Sanction Evasion
The case of Russia's counter-sanctions

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Abstract

Sanction evasion can hamper the effect of international sanctions. This paper aims to establish whether the Russian sent counter-sanctions were evaded by the Western countries by using non-sanctioned countries as transit routes for the sanctioned products. This question is analysed by estimating a gravity equation of trade by applying Pseudo-Poisson Maximum Likelihood and Ordinary Least Squares estimators in a difference-in-differences setup. The data covers all yearly trade flows between all 221 world exporters and importers for the period 2012–2016. The results suggest that on average, trade from sanctioned countries was diverted to non-sanctioned countries, but not further to Russia through these countries. Furthermore, exports in sanctioned products to Russia's neighbouring countries decreased from the Western countries, while the trade from the non-sanctioned neighbouring countries to Russia increased. In conclusion, no large-scale sanction evasion was present in the two years post-sanction imposition.

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1 Introduction

Sanctions are used as an economic international policy tool when some unwanted behaviour of a country is sought to be changed without engaging in an armed conflict. The aim of sanctions is to force the target to comply to the sender's political goal (Barber, 1979). Throughout the 20th and 21st centuries, sanctions have been imposed in many major international conflicts: the Rhodesian civil war, the Cuban missile crisis, the Iranian nuclear program, and the Yugoslav Wars, to mention a few. Although sanctions are a more delicate way to force other countries to obey international rules, they are costly both in an economic and a political sense.

The sanction episode between the Russian Federation and the Western countries is not reaching an end in the foreseeable future and the direct and indirect costs through a stringent political environment are accumulating. Indeed, Russia prolonged the sanctions to be in effect until the end of 2019[1]. The international political conflict was ignited in the aftermath of the Ukrainian internal crisis in 2013, which quickly escalated into an armed conflict in the eastern parts of Ukraine. This was followed by the annexation of Crimean Peninsula to the Russian Federation by separatists with an alleged Russian involvement. As a response, the European Union member states and the USA, in an alliance with others, imposed a set of sanctions on Russian companies and individuals. Russia answered these sanctions with their own set of counter-sanctions targeting a list of food products origin from the Western countries.

In this paper I will evaluate if the counter-sanctions imposed by Russia are being circumvented by exporting to third-party countries who further export to Russia. This so-called *sanction evasion*, *non-compliance* or *triangularization* has been detected in previous sanction episodes, for example in the case of North Korean sanctions (Jung and Kim, 2018), but has not yet been studied on the ongoing episode between the West and Russia. I will use the research of Crozet and Hintz (2016) as a point of departure, first re-estimating their results in a similar setup with different country and time dimension. Thereafter I will shift to the main question of this essay and analyse if the Russian sent sanctions are being circumvented.

To analyse the question of sanction circumvention, I will exploit BACI database's disaggregated product flows for 2012–2016 in a gravity equation setup. The dataset includes 221 exporters[2]. First, I will re-estimate the equations according to Crozet and Hintz (2016) with my data to further confirm their results on trade effects on sanctioned countries. Second, I will run a difference-in-differences estimation on the trade deflection towards countries not being sanctioned, and on the change in trade from these countries towards Russia. Difference-in-differences enables to isolate the effect of sanctions from

[1]RT, 12th July 2018, https://www.rt.com/business/432875-russia-extends-counter-sanctions, retrieved 18th July 2018.

[2]Includes also autonomic areas as separate exporters.

other determinants of trade. I expect to find increased trade in the treatment group compared to the control group of non-sanctioned but similar products in both EU to third-party countries and from third-party countries to Russia. The treatment group consists of the sanctioned animal products and foodstuff, and the control group are the non-sanctioned product groups in the same Harmonised System section (see Appendix A for the sanctioned products).

Research on the Russian sanction episode is suggesting that the sanctions are indisputably inflicting serious economic and political harm. Crozet and Hintz (2016) analysed the effects of the sanctions for both the senders and receivers in the case of the said episode. They found that both the senders and the receivers of the sanctions are hurt by imposing sanctions. They estimate the loss of exports at 114 billion US$ (includes both sanctions from and towards Russia). Of these costs, 44 US$ is borne by the sanctioning Western countries. Most of this is due to the Western sanctions and the effect of retaliation is small (Crozet and Hintz, 2016). Some of the lost trade with Russia is replaced by diverting trade to other countries but the mitigating effects are small, as was found by Crozet and Hintz (2016) for French firms. What has not yet been studied in this sanction episode, is the possible circumvention of the sanctions sent by Russia.

The possible circumvention of the Russian sanctions is an interesting question as sanction evasion is an obstacle for the success of sanctions. The effect of sanctions has been alleviated by sanction evasion as found in studies on previous sanction episodes. Jung and Kim (2018) find that economic sanctions imposed by South Korea on North Korea in 2010 were mostly ineffective due to the non-compliance of Chinese firms. Labels of origin were changed, and North Korean products were further exported to South Korea by Chinese transit firms. Besedes et al. (2018) find that sanctioned countries increase economic activity toward countries that are non-sanctioned in the case of financial sanctions in their study on German firms. In addition, Besedes et al (2017) evidence suggests that if the sanctions are only enforced by the EU, and lack the full support of the United Nations, the evasion of sanctions is more likely. However, the study is considering solely capital flows, which are probably easier to revert in the case of sanctions, than building new export chains. Dadak (2003) found that United Nations imposed sanctions on Yugoslavia were circumvented by exporting through Bulgaria. However, this episode differs in the sense that the evasion was preferred by the Yugoslavian government as it provided them necessary goods. The Russian government has an incentive to control strictly that the origin of the imported products is not from the countries on the sanction list. To summarize, the sanction evasion is preferred by the target but frowned by the sender, which makes it interesting if the Russian counter-sanctions are evaded by Western targets.

Roughly divided, sanctions can be analysed from two perspectives: Effects on sender and effects on target. Naturally, both these categories include numerous sub-categories

of possible analyses. Delimiting the analysis on the economic effects, commonly studied aspects are the effects on goods trade, financial commodities and exchange rates. Effects on the goods trade is quite extensively studied in earlier international sanction episodes as well as in the ongoing episode involving Russian Federation and western countries. In addition to Crozet and Hintz (2016) study on trade destruction and effects on French firms, trade effects on EU has been studied by Christen et al. (2014) and effects on Austria by Christen et al. (2016). The effects on Russia is studied for example by Dreger et al. (2016) who found that majority of the Russian economic turmoil can be explained by the oil shock and fall of ruble rather than the sanctions.

In addition to shedding more light on the ongoing episode and sanction evasion, this paper contributes to the wide literature of economic sanctions in general. The effectiveness of sanctions in achieving policy goals is widely studied, and the consensus is that sanctions are relatively ineffective in reaching their political goals. Hufbauer et al. (1990) studied various sanction episodes and claimed that 30 percent of imposed sanctions lead to political success. This result has later been challenged as inflated numbers, and the real success rate is probably much lower (Dreger et al., 2016). In general, the evidence on sanction success is ambiguous.

However, there is evidence that some qualities in sanction episodes contribute to the success of sanctions. First, costly sanctions are more probable to succeed (Lam, 1990; Drury, 1998; Allen, 2005). The ongoing episode has already inflicted a lot of economic costs, but as a sender, Russia is not very effective in causing serious economic damage. Second, sanctions backed by a larger coalition are more effective (Allen, 2008; Lektzian and Souva, 2007). The most effective of these multilaterally sent sanctions are those imposed as a result of international organisation coordination, such as United Nations sent sanctions (Drury, 1998; Drezner, 2000; Bapat et al. 2013). Sanctions of this nature are harder to circumvent, and the coalition is more likely to stay uniform. The sanction circumvention in this case is interesting, since if the Russian counter-sanctions could be circumvented by the Western firms, the already small effect would be further mitigated. As my focus lies in the triangular trade effects of sanctions, I will not take steps to analyse if the sanctions are working towards reaching their set aims. In addition, since the study is an in median res study on the Russian sanction episode, the effectiveness of the sanctions is hard to establish.

I do not find any robust evidence of sanction circumvention. However, the results suggest that the sanctioned countries somewhat increased their exports in the sanctioned products to non-sanctioning countries when compared to the control group of non-sanctioned products. Unfortunately, the result is not unambiguous: the preferred non-linear estimator points towards this diversion of trade whereas linear estimation suggests the contrary. However, I believe that the non-linear estimation results are more reliable, as illustrated in the sub-sample analyses. As the data is highly heteroscedastic,

with majority of small trade flows, the non-linear estimation yields more robust results. The evidence suggests also that non-sanctioned countries trade in the sanctioned category to Russia decreased compared to the control group. Furthermore, the trade from sanctioned countries to Russia's neighbouring countries decreased and the trade from these countries increased towards Russia. If some sanction evasion is present, it is in small scale and through few specific countries. The circumvention has possibly been made hard by the Russian border control if the origin of products has been scrutinized with more care after the imposition of the sanctions.

The rest of the paper is structured as follows: Second section presents the gravity equation of trade, how sanctions enter the model and how this model is estimated. The third section describes the data. Fourth section presents the results for the trade destruction and the sanction evasion. In the fifth section I discuss the limitations and the robustness of this study. Finally, I discuss the found effects and provide a conclusion.

2 Gravity Equation and Sanctions

To analyse the effects of change in trade flows due to sanctions, I rely on the theoretical framework of gravity equation. The structural gravity equation is formulated by Anderson and van Wincoop (2004), and it is based on the work of Anderson (1979). The model is based on the constant elasticity of substitution demand function (CES) of representative consumer and is the benchmark of contemporary trade policy analysis due to its good predictive power (Feenstra, 2004). Here the gravity equation is presented in a sectoral form. Breaking the trade flows into sectoral trade flows accounts for the fact that as countries grow, they might not trade more of a good but trade more goods instead, according to the monopolistic competition model (World Trade Organization, 2012). Thus, when aggregating trade flows, important information is lost as the aggregation makes the separation between changes in extensive and intensive margin of trade impossible. Furthermore, as many trade policies are targeting specific flows, aggregation moves this information to errors, if not controlled with fixed effects. The structural gravity equation is presented in the following equation:

$$x_{ijkt} = \frac{y_{ikt} y_{jkt}}{y_k t} \left(\frac{t_{ijkt}}{\Pi_{ikt} P_{jkt}}\right)^{1-\sigma_k} \tag{1}$$

Equation (1), the structural gravity equation, explains the trade flow between exporter i and importer j in product group k in time t. The first term on the right-hand-side of the equation is the trading partners' output and expenditure of product k relative to the world output of k. In the context of gravity equation, it can be interpreted as the level of frictionless trade between i and j without trade costs. Following, the second term is the trade cost term. It measures the difference between the actual bilateral trade flows

and the frictionless flows. It can be further decomposed into three components:

$$t_{ijkt} = b_{ijkt} d_{ij}^{\rho} \tag{2}$$

$$\Pi_{ikt} = (\sum_{ikt} (t_{ijkt}/P_{jkt})^{1-\sigma} \theta_{jkt})^{1/(1-\sigma)} \tag{3}$$

$$P_{jkt} = (\sum_{ikt} (t_{ijkt}/\Pi_{ikt})^{1-\sigma} \theta_{ikt})^{1/(1-\sigma)} \tag{4}$$

Equation (2) is the bilateral trade cost between i and j. It is traditionally explained in the literature with geographic and trade policy variables, such as bilateral distance, tariffs and regional trade agreements between the country-pair in question. As later shown, sanction policy enters this term as a trade inhibiting factor, whose effect is then estimated to show the direct effect of the sanctions.

Equations (3) and (4) describe the multilateral resistances (MLR). First being the outward multilateral resistance, which controls for exporter i's ease of market access. Second is the inward multilateral resistance which controls for importer j's ease of market access. As seen from equation (1), the MLRs are part of the trade cost term $(\frac{t_{ijkt}}{\Pi_{ikt} P_{jkt}})^{1/(1-\sigma)}$.

The effect on bilateral trade between i and j is affected by the MLR's in the following way: the larger the MLR of exporter i are with its all trading partners, the smaller the relative bilateral resistance is with the importer j. Therefore, the trade cost is relatively smaller between two countries when the other has a large MLR towards all other partners.

The effect of sanctions come in play through the trade cost term. As sanctions enter in the bilateral trade cost term in the Equation (2), it affects the multilateral resistances in Equations (3) and (4) as the absolute trade cost between the sanction-implicated pair becomes larger, the relative trade cost with all other partners becomes cheaper. This implies that trade should divert from the sanctioned countries to other markets as the relative trade costs decrease. In a similar way, countries not directly affected by the sanctions could expand their trade with the sanction sender as the relative trade costs decrease. These two effects open a possibility for sanction circumvention as well: as the sanctioned countries export to third-party countries, these flows could be directed to Russia.

2.1 Estimating the Effect of Sanctions

The structural gravity equation can be estimated in the following non-linear form:

$$X_{ijkt} = exp(\pi_{itk} + \chi_{jtk} + \mu_{ijk} + \beta S_{ijt}) + \epsilon_j \tag{5}$$

Where π_{itk} is an exporter-product-time fixed effect, controlling for outward multilateral

resistance and exporter characteristics. χ_{jtk} is importer-product-time fixed effect, controlling for inward multilateral resistance and importer characteristics. Importer and exporter characteristics controlled by the respective fixed effects are such as GDP in equation 1. Moreover, all country- and product group -specific characteristics are captured by these terms. μ_{ijk} is an exporter-importer-product fixed effect, and controls for unobservable time-invariant pair-specific traits, such as bilateral trade agreements, colonial relationship, language etcetera. Including pair-fixed effects is also important to include, since it controls for endogeneity of trade policies (Baier and Bergstrand, 2007; Glick and Rose, 2016). S is a dummy for sanctions. It affects the trade cost and in the scope of this paper, this will be a dummy taking different forms depending on the specification in question. ϵ_{ij} is the error term, which will later be clustered on different levels varying on the specification. As the high-dimensional fixed effects control for lot of the endogeneity in the variation, the error term is relatively safe to be treated as true measurement error (World Trade Organization, 2016). I am clustering the standard errors on export-importer level as it is a usual practice in trade literature. More recent studies employ also so-called multilevel clustering of standard errors, where the standard errors are calculated with respect to multiple dimensions in the data (see e.g. Larch et al, 2017). However, as I am following the work of Crozet and Hintz (2016), I use the approach of exporter-importer standard error clustering. Correia (2015) notes that clustering on the panel id might provide underestimated standard errors and overestimated significance in the presence of singletons, and therefore I run the estimations without singleton groups.

Fixed effects model is the benchmark model in estimating gravity equation. The most important reason is that it enables a theory-consistent estimation of the MLRs (Olivero and Yotov, 2012; Egger, 2016). The fixed effects estimations perform well in Monte Carlo simulations when comparing to other methods of price index estimations (Egger, 2016). The second advantage of using a fixed effects model is that it enables running the estimations with only bilateral trade values as the fixed effects absorb exporter-, importer- and pair-specific characteristics. This is also a downside of the FE model, since this means that the effect of time-invariant bilateral variables cannot be estimated. However, since the aim of this paper is to analyse the effects of Russian counter-sanctions on the trade flows, this feature does not set constraints for this study.

The gravity specification with fixed effects can be estimated either in its nonlinear multiplicative form with Poisson Pseudo Maximum-Likelihood (PPML) estimator or in a log-linearized form with ordinary least squares (OLS) estimator. For the choice of preferred estimator, there is a lot of evidence supporting the use of PPML, as it outperforms OLS in the sense of reliability and minimization of estimation bias (Santos Silva and Tenreyro, 2006; Faully, 2015). Furthermore, PPML is good in dealing with zero trade flows. As OLS needs log-linearized form of the gravity equation, zero trade flows are problematic, since the logarithm of zero is not defined. This is often dealt with by replac-

ing zero flows with a small number or by dropping zero flows. However, as the dataset in this paper does not include any zero trade flows due to aggregating into sanctioned and non-sanctioned trade, the OLS estimates are not affected by this problem. Another issue with trade data is the presence of heteroscedasticity. According to Santos Silva and Tenreyro (2006), estimating heteroscedastic data with OLS leads to biased and inefficient estimates. This is the result of OLS putting relatively more weight on small trade flows, when compared with PPML. As I include the trade between all exporters in the world, the mean of the trade flows is small (see Table 1 in the descriptive statistics). Larch et al. (2017) showed that the inclusion of small countries in the sample leads to divergence in the OLS and PPML results as the bias of OLS increases. Therefore, nonlinear estimation is preferred in the presence of heteroscedasticity.

All the pros considered, PPML is the preferred estimator for gravity equation. However, OLS performs also quite well when high-dimensional fixed effects are included. Sometimes the estimations run with OLS are more robust than with non-linear methods due to incidental parameter problems caused by large set of fixed effects (Charbonney, 2012). This is also used as reasoning for the Crozet and Hintz (2016) OLS estimations on French industry level data. However, as the incidental parameter problem is mostly affecting pseudo maximum-likelihood panel data estimators based on other, such as negative binomial, distributions than Poisson, I do not consider this as a problem within this study (Dhaene and Jochmans, 2011). Furthermore, Fernandez-Val and Weidner (2014) showed that PPML fixed effects estimations are not affected by incidental parameter problems as long as the explanatory variables are strictly exogenous. Nevertheless, I will estimate the difference-in-difference estimations with both linear and non-linear estimators for robustness.

3 Data and descriptive statistics

3.1 Data source

To estimate the partial equilibrium trade effects of the Russian counter-sanctions, I will use world trade data retrieved from the BACI database which is developed from the United Nations Comtrade database by Centre d'Etudes Prospectives et d'Informations Internationales. As earlier mentioned, all other effects are estimated with fixed effects, therefore no additional data on the exporter and importer characteristics is needed. This yields theory consistent estimations of the structural gravity model (see e.g. Feenstra, 2004). This method is also employed by Crozet and Hintz (2016). I will run also the FE estimations with both OLS and PPML.

3.2 Country, product group and time dimension

Countries that face the Russian counter-sanctions are all EU member states, Australia, Canada, Georgia, Japan, Montenegro, New Zealand, Norway, Ukraine and USA. Together, 37 countries[3] imposed sanctions on Russia and respectively were facing the Russian sent counter-sanctions.

In HS4 level, 33 product groups of foodstuff face the Russian embargo [4]. I use more disaggregated data on the HS6 level, which returns a total of 275 product groups of banned articles. To perform a difference-in-differences analysis on the trade-effects, I define a suitable control group. A natural choice for this is to use other foodstuff from the same categories not facing the sanctions. These are the other foodstuff in HS2 dimension where the sanctioned product groups belong. I use the list of banned products to filter out all banned products from the foodstuff HS6 codes and use the remaining approx. 450 product groups as control group. This yields approximately 3 million observations of sanctioned product flows and control group flows spanning from year 2012 to 2016. Following Crozet and Hintz (2016), I will aggregate the data to sanctioned and non-sanctioned product groups. This yields 153927 nonzero observations in the $ijtk$ dimension. Table 1 presents the data used in the analysis.

Imports are measured in thousand dollars with the mean of 44 million dollars. The proportion of sanctioned product flows is smaller in the dataset as there is slightly more non-sanctioned product groups included as a control group. The mean of the sanctioned flows is 35 million dollars, and for the control group 51 million dollars. These imply that the imports of agricultural products are dominated with small flows, as the distribution is following a power-law distribution. As the flows are aggregated, no zero-flows are present in the data. The data covers all the bilateral imports and exports between all 221 exporters in the world. The data covers the period of 2012–2016, that is five years. From these, 2012–2014 are defined as pre-sanction period and 2015–2016 as post-sanction period.

3.3 First look into change in trade

To get a preliminary view how the trade has changed in the treatment and control groups between the sanctioned and Russia, sanctioned and rest of the world, and rest of the world and Russia, I use a simple metric of banned product flows divided by banned plus control group. This metric gives a hint of how the the sanction episode have changed the trade pattern. The shares for different groups are presented in Table 2.

[3]Belgium and Luxembourg are reported as a single economy in the dataset, reducing the number of sanctioned countries to 36. For the complete list of sanctioned countries, see appendix B.

[4]Within these product groups there are exemptions such as products destined for baby food and lactose-free products. For complete list of product groups, see Appendix A.

Table 1: Descriptive statistics

Variable	Unit	N	Mean	SD	Min	Max
All trade flows						
Imports	Thousand US$	153 927	43 786	324 042	1	19 880 000
LogImports	Log of Imports	153 927	6.735	3.156	0	16.81
Exporter		153 927	113.4	64.15	1	221
Importer		153 927	111.6	63.77	1	221
Year		153 927	2014	1.406	2012	2016
Sanctioned trade flows						
Imports	Thousand US$	67 354	34 893	228 774	1	11 960 000
LogImports	Log of Imports	67 354	6.642	3.077	0	16.30
Exporter		67 354	114.5	64.34	1	221
Importer		67 354	111.7	63.76	1	221
Year		67 354	2014	1.406	2012	2016
Non-sanctioned trade flows						
Imports	Thousand US$	86 573	50 704	381 928	1	19 880 000
LogImports	Log of Imports	86 573	6.807	3.214	0	16.81
Exporter		86 573	112.5	63.98	1	221
Importer		86 573	111.5	63.78	1	221
Year		86 573	2014	1.406	2012	2016

Table 2: Import shares

	2012	2013	2014	2015	2016
World share	33.1 %	34.4 %	35.3 %	35.4 %	36.1 %
All importers to Russia	55.2 %	56.2 %	54.3 %	50.0 %	47.7 %
Sanctioned importers to Russia	50.3 %	50.0 %	39.4 %	15.6 %	13.7 %
Non-sanctioned importers to Russia	60.4 %	62.1 %	64.0 %	63.6 %	60.7 %
Sanctioned countries to non-sanctioned	31.2 %	33.2 %	34.4 %	33.8 %	34.8 %
Sanctioned to sanctioned	29.8 %	31.2 %	32.7 %	33.4 %	34.6 %
Non-sanctioned to non-sanctioned	34.1 %	36.7 %	39.6 %	43.3 %	44.8 %

First, when looking into the world trade share of the sanctioned products, we can see that there has been a slightly increasing trend in the sanctioned products' trade from 2012 to 2016. When turning into the trade to Russia, we can see a drop in 2015 and 2016, suggesting that the sanctioned trade is not replaced to full extent by trade from other countries. The share of sanctioned countries trade to Russia shows a clear drop due to the sanctions, as expected and known from previous studies. The decline from 2013 to 2014 share is explained by the sanctions coming into effect in August 2014. Nothing dramatic have happened either in the import share of non-sanctioned countries from countries facing sanctions: changes between the years from 2013 and 2016 are rather small and goes to both directions. The non-sanctioned countries trade to Russia in the sanctioned product group showed increase before the sanctions but decrease thereafter. Sanctioned countries' trade between each others show a steady increase from 2012 to 2016, and the effect of sanctions cannot be distinguished from these descriptive figures. What is interesting is the large increase in non-sanctioned countries trade with other non-sanctioned countries: almost 10 % in five years.

4 Results

I will first analyse the direct trade effects of sanctions between the sanctioned countries and Russia, and compare these results with Crozet and Hintz (2016) results to control how the differences in the datasets affect the results. Thereafter, I move to the analysis of sanction circumvention where I estimate the average treatment effect of sanctions for the three following trade flows: Sanctioned to Russia, sanctioned to non-sanctioned and non-sanctioned to Russia. Lastly, I run sub-sample estimations to further investigate the possibility for sanction evasion.

Crozet and Hintz (2016) estimated the partial equilibrium effect of both Western sent sanctions as well as the Russian counter-sanctions. Their data on the trade flows differs from the data used in this paper in three ways. First, the non-sanctioned product flows are all other flows than sanctioned flows. The use of all product categories in the dataset serves their purpose of estimating the general equilibrium effects of the sanctions as well. However, as I am mainly interested in the difference-in-difference analysis of sanction circumvention, I restricted the non-sanctioned product groups to similar product groups than the sanctioned as previously explained.

Second, the frequency of the Crozet and Hintz (2016) data is monthly compared to the yearly data of this study. Fortunately, yearly trade figures are well enough to calculate the theory consistent fixed effects in a panel of 5 years. However, correct determination of the sanction period becomes difficult as the sanctions were imposed in August 2014. I declare the pre-sanction period as years 2012-2014 and post-sanction period as 2015-2016. This means that part of year 2014 is already affected by the sanctions. This may affect

the results, as part of the non-treatment period is treated already.

Third, the country-set includes 70 largest exporters in the world. I included all the exporters in the BACII dataset to control for all the trade flows. This is important for estimating the trade diversion in its whole scale. Furthermore, including all the countries in the dataset allows also more precise estimation of the country and year fixed effects as the information of countries trade patterns increase.

4.1 Direct trade effects

I estimate the direct trade effects of sanctions for different country-sets with the following specification

$$X_{ijkt} = exp(\pi_{itk} + \chi_{jtk} + \mu_{ijk} + \beta S_{ijt}) + \epsilon_j \tag{6}$$

The sanction dummy takes value 1 if the specific country-pair is in question and the period is after sanctions. This measures the average effect of sanctions on the trade flows before and after the sanction implementation for the country-pair we are interested. The estimations are run for both sanctioned and non-sanctioned imports in three different groups: sanctioned to Russia, EU to Russia and non-EU sanctioned countries to Russia, as in Crozet and Hintz (2016). Furthermore, I run the estimations for the sanctioned and non-sanctioned product flows separately. I use PPML estimator with high-dimensional fixed effects to get conservative and theory consistent estimates of the sanction effects. The fixed effects included are exporter-year-product, importer-year-product and importer-exporter-product. I employ the Larch et al. (2017) method of computing the large amount of fixed effects as otherwise Stata's variable limit would be met[5]. In addition to enabling theory-consistent estimation of the sanction effects, their method checks for the existence of estimates and therefore mitigates the possibility of a spurious regression and iteratively drops the singletons[6]. I cluster the standard errors on the importer-exporter as is customary, and because I believe that the errors are correlated on exporter-importer pairs. Table 3 presents the results for change in trade for the sanctioned and non-sanctioned product groups between the pre- and post-sanction periods, all other trade effects controlled by fixed effects. The coefficients are read as elasticities who tell effect of sanctions all other things controlled.

Column (1) and (2) show the change in trade between sanctioned countries and Russia before and after the sanctions in sanctioned and non-sanctioned product groups, respectively. The sanctioned product groups suffered a drop of 85.1 % and the non-sanctioned control drops 34.7 %. When looking separately at the EU exporters, the exports of

[5]As the variable limit in Stata is 11000, traditional dummy-coding for fixed effects cannot be performed. The system of equations is solved iteratively so that each fixed effects are given initial guesses, estimate is computed, fixed effects are updated and this is repeated until convergence.

[6]See Correia (2016) for further information of the computing process.

Table 3: Re-estimation

Dependent variable CATEGORY	(1) Imports Sanct.	(2) Imports Non-sanct.	(3) Imports Sanct.	(4) Imports Non-sanct.	(5) Imports Sanct.	(6) Imports Non-sanct.
Sanctioned to Russia	-1.903***	-0.426***				
	(0.279)	(0.0657)				
EU to Russia			-1.444***	-0.196***		
			(0.320)	(0.0704)		
Non-EU to Russia					-2.046***	-0.706***
					(0.462)	(0.240)
Observations	67,354	86,573	67,354	86,573	67,354	86,573
Pseudo R-squared	0.997	0.997	0.997	0.997	0.997	0.997

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All estimations include ipt, jpt and ijp fixed effects. Standard errors are clustered at ijp level.

sanctioned product to Russia dropped 76.4 % and the non-sanctioned 17 %. For the non-EU exporters, the respective drops are 87.1 % and 50.6 %. The results show that the sanctioned trade to Russia stopped effectively after the sanctions were imposed. The remaining amount of trade is due to the exemptions, such as products used for baby food and lactose free dairy products.

I compare these results with Crozet and Hintz (2016) results in Table 4. I have transformed the logarithmic estimates to percentages[7]. All the presented figures are significant at the 1 % level.

Table 4: Comparison of results

	Author's estimations		Crozet and Hintz (2016)	
	Sanctioned	Non-sanctioned	Sanctioned	Non-sanctioned
Sanctioned to Russia	-85.1 %	-34.7 %	-86.7 %	-12.5 %
EU to Russia	-76.4 %	-17.8 %	-84.90 %	-13.40 %
Non-EU to Russia	-87.1 %	-50.6 %	-91.40 %	Not significant

As seen from the table, the estimated partial equilibrium effects of the sanctioned product flows are close to each other. The differences in the non-sanctioned product groups are not comparable, because of the previously explained differences in the included product groups. Crozet and Hintz (2016) estimate the effects for all other product groups and find that they also drop due to sanctions, as a collateral damage of the sanctions. My

[7] $e^{coeff} - 1$ gives the percentage change.

estimations for the non-sanctioned food-stuff shows that the effect is significantly pronounced for the trade coming outside EU. This suggests that the non-EU firms importing to Russia might be importing both sanctioned and non-sanctioned product and therefore the sanctions hit indirectly the non-sanctioned control group for these countries particularly hard when compared to EU countries. This, however, cannot be confirmed without access to firm-level data.

Generally, the mismatches in the results are probably due to following reasons. First, the imposition of sanctions cannot be determined as accurately as with the Crozet and Hintz (2016) monthly data, so that year 2014 mitigates the effects of sanctions, since 4 months of that year are already affected by the treatment effect but still defined as untreated. Second, in my dataset, the post sanctions period is longer (years 2015 and 2016) when in their study, the period for post sanctions stretch from August 2014 to January 2015. Therefore, the trade has less time to adjust. Third, I use the trade figures from all countries to all countries instead of the 70 largest traders in the world. This way, I can estimate the fixed effects more accurately, since there is more data to rely on. This might be the reason why the coefficient for non-EU countries is significant when comparing to Crozet and Hintz (2016) insignificant one.

Overall, this exercise shows that Crozet and Hintz (2016) partial equilibrium results are possible to replicate with yearly data and that their estimations are quite robust. In their essay, they also estimate the trade effects in a general equilibrium gravity environment to account for the second order effects of the sanctions. The results were not differing much from the direct, partial equilibrium effect of the sanctions, which suggests that largest economic impact was caused by the direct destruction of the trade due to the sanction policy. On the sanctioned product groups this obviously caused the sudden stop in the import of these products. For the other, non-sanctioned products that were also negatively affected by the imposition of sanctions, the effect is arguably caused by the increase in tensions between West and Russia following the sanctions. Furthermore, the results show that there is still a significant difference on the sanctioned and non-sanctioned product flows in my dataset, which allows for proper difference-in-differences estimations in the later sections, as the two categories have parallel trends otherwise.

From now on I will continue by estimating the possible triangular trade effect of the sanctions. That will be the main analysis of my paper.

4.2 Sanction evasion

In this section I study the possible sanction evasion. For a large scale sanction evasion to be in place, first, the trade from sanctioned countries must be diverted to third-party countries, and second, these countries should increase their trade to Russia thereafter. Therefore, I run difference-in-difference gravity estimations. This method establishes

the average treatment effect of the sanctions as it compares the change in trade of the sanctioned products to change in trade of the non-sanctioned control group. As previously explained, the control group consists of other animal products and foodstuff in the same HS2 group where the sanctioned products are. Difference-in-difference analysis have been used in trade studies like in Heilmann's (2015) study on consumer boycotts and in Crozet and Hintz's (2016) study on the Russian sanctions' effect on French firms. The estimation includes change in trade to Russia from sanctioned countries, the trade flows of sanctioned products compared to non-sanctioned flows from sanctioned countries to non-sanctioned third-party countries, and change in the sanctioned flows compared to non-sanctioned flows from these non-sanctioned countries to Russia. If the change in the trade to non-sanctioned countries and the change in trade from these countries to Russia are positive, there is space for sanction evasion. The non-linear specification is as follows:

$$X_{ijkt} = exp(\pi_{it} + \chi_{jt} + \mu_{ij} + \beta_1 S_{ijt} * SR + \beta_3 S_{ijt} * NR + \beta_3 S_{ijt} * SN) + \epsilon_j \qquad (7)$$

and the linear equivalent is presented as

$$ln(X_{ijkt}) = \pi_{it} + \chi_{jt} + \mu_{ij} + \beta_1 S_{ijt} * SR + \beta_3 S_{ijt} * NR + \beta_3 S_{ijt} * SN + \epsilon_j \qquad (8)$$

The coefficients of interest are β_1, β_2 and β_3. These tell the average effect of sanctions on the sanctioned trade compared to the control group. Dummies SR, NR and SN refer to sanctioned countries exports to Russia, non-sanctioned countries trade to Russia and sanctioned countries trade to non-sanctioned countries, respectively. These dummies interact with the sanction difference-in-differences dummy S, which takes value 1 if the trade flow is of sanctioned products and period is after the implementation of said sanctions. Consequently, the coefficient of each interaction measures the average treatment effect of sanctions on the sanctioned product flows when looking on the bilateral trade on the country-pair set in question. Both estimations include exporter-time, importer-time and exporter-importer fixed effects to capture the previously discussed MLR terms, time-variant importer- and exporter-specific effects and country-pair specific effects, respectively. This differs from the estimates of the direct trade impact estimations as the fixed effects do not vary on the product group level. This is to avoid collinearity problems in this full sample analysis: The non-sanctioned to Russia dummy would be perfectly collinear with the set of fixed effects. However, I believe that this is still a sufficient level of fixed effects as the two product groups behave in a similar manner. Standard errors are clustered in the previous manner on the exporter-importer level and treated as true measurement error. The results of the estimations are presented in Table 5. The first column

shows the PPML FE estimation results and the second column the OLS FE results.

Table 5: Full sample estimation

Variables	(1) PPML FE Imports	(2) OLS FE log(Imports)
Sanctioned to Russia	-2.188***	-2.718***
	(0.388)	(0.348)
Sanctioned to non-sanctioned	0.0570**	-0.644***
	(0.0254)	(0.0341)
Non-sanctioned to Russia	-0.147**	0.0375
	(0.0606)	(0.250)
it FE	Yes	Yes
jt FE	Yes	Yes
ij FE	Yes	Yes
SE clustering	ij	ij
Observations	147,129	150,486
R-squared		0.803

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The PPML estimation show a drop of 88.8 % on the sanctioned trade to Russia and the OLS estimation a drop of 93.4 %. This further confirms the trade destruction in the sanctioned trade to Russia. The trade from sanctioned countries to non-sanctioned countries increased 5.9 % compared to the control group, when looking at the PPML estimation results. The OLS estimation results show a dramatic drop of 47.5 %. From these two contradicting results, I lean to the PPML result because, as mentioned before, the OLS tends to give biased results in the presence of heteroscedasticity. Additionally, as seen from the trade shares earlier, the share of sanctioned products increased from the period before sanctions. This result suggests that, on average, the sanctioned product flows diverted to non-sanctioned countries. This leaves space for circumvention if these flows are further exported to Russia. However, when looking at the result for the non-sanctioned countries trade to Russia, the effect is negative. The PPML estimation suggest a drop of 13.7 % in the sanctioned product flows when compared to the average change in the control group. The estimate for the OLS specification is insignificant. Despite the inclusion of multiple fixed effects, the standard errors are large for the sanctioned to Russia trade, which suggest that some systemic variation may be included in the error term. For other coefficients, the errors are smaller and probably more robust.

The results suggest that even though the trade from the sanctioned countries did increase to the non-sanctioned trading partners, the trade was not re-directed to Russia. On the one hand, the country-set of all countries makes it hard to identify the change in trade between specific country-pairs. These results show only the average treatment effect of sanctions relative to all other importers and therefore do not tell if there are

some non-sanctioned countries that had increased imports from sanctioned countries and thereafter increased exports to Russia in the same product categories. On the other hand, this result shows that in a global scale the trade has not increased to Russia in the sanctioned product groups so that large scale sanction evasion could be possible. In the next sub-section, I will analyse the sanction effects on different country groups to further evaluate if some, smaller scale evasion was present.

4.3 Sub-sample analysis on sanction evasion

The results from the last sub-section suggest, that no large-scale sanction evasion was present. Therefore, I run sub-sample analyses on different country-samples to see if distance, close ties to Russia and value of trade pre-sanctions affect the results. These country-sets are sanctioned Russian neighbours, non-sanctioning Russian neighbours, and relatively and absolutely largest exporters of the sanctioned products pre-sanctions. I also show how the inclusion of smaller flows change the OLS estimates in a large proportion as smaller flows are included as noted by Santos Silva and Tenreyro (2006) and further discussed in Faully (2015). The methodology is same as in the full-sample analysis: The country-pairs interact with the post-treatment dummy and the coefficient measures the average treatment effect. In addition, the fixed effect structure is now including the product level to allow sectoral variation. However, as mentioned before, the control and the treatment groups behave in a similar manner, so this is ought to not have a large effect on the results[8].

First, I investigate how the trade to Russia's neighbouring non-sanctioning countries have changed. I define the neighbouring countries as Russia's border neighbours and include Serbia and Macedonia due to their proximity to, and close trade relationships with Russia. From the border neighbours Azerbaijan, Belarus, China, Kazakhstan, North Korea, Mongolia I will exclude China and North Korea. China is an outlier as it is one of the largest exporters in the world, and North Korea is embargoed itself, and western exports to North Korea are halted. The estimation results are presented in Table 6.
As seen from column (1), the change in trade to Russia's neighbours from the sanctioned countries have decreased around 24 %, in contrary to the set of all non-sanctioned countries where the trade increased. Furthermore, the countries neighbouring Russia, have increased their exports to Russia in the sanctioned products 150 % when compared to the control group. OLS suggest a larger drop to Russian neighbours, and trade from neighbouring countries to Russia. However, as an illustrative evidence of the OLS's feature of putting more weight on the small trade flows, I ran the estimation so that I included North Korea to the sample of neighbouring countries as well. As seen from the difference

[8]Here the inclusion of product level dimension to the fixed effects does not cause a collinearity problem as was the case in the previous the full-sample estimation.

Table 6: Trade to Russia's non-sanctioned neighbours

	(1)	(2)	(3)	(4)
	PPML FE	OLS FE	PPML FE	OLS FE
Dependent variable	Imports	LogImports	Imports	LogImports
Sanctioned to neighbours	-0.280**	-0.413***	-0.289**	-0.435***
	(0.139)	(0.106)	(0.136)	(0.104)
Neighbours to Russia	0.931***	1.219***	0.928***	1.734***
	(0.165)	(0.305)	(0.165)	(0.520)
itp FE	Yes	Yes	Yes	Yes
jtp FE	Yes	Yes	Yes	Yes
ijpFE	Yes	Yes	Yes	Yes
SE clustering	ij	ij	ij	ij
Observations	153,927	147,010	153,927	147,010
R-squared	0.994	0.936	0.994	0.936

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

between Column (2) and (4), changing the country-set affects the estimation result a lot when considering OLS. Inclusion of North Korea, which increased it trade to Russia a lot after the sanctions, increases the coefficient a lot as the large relative increase from pre-sanction to post-sanction is weighted as for other countries even though the absolute increase in trade is miniscule. This leads to the conclusion that the main estimations are also more reliable in the PPML than in the OLS, as OLS puts more weight on the smaller trade flows. The difference in the coefficients between column (1) and (3) is relatively small, as the non-linear estimation handles the heteroscedasticity better. This further speaks in behalf of the PPML estimator.

Next, I turn to the relatively largest exporters: Cyprus, Latvia, Denmark, Greece, Ireland and Lithuania. These all exported over 30 % of their agriculture production to Russia in 2013 and suffered a significant drop when the sanctions were imposed. Unfortunately, the coefficients are insignificant for those countries and not much can be said (see Appendix C). However, when turning to the ten largest exporters by export value lost between 2013 and 2016, significant difference to the sanctioned country average effect can be found. The countries are Lithuania, Poland, Germany, the Netherlands, Denmark, Spain, Finland, Belgium and France from the EU, and Norway from the non-EU countries. The estimation results are presented in table 7.

These countries experienced a comparable loss in relative terms in exports to Russia, a drop of 82 %, which is few percent less than the whole sanctioned sample average (see Table 4). When looking to the diversion to non-sanctioning countries there is an increase of around 11 %. This increase in trade is two times as large as the average increase to non-sanctioning countries from all the sanctioned countries. However, this trade was not diverted to Russia's neighbours: trade in the sanctioned products to these countries decreased 37 % when compared to the control group. Not surprisingly, countries

Table 7: Largest losers in absolute export value

VARIABLES	(1) PPML Imports	(2) OLS LogImports
Top exporters to Russia	-1.697***	-2.510***
	(0.567)	(0.584)
Top exporters to non-sanctioned	0.101**	0.0435
	(0.0419)	(0.0414)
Top exporters to neighbours	-0.459***	-0.141
	(0.146)	(0.150)
itp FE	Yes	Yes
jtp FE	Yes	Yes
ijpFE	Yes	Yes
SE clustering	ij	ij
Observations	153,927	147,010
R-squared	0.994	0.936

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

with largest exports to Russia are affected the most. It is interesting though that these countries are also the ones that have diverted their trade to non-sanctioning countries more than the average. This might be due to the previously pondered idea of these countries working as transit countries to Russia.

The sub-sample analyses further strengthen the suggestive results of the full-sample analysis of no sanction evasion.

5 Robustness

The results suggest that no sanction evasion was present in a large scale, nor through Russia's neighbours. However, there might still be some non-compliance from some exporters, but this cannot be proved without having access to firm-level data and detailed export chain information.

One reason for no quantifiable sanction evasion is that the Russian border control might have tightened as the sanctions were imposed. The sanctions did not only exempt the direct trade from the sanctioned countries but is banning the products by original source principle. This makes the evasion of sanctions costly due to need of repacking the products in the third-party countries to allow them to be exported further to Russia. This is also a practice that has probably significant setup time, so the trade flows need some time to accustom to this abrupt change in trade policy. Furthermore, the Russian case differs from the sanction cases described in the introduction in the sense that Russia has an incentive to prevent the imports, as they have set the sanctions to hurt western exporters. Normally, sanctions are evaded by countries that are subject to embargo.

Even though the results from section 4.1 suggest that use of yearly data results in comparable results to monthly data, monthly data would still allow for the better determination of the exact time sanctions were imposed. Furthermore, this would enable to study in more detail how the trade between the sanctioned and non-sanctioned and non-sanctioned and Russia changed directly after the sanctions were set on place. The enforced border control of Russian officials may have been a reaction to initial non-compliance of importers. Within this dataset, this is cloaked by the imprecise sanction determination.

When it comes to methodological approach of analysis of sanction effects, I believe that the results are robust. The dummy measures the average treatment effect of sanctions on the country-set in question in each regression. It tells the differences in the averages pre-post sanctions and is a suggestive measure of how the sanctioned product flows have changed due to the sanctions. However, as I cluster the standard errors in a conservative way, I believe that the results of the estimations are considerably robust. The estimation results on the sub-sample country-set show further confirmation of estimation bias of OLS as smaller flows are included in the sample, suggesting that the preferred PPML results should be used as benchmark as seen from table 7. Therefore, based on my findings I argue that PPML estimates as more robust results. Furthermore, following the use of three fixed effects, omitted variable bias is minimized as all other effects than the sanction effects are controlled for. This results also in the large explanatory power of the estimations.

6 Conclusion

In this paper I analysed the possible sanction evasion of Russian counter-sanctions. In addition, I confirmed Crozet and Hintz (2016) estimations of trade destruction to Russia from the sanctioned Western countries. To study the question if countries have evaded Russian sent sanctions, I conducted multiple difference-in-differences panel estimations with different country dummies on BACI yearly trade data on all world trade flows.

The evidence suggests that no sanction evasion was present in the two succeeding years after the imposition of sanctions. This is evident when looking at the full-sample estimation as well as the sub-sample analyses on Russian neighbouring countries as well as the largest hit Western exporters. However, I find that on average the sanctioned countries increased their trade to non-sanctioning countries, when compared to the control group. Moreover, the largest western losers by lost trade to Russia diverted their trade more than the average of all sanctioned countries. Lastly, I found that Russia's non-sanctioned neighbours increased their exports to Russia even though sanctioned countries exports in the sanctioned product groups decreased to these countries.

For future research I suggest to look at the individual country export chains to deter-

mine more precisely how the exports change due to sanctions. An average effect study can only be suggestive. However, the causality in this study when it comes to the destruction of trade to Russia is robust, and in the line with studies conducted before on the case. Moreover, I find evidence on the diversion of trade flows to non-sanctioning countries in general. This effect should be further studied with disaggregation of importers to evaluate to which countries the trade has diverted. In conclusion, no large-scale sanction evasion was present in the aftermath of sanction imposition.

A note on the econometric approaches to achieve theory consistent estimates of the structural gravity equation is also on place here. The research has developed a lot in the past fifteen years, so that the results from the 90's can be considered naive in the sense that they most likely are affected by omitted variable biases as the set of regressors cannot address the endogeneity of trade policy variables. Fortunately, the estimator development from a data-driven point of view in the past 10 years, especially the fixed effects estimators, have yielded more robust and conservative results. As the methods improve, more theory consistent replicates of past studies could and should be conducted.

Furthermore, as Russian non-sanctioned neighbours are exporting more to Russia due to the sanctions and importing less from sanctioned countries, further research of the effects on these countries could be in place. On the one hand, the economic effects on these countries could be positive in the terms of increasing the trade to Russia and boosting the production in these countries. On the other hand, this has political consequences as Russia's and its neighbouring countries' ties strengthens as the West is ostracized by Russia. This might further distance the Western countries and Russia.

References

[1] Allen, S. H. (2005). The Determinants of Economic Sanctions Success and Failure, *International Interactions*, Vol. 31, No. 2, pp. 117–138.

[2] Allen, S. H. (2008). Political Institutions and Constrained Response to Economic Sanctions, *Foreign Policy Analysis*, Vol. 4, No. 3, pp. 255–274.

[3] Anderson, J. E. (1979). A theoretical foundation for the gravity equation, *American Economic Review*, Vol. 69, pp. 106–116.

[4] Anderson, J. E. & van Wincoop, E. (2003). Gravity with gravitas: a solution to the border puzzle, *American Economic Review*, Vol. 93, pp. 170–192.

[5] Baier, S. L., and Bergstrand, J. H. (2007). Do Free Trade Agreements Actually Increase Members' International Trade?, *Journal of International Economics*, Vol. 71, No. 1, pp. 72–95.

[6] Bapat, N. A., Heinrich, T., Kobayashi, Y. and Morgan, C. (2013). Determinants of Sanctions Effectiveness: Sensitivity Analysis Using New Data, *International Interactions*, Vol. 39, pp. 79–98.

[7] Barber, J. (1979). Economic Sanctions As a Policy Instrument, *International Affairs*, Vol. 55, No.3, pp. 367-384.

[8] Besedes, T., Goldbach, S., & Nitsch, V. (2017). You're banned! The effect of sanctions on German cross-border financial flows, Economic Policy, April, p. 266.

[9] Besedes, T., Goldbach, S., & Nitsch, V. (2018). Cheap talk? Financial sanctions and non-financial activity, Deutsche Bundesbank, No. 9.

[10] Charbonneau, K. B. (2012). Multiple Fixed Effects in Nonlinear Panel Data Models: Theory and Evidence, Princeton University.

[11] Christen, E., Fritz, O., Huber, P. and Streicher, G. (2014). The Economic Impacts of the EU-Russia Trade Conflict, Research Report for the Austrian Federal Ministry of Science, Research and Economy, WIFO.

[12] Christen, E., Fritz, O., Streicher, G. and Hinz, J. (2016). Effects of the EU-Russia Economic Sanctions on Value Added and Employment in Austria and the EU, Research Report for the Austrian Federal Ministry of Science, Research and Economy, WIFO.

[13] Correia, S. (2016). REGHDFE: Stata Module to Perform Linear or Instrumental-Variable Regression Absorbing Any Number of High-Dimensional Fixed Effects, https://ideas.repec.org/c/boc/bocode/s457874.html.

[14] Crozet, M. & Hinz, J. (2016). Collateral Damage: The impact of the Russia sanctions on sanctioning countries' exports, CEPII Working Paper 2016-16, June 2016, CEPII.

[15] Dadak, C. (2003). The 1992–96 Bulgarian Trade Data Puzzle: A Case of Sanctions Breaking?, *Cato Journal*, Vol. 22, No. 3, pp. 511–532.

[16] Dhaene, G., & K. Jochmans (2011). Profile-score adjustments for nonlinear fixed-effect models. Mimeo.

[17] Dreger, C., Kholodilin, K. A., Ulbricht, D. & Fidrmuc, J. (2016). Between the hammer and the anvil: The impact of economic sanctions and oil prices on Russia's ruble, *Journal of Comparative Economics*, Vol. 44, pp. 295–308.

[18] Drezner, D. W. (2000). Bargaining, Enforcement, and Multilateral Sanctions: When Is Cooperation Counterproductive?, *International Organization*, Vol. 54, No. 1, pp. 73–102.

[19] Drury, C. A. (1998). Revisiting Economic Sanctions Reconsidered, *Journal of Peace Research*, Vol. 35, No. 4, pp. 497–509.

[20] Egger, P.H. & Staub, K.E. (2016). GLM estimation of trade gravity models with fixed effects, Empir Econ, Vol. 50, No. 1, pp 137–175.

[21] Faully, T. (2015). Structural gravity and fixed effects, *Journal of International Economics*, Vol. 97, No. 1, pp. 76-85.

[22] Feenstra, R. C. (2004). Advanced International Trade: Theory and Evidence. Princeton University Press, Princeton, NJ.

[23] FernÃąndez-Val, I., & M. Weidner (2016). Individual and Time Effects in Nonlinear Panel Models with Large N, T, *Journal of Econometrics*, Vol. 192, No. 1, pp. 291–312.

[24] Glick, R., and A. K. Rose (2016). Currency Unions and Trade: A Post-EMU Reassessment, *European Economic Review*, Vol. 87, pp. 78–91.

[25] Lam, S. L. (1990). Economic Sanctions and the Success of Foreign Policy Goals: A Critical Evaluation, *Japan and the World Economy*, Vol. 2, No. 3, pp. 239–248.

[26] Larch, M., Wanner, J., Yotov, Y. V. & Zylkin, T. (2017). The Currency Union Effect: A PPML Re-assessment with High-dimensional Fixed Effects, Drexel University School of Economics Working Paper 2017-07.

[27] Lektzian, D. & Souva, M. (2007). An Institutional Theory of Sanctions Onset and Success, *Journal of Conflict Resolution*, Vol. 51, No. 6, pp. 848–871.

[28] Haidar, J. I. (2017). Economic Policy. Apr2017, Vol. 32, pp. 319-355.

[29] Hufbauer, G. C., Schott, J. J & Elliott, K. A. (1990). Economic Sanctions Reconsidered: History and Current Policy. Washington, DC: Institute for International Economics.

[30] Heilmann, K. (2016). Does political conflict hurt trade? Evidence from consumer boycotts, *Journal of International Economics*, Vol. 99(C), pp. 179–191.

[31] Jung, S. & Kim, B. (2018).Trade Between North Korea and China: Firm-Level Analysis, *Emerging Markets Finance and Trade*, Vol. 54, No. 7, pp. 1475–1489.

[32] Olivero, M. P. & Yotov, Y. V. (2012). Dynamic Gravity: Endogenous Country Size and Asset Accumulation, *Canadian Journal of Economics*, Vol. 45, No. 1, pp. 64–92.

[33] Santos Silva, J. M. C. & Tenreyro, S. (2006). The Log of Gravity, *The Review of Economics and Statistics*, Vol. 88, No. 4, pp. 641–658.

[34] World Trade Organization, 2012. A Practical Guide to Trade Policy Analysis. World Trade Organization, Geneva.

[35] World Trade Organization, 2016. An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model. World Trade Organization, Geneva.

Appendix A

Table 8: List of product groups targeted by Russian counter-sanctions

Code	Description	Code	Description
201	Meat of bovine animals, fresh or chilled	202	Meat of bovine animals, frozen
203	Meat of swine fresh, chilled or frozen	207	Meat and edible offal, fresh, chilled or frozen
210	Meat and edible offal, salted, in brine, dried or smoked	301	Live fish
302	Fish, fresh or chilled	303	Fish, frozen
304	Fish fillets and other fish meat, etc	305	Fish, dried, salted, smoked or in brine
306	Crustaceans, etc.	307	Molluscs, etc.
308	Other aquatic invertebrates	401	Milk and cream
402	Milk and cream, concentrated or containing sweetening matter	403	Buttermilk, yogurt and other fermented milk and cream
404	Whey products consisting of natural milk constituents	405	Butter and fats derived from milk, dairy spreads
406	Cheese and curd	701	Potatoes, fresh or chilled
702	Tomatoes, fresh or chilled	703	Onions, leeks and other alliaceous vegetables, fresh or chilled
704	Cabbages and similar edible brassicas, fresh or chilled	705	Lettuce and chicory, fresh or chilled
706	Carrots and similar edible roots, fresh or chilled	707	Cucumbers and gherkins, fresh or chilled
708	Leguminous vegetables, fresh or chilled	709	Other vegetables, fresh or chilled
710	Vegetables, frozen	711	Vegetables provisionally preserved
712	Dried vegetables, whole, cut, sliced, broken or in powder	713	Dried leguminous vegetables, shelled
714	Manioc, arrowroot and similar roots	801	Coconuts, Brazisl nuts and cashew nuts
802	Other nuts, fresh or dried	803	Bananas, including plantains, fresh or dried
804	Dates, figs, pineapples, avocados, guavas, mangoes	805	Citrus fruit, fresh or dried
806	Grapes, fresh or dried	807	Melons (including watermelons) and papaws (papayas), fresh
808	Apples, pears and quinces, fresh	809	Apricots, cherries, peaches, plums and sloes, fresh
810	Other fruit, fresh	811	Fruit and nuts, frozen
813	Fruit and nuts, provisionally preserved	1601	Sausages and similar products, of meat, meat offal or blood
1901	Malt extract; food preparations of flour, groats, meal, starch or malt extract, etc.	2106	Food preparations not elsewhere specified or included

Appendix B

Table 9: List of countries targeted by Russian counter-sanctions

Australia	Japan
Austria	Latvia
Belgium-Luxembourg	Lithuania
Bulgaria	Malta
Canada	Montenegro
Croatia	Netherlands
Cyprus	New Zealand
Czech Rep.	Norway
Denmark	Poland
Estonia	Portugal
Finland	Romania
France	Slovakia
Georgia	Slovenia
Germany	Spain
Greece	Sweden
Hungary	Ukraine
Ireland	United Kingdom
Italy	USA

Appendix C

Table 10: Relatively largest exporters to Russia

VARIABLES	(1) PPML Imports	(2) OLS LogImports
Top relative exporters to Russia	-0.979	-3.673***
	(0.786)	(1.351)
Top relative exporters to non-sanctioned	0.0259	0.0571
	(0.0679)	(0.0576)
itp FE	Yes	Yes
jtp FE	Yes	Yes
ijpFE	Yes	Yes
Observations	153,927	147,010
R-squared	0.994	0.936

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.