Radboud Universiteit Nijmegen

MTH Economics

International Business

The economic sanctions on Russia: the direct and "third-country" effect

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Submission date:	24/06/2019

Abstract

By using disaggregated trade data, this paper analyses the effects of both Western sanctions and the retaliatory Russian sanctions on Russian imports. More importantly, it was examined whether Russia manages to circumvent the imposed sanctions by conducting trade elsewhere. First, a theoretical framework provides a foundation of how sanctions affect a target country's imports and what consequences this could have in terms of welfare. Thereafter, the hypotheses were empirically tested using a Poisson Maximum Likelihood (PPML) panel data estimation. The data set includes all countries with which Russia conducted trade over the course of 2011-2017. The results indicate that the Western sanctions do not seem to affect Russian imports. Yet when distinguishing between dual-use products and products that are not dual-use, Russia appears to import more dual-use products from countries that have not imposed sanctions. The Russian sanctions were found to negatively affect Russian imports. However, Russia compensates for this by increasing trade with non-sanctioning countries. Lastly, Russian imports in products that were not subject to a sanction were not affected in this period.

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1. Introduction

The political conflict between Western countries and Russia worsened when the annexation of the Crimea took place. In order to alter Russia's detrimental behaviour, Western countries imposed several sanctions on Russia. These sanctions comprise asset freezes, visa bans and export restrictions. The latter relates to the fact that the Western countries would no longer export arms and related materials, dual-use goods intended for military use and several products related to the exploration and production of oil (European Commission, 2015). In turn, Russia retaliated by imposing a sanction themselves. This particular sanction held that Russia would no longer import any agri-food goods and raw materials from the countries which had imposed sanctions on Russia. As of today, the sanctions are still in place. It is evident that Russia's behaviour has not changed, as the Crimea is still annexed, but what has been achieved by these sanctions?

This paper aims to address whether the current trade-related sanctions imposed on Russia are effective in reducing bilateral trade. More importantly, does Russia truly suffer, or does the country manage to circumvent the sanctions by conducting trade elsewhere? The latter relates to the concept of diverting trade or "sanction-busting" and represents the central issue in this paper. The research will aim to provide a more accurate picture of specific economic, trade-related sanctions by the incorporation of disaggregated bilateral trade data on the specific sanctioned products. This is in contrast with the vast majority of literature, which incorporates overall trade data to assess the overall effect of a wide range of sanctions. Another contrast with literature is that often the perspective of sender countries is considered, whereas this paper considers the perspective of a country targeted with sanctions. This paper, therefore, sets itself apart by isolating a commonly used sanction by addressing its' particular effects on bilateral trade from the perspective of Russia.

In order to establish an understanding of the topic as such, the first section of this paper will provide a thorough review of relevant literature on economic sanctions. Thereafter, the theoretical three-country framework by Baldwin and Wyplosz (2006) will be employed to provide a foundation for understanding and analysing the consequences of economic sanctions for both senders and targets of these sanctions. Following the theoretical framework, the methodology for empirically analysing the collected data will be discussed. Subsequently, the descriptive statistics and the findings of the empirical analysis will be presented and reflected upon. The paper will conclude by reviewing the key implications of the findings.

2. Literature overview

2.1 Economic sanctions

Imposing economic sanctions, defined as *"the deliberate, government inspired withdrawal, or threat of withdrawal, of customary trade or financial relations"*, has become a frequently used tool to alter a countries' behaviour (Hufbauer, et al., 2009, p. 3). Sanctions are often used to exploit a targets' necessity for a certain good or service and they can, therefore, be considered as economic warfare (Baldwin, 1985; Eyler, 2007). This is also because by construction, economic sanctions are nontariff barriers to trade. Examples of economic sanctions are quantity restrictions, embargoes and quotas (Eyler, 2007). The main goal of economic sanctions is to alter the behaviour of the targeted country. The sanctions aim to do so by hurting countries economically, often by means of trying to reduce trade. In terms of altering country behaviour, the effectiveness of economic sanctions has been found to have limited use (Hufbauer, et al., 1997). An example of this is that US sanctions have not resulted in the desired results of transforming the Islamic regime in Iran, whilst economic sanctions have been present in various forms for over thirty years (Torbat, 2005). In the economic context, empirical evidence on the effectiveness of sanctions is mixed. The latter might be due to that trade restrictions could raise costs for the country targeted with sanctions, but these same restrictions might also harm the sanctioning country (Dreger, et al., 2016).

2.2 The economic effects of economic sanctions

Part of literature considers the effects of economic sanctions on a variety of economic indicators. Neuenkirch and Neumeier (2015), for example, found that all economic sanctions imposed by the United Nations (UN) and the United States (US) between 1976 and 2012 had a significant negative effect on the GDP growth of target states. In addition, Hoffman and Neuenkirch (2017) analysed the impact of the escalation of conflict on stock returns. That is, they account for the pro-Russian protest, the change of government and the imposition of sanctions following the annexation of Crimea in Ukraine. They found that an escalation of sanctions could cause a decrease in stock returns. Another variable of interest in sanction literature is the exchange rate. Taking Russia as an example, Dreger et al. (2016) provide evidence that sanctions that the volatility of oil prices is most relevant to explain the development of the exchange rate. In fact, they find that sanctions do not significantly affect the Russian currency development. Other authors have provided evidence for that the imposition of sanction, especially trade sanctions, could significantly increase income inequality and reduce the share of income of the richest quintile of target states. These effects are more impactful when sanctions are imposed for a longer period of time (Afesorgbor & Mahadevan, 2016).

In contrast to these variables, a great deal of literature has focused on the effects of economic sanctions on bilateral trade. This is not surprising, given that economic sanctions are often trade related. Caruso (2003) and Hufbauer, et al. (1997) found that trade sanctions decrease trade between the target and the sender by about 90%. In a similar vein, Yang et al. (2004) and Frank (2017) have found that extensive trade sanctions have a consistent negative effect on bilateral trade. Moreover, Crozet and Hinz (2016) estimated that the Western and the Russian counter sanctions could lead to a $4.7 billion loss in global trade. Another interesting finding was that a great deal of this lost trade was incurred through products that were not sanctioned (Crozet & Hinz, 2016). Apart from the direct effects of economic sanctions on trade, part of literature also considers the difference in effects between threatening with the imposition of sanctions and actually imposing them. Afesorgbor (2019), for example, found that merely threatening with sanctions could boost trade between the sender and the target of these sanctions. In line with other literature, it was found that the actual imposition of sanctions could decrease trade between sender and target (Afesorgbor, 2019). These findings, however, are in contrast with evidence by Kohl and Reesink (2016) who found no significant effect of the threat of sanctions on trade.

Despite the effect of economic sanctions on bilateral trade, evidence on their effect on a target country's total trade with all partners is less conclusive. In fact, there is little evidence that the effect on total trade of the targeted country is powerful (Hufbauer, et al., 2009). A reason for this could be that the sanctions are not comprehensive enough. That is, in order to produce substantial economic damage to a target country, the sanctions have to be comprehensive in terms of coverage and the opportunities to redirect trade must be curtailed (Kaempfer & Lowenberg, 1992). Ideally, this would entail that a great deal of the world market for the particular sanctioned goods should impose sanctions (Kaempfer & Lowenberg, 1992). These conditions are, seemingly, hard to match. This could imply that sanctioned countries may have found a way to circumvent the intended effects of trade sanctions.

2.3 Third-country orientation

When conceptualising the imposition of sanctions, the involved entities fall into three distinct categories. The categories comprise "sender" state(s), "target" states and "third-party" states. Whereas the first category represents the countries responsible for imposing sanctions, the second relates to countries targeted with the sanctions and the third revolves around all countries of the rest of the world (Early, 2015). Seeking assistance from third parties is a likely strategy to pursue for targeted countries, when they wish to escape from the intended economic consequences of the imposed sanctions as such. It sometimes occurs that third parties deliberately, with political motivations, aim to overturn the negative consequences of sanctions on a target, known as the "black knight effect" (Peksen & Peterson, 2016). This effect is part of a larger concept known as "sanction-busting". This concept also holds that third parties engage in (more) trade because they can take advantage of the potential weakened terms of trade of the targeted country (Early, 2015). The phenomenon of sanction-busting has often been pinpointed as being a main reason for the failure of economic sanctions (Yang, et al., 2009). There is less opportunity for this, however, when sanctions are imposed multilaterally. That is, of the fact that there are fewer options left for sanction evasion or trade diversion by a targeted country (Biersteker & van Bergeijk, 2015).

A notable example of a study that found evidence for targeted countries to redirect or divert their trade is Haidar (2013). When considering the economic sanctions imposed on Iran, it was found that Iranian exporters divert more than half of their trade to new destinations based on firm level export data (Haidar, 2013). In a similar vein, Popova and Rasoulinezhad (2016) found macro level evidence that Iran reoriented its' trade flows away from Europe towards Asia. Yang, et al. (2004) found that US sanctions caused significant reduction of trade between the US and the targeted countries. More importantly, they also found that the same sanctions caused trade between the target countries and the EU and Japan to increase. When looking at the perspective of sanction senders, Crozet and Hinz (2016) find that trade diversion effects are insignificant or small. Yet, their evidence does suggest that both EU and Russian companies, at least, partly divert their trade flows to other markets. However, these results also indicated that these companies did not manage to fully compensate for the losses of EU exports to Russia (Fritz, et al., 2017).

Though typically assumed, third-country trade promotion due to the imposition of economic sanctions is not always the case. That is, economic sanctions may hurt trade between third countries and targeted countries as well due to 'network effects'. This is because economic sanctions could depress the overall economic activities of target countries in such a way, that trade with other countries could also be negatively affected as a result of diminished demand (Yang, et al., 2009). Next to these trade disruptions, the increased transportation costs could play a role in deteriorating neighbour countries' trade (Slavov, 2007).

Evidence for this potential negative effect on third-country trade was found by Slavov (2007), who posits that the trade flows of neighbouring countries, in relation to the sanctioned country, tend to fall as a consequence of the sanctions. From this perspective, it could be argued that neighbouring or third-countries are innocent bystanders. When distinguishing between extensive, moderate and limited sanctions, Caruso's (2003) evidence suggests that unilateral extensive sanctions have a negative impact on trade. In constrast, both moderate and limited sanctions induced a positive effect on third party bilateral trade with the target. This implies that Caruso (2003) has found evidence for both the negative network effects and the trade promoting sanction-busting effects. The latter raises the question as to what extent the above mentioned findings hold when distinguishing between different types of sanctions. That is, apart from the results from Hufbauer et al. (1997) who started distinguishing between these types of sanctions in the first place. Another explanation for why part of literature finds weak overall effects of sanctions, is that sometimes sanctions comprise a narrow range of products. That is, a narrow range to the extent that it does not have much impact on overall bilateral trade flows (Yang, et al., 2004).

2.4 The case of Russia

Following the destabilisation of Ukraine and the annexation of the Crimea and Sevastopol, the political conflict between Western countries and Russia deteriorated even further (Fritz, et al., 2017). These developments resulted into an ongoing trade conflict between Western countries and Russia. Accordingly, several restrictive measures have been formally enacted against Russia over the course of 2014 (Christen, Fritz, & Streicher, 2015). The imposed sanctions are multi-faceted, given that they comprise diplomatic measures, restrictive measures such as asset freezes and visa bans and economic measures (Dreger et al., 2016). The latter concerns an embargo on the import and export of arms and related materials from/to Russia, a prohibition on exports of dual-use goods and technology to Russia and the exports of certain energy-related equipment and technology destined for oil exploration and production (European Commission, 2015). The last two sanctions relate to exports, which is analogous to a sender economy imposing a voluntary export restraint (Eyler, 2007). A total of 37 countries imposed these trade-related sanctions on Russia (Crozet & Hinz, 2016). The countries involved in the levying of trade sanctions are the United States, the 28 countries of the European Union, Ukraine, Georgia, Moldova, Australia, Canada, Japan, Norway, and Switzerland (Nelson, 2015). In response to the Western sanctions, Russia levied sanctions on the imports of agri-food goods and raw materials from the countries imposing sanctions on Russia. The countries involved in the ongoing trade conflict are displayed in figure one below.

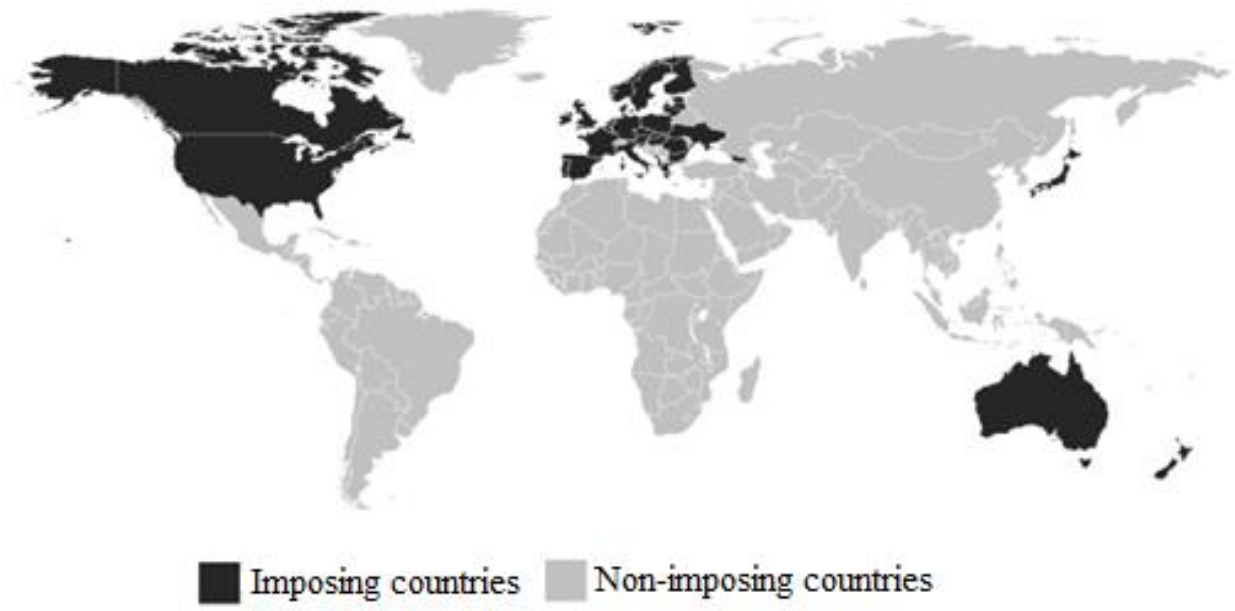

Figure 1 Adopted from Crozet and Hinz (2016) : Countries imposing sanctions on Russia and subject to retaliatory sanctions.

In particular, the Russian import restriction involved beef, pork, poultry, milk, fish, vegetables, fruits and products related to these edibles (Christen, Fritz, & Streicher, 2015). When comparing the sanctions imposed by Western countries to those imposed by Russia on Western countries, it is important to note that the Russian sanctions are more comprehensive in terms of products (Fritz, et al., 2017). This becomes even more evident when considering that the Russian sanctions comprise almost all products coded under the HS2 codes 02 meat, 03 fish, 04 dairy products, 07 vegetables and 08 fruit. In contrast, the sanctions imposed on Russia are more product-specific and can be classified under the following 2-digit HS code groups: 27, 29, 38, 39, 71, 73, 82, 84, 85, 87- 90 and 93 (Appendix A; Appendix B) (Crozet & Hinz, 2016). These specific HS code groups also include the main sanctioned dual-use products. These dual-use products comprise *''goods, software and technology that can be used for both civilian and military applications''* (European Commission, n.d.). Even before the sanction, exporting dual-use goods is allowed under certain conditions which requires an authorisation or license. After the imposition of the sanction, the export of all dual-use goods for military use is prohibited. That is, unless contracts or agreements for these exports were established before the 1st of august 2014 (SIPRI & Ecorys, 2015). Similar to the sanctioned energy-related equipment and technology destined for oil exploration, the sanctioned dual-use products cover a relatively small proportion of the total products covered by the 2-digit HS code groups (SIPRI & Ecorys, 2015).

The fact that the Russian sanctions are more comprehensive, in terms of 2-digit HS code group coverage, becomes even more evident when looking at figure 2 below. The latter implies that the Russian sanctions might have a large effect on trade compared to the Western sanctions. Another reason why the Russian sanctions might be more effective could be that the EU is one of the largest suppliers of agri-food products to Russia, whereas the Western sanctioned products represent a relatively small share in exports to Russia (Fritz, et al., 2017). Figure 2 is a visual representation of EU28 exports of sanctioned products to Russia over the period of 2009-2018, which reveals the basic intuition of the effects of sanctions. The data is presented in kilograms in order to account for potential price fluctuations. From figure 2 it can be derived that the sanctions imposed by Russia, concerning agri-food product groups, cause the EU28 exports to approach zero after the imposition of sanctions mid-2014. A similar decrease is to be observed when looking at the EU28 exports of arms and dual-use products. In contrast to agri-food exports, arms and dual-use exports does not approach zero. Presumably, this is due to the fact that the sanctions imposed by the EU are less comprehensive in terms of 2-digit HS code group coverage.

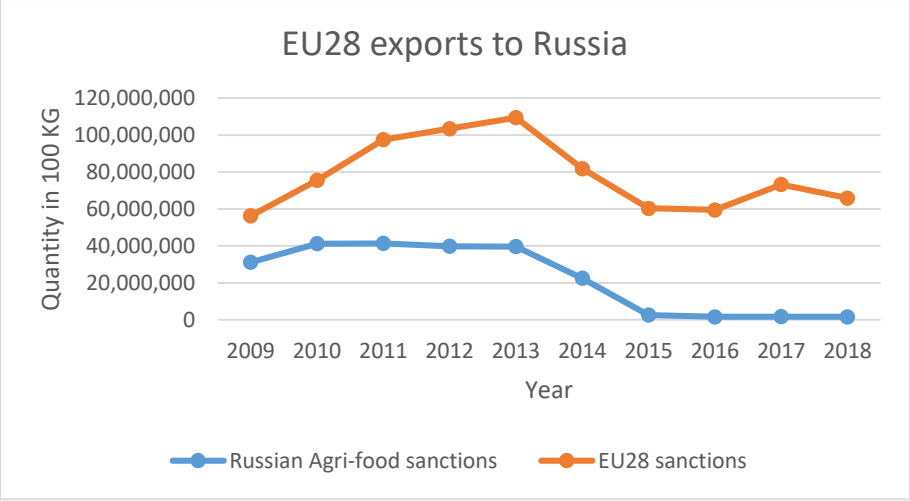

Figure 2 Authors' compilation based on data derived from Eurostat (2019)

3. Theoretical framework

3.1 Introduction

In international trade theory, it is common knowledge that free trade maximises world economic welfare (Smeets, 2018). Imposing trade sanctions on countries, sectors or products could therefore disrupt welfare maximisation. In that light, it could be argued that economic sanctions can be treated as a negative form of a trade agreement (Frank, 2017). Typically, two-country trade policy analysis in partial equilibrium is used to illustrate policy changes. Applying partial equilibrium analysis to the imposition of trade sanctions is also relevant because it could differ per product group if an economy is perceived to be small or large. When a sanctioned country would be a small economy in a certain product group, this would mean that they would be price takers on the world market (Caruso, 2003). This is because whenever a country is small in an international market, their domestic trade policies cannot affect the world price of a good (Suranovic, 2010). Conversely, countries can be price setters in product groups when they are relatively large. Despite the fact that Russia is the largest country in the world, it cannot be assumed that Russia is a large country in world trade. This becomes particularly evident when considering that Magee and Magee (2008) found evidence that even the US, one of the largest economies in the world, is typically a small country in world trade. This is also argued by Smeets (2018), who states that sanction analysis depends on the relative balance of powers between countries, since the weaker party will face deteriorating terms of trade.

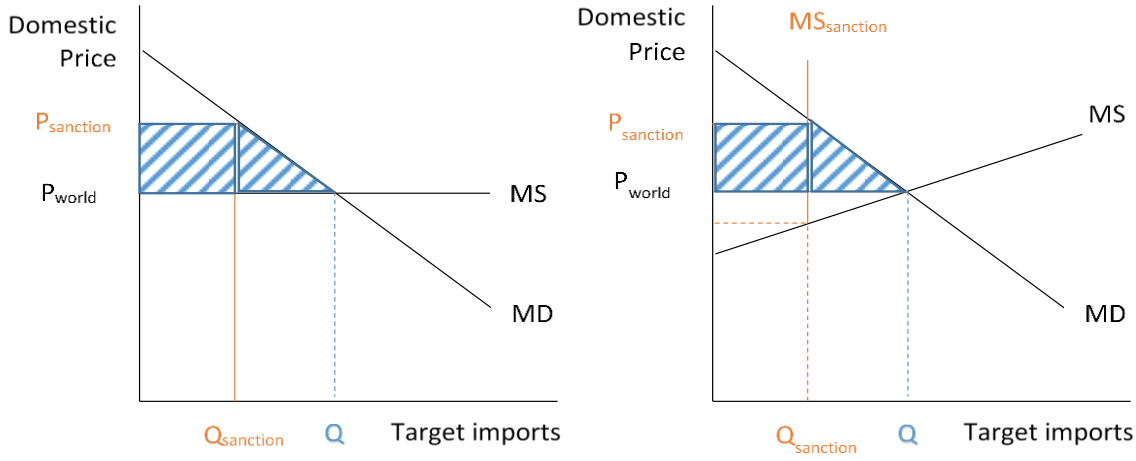

Figure 3 two-country partial equilibrium model: small and large country

The partial equilibrium situation and the difference between a small and a large economy can be depicted as above in figure 3 In both graphs the MS curve represents the world import supply and the MD curve represents the import demand faced by a particular country. In a small price-taking economy on the left-hand side, the import supply (MS) is a flat line. When a trade sanction is imposed in the form of an export restraint, the small economy moves from an equilibrium situation importing quantity Q to a limited quantity $Q_{sanction}$. The consumers in the targeted country are, therefore, burdened with a higher domestic price for the sanctioned goods. This latter results from a situation of relative scarcity (Caruso, 2003). In terms of welfare,

the sanctioned country faces a negative domestic price effect (from P_{world} to $P_{sanction}$) and a negative trade volume effect (from quantity Q to quantity $Q_{sanction}$). These losses are captured by the striped area in figure 3. The rents pertain to either exporters or a government. The latter could be the case when a government would competitively auction export licences. In contrast, when the export licenses are issued for free the rents would pertain to the exporters (Caruso, 2003). For a large price-setting economy, the import supply (MS) is an upward sloping line. The latter holds that the imposition of a sanction could have consequences for the world price. For the large economy, the import supply curve becomes a straight line up at the sanction quantity once the sanction has been imposed. The world border price increases to $P_{sanction}$, from which the rents are earned by the exporters. These rents are larger than in a small country. Inherently, this has implications for the welfare effects of the sanctioning suppliers of imports. The increase in world price results in a positive price effect (striped rectangle) and a negative trade volume effect (striped triangle) for the exporters. These exporters, thus, sell a restricted quantity at an increased price (Krugman, 2008). In contrast with the exporters facing a large economy, the exporters dealing with a small economy experience no positive price effect and they are even subject to a negative trade volume effect.

The senders of sanctions are, however, not the only parties to consider. Both the situation in which the world price increases and the one in which it does not could have welfare implications for countries that have not imposed sanctions. The large economy and the small economy situation relate to a shortfall in supply, stemming from the imposed sanction placed on the exports of a product group. This shortfall could, however, benefit exporting countries that have not imposed sanctions and are not involved in the conflict (Caruso, 2003). The latter relates to the potential event of sanction-busting, which involves three categories of countries (Early, 2015). In order to consider these 'third countries', it is deemed necessary to analyse the imposition of sanctions using a three-country framework. The latter, along with that sanctions can be treated as a negative form of a trade agreement, make graphical analysis based on the work of Baldwin and Wyplosz (2006) particularly relevant. This is because it provides a three-country framework for analysing the consequences of preferential trade agreements for both members and non-members (World Trade Organization, 2011). Because of the fact that the sanctions at hand pertain certain products or product groups, it is important to consider the analysis in partial equilibrium. This way, a foundation for understanding the potential welfare effects following the imposition of trade sanctions can be constructed. In fact, this type of analysis could isolate the sanctions by looking at a partial equilibrium situation and it could take into account whether the Russian economy is small or large. It is for this reason that it can be justified to look at the effects of economic sanctions on bilateral trade. By analysing the sanctions by means of such a framework, the potential welfare consequences of bilateral trade effects can be motivated and verified.

4.2 The framework

3.2.1 A large economy

The framework by Baldwin and Wyplosz (2006) highlights the discriminatory effect of preferential trade liberalization. That is, it shows the tradeoffs between volume effects and the terms-of-trade effects. As mentioned before, the framework considers three countries: Home, Partner and the Rest of the World (RoW). When conceptualising the imposition of sanctions, the framework can be adapted by employing the aforementioned country categories of sender states, target states and third-party states (Early, 2015). The framework, thus, consists of three interconnected graphs. The graph in figure 4 on the left-hand side represents the export supply for countries that are going to impose sanctions. Similarly, the graph in the middle serves as the export market for all third-party countries. In other words, this graph pertains countries that have not imposed sanctions and it includes a curve epitomising the export supply (XS) of these countries. The export supply curve (XS) for these sender countries offers a graphical representations of the amounts they are willing to export at any given border price. Lastly, the graph on the right-hand side serves as the market for imports and exports in the country targeted with sanctions. In this particular graph, both import demand curve (MD) and an import supply curve (MS) are present. The former, inherently, serves as the demand of imports in the targeted country. The latter, however, represents the total import supply available to the country. This total of import supply is analogous to the sum of the export supply curves for third-party and sender countries.

In order to analyse how countries are affected by being restricted in their imports, it is important to look at an initial situation in which there is open trade across all countries. Under these conditions, the target country imports the quantity M at a price of free trade (Pft) defined by the equilibrium of the imports supply MS and import Demand MD curves in the target country. Again, it is important to note that M is the sum of export quantities from third-party countries (Xtp) and sender countries (Xs). Graphically, this can be observed by looking at the intersections of the open trade price line Pft and each country's export supply curve. After having considered the free trade situation, the imposition of sanctions can be incorporated in the framework. Once the sanction is imposed, the sender countries no longer trade the sanctioned products with the target country. This implies that their export supply function is no longer a component of the aggregate import supply function in the target country.

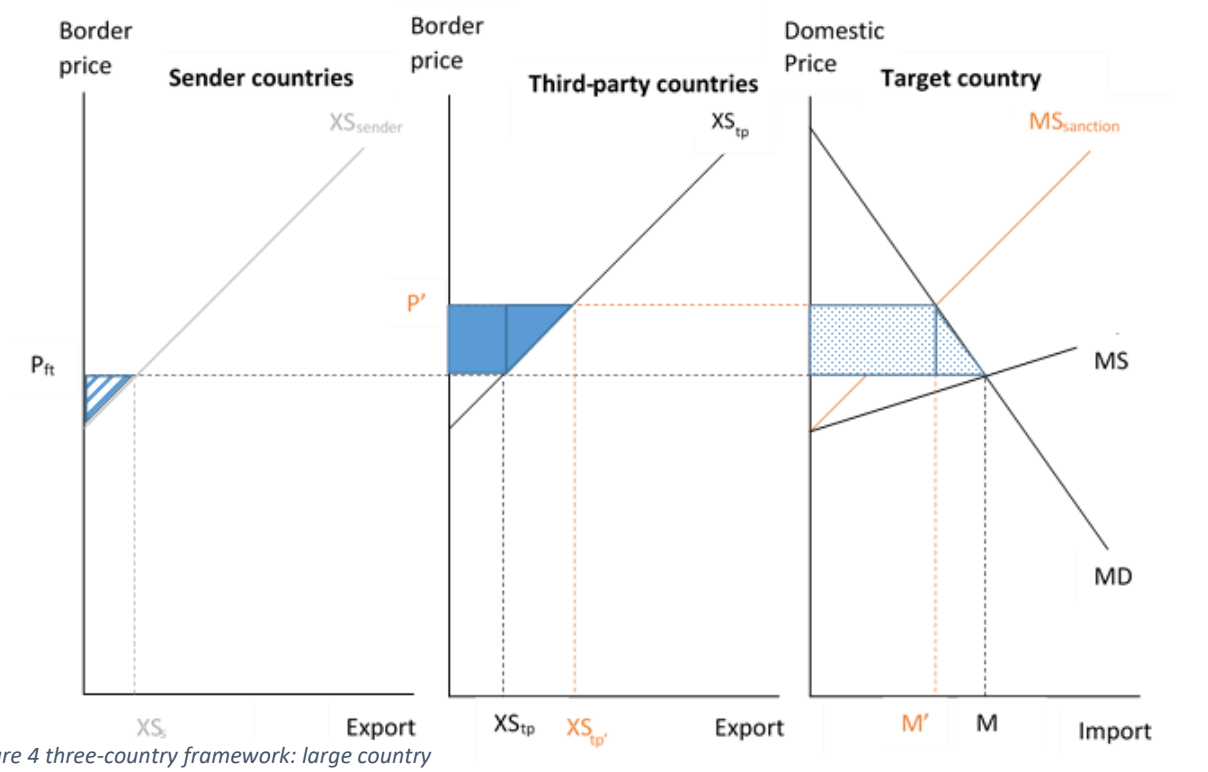

Figure 4 three-country framework: large country

In turn, this implies that the import supply curve now becomes equal to the export supply curve of third-party countries, shifting import supply up to $MS_{sanction}$. For the sender country, this holds a negative trade volume effect (from XS to zero). The targeted country suffers from a negative trade volume effect (from M to M') and a negative price effect (from P_{ft} to P'). As a consequence of this sanction, the domestic price for the good at Home rises to P' and the quantity of imports reduces to M'. At this price, third-party countries are willing to export more. In doing so, they partially compensate for the incurred loss of imports by targeted countries. This means that the border price for third-countries also rises to P' and their respective exports increases to X_{tp}'. The latter relates to that third-party firms can now take advantage of the target firms' weakened terms of trade, forcing them to pay more for the sanctioned goods they import (Early, 2015). In turn, this translates in a positive border price effect (from P_{ft} to P') and a positive trade volume effect (from X_{tp} to $XS_{tp'}$).

Another option could be that this terms-of-trade distortion creates incentives for circumvention and non-cooperation (Kaempfer and Lowenberg, 1999). The latter relates to the concept of sanction-busting, which could imply increasing trade with existing third-party trade relations as shown in figure 4. It could, however, also imply the establishment of new trade relationships with countries that have not imposed sanctions. For these new trade partners, it was not profitable to trade at the initial world market price P_{ft}. Now that the price has increased to a level above the free trade price, it might be feasible for some countries to start trading. Therefore, these new trade partners could now enter the market due to the sanctions. Inherently, these potential new trading partners had a price at which they would start to trade above P_{ft}. In turn, this means that now both new market entrants and third-party countries have to be considered, whereas the sender countries do not have to be considered.

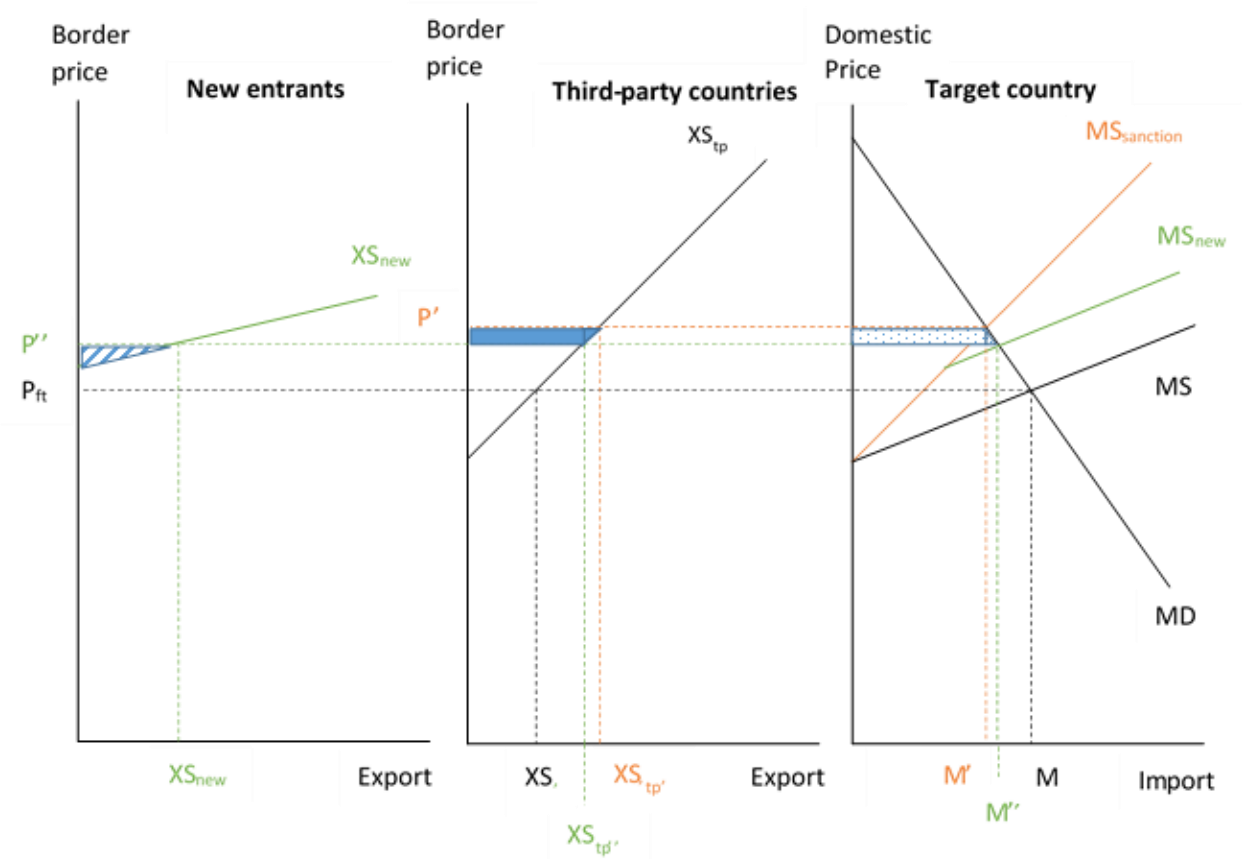

Figure 5 three-country framework: large country sanction busting

The situation is considered in figure 5 and the labels for the axes and curves have the same connotations as they had in figure 4. After the imposition of sanctions, the MS curves shifts up to $MS_{sanction}$ which leads to an increase in price from P_{ft} to P'. Third-party countries now increase their exports from XS to $XS_{tp'}$ so that the targeted country now imports M' instead of M. In theory, the border price could have increased to a level above the price at which new entrants would start to trade. The latter is displayed graphically in the

left-hand panel of figure 5. In turn, this leads to a new aggregate import supply MS curve (MS_{new}) since it now consists out of XS_{new} and XS_{tp}. The MS_{new} curve is not a straight line because there is a threshold price below which the new entrants would not trade. In the new equilibrium where MS_{new} meets MD, the target country will import M'' and the new domestic price is P''. This means that the border price decreases from P' to P'' for third-party countries relative to the initial sanction situation. Following this border price decrease, third-party countries now export $XS_{tp''}$ instead of $XS_{tp'}$. At the new border price, the new entrants now export XS_{new}. In terms of welfare effects, the new entrants experience a positive border price effect (from where their XS curve meets the border price axis to P'') and a positive trade volume effect (from zero exports to XS_{new}). In turn, the third-party countries face a negative price effect (from P' to P'') and a negative trade volume effect (from $XS_{tp'}$ to $XS_{tp''}$). Lastly, the targeted country yields a positive price effect (from P' to P'') and a positive trade volume effect (from M' to M'') relative to the initial sanction situation.

3.2.2 A small economy

As mentioned before, the domestic trade policies of small economies cannot affect the world price of a good (Suranovic, 2010). In the three-country framework, the latter translates into flat export supply (XS) curves for both sender countries and third-party countries. Consequently, the aggregate import supply (MS) curve in the target country resulting from those XS curves is also a flat line. Following the imposition of an export sanction, the small economy experiences less import supply. This is because the sender economy no longer exports the sanctioned goods to the target country, highlighting the importance of considering the situation in partial equilibrium.

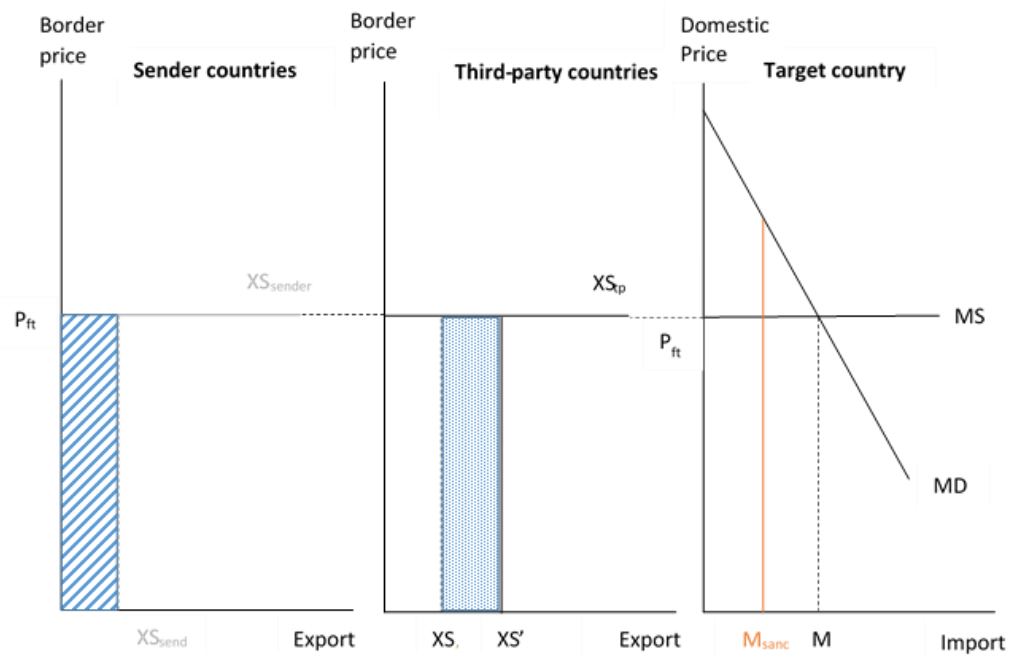

Figure 6 three-country framework: small country

The equilibrium situation moves from where MS met MD to where the available import quantity after the sanction $Q_{sanction}$ meets MD. Given that the third-party countries have perfectly elastic export supply, the target country will substitute the shortfall in export supply caused by the sanction. This results in no price effect in the target country. For sender countries, the imposition of such a sanction leads to a negative trade volume effect (from XS_{send} to zero). In contrast, for third-party country the result would be a positive trade volume effect (from XS to XS').

3.3 Russia

By analysing trade flows and world output data, Magee and Magee (2008) find that the influence of the United States tariffs on world prices is negligible in most industries. In doing so, they posit that industrial organisation scholars consider having over 50% market share in any given world product market to be a threshold to have monopsony power. International economists, however, do not consider this threshold to be a prerequisite for a country to be large in world markets. To the best of the author's knowledge, international economists do not uphold a threshold for a country to be considered large in world markets. It is, however, evident that a country is considered small when it is not able to affect world market prices. Therefore, the export supply offered to this country should be perfectly elastic. A great deal of literature is devoted to the econometric estimation of this elasticity. Yet, the estimates vary widely and are relatively old (Tokarick, 2014). Estimating such elasticities is beyond the scope of this paper. In order to gain a basic understanding as to whether Russia is a small or a large country in world trade similar descriptive statistics as in Magee and Magee (2008) are computed. Moreover, a closer look at the prices of the product groups subject to Russia's sanctions will be taken.

Magee and Magee (2008) look at the shares of world imports for the twenty largest importers. A similar analysis can be performed for Russia. As the sanctions have been imposed over de course of 2014, it is deemed most appropriate to look at 2013. This is because, at then, the Russian import shares have not been influenced by the sanctions as such. Table 1 provides an excerpt of the tabulated twenty largest importers, for which the entire table can be found in Appendix D. In addition, it provides the shares of world imports for the twenty largest importers over the period of 2011-2017.

Table 1 Share of imports and relative rank in world trade

Country	Year	2011	2012	2013	2014	2015	2016	2017
United States	Share of world imports	12.24%	12.47%	12.23%	12.62%	13.80%	13.82%	13.34%
	Rank	1	1	1	1	1	1	1
China	Share of world imports	9.41%	9.70%	10.24%	10.25%	10.01%	9.75%	10.22%
	Rank	2	2	2	2	2	2	2
Russian Federation	Share of world imports	1.75%	1.79%	1.79%	1.61%	1.15%	1.18%	1.32%
	Rank	17	17	16	17	20	20	19

As table 1 shows, Russia does not come close to the 50% standard required for monopsony power and the ability to control prices in a market. Another thing that can be derived from the table is that from 2015 on, both the Russian import share and their rank relative to the other large importers deteriorates. A potential cause of this might be the imposed sanctions.

In order to consider the economic sanctions, the Russian imports as a percentage of world supply were calculated. This way, the relative position of Russia in the sanctioned product groups can be isolated. Given that the Russian sanctions were the most comprehensive ones in terms of product group coverage, those product groups were considered. This is also because the Western sanctions involve HS 6-digit product codes, covering a relatively small portion of HS 2-digit product categories.

Table 2 Share of imports and relative rank in HS 2-digit trade

Country	HS 2-digit	02 meat	03 fish	04 dairy	07 vegetables	08 fruits
Russia	Imports as % of world supply	5.89%	2.83%	4.92%	4.28%	6.05%
	Rank relative to other importers	3	12	6	5	3
United States	Imports as % of world supply	5.26%	14.52%	2.57%	13.04%	11.78%
	Rank relative to other importers	6	1	10	1	1
China	Imports as % of world supply	5.18%	5.92%	5.85%	3.79%	3.87%
	Rank relative to other importers	8	3	3	8	8

In table 2 The Russian imports as a percentage of world supply are displayed. Again, it can be noted that Russia does not come close to the 50% threshold to be able to exercise monopsony power. It is for this reason that it can be argued that Russia is a relatively small country in international trade. Russia does seem to be a top ten importer of almost every product category subject to their sanction. In fact, for meat and dairy they have similar import shares as the world's largest importers in general, China and the United States. From this viewpoint, it could be argued that Russia is a relatively large country in world trade. The assumption that follows from this argument is that Russia could be able to influence world prices. In order to check for this, a closer look will be taken at the prices for the Russian sanctioned product categories.

3.3.1 Price levels

As argued in paragraph 3.1, the imposition of a sanction causes the import supply of sanctioned products to decrease. The latter, in turn, could lead to a higher domestic price in Russia for these particular products. As to be seen in figure 7, consumer prices in Russia increased substantially following the adoption of sanctions. Because of the fact that the Russian sanctions were food related, it is interesting to note that the consumer prices for food have increased 8% more than the consumer prices of other goods (Gros & Di Salvo, 2017). This could indicate that Russia is, in fact, a small country in world trade for the agri-food related products subject to their sanction. This is because, as mentioned before, consumers could be burdened with a higher domestic price for the sanctioned goods due to the relative scarcity of the sanctioned products (Caruso, 2003).

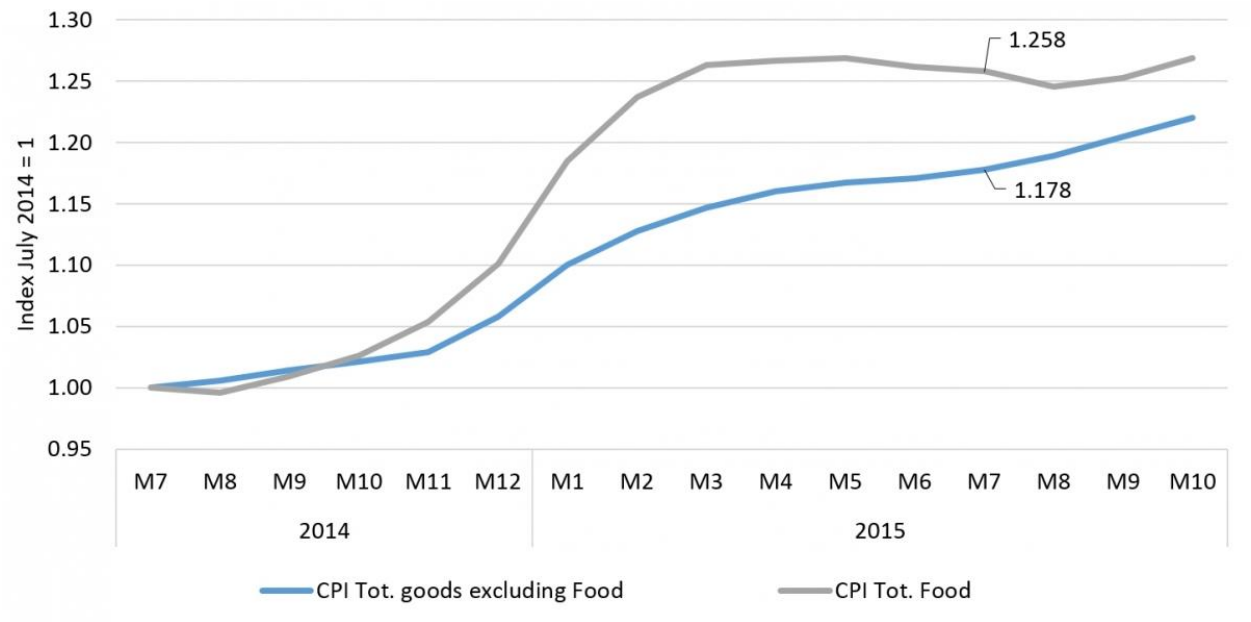

Figure 7 Russian Consumer Price Index since the imposition of sanctions (Gros & Di Salvo, 2017)

When the presumption that Russia is a small country in world trade for the sanctioned products is translated to the three-country framework, it can be argued that Russia does not suffer negative price effects. This is because an embargo, as mentioned before, does not lead to a domestic price effect given that third-parties compensate for the lost trade. That is, apart from the situation in which Russia would receive the rents. To the best of the author's knowledge, there is no evidence that Russia receives the rents. Caruso (2003) argued that, in most cases, the exporters obtain the rents in such situations. This, however, is not an assumption that can be made based on the available information. Therefore, it is merely an educated guess that Russia is a small country in world trade for the sanctioned products.

4. Methodology

4.1 Definition of research problem and objectives

In the literature review, it was established that a more accurate picture of the effects of trade or economic sanctions can potentially be measured. That is, in terms of both trade effects and trade diverting or sanction-busting effects. Given that both positive effects and negative effects have been found on the trade with third parties, the question arises whether Russia truly suffers from the imposed sanctions (Caruso, 2003; Hufbauer et al., 1997). That is, does Russia compensate the losses incurred from the sanctions by increasing trade with third countries? Based on the discussed studies and the rationale for looking at the case of Russia, the following research question was posed: *What is the effect of the imposed economic sanctions on Russia on Russian imports from non-sanctioning countries?* In other words, does Russia manage to bust through the imposed sanctions and redirect or divert their trade successfully? The latter represents the research problem at hand, from which the accompanying objectives can be derived. The objectives concern three issues and are, therefore, threefold. Literature is relatively unanimous in considering the effects of economic sanctions on bilateral trade to be negative. It is for this reason that the most important objective relates to creating a more accurate picture of the sanction-busting effects of these sanctions. Nevertheless, the other objective considers the more precise estimation of the presumed negative effects of economic sanctions on bilateral trade. The last objective relates to which sanctions have the largest impact on bilateral trade, given that both Western countries and Russia itself have imposed sanctions concerning Russian imports. When considering the objectives of this research along with the discussed studies above, the following hypotheses can be postulated:

H1: The economic sanctions imposed by Western countries have a negative effect on Russian imports from these sender countries.

H2: The economic sanctions imposed by Russia have a negative effect on Russian imports from the countries subject to these sanctions.

H3: The Western imposed economic sanctions have a positive effect on Russian imports from, non-sanctioning, third party countries.

H4: The Russian imposed economic sanctions have a positive effect on Russian imports from countries that are not subject to these sanctions.

4.2 Methodology and operationalisation

4.2.1 The gravity model

Nowadays, the gravity model has become a widely used empirical model to analyse international trade and investment flows (Hufbauer, et al., 2009). The model is considered to be a workhorse in international trade due to its' solid theoretical foundations. The gravity model predicts that "*international trade between two countries is directly proportional to the product of their sizes and inversely proportional to the trade frictions between them"* (Yotov, et al., 2016, p. 5). Another favourable feature of the model is its' predictive power and that it simultaneously accomodates multiple countries such that it can be utilised to capture linkages between markets. Lastly, the setting of the gravity model is very flexible, allowing for integrating other linkages (Yotov, et al., 2016). The latter characteristic, made it particularly possible for the model to become a regular framework for the empirical analysis of economic sanctions (Yang, et al., 2009). This becomes even more evident when looking at the above discussed literature because the majority of authors, such as Caruso (2003), Hufbauer et al. (1997) and Yang et al. (2004) among others, have employed such a gravity model.

The basic specification of the gravity model is as follows: $\ln TRADE_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} * GDP_{jt} + \beta_2 \ln DIST_{ij} + \beta_3 LANG_{ij} + \beta_4 ADJ_{ij} + \beta_5 BLOC_{ij} + \beta_6 A_t + u_{ijt}$. In this basic specification, the dependent variable is the bilateral trade flows between country *i* and country *j* at time *t*. That is, the natural logarithmic form of bilateral trade flows. The other variables preceded by *ln* are also in a natural logarithmic form. Implicitly, the GDP variables denote the gross domestic products of country *i* and country *j* at time *t*. The DIST variable denotes the distance between two countries. Other common control variables include dummy variables for *Language*, *Adjacency* and *Trade Bloc*. The language variable refers to a dummy variable which takes the value one when two countries involved in trade share a common language. In turn, Adjacency relates to whether two countries share a common border. Lastly, Trade Bloc refers to whether the trading countries are both members of regional or preferential trading blocs. Moreover, and perhaps most importantly, *A* could denote a variety of factors but is commonly a dummy variable. This variable is either aiding or resisting trade between countries such as a trade agreement, WTO membership, a conflict or (non-)tariff barrier to trade (Caruso, 2003). Lastly, u_{ijt} represents the random error term. The fact that the gravity model can be thought of as being the workhorse in international trade, already signals that the data can be assumed to be readily available. This highlights the feasibility of the study as such.

4.2.2 An extension of the gravity model

In order to make the model suitable for the paper at hand, it is important to make some alterations to the basic specification of the gravity model. Given that both the Russian and the Western sanctions affect Russian imports, the latter will be the dependent variable. This implies that the analysis pertains the Russian perspective. In additon, provided that the aim of this research is to look at the effects of imposed economic sanctions, it is inherent that the key variable of interest respresents those sanctions. In doing so, it is important to distinguish between the countries that have imposed sanctions and those that have not. Conversely, one has to differentiate between the sanctions imposed by Western countries and the retaliatory sanctions imposed by Russia. Another pivotal distinction to make is the one between sectors or products that have been targeted by sanctions and those that have not been targeted. The latter can be done by using the United Nations Comtrade (2019) disaggregated trade data.

Regardless of whether the Russian or the Western sanctions are considered, there are different scenarios to consider in terms of these sanctions. For both the Western and the Russian sanctions, there are four possible scenarios displayed in table 3. Each distinct scenario pertains either a sanctioned or a non-sanctioned product and a sanctioning or a non-sanctioning country. Therefore, each dummy comprises two considerations. The first consideration holds whether the transactions involves a product that is targeted by the sanction or not, whereas the second concerns whether the partner in the transaction is imposing sanctions on Russia or is subject to the retaliatory sanctions imposed by Russia.

Table 3 Possible scenarios

Dummy variable	Sanctioned product?	Sanctioning country?
Scenario 1	Yes	Yes
Scenario 2	Yes	No
Scenario 3	No	Yes
Scenario 4	No	No

Scenario three and four relate to trade transactions in non-sanctioned products. When considering the Western sanctions, for example, it is important to also exclude the products sanctioned by Russia for these dummies. This is because, otherwise, the dummies would capture part of the effect of the Russian sanction. Conversely, the same holds when considering the Russian sanctions so that the products subject to Western sanctions have to be excluded. Therefore, it is because of the fact that both the Western sanctions and the retaliatory Russian sanctions are considered that scenario three and four are the same for both the Western sanctions and the Russian sanctions. These scenarios, in turn, translate to four distinct scenarios as displayed in table 4.

Table 4 Dummy variables

Dummy variables (Western or Russia specific)	**Abbreviation**
$D_{\text{sanctioned product x sanctioning country}}$	$D_{sp,sc}$
$D_{\text{sanctioned product x non-sanctioning country}}$	$D_{sp,nsc}$
Dummy variables (non-sanctioned products)	
$D_{\text{non-sanctioned product x sanctioning country}}$	$D_{nsp,sc}$
$D_{\text{non-sanctioned product x non-sanctioning country}}$	$D_{nsp,nsc}$

The first two dummies in table 4 are specific to either the Western or the Russian sanctions. This implies that they involve the sanctioned products (*sp)* by a sanctioing country (*sc)*. The two dummy variables considering non-sanctioned products (*nsp*), as mentioned before, pertain only to the products that are not subject to both the Russian and the Western sanctions. Therefore, these particular dummies reflect Russian imports from sanctioning countries and non-sanctioning countries (*nsc)* in non-santioned products. The incorporation of a great deal of dummy variables could make it increasingly difficult to interpret empirical results. Therefore, several estimations will be computed where a distinction will be made between whether the products were targeted and whether the sanctions were Western or Russian. This means that, two dummies will be included per estimation, in order for them to remain clear and comparable.

As mentioned before, Dreger et al. (2016) have provided evidence that the volatility of oil prices and the exchange rate are other factors weakening the Russian economy. Implicitly, these factors could also affect bilateral trade. In order to capture their effect on trade, control variables will be added for oil price and the exchange rate between country pairs. The fact that a variable for GDP is also included could imply that multicollinearity between the oil price, the exchange rate and GDP might become an issue. This is because two or more independent variables could then be correlated (Wooldridge, 2015). In order to account for this, a VIF test will be employed.

4.3 The method

As mentioned before, the sample will consist of all countries that have trade relations with Russia over the course of 2011-2017. Including multiple years allows for variation of variables over time. In turn, using the United Nations Comtrade (2019) disaggregated trade data allows for classifying the transactions. As mentioned before, a distinction will be made between transactions involving sanctioned products and transactions that do not. A common method in analysing gravity models is an ordinary least-squares (OLS) regression. This is because it can be used to estimate the independent effect of each factor, holding the other variable effects constant (Hufbauer et al., 1997). When analysing panel data, however, a fixed effects model is often deemed more appropriate since it is more useful in capturing unobservable country-specific factors (Caruso, 2003). In fact, the fixed effect panel approach is an adequate solution to capture unobservable "multilateral resistance" (Anderson & van Wincoop, 2003). A downside of this estimation technique is that it is unable to incorporate variables that do not vary over time (Early, 2006). Using a fixed effects estimation would, therefore, lead to loss of information in gravity models. Moreover, a panel fixed effects estimation would eliminate zero trade flow observations and could potentially cause sample selection bias. An estimation technique that deals with zero trade flows, provides unbiased estimates in the presence of heteroscedasticity and could account for fixed effects as well is the Poisson Pseudo Maximum Likelihood (PPML) method (Gómez-Herrera, 2013; Yotov et al., 2016). It is for this reason that PPML is the preferred method. This is mainly because trade data is often plagued with heteroscedasticity and PPML puts less weight on outlying observations. For robustness purposes, both OLS and the fixed effects panel approach will be employed to estimate the gravity model. The coefficients of these particular estimations can be used to check for the basic intuition of coefficients and to compare them with the PPML results.

4.3.1 Fixed effects

Although PPML is the method of preference, a Hausman test was performed in order to check whether the fixed effects approach is preferred over a random effects approach. Based on the results of this test in appendix E, the fixed effects approach appears to be the preferred method. The latter advocates for the addition of fixed effects to the PPML estimations. Fixed effects will be included for country pairs, years and products (Baldwin & Taglioni, 2006). In turn, this leads to omitting the distance, language and adjacency variables due to the fact that they are time invariant. Yotov et al. (2016), however, argue that these variables are better captured by including country pair fixed effects. Moreover, country pair fixed effects account for potential endogeneity of trade policy variables such as RTA (Yotov, et al., 2016). Year fixed effects are included to control for macroeconomic conditions (Sanjuán López, Rau, & Woltjer, 2019).

Lastly, products specific fixed effects are included at HS 6-digit level to account for all unobservable effects specific to a product (Grant, Hertel, & Rutherford, 2008). An example of this could be issues related to food safety and animal disease in the agri-food sector (Hejazi, Grant, & Peterson, 2017). The aforementioned fixed effects for years ($\propto_t$), country pairs (μ_{ij}), and products (δ_p) will be included alternately in order to see what provides the best fit for the model.

4.3.2 Potential issues

In panel data, it is important to consider potential issues such as serial correlation, heteroscedasticity and multicollinearity (Wooldridge, 2015). In order to explore whether multicollinearity might be an issue, a correlation matrix was computed (Appendix G). Given that researchers often choose 0.8 to be a correlation value that would raise issues, it has to be noted that the *Exchange rate* and *Oil price* variables might raise issues (Studenmund, 2017). In order to detect the severity of the multicollinearity caused by these variables, a variance inflation factor (VIF) test was performed (Appendix F). This test indicates the extent to which multicollinearity has caused the variance of estimated coefficients to increase. Typically, multicollinearity is considered to be severe when VIF>5. Given the results in Appendix F, multicollinearity appears to be rather severe. A common remedy is to increase the sample size, yet the sample size at hand already contains around one million observations. Another approach is to do nothing. This is because multicollinearity will not always reduce t-scores enough to make an estimation insignificant. Moreover, leaving out a variable that belongs in an equation would cause specification bias (Studenmund, 2017). Given the fixed effect specification, however, the time effects capture global and Russia-specific developments such as oil shocks and exchange rate volatility (Klaassen & Teulings, 2015). The latter makes including the variables for *Oil price* and *Exchange rate* redundant, as they are perfectly collinear with the time fixed effects.

The other common issues with panel data comprise serial correlation and heteroscedasticity (Wooldridge, 2015). In order to check on the presence of serial correlation in the dataset, a Wooldridge test for autocorrelation in panel data was computed in Appendix I. The significant test indicates the presence of serial correlation (Drukker, 2003). To control for this, the standard errors were clustered by country pair (Yotov, et al., 2016). Lastly, the presence of heteroscedasticity was detected by finding a significant result of the Breusch-Pagan diagnostic in Appendix H. PPML, by default, presents well in the presence of heteroscedasticity and computes robust standard errors (Silva & Tenreyro, 2006). When performing robustness checks by means of fixed effects estimations, the robust option will be added to control for heteroscedasticity.

4.3.3 Model specification

Now that the variables of interest have been identified and the method of analysis has been determined, it is clear that the specification of the estimations will look as follows:

Table 5 Specifications of estimations considering Western sanctions

Trade estimations
(1) $IMPORT_{ijpt} = \beta_0 + \beta_1 \ln GDP_{it} * GDP_{jt} + \beta_2 OIL_t + \beta_3 EXCHANGE_{ijt} + \beta_4 D_{sp,sc} + \beta_5 D_{sp,nsc} + \mu_{ij} + \propto_t + \delta_p + \varepsilon_{ijt}$
(2) $IMPORT_{ijpt} = \beta_0 + \beta_1 \ln GDP_{it} * GDP_{jt} + \beta_2 OIL_t + \beta_3 EXCHANGE_{ijt} + \beta_4 D_{nsp,sc} + \beta_5 D_{nsp,nsc} + \mu_{ij} + \propto_t + \delta_p + \varepsilon_{ijt}$

In table 5, the specifications of the proposed estimations considering the sanctions are displayed. That is, equation one pertains to either the Russian or the Western sanctions, whereas equation two is the same for both types of sanctions. In the tables, the subscript *i* denotes Russia and *j* denotes the involved trade partner. In addition, the subscript *p* represents the HS 6-digit product code and enables differentiation between sanctioned and non-sanctioned products. In order to make this distinction, the subscripts *i* and *j* are left out for the dummies. Instead, these subscripts make place for *sp* denoting sanctioned products and *nsp* denoting non-sanctioned products, followed by *sc* representing sanctioning countries and *nsc* relating to non-sanctioning countries. Lastly, the subscript *t* denotes the point in time at which the data on a specific variable was recorded. Apart from the introduced variables, it is important to note that μ_{ij} is the country pair fixed effect which captures the traditional time-invariant gravity variables. Moreover, α_t denotes the year fixed effect and δ_p denotes the product fixed effect. Other than that, ε_{ijt} represents the robust standard errors controlling for heteroscedasticity.

4.4 The data

The dependent variable

In the gravity model, the dependent variable is bilateral trade. This is defined as exports plus imports and expressed in current dollars (Hufbauer et al., 1997). Many authors also specify their gravity equation by using either exports or imports as a dependent variable (Frank, 2017; Yang, et al., 2004). Since both the Western sanctions and the Russian sanctions affect Russian imports, it is deemed most appropriate to use Russian imports as the dependent variable. The dependent variable will, therefore, be $Import_{ijpt}$ where i will always represent Russia. The data are to be derived from the UN Commodity Trade Statistics Database (COMTRADE) (United Nations , 2019). This is because it is the most commonly used source of merchandise trade flow data, disaggregated by commodity. Trade values are in current US dollars converted from national currencies and are available up to the 6-digit level according to the Harmonised System (HS) (Yotov, et al., 2016).

Both the sanctions imposed by Western countries and the sanctions imposed by Russia cover multiple sectors. In fact, these sanctions sometimes only cover one product group of a specific sector. Though relevant in particular occasions, subdividing the commodities into sectors is inappropriate in this occasion. Therefore, the traded goods will be classified as sanctioned goods and non-sanctioned goods. By exploiting the characteristics of HS 6-digit UN COMTRADE data, the latter can be performed in a very precise manner.

Independent variables

GDP and GDPcap

Data on GDP can be obtained from the World Bank's World Development indicators and are in current US dollars (The World Bank Group, 2019). The variable $GDP_{it} * GDP_{jt}$ is the product of the GDP's of countries *i* and *j* at time *t*, often referred to as the *MASS* of two countries. Similar to GDP data, GDP per capita data are obtained from the World Development Indicators (The World Bank Group, 2019). As a substitute for GDP, the variable $GDPcap_{it} * GDPcap_{jt}$ can be included. In turn, this represents the product of the GDP's per capita of countries *i* and *j* at time *t*. This variable tends to capture the income effect of international trade because when countries become richer they tend to trade more. In contrast, when the driving force between a growing economy is population growth they tend to trade at a slower rate (Yang, et al., 2004).

Trade Bloc/RTA

This variable is a dummy variable equal to the value of one if two countries belong to the same trading bloc. In any other case, the variable takes the value zero. This dummy will consider trade agreements, for which data can be derived from the WTO databank (World Trade Organization, 2019). It is important to note that the years 2011-2017 are going to be considered in this research. It is for this reason that the Eurasian Economic Union (EAEU) and the Treaty on a Free Trade Area between members of the Commonwealth of Independent States (CIS), which were established in 2015 and 2012 respectively, are deemed most relevant to include.

Exchange rate and Oil price

Both the relevant exchange rates in relation with the Russian Ruble and the average annual OPEC crude oil price in US dollar per barrel can be derived from the website of Statista (2019). As mentioned before, these variables are expected to have a high correlation with the Russian GDP. This might lead to multicollinearity and could mean that the variables will be excluded depending on the results of the VIF test. In order to be complete, however, the variables will be included at first.

Sanction dummies

Here it is important to note that there are other types of sanctions at stake. Yet, thanks to measuring bilateral trade at product-level, it is possible to isolate the effect of trade sanctions relating to Russian imports as such. A common approach is to use total trade data and to include, for example, financial sanctions as well. This is because they may reduce trade by denying investment (Caruso, 2003). It is, however, harder to distinguish which part of the effect is to be attributed to a certain type of sanction. As mentioned before, two groups of four distinct sanction dummies will be generated. Each of which will capture an entity and product specific scenario by taking the value of one when the scenario applies and zero in any other case. Each of these groups of dummies is to be included in a separate regression. The different possible scenarios are to be found in table 1 and table 2, as discussed in section 4.2.2. The dummies S.WEST.BUST and S.RUS.BUST can be considered as being the most important ones, given that they capture the third country effect. This is because this variable reflects the situation in which the sanction affects the trade in targeted products with a country that has not imposed these product-specific sanctions.

5. Results

5.1 Descriptive statistics

After having explored basic trade data in figure 2, the benefits of having composed a dataset specific to the case of Russia can be exploited. Both the relative importance of products sanctioned by Western countries and those sanctioned by Russian countries can be analysed. The latter might indicate the extent to which Russia can be hurt by the imposed sanctions. Moreover, the data can be utilised to provide an overview of how Russian imports have developed over the years. In turn, this could offer a basic understanding of whether Russia suffers from the imposed sanctions. That is, both the sanctions imposed by Western countries and the retaliatory Russian sanctions can be considered. Another notion that can be examined is the extent to which Russia manages to 'bust through the sanctions' by increasing trade in sanctioned products with third-parties. Following the graphical analysis, the intuitive consequences of the sanctions can be validated by means of empirical analysis.

5.1.1 Western sanctions

The first thing that can be considered by analysing the data, is the extent to which trade in the sanctioned products is important for Russia. The latter can be done for both the Western sanctions and the retaliatory Russian sanctions. For the Western sanctions, it might be important to distinguish between dual-use commodities and commodities that are not dual-use. This is because dual-use products are subject to licenses and dual-use products that are not intended for military use were not subject to the sanction (SIPRI & Ecorys, 2015). Therefore, the data on these dual-use products must be treated with great care. Table 6 and table 7 display the shares of Russian imports of sanctioned products relative to overall Russian imports.

Table 6 Relative importance of Western sanctioned products: Not dual-use

Product category/Year	2011	2012	2013	2014	2015	2016	2017
73	0.70%	0.25%	0.29%	0.25%	0.19%	0.22%	0.34%
82	0.04%	0.04%	0.05%	0.05%	0.05%	0.05%	0.04%
84	0.26%	0.27%	0.27%	0.25%	0.26%	0.25%	0.22%
87	0.61%	0.68%	0.66%	0.60%	0.49%	0.52%	0.56%
89	0.54%	0.00%	0.00%	0.28%	0.00%	0.35%	0.00%

As to be seen in table 6, the commodities sanctioned by Western countries that are not dual-use comprise a small part of overall Russian imports. This is not surprising when considering that the Western sanctions are HS 6-digit specific (Appendix A). After the imposition of the sanctions, the share of imports of sanctioned products relative to overall Russian imports does not seem to decrease substantially. This could indicate that Russia imports these specific products from countries that have not imposed sanctions on them.

For the dual-use products subject to the Western sanction, the commodities were classified under HS 2-digit. This is because the list of dual-use products, of which an excerpt is provided in Appendix C, covers 116 pages of HS codes. As displayed in table 7, the dual-use products subject to a Western sanction represent greater shares of total Russian imports. In fact, the products pertaining to nuclear reactors, machinery and mechanical appliances (84) and electrical machinery and equipment and parts thereof (85) represent about 13% of total Russian imports in 2013. Following the imposition of sanctions, the shares of Russia dual-use imports relative to overall Russian imports appear to increase steadily for some product categories. Because of the fact that only dual-use products intended for military use are subject to the Western sanction, this does not necessarily indicate that Russia is increasingly importing dual-use products from countries that have not imposed sanctions.

Table 7 Relative importance of Western sanctioned products: dual-use

Product category/Year	2011	2012	2013	2014	2015	2016	2017
39	0.75%	1.00%	0.75%	0.81%	0.98%	0.91%	0.84%
84	7.11%	3.47%	7.06%	7.34%	8.12%	7.83%	7.48%
85	5.84%	2.49%	6.09%	6.34%	6.56%	7.09%	7.18%
88	0.66%	0.17%	1.43%	2.64%	2.04%	1.22%	2.88%
90	1.20%	2.76%	1.25%	1.23%	1.33%	1.39%	1.34%

In more absolute terms, the total of Russian imports of products subject to a Western sanction increased from 2300 billion Russian Ruble in 2013 to around 2700 billion Russian Ruble in 2014. There are two possible explanations for this surge of Russian imports. The first relates to the fact that a great deal of Western sanctioned products are dual-use and are subject to authorisations and licenses. Other than that, authorisations concluded before the 1st of august 2014 were still valid (SIPRI & Ecorys, 2015). A second explanation relates to the concept of sanction-busting, where Russia would turn to countries that have not imposed sanctions for products subject to a sanction.

5.1.2 Russian sanctions

Other than the sanctioned products by Western countries, the sanctioned products by Russia itself are also important to consider. Figure 8 depicts total Russian imports of products subject to their own sanction in billion Russian Ruble. It was deemed necessary to report the values in Russian Ruble as the exchange rate for the Russian Ruble has changed from 38.38 RUB/$ in 2013 to 60.94 RUB/$ in 2014 (Statista, 2019). Therefore, reporting in US$ could have given a faulty representation of how Russian imports developed over time. Because of the fact that UN comtrade reports in US$, the values were converted by means of the real exchange rate. Here, it can be observed that the imports decrease from around 411 billion Russian Ruble in 2013 to around 330 billion Russian Ruble in 2014. In fact, these imports further decrease to around 210 billion Russian Ruble in 2015 and around 180 billion Russian Ruble in 2016. It can be noted that the decrease in imports over the course of 2015 and 2016 has been of less magnitude when compared to the period of 2013 and 2014. This might already signal that Russia had managed to redirect their trade to a certain extent. Another, perhaps more likely, explanation might be that exporters from sanctioning countries have found their way around the sanctions. The latter implies that exporters from these countries use 'intermediaries' to get their products to their final destination. In 2017, an increase of imports in Russian sanctioned products to 200 billion Russian Ruble can be observed. The latter can be argued to be a clear sign of 'sanction-busting'.

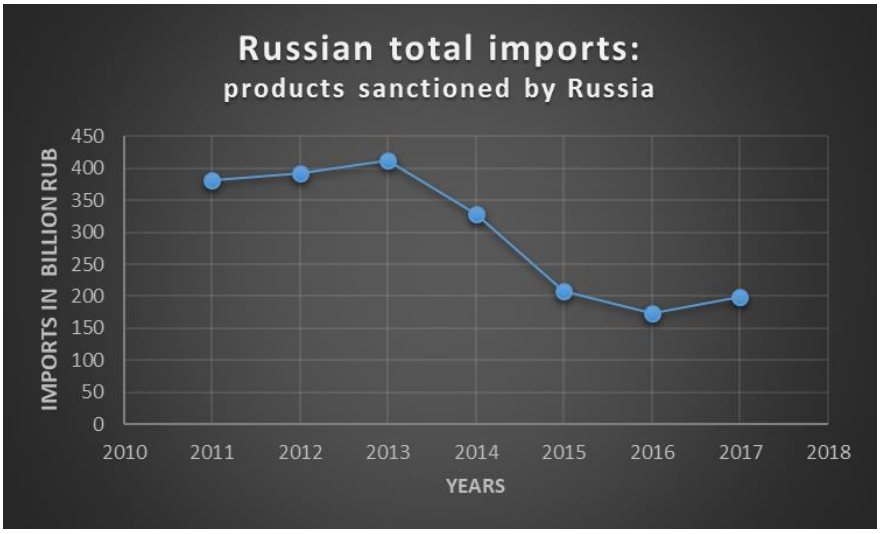

Figure 8 Russian imports of Russian sanctioned products

5.1.3 Sanction-busting

Both figure 7 and figure 8, to a certain extent, signal that Russia potentially manages to redirect their trade. In order to take a closer look at whether they actually 'busts' through the imposed sanctions, the trade in sanctioned products with third-parties can be examined. Figure 9 depicts total Russian imports of products sanctioned by Western countries from third-party countries. As to be seen in figure 9, Russia increases their imports from around 1200 billion Russian Ruble in 2013 to almost 1600 billion Russian Ruble in 2014. Thereafter, they steadily increase their imports in Western countries with third-parties over the course of 2015-2017. This reaffirms the presumed event of 'sanction-busting' in paragraph 5.1.1 and 5.1.2.

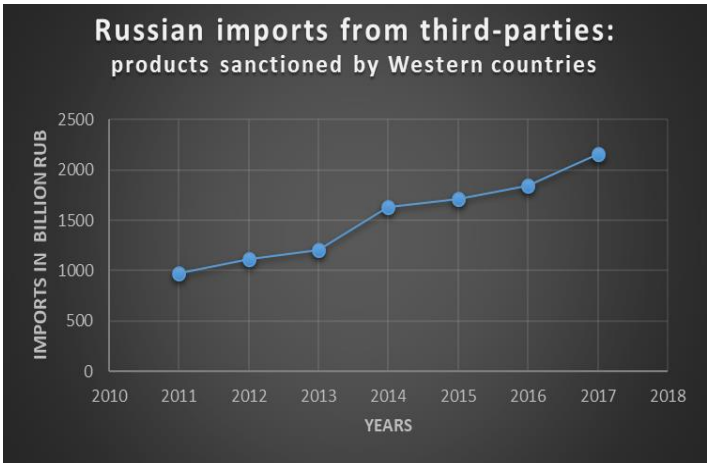

Figure 9 Sanction-busting: Western product sanctions

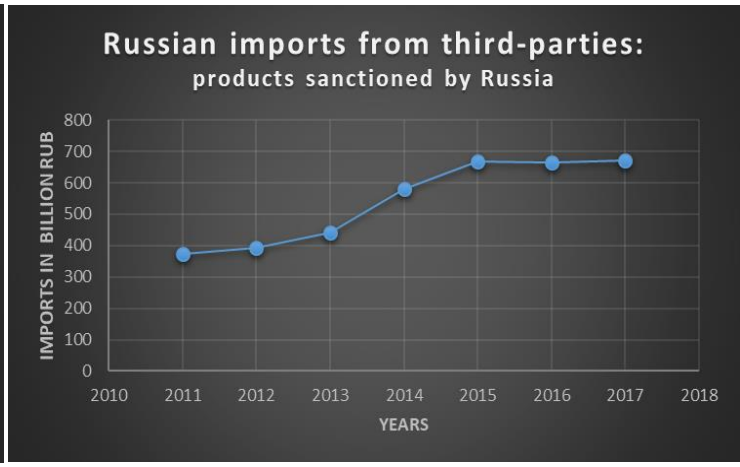

Figure 10 Sanction-busting: Russian product sanctions

When considering the Russian imports from third-parties in Russian sanctioned products, figure 10 shows a surge in imports from 9.7 billion US$ in 2013 to almost 13 billion US$ in 2014. Analogous to the previous situation in figure 9, figure 10 shows that Russia remains to increase their imports from third-parties in sanctioned products over the course of 2015-2017. Again, this signals that 'sanction-busting' might take place for the products sanctioned by Russia. It is, however, evident that Russia was increasing imports from third-parties in these particular products well-before the imposed sanctions. That is, the country increased their imports from third-parties steadily for both Western sanctioned products and Russian sanctioned products. The latter emphasises the need for empirical analysis to see whether sanction-busting takes place.

5.2 Empirical Analysis

5.2.1 Introduction

The descriptive statistics provide a foundation for understanding the effects of sanctions on Russian imports and the extent to which they manage to circumvent these sanctions. Now, the posed hypotheses can be formally tested by means of empirical analysis. The latter will be done by using PPML estimations in which the fixed effects for country pairs, years and products will be added alternately. These estimations will contain imports as a dependent variable, as these type of estimations account for zero trade flows where a logarithmic variable drops zero trade flows (Yotov, et al., 2016). For the PPML estimations, the coefficients can be interpreted as elasticities. In order to be able to compare the results of the dummy variables, each set of estimations in a table contains two dummies. In every table, the dummies cover the same products. For example in table 4, the dummies cover the products subject to the Western sanctions. The resulting coefficients and their implications will be discussed in more detail for each table of estimations.

5.2.2 Western sanctions

5.2.2.1 Sanctioned products

The first dummy variables that will be considered concern Russian imports of products sanctioned by Western countries. The variable $D_{sp,sc}$ represents the trade in these sanctioned products with the Western countries which have imposed the sanctions. In contrast, $D_{sp,nsc}$ involves the situation were Russia imports the products sanctioned by Western countries from other, non-sanctioning, third-party countries. The results are presented in table 8. As expected, the coefficient for the economic mass of country pairs $\ln(GDP_i*GDP_j)$ is positive and statistically significant. Moreover, the coefficient is comparable with Yang et al. (2004) who used the same notation for the economic mass. This implies that the higher the collective income of a country pair, the higher the Russian imports will be. A more surprising finding, however, is the negative insignificant coefficient for RTA. This could imply that the establishment of the Eurasian Economic Union and the free trade area between members of the Commonwealth of Independent States have not increased trade between member countries. Another explanation could be that the countries included in the RTA dummy are similar to the ones included in the *Language* variable, which is absorbed by the country pair fixed effect. This explanation is, at least partly, confirmed when looking at an OLS and PPML estimate without country pair fixed effects and the *Language* variable in appendix J. There, the coefficient for the *RTA* dummy becomes positive and is statistically significant. In turn, this would imply that these trade agreements do increase trade between country pairs and that the coefficient in this model is biased. It is, however, of pivotal importance to include country pair fixed effects because they are a better measure of the standard set of gravity variables such as *Language*, *Distance* and *Contiguity*. Moreover, these fixed effects account for the potential endogeneity of trade policy (Yotov, et al., 2016).

Table 8 Estimation results Western sanctions: sanctioned products

	PPML		
	(1)	(2)	(3)
	Import	Import	Import
$\ln(GDP_i*GDP_j)$	1.036	0.660	0.605
	(11.69)***	(3.99)***	(3.61)***
RTA	-0.167	-0.084	-0.076
	(1.53)	(0.63)	(0.54)
$D_{sp,sc}$	0.302	0.334	0.015
	(3.13)***	(3.43)***	(0.19)
$D_{sp,nsc}$	0.488	0.564	0.226
	(2.34)**	(2.37)**	(1.77)*
Constant	-43.144	-22.056	-17.611
	(8.68)***	(2.38)**	(1.88)*
R^2	0.18	0.18	0.62
N	962,105	962,105	961,912
Fixed effects			
Country pair	Yes	Yes	Yes
Year	No	Yes	Yes
Product	No	No	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$, t-statistics in parentheses

Turning to the main variables of interest in the estimations in table 6, the sanction dummy variables, it can be observed that the coefficient for $D_{sp,sc}$ appears to be positive. When looking at the estimation with the best fit in column (3), thus a PPML model accounting for zero-trade, this coefficient is insignificant. This means that no relation was found between the Russian imports of Western sanctioned products from the Western, sanctioning countries. As mentioned before, this might be due to the fact that a great deal of Western sanctioned products involves dual-use products which are subject to certain authorisations. Moreover, authorisations granted before the 1st of august 2014 were still valid and could have caused an increase in Russian imports of these dual-use products. The rationale behind this is that Russia would like to obtain the products before the authorisations expire. Other than that, the sanction only covered dual-use products which were intended for military use (SIPRI & Ecorys, 2015). This implies that when these dual-use products had no military purpose, importing them was still allowed for Russia. Perhaps part of the complexity of this sanction variable can be disentangled when splitting the Western sanctioned products in two sanction variables where one covers the dual-use products and the other covers the products that are not dual-use as described in Appendix A.

Yet first, the results for $D_{sp,nsc}$ in table 8 will be discussed. Like with the above discussed results, the results in column (3) will be discussed because of the fact that this model provides the best fit. Despite having found no effect for the Western sanction on specific products, Russia does seem to import significantly more of these particular products from countries that have not imposed sanctions. In fact, the result suggests that Russia seems to have increased their imports of these products from third countries by $e^{0.226} - 1 \approx 25.36\%$ following the sanction. In turn, this reaffirms the observed event of Russia 'busting' through the sanctions imposed by Western countries, as observed in paragraph 5.1.2. Now that table 8 has been discussed entirely, the sanction variable can be disentangled by distinguishing between dual-products and products that are not dual-use. The results of this separation are displayed in table 9.

Table 9 Estimation results: not dual-use vs. dual-use

	PPML Import (1)		PPML Import (2)		PPML Import (3)	
	Not dual-use	Dual-use	Not dual-use	Dual-use	Not dual-use	Dual-use
$\ln(GDP_i*GDP_j)$	0.908	1.024	0.718	0.665	0.667	0.607
	(12.74)***	(11.59)***	(4.28)***	(4.03)***	(3.86)***	(3.62)***
RTA	-0.156	-0.166	-0.074	-0.083	-0.063	-0.075
	(1.29)	(1.50)	(0.56)	(0.63)	(0.45)	(0.54)
$D_{sp,sc}$	-1.200	0.285	-1.231	0.316	-0.198	0.032
	(0.99)	(2.80)***	(0.99)	(3.06)***	(1.21)	(0.38)
$D_{sp,nsc}$	0.207	0.461	0.242	0.533	0.040	0.247
	(0.18)	(2.09)**	(0.21)	(2.14)**	(0.11)	(1.90)*
Constant	-35.957	-42.505	-25.309	-22.376	-21.101	-17.709
	(9.01)***	(8.57)***	(2.69)***	(2.42)**	(2.18)**	(1.88)*
R^2	0.17	0.18	0.17	0.18	0.60	0.61
N	962,101	962,105	962,101	962,105	961,908	961,912
Fixed effects						
Country pair	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	No	Yes	Yes	Yes	Yes
Product	No	No	No	No	Yes	Yes

* p<0.1; ** p<0.05; *** p<0.01, t-statistics in parentheses

When looking at the specification with the best fit in column 3, which includes all the fixed effects, it can be noted that $D_{sp,sc}$ now has the expected sign for oil exploration related products. Yet, this coefficient is insignificant so that no relation can be inferred with Russian imports. For dual-use products, $D_{sp,sc}$ still takes on a positive, but insignificant, coefficient. The coefficient being positive can be justified using the same reasons as above. From the $D_{sp,nsc}$ variable, it can be derived that Russia does not seem to import more sanctioned products that are not dual-use from third-parties. For the dual-use products, however, Russia does seem to import $e^{0.247} - 1 \approx 28.02\%$ more from countries other than the ones imposing sanctions on them. The latter, in turn, can be regarded as being evidence for sanction-busting.

5.2.3 Russian sanctions

5.2.3.1 Sanctioned products

Now that the Western sanctions have been discussed thoroughly, the Russian sanctions are left to be considered. First, the dummies $D_{sp,sc}$ and $D_{sp,nsc}$ will be estimated in order to be able to compare imports from Western countries and imports from third-party countries in products sanctioned by Russia. $D_{sp,sc}$ represents the situation in which Russia imports sanctioned products from the Western countries that are subject to their sanctions. In turn, $D_{sp,nsc}$ considers the scenario in which Russia imports sanctioned products from countries that have not been sanctioned by Russia. The estimates for the economic mass ($\ln(GDP_i*GDP_j)$) and RTA are similar to earlier estimates and, therefore, not discussed in this section. The results can be found in table 11.

Table 10 Estimation results Russian sanctions: sanctioned products

	PPML		
	(1)	(2)	(3)
	Import	Import	Import
$\ln(GDP_i*GDP_j)$	0.935	0.647	0.602
	(16.37)***	(4.22)***	(3.90)***
RTA	-0.172	-0.098	-0.076
	(1.62)	(0.80)	(0.58)
$D_{sp,sc}$	-1.601	-1.632	-1.195
	(3.44)***	(3.50)***	(2.49)**
$D_{sp,nsc}$	1.038	1.089	0.514
	(2.65)***	(2.82)***	(1.59)**
Constant	-37.483	-21.298	-17.441
	(11.71)***	(2.48)**	(2.02)**
R^2	0.18	0.18	0.62
N	962,105	962,105	961,912
Fixed effects			
Country pair	Yes	Yes	Yes
Year	No	Yes	Yes
Product	No	No	Yes

* p<0.1; ** p<0.05; *** p<0.01, t-statistics in parentheses

Analogous to the analysis of Western sanctions, column 3 provides the best fit of the estimated model. It is for this reason, that these estimates will be discussed. As expected, the coefficient for $D_{sp,sc}$ is significantly negative. This implies that Russia does, in fact, import less of the sanctioned products from the countries that are subject to their sanction. More specifically, the estimate holds that Russia imports $1 - e^{-1.195} \approx 69.73\%$ less from these particular countries. As for the Russian imports of these same products from third-party countries, the coefficient for $D_{sp,nsc}$ indicates that Russia increases their trade with them. This implies that Russia has managed to redirect their imports and 'bust' through the self-imposed sanctions. In fact, Russia imports $e^{0.514} - 1 \approx 67.20\%$ more of the Russian sanctioned goods from third-parties.

5.3 Non-sanctioned products

The dummies that are to be analysed in this section cover all products that are not subject to a Western or a Russian sanction. Moreover, $D_{nsp,sc}$ represents the situation in which Russia imports from these sanctioning Western countries. Conversely, $D_{nsp,nsc}$ considers the scenario in which Russia imports from countries that have not imposed sanctions. The results for these dummies are to be found in table 11. Looking at column 3 which provides the best fit of the model, it can be noted that the coefficients for the economic mass and RTA are consistent with earlier findings. For this reason, interpretations of these coefficients will not be discussed.

Table 11 Estimation results Western sanctions: non-sanctioned products

		PPML	
	(4)	(5)	(6)
	Import	Import	Import
$\ln(GDP_i*GDP_j)$	0.577	0.709	0.685
	(3.52)***	(2.84)***	(2.98)***
RTA	-0.141	-0.074	-0.059
	(0.97)	(0.58)	(0.43)
$D_{nsp,sc}$	-0.613	-0.622	-0.051
	(6.12)***	(6.59)***	(1.29)
$D_{nsp,nsc}$	-0.547	-0.583	-0.072
	(2.50)**	(2.57)**	(0.47)
Constant	-14.380	-24.644	-22.099
	(1.65)*	(1.76)*	(1.71)*
R^2	0.18	0.18	0.61
N	962,105	962,105	961,912
Fixed effects			
Country pair	Yes	Yes	Yes
Year	No	Yes	Yes
Product	No	No	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$, t-statistics in parentheses

The estimate for both $D_{nsp,sc}$ and $D_{nsp,nsc}$ in column 3 are negative, yet insignificant. This means that no inference should be drawn concerning the imports of Russia in products that are not sanctioned. This applies to both the results for imports from countries that have not imposed sanctions and the imports from countries that have not. This implies that the overall trade relation has not deteriorated. This is in contrast with findings by Crozet and Hinz (2016), who found that a great deal of lost trade was incurred through products that were not sanctioned.

6. Conclusion

This paper analysed the impact of Western sanctions on Russian imports, along with the effect of the retaliatory Russian sanctions on their own imports. More importantly, it was examined whether Russia has been able to circumvent the imposed sanctions by importing from third-party countries. The analysis was performed by applying a gravity model to disaggregated, yearly trade data. In doing so, the economic trade sanctions were isolated from the financial sanctions such as the asset freezes.

The descriptive statistics indicated that the Russian imports of products sanctioned by Western countries did not decrease following the imposition of the sanction. This signalled that either the Western sanctions have not had the desired effect on Russian imports, or that Russia has managed to redirect their imports, or both. In contrast, Russian imports of products subject to their own sanction seem to have decreased considerably. These imports, however, appear to stabilise over time and even experience an increase relative to the year before. The latter, in turn, could be an indicator of Russia having managed to redirect their imports of Russian sanctioned products.

The above notions were formally tested by means of empirical analysis using panel data. The panel comprised every trade partner Russia had between 2011-2017. In order to analyse the specific effects of both Western and Russian sanctions, several sanction dummies were incorporated. These dummies allowed for the analysis of the direct effect of sanctions on Russian bilateral imports, the 'sanction-busting' effect and the effects on trade in non-sanctioned products with both sanctioning countries as well as countries that had not imposed sanctions. Whereas it was empirically found that the Western sanctions had no significant effect on Russian imports, the retaliatory Russian sanctions were found to have a significant negative effect on their own imports. In fact, Russia appears to have imported 69.73% less of the Russian sanctioned products from the countries subject to the sanction. Following these empirical findings, the first two hypotheses can be revisited. These hypotheses concerned whether the economic sanctions had a negative effect on Russian imports. That is, the imports from countries imposing sanctions in the case of the Western sanctions and imports from the countries subject to the sanctions in the case of the Russian sanctions. Given that no statistically significant result was found for the Western sanction, the first hypothesis can be rejected. In contrast, the second hypothesis can be accepted due to the positive significant effect that was found for the Russian sanctions.

Now turning to the 'sanction-busting' effect, it was found initially that Russia increased their imports in products sanctioned by Western countries from countries that had not imposed these sanctions by 25.36%. However, after making the distinction between the products related to the exploration of oil and the dual-use products this finding no longer holds. For the oil exploration equipment subject to the Western sanction, no significant result was found. This indicates that Russia does not seem to import more of these particular products from countries that had not imposed sanctions. Conversely, evidence was found for that Russia has increased imports of dual-use products from non-sanctioning countries. The latter provides evidence for Russia increasing trade in sanctioned products with third-party countries, 'sanction-busting'. When relating these findings to the hypotheses, it can be argued that the third hypothesis can be rejected. The latter, however, only holds for dual-use products. More consistent results have been found when considering the Russian sanctions. That is, a statistically significant evidence has been found that Russia imports 67.20% more of the products that fall under their sanction from countries that are not subject to their sanction. This result remains significant over the range of specifications with different fixed effects and can, therefore, be regarded as being evidence for 'sanction-busting'. In turn, this implies that the fourth hypothesis can be accepted. Another finding relates to the non-sanctioned products. Imports of these particular products were found to experience no effect during the sanctions episode.

After having revisited the hypotheses, the overarching research question has to be answered: *What is the effect of the imposed economic sanctions on Russia on Russian imports from non-sanctioning countries?* This answer to this question is twofold. For the Russian sanctions the short answer is yes. The analysis shows that Russia does manage to circumvent their self-imposed sanction by importing the sanctioned products from third-parties. The answer for the Western sanctions is more sophisticated. This is because Russia does seem to manage to redirect their imports toward third-parties for the Western sanctioned products. However, the latter only holds for dual-use products because no effect was found for products that were not dual-use. Considering these answers, along with the tested hypotheses, it seems that the Russian sanctions have a greater effect on their imports than the Western sanctions. Although they do suffer, it also appears that Russia has managed to circumvent both of the imposed sanctions to a certain extent. The latter is in line with the notion that Russia is a small country in world trade, which would mean that there would be no real welfare effects based on the theoretical framework. Therefore, it can be noted that Russia, at least partially, compensates for the incurred losses through sanctions.

6.1 Limitations and future research

A possible limitation of this research pertains to the product codes used for the sanctioned products. Despite the fact that the used data is disaggregated at HS 6-digit level, Western countries provide CN 8-digit product codes. The first six digits are harmonised worldwide, yet it could be that not all commodities falling under the HS 6-digit code are subject to a sanction. HS 8-digit data is, however, not available via UN comtrade. In line with this drawback of the research, another limitation is the usage of dual-use product data. This is because it is unknown whether an import transaction was destined for military purposes and, therefore, subject to a sanction. The latter, along with the usage of HS 6-digit data instead of 8-digit data, might have caused the estimates to be biased. Other than these data limitations, the PPML method is sometimes critiqued to provide biased estimates in some specifications. This is despite the fact that PPML has been generally accepted to be the new benchmark for gravity estimation. In order to validate the results of this research, the estimation for the Russian sanctions were also performed using a panel data fixed effects method. This particular estimation was chosen, given that it provided the most significant results. The results of these robustness estimations can be found in Appendix M and are in line with the results computed via PPML estimations. In turn, this confirms the robustness of results in this results.

The most straightforward area for future research would be to re-examine previous studies whilst using disaggregated data. The latter might provide a more accurate picture of the effects of economic sanctions. Another interesting area for future research might be to quantify the losses in trade through sanctions and the extent to which a sanctioned country 'busts' through these sanctions. This will become increasingly relevant once the sanctions imposed on Russia have been relieved. Lastly, it could be interesting for future research to zoom in on 'sanction-busting'. That is, it could prove fruitful to look at whether the targeted country typically turns to new trade partners or increases trade with existing partners. Another way to approach this would be to look at whether sender countries increase their trade with the same trade partners with which the targeted countries increase their trade in sanctioned products. This would imply that sender countries themselves circumvent their own sanctions.

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8. Appendices

Appendix A: Product codes of sanctioned products, the first 6 digits are harmonised worldwide

EU	Australia	US	Product group
CN code	AHECC code	Schedule B No.	
7304 11	7304 11	730411	Iron or steel;seamless, line pipe of a kind used for oil or gas pipelines
7304 19	7304 19	730419	Iron or steel;seamless, line pipe of a kind used for oil or gas pipelines
7304 22	7304 22	730422	Steel, stainless; seamless, drill pipe, of a kind used in drilling for oil and gas
7304 23	7304 23	730423	Iron or steel; seamless, drill pipe, of a kind used in drilling for oil or gas
7304 29	7304 29	730424	Iron or steel; casing and tubing, of a kind used in drilling for oil and gas
7305 11	7305 11	730429	Iron or steel; line pipe of a kind used for oil or gas pipelines
7305 12	7305 12	730511	Iron or steel; line pipe of a kind used for oil or gas pipelines
7305 19	7305 19	730512	Iron or steel; line pipe of a kind used for oil or gas pipelines
7305 20	7305 20	730519	Iron or steel; line pipe of a kind used for oil or gas pipelines
7306 11	7306 11	730520	Steel, stainless; line pipe of a kind used for oil or gas pipelines
7306 19	7306 19	730611	Steel, stainless; line pipe of a kind used for oil or gas pipelines
7306 21	7306 21	730619	Steel, stainless; casing and tubing, of a kind used in drilling for oil and gas
7306 29	7306 29	731100	Steel, stainless; casing and tubing, of a kind used in drilling for oil and gas
8207 13	8207 13	820713	Tools, interchangeable; rock drilling or earth boring tools, with working parts of cermets
8207 19	8207 19	820719	Tools, interchangeable; rock drilling or earth boring tools, with working parts of cermets
8413 50	8413 50	841350	Pumps; reciprocating positive displacement pumps for liquids
8413 60	8413 60	841360	Pumps; rotary positive displacement pumps for liquids
8413 82	8413 82	841382	Liquid elevators
8413 92	8413 92	841392	Liquid elevators, parts thereof
8430 49	8430 49	842139	Boring and sinking machinery; not self-propelled
ex 8431	8431 39	843049	Parts for boring or sinking machinery
8705 20	8431 43	843139	Vehicles; mobile drilling derricks
8905 20	8431 49	843143	Floating or submersible drilling or production platforms
8905 90	8705 20	847989	Vessels; light, fire-floats, floating cranes and other vessels
	8905 20	870520	
	8905 90	870899	
		890520	
		890590	

Appendix B: Dual-use product categories based on a European Commission report (SIPRI & Ecorys, 2015)

Dual-use main categories	Product group
27	Mineral fuels, mineral oils and products of their distillation
29	Organic chemicals
38	Chemical products
39	Plastics and articles thereof
71	Precious metals; metals clad with precious metal
84	Nuclear reactors, boilers, machinery and mechanical appliances
85	Electrical machinery and equipment and parts thereof
88	Aircraft, spacecraft and parts thereof
89	Ships, boats and floating structures
90	Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus

Appendix C: Excerpt TARIC CN-DCU correlation table for dual-use goods (116 pages in total)

CN Codes 2017	TARIC Footnote for SAD	DU codification
8401100000	DU583	0A001a
8401400000	DU444	0A001b
8426110000	DU002	0A001c
8426190000	DU002	0A001c
8426990000	DU002	0A001c
8428909000	DU002	0A001c
8401400000	DU003	0A001d
8109900000	DU398	0A001e
8401400000	DU398	0A001e
8109900000	DU399	0A001f
8401400000	DU399	0A001f
8413504000	DU400	0A001g
8413608000	DU400	0A001g
8413708100	DU400	0A001g
8413810000	DU400	0A001g
8401400000	DU401	0A001h
8419500000	DU402	0A001i
8419908500	DU402	0A001i
9030100000	DU403	0A001j
8401400000	DU683	0A001k
7507200000	DU404	0B001a
7508900000	DU404	0B001a
8401200000	DU404	0B001a
8481806900	DU404	0B001a

Appendix D: Share of imports of the twenty largest importers in the world

Country	Year	2011	2012	2013	2014	2015	2016	2017
United States	Share of world imports	12.24%	12.47%	12.23%	12.62%	13.80%	13.82%	13.34%
	Rank	1	1	1	1	1	1	1
China	Share of world imports	9.41%	9.70%	10.24%	10.25%	10.01%	9.75%	10.22%
	Rank	2	2	2	2	2	2	2
Germany	Share of world imports	6.78%	6.16%	6.20%	6.31%	6.26%	6.48%	6.44%
	Rank	3	3	3	3	3	3	3
Japan	Share of world imports	4.62%	4.73%	4.37%	4.25%	3.86%	3.73%	3.72%
	Rank	4	4	4	4	4	4	4
United Kingdom	Share of world imports	3.66%	3.71%	3.47%	3.61%	3.73%	3.91%	3.57%
	Rank	6	5	6	5	5	5	5
France	Share of world imports	3.89%	3.60%	3.58%	3.55%	3.40%	3.49%	3.43%
	Rank	5	6	5	6	6	6	6
Hong Kong	Share of world imports	2.76%	2.95%	3.27%	3.14%	3.33%	3.36%	3.27%
	Rank	10	8	7	7	7	7	7
Netherlands	Share of world imports	3.21%	3.13%	3.10%	3.08%	3.05%	3.08%	3.18%
	Rank	7	7	8	8	8	8	8
Korea, Rep.	Share of world imports	2.83%	2.77%	2.71%	2.75%	2.60%	2.49%	2.65%
	Rank	9	9	9	9	9	11	9
Italy	Share of world imports	3.02%	2.61%	2.52%	2.48%	2.45%	2.50%	2.51%
	Rank	8	11	10	10	11	10	10
India	Share of world imports	2.51%	2.61%	2.44%	2.42%	2.34%	2.22%	2.48%
	Rank	12	10	12	12	13	14	11
Canada	Share of world imports	2.50%	2.54%	2.50%	2.48%	2.56%	2.54%	2.45%
	Rank	13	12	11	11	10	9	12
Mexico	Share of world imports	1.95%	2.03%	2.05%	2.15%	2.41%	2.44%	2.39%
	Rank	16	14	14	14	12	12	13
Belgium	Share of world imports	2.52%	2.34%	2.37%	2.37%	2.24%	2.33%	2.27%
	Rank	11	13	13	13	14	13	14

Spain	Share of world imports	2.03%	1.80%	1.79%	1.88%	1.86%	1.91%	1.95%
	Rank	14	16	17	16	15	15	15
Singapore	Share of world imports	1.98%	2.03%	1.96%	1.92%	1.77%	1.79%	1.82%
	Rank	15	15	15	15	16	16	16
Switzerland	Share of world imports	1.12%	1.58%	1.69%	1.44%	1.51%	1.66%	1.49%
	Rank	20	18	18	19	18	18	17
United Arab Emirates	Share of world imports	1.24%	1.37%	1.42%	1.44%	1.57%	1.66%	1.48%
	Rank	19	20	19	18	17	17	18
Russian Federation	Share of world imports	1.75%	1.79%	1.79%	1.61%	1.15%	1.18%	1.32%
	Rank	17	17	16	17	20	20	19
Australia	Share of world imports	1.32%	1.39%	1.27%	1.24%	1.24%	1.20%	1.27%
	Rank	20	19	20	20	19	19	20

Appendix E: Hausman test results

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+------------------------------------------------------------
     lnmass  |    .7164843     .4899251       .2265592        .0049081
         rta |    .0169758     .0299295      -.0129537        .0035644
   swestrus  |   -.0096652      -.07766       .0679948        .0029279
   swestbust |    .1736758      .120584       .0530918        .0031168
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =     4011.06
                Prob>chi2 =      0.0000
```

Appendix F: VIF

```
. vif
```

Variable	VIF	1/VIF
oilprice	172.83	0.005786
exchange	172.39	0.005801
language	2.30	0.434567
lndistance	1.73	0.578711
contiguity	1.69	0.593056
lnmass	1.57	0.636322
rta	1.52	0.658393
swestrus	1.09	0.913627
swestbust	1.07	0.932088
Mean VIF	39.58	

Appendix G: Correlation table

```
. correlate lnimport lnmass oilprice exchange rta language contiguity lndistance swestrus swestbust swestrus1 nosanwest
(obs=698,123)
```

	lnimport	lnmass	oilprice	exchange	rta	language	contig~y	lndist~e	swestrus	swestb~t	swestr~1	nosanw~t
lnimport	1.0000											
lnmass	0.2001	1.0000										
oilprice	0.0537	0.1360	1.0000									
exchange	-0.0536	-0.1358	-0.9971	1.0000								
rta	-0.0078	-0.3418	-0.1176	0.1195	1.0000							
language	0.0196	-0.4965	-0.0051	0.0051	0.5652	1.0000						
contiguity	0.0932	-0.2777	-0.0101	0.0101	0.3084	0.5720	1.0000					
lndistance	-0.0412	0.4964	-0.0012	0.0012	-0.2899	-0.4861	-0.5053	1.0000				
swestrus	0.0388	-0.0462	-0.2641	0.2608	-0.0259	-0.0137	-0.0021	-0.0753	1.0000			
swestbust	0.0071	0.0040	-0.2023	0.1997	0.0641	-0.0059	-0.0191	0.1279	-0.0024	1.0000		
swestrus1	-0.0606	-0.1072	-0.5863	0.5788	-0.0538	-0.0050	0.0272	-0.2015	-0.1155	-0.0889	1.0000	
nosanwest	-0.0350	-0.0374	-0.4548	0.4487	0.2013	0.0249	-0.0079	0.2217	-0.0907	-0.0703	-0.1970	1.0000

Appendix H: Heteroscedasticity test results

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lnimport

         chi2(1)      =  2585.90
         Prob > chi2  =   0.0000
```

Appendix I: Autocorrelation test results

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,   95941) =   8257.150
           Prob > F =      0.0000
```

Appendix J: Checking for the effect of RTA

	FE	PPML
	lnImport	Import
$\ln(GDP_i*GDP_j)$	0.566	0.681
	(321.58)***	(70.36)***
Contiguity	0.746	0.666
	(109.08)***	(27.17)***
lnDistance	-0.901	-0.889
	(151.08)***	(26.45)***
RTA	0.175	0.303
	(16.66)***	(7.77)***
WEST $D_{sp,sc}$	0.098	0.008
	(6.58)***	(0.16)
WEST $D_{sp,nsc}$	-0.064	0.237
	(3.68)***	(2.82)***
Constant	-12.661	-15.11
	(144.32)***	(36.43)***
R^2	0.32	0.55
N	698,083	961,915
Fixed effects		
Country pair	No	No
Year	Yes	Yes
Product	Yes	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Appendix K: Generic OLS: intuition

	lnImport	lnImport	lnImport	lnImport
$\ln(GDP_i*GDP_j)$	0.452	0.441	0.453	0.441
	(227.37)***	(220.35)***	(227.36)***	(220.35)***
lnDistance	-0.556	-0.609	-0.577	-0.609
	(83.48)***	(87.30)***	(87.47)***	(87.30)***
Contiguity	0.442	0.431	0.437	0.431
	(51.38)***	(50.02)***	(50.81)***	(50.02)***
Language	0.549	0.489	0.539	0.489
	(44.30)***	(39.34)***	(43.50)***	(39.34)***
RTA	-0.010	-0.029	-0.028	-0.029
	(0.74)	(2.12)**	(2.17)**	(2.12)**
WEST $D_{sp,sc}$	0.524			
	(39.40)***			
WEST $D_{sp,nsc}$	0.346			
	(20.56)***			
WEST $D_{nsp,sc}$		-0.368		
		(47.97)***		
WEST $D_{nsp,nsc}$		-0.061		
		(6.44)***		
RUS $D_{sp,sc}$			-0.813	
			(16.86)***	
RUS $D_{sp,nsc}$			1.026	
			(33.62)***	
RUS $D_{nsp,sc}$				-0.368
				(47.97)***
RUS $D_{nsp,nsc}$				-0.061
				(6.44)***
Constant	-9.206	-8.051	-9.056	-8.051
	(88.17)***	(76.20)***	(86.94)***	(76.20)***
R^2	0.08	0.08	0.08	0.08
N	698,123	698,123	698,123	698,123

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Appendix L: Excluded variables due to fixed effects

Distance

The distance variable denotes the distance between two country *i* and country *j*. These distances have been taken from the French Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), which have computed them by using the bilateral distance between the biggest cities of the two countries. In addition, city-level data was used to assess the geographic distribution of population. The latter, resulting in the share of a city in the overall country's population, was used as a weight for the distance measure (Mayer & Zignago, 2011).

Language

The language variable refers to a dummy variable which takes the value one when two countries involved in trade share a common language. At first, the data was taken from the CEPII database (Mayer & Zignago, 2011). This database, however, only identified Belarus, Kyrgyzstan and Kazakhstan as having the same language as Russia. Given the Soviet history, Russian is considered to be an unofficial language in many former Soviet countries. For this reason, those countries were also included. These countries comprise Ukraine, Estonia, Lithuania, Moldova, Tajikistan, Turkmenistan and Uzbekistan.

Contiguity/Adjancency

The adjacency is more simplistic and relates to whether two countries share a common border and are, thus, contiguous. Again, this variable was taken from the CEPII database (Mayer & Zignago, 2011).

Appendix M: Robustness check – fixed effects Russian sanctions

	FE Russian sanctions		
	(1)	(2)	(3)
	lnImport	lnImport	lnImport
$\ln(GDP_i*GDP_j)$	0.548	0.350	0.331
	(16.41)***	(3.95)***	(3.11)***
RTA	-0.060	-0.038	-0.041
	(1.17)	(0.62)	(0.54)
$D_{sp,sc}$	-0.705	-0.706	-0.927
	(3.00)***	(2.99)***	(3.19)***
$D_{sp,nsc}$	0.865	0.882	0.740
	(5.80)***	(5.91)***	(4.39)***
Constant	-18.759	-7.855	-6.817
	(10.20)***	(1.61)	(1.16)
R^2	0.12	0.12	0.38
N	698,122	698,122	698,082
Fixed effects			
Country pair	Yes	Yes	Yes
Year	No	Yes	Yes
Product	No	No	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$, t-statistics in parentheses