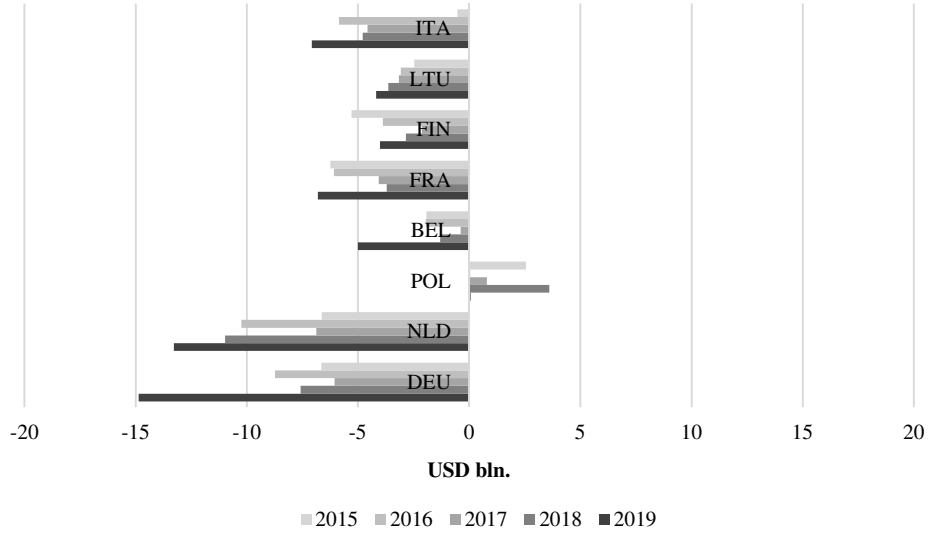




Source: Authors' calculations based on estimation results.

Figure A.2

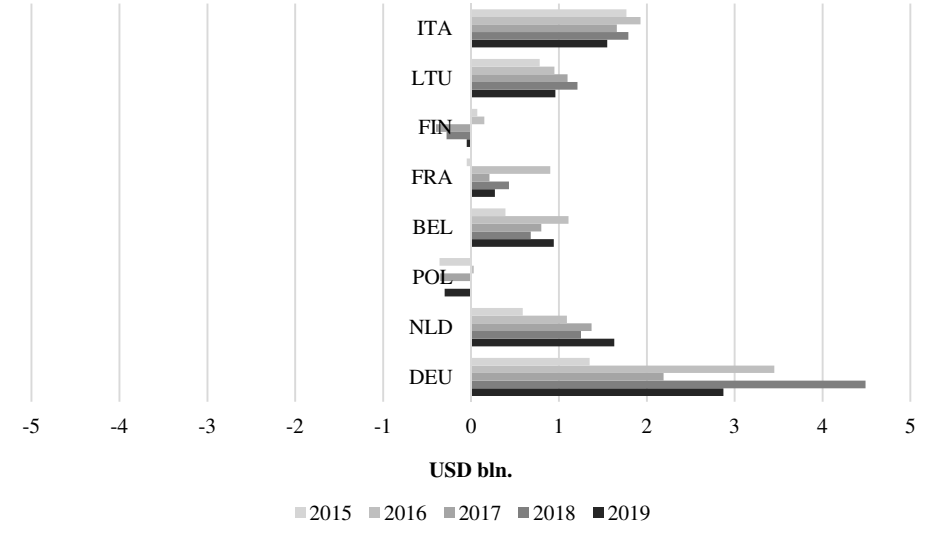
Actual Minus Potential Levels of RF-to-EU Trade, 2015 – 2019



Source: Authors' calculations based on estimation results.

Figure A.3

Actual Minus Potential Levels of EU-to-RF Trade, 2015 – 2019



Source: Authors' calculations based on estimation results.