**ERASMUS UNIVERSITY ROTTERDAM**

# THESIS TITLE

Assessing the Impacts of Sanctions on International Energy Trade:

To what extent have the economic sanctions of Western countries altered Russia's bilateral trade of mineral fuels?


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This dissertation is submitted to the Erasmus School of Economics
in partial fulfilment of the requirements for the degree of

***MSc Economics and Business: International Economics***

May 2023

**ABSTRACT**

Globalization has exposed political vulnerabilities to countries with conflicting interests by enabling counterparts to take advantage of economic interdependencies between nations and engage in trade wars. This restriction of trade aims to the economic suffocation of sanction targeted states in order to achieve political objectives through coercion, however, the efficacy of such policies is very much debated. In this paper, we examine the case of the Russian Federation trade sanctions imposed by a group of Western countries in the year of 2014 as a consequence of the Russian annexation of Crimea. After modelling the bilateral trade of mineral fuels between the Russian Federation and 57 partner countries via the gravity equation, we employ a difference-in-difference technique to identify any causal effects of economic sanctions on the international energy trade. To do so, we investigate the differences in the mineral fuel trade flows before and after the implementation of trade restrictions for a group of sanctioning countries and a control group of non-sanctioning countries. The analysis deduces that economic sanctions are responsible for about 47% reduction in the bilateral trade of energy-related commodities between the sanction-sending countries and the Russian Federation. An equivalent analysis for the trade flows of non-mineral fuels is also conducted, showing no statistically significant effects of sanctions on these traded products. The investigation suggests that the design of sanctions was indeed effective in isolating the economic damage on the Russian energy sector.

Key Words: Economic sanctions, trade wars, gravity model, difference-in-difference, energy trade

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# CHAPTER 1 – INTRODUCTION

## 1.1 Introducing Sanctions

It is no news to the international trade literature that globalization has brought about deeper interconnections between the economies and cultures of nations around the world (Faulconbridge and Beaverstock, 2009). The specialization of countries into the production of goods and services that they have a comparative advantage over, has led to greater efficiencies on the one hand but also greater dependencies on the other hand (Grossman and Helpman, 2015). Simply, countries rely on international trade to make sure they can supply the home markets with products that cannot be domestically produced anymore as a result of globalization. This mutual reliance has given leverage for national governments to exercise authority over transnational matters by weaponizing interdependence and engaging in trade wars (Farrell and Newman, 2019).

In fact, over the past decades, there have been multiple cases that saw sovereign states using economic and trade punishments as a means of foreign policy statecraft to achieve political objectives in the arena of world affairs. Hufbauer (2009) constructed one of the most comprehensive catalogues in international trade literature regarding numerous case studies of trade sanction episodes, providing researchers with vital insight into the cause and effects of economic sanctions. What we can learn from this archive is that first, trade sanction incidents have been on the rise since the end of World War 1, which by no surprise, correlates with the globalization process around the world as mentioned earlier. Second, the use of economic sanctions at its core, aims to substitute the use of military conflict between nations by having sanction-sending countries demand political concessions from targeted states through economic suffocation. Last but not least, in terms of effectiveness, the trade sanctions are shown to attain a very low score in achieving their objectives with Hufbauer indicating that only a mere share of the cases (34%) are being considered successful.

## 1.2 Timeline of Events

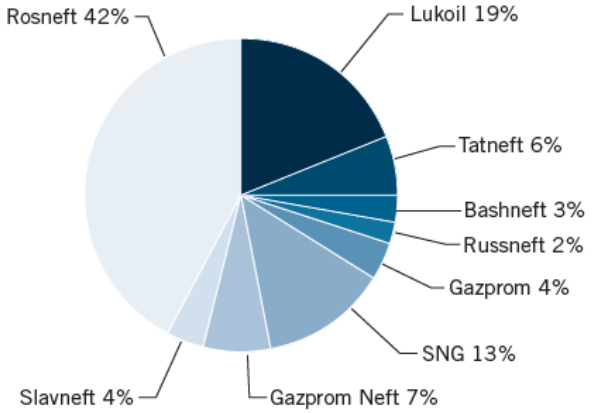
Having said that the recent developments in the Easternmost part of the European continent are coming to question Hufbauer's findings over the success tale of economic sanctions and their ability to prevent the use of force and military confrontation. During the year of 2013, Ukrainian President Viktor Yanukovych refused to sign the EU-Ukraine Association Agreement deal that planned for a greater economic and political integration between Ukraine and the European Union and instead opted for closer ties with the Russian Federation (Saluschev, 2014). This allegedly led the Ukrainian population to voice their discontent over this decision, triggering the Euromaidan Uprising that overthrow the Ukrainian government (Biersack and O'Lear, 2014). Amidst the disarray, Russian troops entered the Crimean Peninsula demanding secession of power by taking control over government buildings and later on culminating tensions by executing a de-facto referendum that prompted the annexation of Crimea into the Russian Federation.

What followed in reaction to this turn of events was a series of economic sanctions imposed on the Russian Federation with the United States (US) and the European Union (EU) being at the forefront of this initiative. Apart from punishments relating to asset freezes and travel bans on Russian and Ukrainian officials responsible for the operations in Crimea, the Western sanctions also took aim at Russia's Achilles heel, the energy sector (Welt et al., 2020). More precisely, the economic sanctions were designed to hurt the energy sector of the Russian Federation via 3 distinct channels (Russel, 2022).

First, as shown in figure 2, Western sanctions attempted to restrict the ability of Russia to exploit its energy reserves by banning a number of exported pieces of equipment and technologies related to drilling and exploration of oil and natural gas. Given the fact that the export of oil and natural gas make up two-thirds of Russia's export revenues (Fjaertoft and Overland, 2015) it is fair to deduce that bilateral trade flows of mineral fuels are likely to be affected by this set of actions. Second, financial restrictions on important Russian oil companies were also imposed via the sanctioning mechanism (Overland and Kubayeva, 2018). This action has limited the ability of oil company giants like Rosneft - which contributes over 40% of the total Russian oil production - to access EU capital markets in order to acquire the necessary funding needed for operating new projects. Third, a combination of EU and US sanction plans was designed to restrict lending to

numerous Russian banks from Western financial institutions (Fritz et al., 2017). The lack of credit constitutes a great constraint for Russian banks' ability to finance new investments in the oil and natural gas industry. This is evident by the fact that the reduction in oil production is linked to the decline of investment in the oil sector (Fjaertoft and Overland, 2015). Moreover, targeted Russian banks included banks with their main portfolio related to the oil and natural gas industries (i.e. Gazprombank) which further highlights that trade sanctions intend to hurt the Russian energy sector (US Congress, 2022).

***Figure 1: Russian Oil Production by oil company***




*Source: Russian Ministry of Energy*

***Figure 2: Energy Related Sanctions against the Russian Federation***

| | Equipment designated for |
|---|---|
| Equipment export ban | Deep water<br>Offshore Arctic<br>Shale oil production |
| | **Ban on credit lasting longer than 30 days to state banks and oil companies** |
| Financial instruments ban | ***Banks***<br>Sberbank<br>VTB Bank<br>Gazprombank<br>Vnesheconombank<br>Rosselkhozbankg<br>Bank of Moscow (US only)<br>***Oil companies***<br>Rosneft<br>Transneft (EU only)<br>Gazprom Neft |

*Source: EU Commission and US State Department*

## 1.3 Motivation

Altogether, it is clear that an effort is exerted by the Western nations to destabilize the energy industry and trade of the Russian Federation through the use of economic force. Nevertheless, judging from the fact that sanctions did not reverse the course of events but on the contrary led to a full-scale war a few years later (Russian Invasion 2022), the impacts of these trade policies to subdue Russian hostilities by restricting fossil fuel exploitation and the export-led capabilities of the Russian economy are faced with fierce criticism. This makes the dispute of the Russo-Ukrainian-induced trade sanctions of particular interest to investigate. In the academic literature, a mixture of ambiguous findings regarding the effects of sanctions against the Russian Federation creates a very obscure picture as to the economic implications that trade sanctions brought about.

In that aspect, some researchers have found strong evidence suggesting the negative consequences of sanctions on the Russian economic growth trends (Kholodilin and Netsunajev, 2016), complementing quantitative estimates from International Monetary Fund sources (IMF, 2015) that indicate a 1.5% reduction in the Russian GDP in the short run which raises cumulatively to 9% over the longer run. On the other hand, however, due to the fact that the imposition of trade restrictions coincides with the fall of oil prices and the depreciation of the Russian currency (Ruble), it makes the effort to disentangle the effects of sanctions on the Russian economy from other contributing factors more difficult (Fritz et., 2017) (Russel, 2022).

This argument has been elaborated by other research papers which suggest that trade restrictions imposed by the US-led coalition of countries against Russia were not the main driver for the decline of the Russian economy but a contributing factor (Klinova and Sidorova, 2019). In the same line, Dreger et al., (2015) argue that the weakening Russian currency has impacted the Russian economy to a larger extent compared to the trade war while Gurvich and Prilepskiy (2015) added on that, by citing oil price volatility as the main source of evil for the depressed Russian economic performance.

Lastly, given the heavy reliance of EU countries on Russian energy to supply their domestic economies with this much-needed factor of production to fuel their economic activities, it stimulates further interest in understanding the impacts of sanctions on that particularly sensitive area. The interdependence between the European Union and the Russian Federation is evident by the fact that the EU has Russia as its largest energy provider, with a third of its total share of oil and natural gas imports being supplied from that specific country while the Russian Federation fossil fuel trade with EU constitutes almost 70% of its total exports and accounts for half of the total government revenues (European Parliament, 2015).

## 1.4 This Paper

Given the ambiguity of evidence found in the literature regarding the impacts of sanctions on the Russian Federation, we aim to construct an analysis that isolates the effects of trade sanctions on the bilateral trade of Russia. In this paper we employ the standard gravity model to evaluate the

long-term impacts of trade sanctions on the bilateral trade of mineral fuels and non-mineral fuels between the Russian Federation and 57 of its trade partners. In section 2, we evaluate an extensive list of research papers related to effects of sanctions and pinpoint areas that suffer from improper justification, so thereafter try to adapt our model in a way that contributes to the existing literature. Section 3 is dedicated to the data and their sources. We are going to assess a number of other variables that have confounding effects on the relationship between economic sanctions and mineral fuel trade. These determining factors of bilateral trade enter our gravity equation as control variables. We use data from a number of sources such as UN Comtrade, ITC and World Bank.

In section 4 we introduce our methodological approach to identify the effects of economic sanctions on the bilateral trade of Russia. By using the difference-in-difference statistical approach, we evaluate the difference between the average trade flows of mineral fuels, before and after the imposition of sanctions for two groups of countries: a) sanction-sending (treatment) b) non-sanctioning (control) countries. Any potential impacts of sanctions can then be realized within the difference between the treatment and the control groups. Finally, in sections 5 and 6 we will discuss our findings and conclude whether this empirical approach was able to yield accurate and unbiased results by comparing them to other related papers.

# CHAPTER 2 – LITERATURE REVIEW

In this section, we revise a brief history of economic sanctions and highlight their importance on international trade. Next, we review several papers related to the economic effects of trade sanctions and explain how these findings are connected to our own research. Due to the limited number of scientific papers regarding the Russian Federation sanctions during the Crimean Crisis, we first construct a literature review that relates to the impacts of sanctions on different countries in various other sanctioning incidences, before ultimately shifting the focus on papers that conduct analysis for our specific case study regarding the US-led coalition trade war against the Russian Federation in 2014.

## 2.1 History of Economic Sanctions

Economic sanctions as a tool of foreign policy measure have deep roots in the history of human civilization. In the book 'Economic Sanctions Reconsidered' (Hufbauer et al., 2009) the authors explore a chronological list of a selection of more than 150 sanctioning episodes throughout the documented human history. As a matter of fact, events from the distant past revealed that the first known use of economic sanctions stemmed from the Ancient Greece of Pericles in the year of 432BC. On that occasion, the Athenian Empire imposed a series of sanctions known as the Megarian Decree upon the rival city-state of Megara which saw Megarian merchants banned from accessing the trading ports and marketplaces of Athens and its allies (Brunt, 1951). What followed was Megara's economic downfall as the state was heavily dependent on trade with the Athenian Empire for commerce. Many historians argue that the epitome of Athenian use of economic force on Megara had set other neighboring city-states in fear of trade isolation due to Athenian desire for hegemony in the region. This in turn significantly influence the decision of a rival coalition of cities led by Sparta to enter into a direct military confrontation with Athens one year after the imposition of the Megarian Decree (Chan and Drury, 2000). This was later passed on the books of history as the Peloponnesian War which lasted 27 years and led to the fall of the Athenian Empire.

Alongside Hufbauer, other researchers have tried to evaluate the implications of trade sanctions through a holistic examination of numerous sanctioning incidents from the historical past of the Economics discipline. Jing et al., (2003) after conducting a probit-logit analysis for a dataset accounting for more than 100 sanctioning episodes, shed light on the determinants influencing the success rate of trade sanctions. The authors concluded that the relative size of the sanction-sending country compared to the size of the targeted country plays a very important role in the effectiveness of economic sanctions. They present clear evidence suggesting that sanctions are more likely to be impactful if the country imposing sanctions is economically larger than the receiving country. The same authors implied that economic integration and trade relationship between the sanction-sending and sanction-receiving countries prior to the imposition of sanctions also influence the efficacy of this policy. Other research papers indicate that the participation of third countries allied to the sanctioner country, increases the likelihood of trade sanctions success (Martin, 1994) (Mastanduno, 1993). These findings are relevant to our research, as we are considering a combination of countries with different economic sizes that colluded against the Russian

Federation. Therefore, such factors must be addressed and controlled in our empirical approach in order to isolate the effects of economic sanctions on bilateral trade.

## 2.2 The General Case: Reviewing Economic Sanctions

Coming now to the individual sanctioning incidents set in the modern era, we can realize that despite the numerous years that separate the modern world from the ancient Greek Period, there are striking similarities in the purpose and effects of economic sanctions for both the sending and receiving countries as well as on international trade as a whole.

First, just like the economic decline of Megara after the imposition of trade sanctions from the Athenian Empire, there are multiple studies emphasizing the negative impacts of sanctions on the receiving countries. Caruso (2003) conducted an empirical analysis regarding the impact of economic sanctions on the bilateral trade between the US and several other target countries. In a similar fashion to our paper, he employed the gravity model using panel data for both the aggregate flow values of US imports and exports to a number of its trade partners, while incorporating a dummy variable representing the sanction shock. The results point out that the extent to which bilateral trade was affected depends on the sanction intensity. Although modest trade sanctions seem to have no noteworthy impact on trade, more intense sanctions, however, were shown to have played a significant role in the decline of bilateral trade between the US and the targeted states by causing a trade reduction somewhere between 50% up to 90%

Adding to the importance of economic sanctions on bilateral trade, Hufbauer and Oegg (2003) have also constructed a gravity model to examine trade flow changes that arose from a list of sanctioning episodes involving the US. This analysis goes as far as to suggest that in some cases where the design of sanctions was considered extensive and severe, like in the case of Cuba and North Korea, trade restrictions decrease bilateral merchandise trade by 95%. Also, the paper implies that the negative effects of trade wars linger even long after the removal of sanctions due to the fact that businesses in targeted countries deem the US as an unreliable supplier hence in fear of future trade disruption, they adapt to this trade shock by engaging in business with alternative countries.

In another related paper (Dizaji and Van Bergeijk, 2013), the authors through the use of Vector Autoregressive Models (VAR) examine the impact of economic sanctions against Iranian oil on various macroeconomic indicators as well as on a political level, with sanction-sending countries aiming for an Iranian regime change to a more democratic setting. The effects of the trade sanctions are analyzed for 3 distinct periods of time: a short-term period (first 2 years after sanctions), a medium-term period (impact at the 5$^{th}$ year), and a long-term period (10 years). The results suggest that although the initial shock to the Iranian economy is significant by producing depressive tendencies on GDP and the investment outlook, in the long run, these effects seem to fade off and turn out to be insignificant in causing a regime change in the country. The economy proved to be more resilient and adaptable to trade shocks. Apart from the effectiveness of sanctions over time, this paper is also connected to our paper by focusing on the impacts of energy-related sanctions. Just like in the Russian case, sanctions on Iranian oil also seem to influence the ability of the country to finance new projects due to the deteriorating investment sentiment and the country's dependencies on that exporter commodity.

Neuenkirch and Neumeier (2015) conduct an OLS regression analysis on the effects of 67 sanctioning episodes, where the United States (US) and the United Nations (UN) posed as the sanction-sending counterparts, showing a statistically significant decline in the target country's GDP. More precisely, they provide empirical evidence suggesting that sanctions are responsible for a reduction of at least 2% in the annual rate of growth of GDP per capita in the target country's economy. Moreover, after performing a counterfactual analysis they suggest that the adverse effects of economic sanctions are felt in the economy for a span of a 10-year period.

No matter the extent to which sanctions have brought about economic damage to the receiving countries, one thing is for certain in the literature and that is the uncertainty over the effectiveness of trade sanctions in delivering the required outcomes to coerce a political change. Morgan et al., (2014) after reviewing numerous trade sanction incidents in the post-World War 2 period, found out that only 51% of the multilateral sanction had success in their aim. This is on the same page as Hufbauer (2009) who also pointed out that the impacts of sanctions are counterproductive for both sending and receiving ends and result in failure in 66% of the cases.

## 2.3 The Russian Federation Case: Sanctions during the Russo-Ukrainian Conflict

The criticism over the effectiveness of trade sanctions is no stranger to the Russo-Ukrainian case too. Fritz, et al. (2017) argue that while there is indeed an economic cost inflicted on Russia after the imposition of trade restrictions, it is not possible to determine the actual size of the sanction shock as it is very difficult to disentangle it from the adverse effects of other macroeconomic shocks hitting the Russian economy during the same period. In that regard, many economists emphasize the detrimental effects that the reduction in the price of oil in 2014 has brought to the Russian economy (Tuzova and Qayum, 2016) (Ahn and Ludema, 2017) as energy commodities are the main source of export revenue for the Russian Federation (Fjaertoft and Overland, 2015). Gurvich and Prilepskiy (2015) even infer that the impact of falling oil prices is at least 3 times greater than the impact of sanctions. Other studies come to verify these claims with Klinova and Sidorova (2019) indicating oil price fluctuations as the most determining factor for the Russian economic downturn while sanctions are just exacerbating these ongoing depressive tendencies.

***Figure 3: Export Price Index of Mineral Fuels, Mineral Oils and Products of Their Distillation***


*Source: International Monetary Fund*

The significant reduction observed post-sanctions in the values of mineral fuels exported by the Russian Federation is also linked to the depreciation of the Russian currency taking place at that time (Kholodilin and Netsunajev, 2016). This is further reinforced by the research of Dreger, at al. (2015) who suggest that the reduction of oil prices caused a sharp depreciation in the Russian Ruble which was much greater than the impacts sanctions had on the exchange rate. A lower price for Ruble subsequently means lower costs to buy Russian commodities and therefore the effecst of currency depreciation on the bilateral is intuitive and very important to control in our model.

Adding to the ambiguity of evidence regarding the effectiveness of sanctions, there are reports suggesting that a potential trade diversion from European to Asian Markets moderated the impact of trade sanctions (Harrell et al., 2017). Moreover, Giumelli (2017) also suggests that the reduction in bilateral trade due to sanctions is not uniformly distributed between all EU member states. In fact, certain countries have seen their export volumes to Russia increase after the 2014 trade restrictions were in place. This is in line with Doornich and Raspotnik (2020) who imply that although trade sanctions initially cause a substantial reduction in the bilateral trade with Russia, over time, trade managed to recover.

In a more recent paper, Bělín and Hanousek (2021) also make use of the difference-in-differences technique to evaluate the effectiveness of sanctions on the bilateral trade of Russia only to realize that sanction-sending countries suffer 8 times more in terms of trade flow reductions than Russian Federation did. More precisely, they suggest that sanctions targeting oil extraction equipment had a minimal impact on the trade of those products whereas Russian retaliations in response to the Western sanctions have brought about significant damage to the EU. Related to this paper, Crozet and Hinz, (2016) set focus entirely on the impacts that trade sanctions brought about on the sanction-sending countries. Following a structural gravity framework, the authors assess both macro and micro-level data to examine the collateral damage inflicted on the export values of Western sanctioner countries. Their results show a considerable negative impact for the EU countries amounting to be around US$46.2 billion in losses from export revenues. Nevertheless, in contrast to Bělín and Hanousek (2021), they imply that the main cause of this damage is not the retaliatory sanctions coming from Russia but instead their own actions of imposing sanctions as the majority of lost trade comes from goods which are not directly selected from the Russian counter-sanctions.

The closest work to our study is coming from the paper of Nguyen and Do (2021), in which the authors use panel data of two different groups of countries (sanctioning and non-sanctioning) that purchase oil products from the Russian Federation and employ the difference-in-difference method to identify the causal effect of sanction in bilateral trade of Russia. Parallel to our paper, the sanctions under consideration refer to the sanctions imposed by the EU and its allies against the Russian Federation after the annexation of Crimea. They have also considered countersanctions that Russia enforced on agro-product imports coming from those countries. Their analysis

concluded that there is a significant reduction in trade for both sides; meaning that Russia has lost around 35% in the export values of oil products as a result of the trade sanctions while countersanctions are responsible for a 55% reduction in the trade values of agro-product exports for the sanction sending countries. Lastly, Larch, et al. (2022), also examine the impacts of sanctions on the mining sector of the Russian Federation. The authors model the bilateral trade of mineral fuels using the gravity equation while taking into account country-fixed effects. Their findings follow the trajectory of Nguyen and Do (2021), by suggesting that sanctions have reduced the mining trade of Russia with sanction-sending countries by 44%.

## 2.4 Contribution

It is made clear that there is missing clarity as to what factors and to what extent are they responsible for the downward trends in the Russian economy. Different points of view infer different conclusions making the effort to disentangle the effects of sanctions from other macroeconomic shocks affecting trade extremely difficult. Hence, this heightens the importance of our research in trying to isolate the impact of economic sanctions on the Russian Federation, and we hope that by conducting our own analysis we can enrich the existing literature by addressing some of the uncertainties discussed earlier.

In this regard, most papers evaluated the impact of trade restrictions on the macroeconomic performance of the Russian economy using GDP as the major indicator (Havlik, 2014), (Gurvich and Prilepskiy, 2015) (Kholodilin and Netsunajev, 2016), whereas our research is more orientated towards international trade. More specifically this paper is focused on the sanctions' impact over the bilateral trade flows vis-à-vis the Russian Federation. The few papers that did analyze the impact of sanctions in terms of trade flows, did so by using data related to only a few years before and after the imposition of sanctions thus concentrating on the short-term and medium-term effects of the trade war. For example, Crozet and Hinz (2016) used monthly data regarding the export trade flows of sanctioning and non-sanctioning countries that commerce with Russia, managing to capture the impacts of sanctions over a short period of time. The same applies to Borisov, et al (2020) who use panel data spanning over the years between 2012 and 2016. Nguyen and Do (2021), focus their research on the medium-term effects by analyzing a dataset covering trade between 2011 and 2018 and even in this case the time period under consideration is almost half

the number of years in our study, making our paper on of the few that evaluate the long-term implications of sanctions.

In addition, our selection of time span can potentially offer us more accurate conclusions by providing us with minimal skewness since we consider the bilateral trade flows 7 years before and 7 years after the first sanction was levied upon the Russian Federation in 2014. In comparison to this, other papers that attempted to investigate the effects of sanctions over an extended period of time (Larch et al., 2022) included data mostly coming from the years before the sanction (15 years before) and only a handful of years after the trade shock (3 years after), therefore, setting the data skewness and the long-run assessment of the sanction shock into question.

Moreover, in contrast with the aforementioned papers in the literature, our paper also sets aside from the rest, in the number of countries under consideration. In fact, most papers evaluated the implications of sanctions on the economies and bilateral trade between the Russian Federation and the European Union (Kholodilin and Netsunajev, 2016), (Giumelli, 2017) (Klomp, 2020) while others concentrated only on Russia's greatest trade partners (Bali, 2018) or on a single country partner i.e. Germany (Fedoseeva and Herrmann, 2019) and France at the firm level (Crozet and Hinz, 2016). Even in cases where more countries are being considered, like in the case of Kutlina-Dimitrova (2017) who accounted for 31 trade partners of the Russian Federation, it's still short of the 57 countries we are analyzing. This offers us the advantage of providing conclusive remarks regarding the effects of sanctions on the whole energy trade, as the countries under consideration make up on average 95% of the total energy-related trade flows from Russia to the rest of the world. Added to this, our paper's investigation specializes in the impacts of sanctions on a sectoral level of the Russian economy, rather than the whole aggregate level that most papers consider (Doornich and Raspotnik, 2020). This paper mainly focuses on the energy sector by evaluating the impacts of trade restrictions on the bilateral trade of both mineral fuel and non-mineral fuel products, and then try to deduce whether sanctions were indeed the main source of damage to the energy trade or a way of destabilizing the economy as a whole.

Lastly, we have encountered many reports in the literature describing the important impications of oil price fluctuations in contaminating the findings of many researchers regarding the real impacts

of sanctions on the Russian Federation (Dreger et al., 2015) (Ahn and Ludema, 2017). Due to Russia's heavy dependence on that specific commodity and considering the effects that oil prices have on the demand for Russian energy exports, we therefore, try to address this issue in our paper by incorporating a variable in our model to hold fix the effects of oil prices and aim to isolate the effects of trade sanctions as much as possible.

# CHAPTER 3 – DATA

## 3.1 Mineral Fuel Trade Flows

The central aim of this paper is to evaluate the impact of economic sanctions on the energy trade between the Russian Federation and its partners. At the same time, by using a list of control variables we are assessing the effects of various other factors that potentially influence this bilateral trade. According to the Observatory of Economic Complexity (OEC, 2022), one of the elite sources for international trade data, mineral oils, mineral fuels, and their distillation products were the second most traded commodities worldwide in 2021 with Russia being the leading exporter. Therefore, focusing our analysis through the lens of the main energy supplier of the world, it would help us provide vital insight regarding any potential disruptions in the energy trade as a result of economic sanctions.

In order to conduct this analysis, we require an account of the energy trade flows between the Russian Federation and each one of the countries importing Russian energy. To do so we accessed data from a number of data sources. More precisely, we acquired data from UN Comtrade on the bilateral trade flows of mineral fuels, mineral oils, and products of their distillation (Harmonised System – Code 27) between Russia and 57 of its trade partners. The units of trade flow values are quantified in terms of US dollars ($). For the sake of simplicity, the energy commodities under code 27 of the Harmonized System, which include the main Russian exports of crude oil and natural gas, are referred to as mineral fuels in this paper.

Due to the fact that the Russian Federation exhibits a bellow average democratic index score and is categorized as an authoritarian regime (The Economist Intelligence Unit, 2020), we prefer to

use data on the mineral fuel imports reported from the Russian Federation's partners instead of depending solely on export data provided from Russian institutions. By doing so we hope to eliminate as much reporting and selection bias as possible since during conflict periods misinformation is on the rise for political gains (Hacek, 2022). A very tiny fraction of data concerning certain countries were unavailable through the UN Comtrade source, therefore we supplemented these missing values from the International Trade Centre (ITC, 2023) database.

The time period under consideration is between 2008 and 2021. This is because it provides us with perfect symmetry since trade sanctions were initiated halfway through the year of 2014 which means that we evaluate data regarding bilateral trade flows 7 years before and 7 years after the imposition of sanctions. This allows us to generate as much accurate analysis as possible by discovering any noticeable changes in the trends of energy trade while, at the same time, constructing an investigation for the long-term effects of economic sanctions.

### 3.2 Sanctioning vs Non-Sanctioning

Due to the nature of our statistical analysis (difference-in-difference model) we have to construct two sets of country samples; one that constitutes the treatment group, made up of countries that have imposed sanctions on the Russian Federation, and a control group composed of a number of other countries that did not participate in sanctioning activities. Consequently, countries were naturally selected according to their disposition regarding the sanction policy. Apart from the natural allocation due to the treatment effect, the availability of data was crucial in the decision-making process as to which countries participated in the experiment. Countries that have no available data for the required variables were excluded. Moreover, we selected as many available countries that trade with Russia as possible, to make up for the largest share of Russia's energy exports in every year of our sample. As illustrated in Table 1, the selected countries represent on average over 95% of the total mineral fuel exports from Russia therefore our sample is ideal for exploring any potential disruptions in international energy trade that arises after the imposition of economic sanctions.

*Table 1: Exported mineral fuel values from Russian Federation to sanctioning and non-sanctioning countries*

| Year | Sanctioning | Non-Sanctioning | Total Russian Exports | Sanctioning Share | Non-Sanctioning Share | Total Share of Russian Exports |
|---|---|---|---|---|---|---|
| **2008** | $227,79 | $62,45 | **$306,27** | 74,38% | 20,39% | **94.77%** |
| **2009** | $159,88 | $44,46 | **$206,17** | 77,55% | 21,56% | **99.11%** |
| **2010** | $200,80 | $52,64 | **$259,85** | 77,28% | 20,26% | **97.54%** |
| **2011** | $268,78 | $74,66 | **$360,01** | 74,66% | 20,74% | **95.40%** |
| **2012** | $268,15 | $85,49 | **$364,88** | 73,49% | 23,43% | **96.92%** |
| **2013** | $263,45 | $78,58 | **$358,05** | 73,58% | 21,95% | **95.53%** |
| **2014** | $221,89 | $81,51 | **$321,77** | 68,96% | 25,33% | **94.29%** |
| **2015** | $136,99 | $57,32 | **$197,42** | 69,39% | 29,03% | **98.42%** |
| **2016** | $106,03 | $46,74 | **$152,06** | 69,28% | 30,53% | **99.81%** |
| **2017** | $127,16 | $66,71 | **$208,49** | 60,99% | 31,99% | **92.98%** |
| **2018** | $159,59 | $91,73 | **$274,00** | 58,24% | 33,48% | **91.72%** |
| **2019** | $149,95 | $89,25 | **$251,14** | 59,71% | 35,54% | **95.25%** |
| **2020** | $93,71 | $64,79 | **$163,55** | 57,30% | 39,62% | **96.92%** |
| **2021** | $159,76 | $100,89 | **$269,64** | 59,25% | 37,42% | **96.67%** |

*Source: UN Comtrade and ITC*

The classification of countries into the sanction and non-sanction groups is based in line with other studies in the field regarding the impacts of trade sanctions on the Russian Federation after the Crimean annexation (Crozet and Hinz, 2016) (Bělín and Hanousek, 2021) (Larch et al, 2022). By doing so we allow comparisons to be drawn upon the relevant studies and enrich the existing literature. Nevertheless, we did not limit our decision solely to prior studies but also constructed our own rationale behind the classification of countries into the sanctioning and non-sanctioning groups which is based on 4 pillars shown below in descending order of importance:

1) Official sanction statements and documents released from government sources.
2) Country participation in economic and military alliances.
3) Country voting position in the United Nations General Assembly
4) The specific list of 'unfriendly countries' released by the Russian government.

Developed countries such as the United States of America (USA) and the European Union (EU) members have been at the forefront of this conflict, therefore, there is easier and more abundant access to such information in the form of reports and declarations posted through their various government agencies i.e. State Department and the European Council. For smaller nations, wherever not possible to find official documentation via government sources or statements from government officials regarding sanction enactment, we based their classification into the sanctioning or non-sanctioning groups by reflecting on their status in different alliances. For example, countries participating in economic and military alliances led by the USA (i.e. NATO),

are more likely to be pressured to participle in sanctioning actions against the Russian Federation. This in combination with the official country vote during the United Nations General Assembly (Resolution 68/262, 2014) concerning the territorial integrity of Ukraine and the recognition of the Crimean annexation, provides us with a clear indication as to which one of the two groups, the countries in question are more inclined to be part of. Lastly, a list of unfriendly countries signed by the Russian president in 2022 provides us with further evidence on which countries beheld hostile sentiment towards the Russian Federation. A classification table can be found in the appendices for more information.

### 3.3 Determinants of Bilateral Trade

We also extracted data regarding a number of other variables that influence bilateral trade between the Russian Federation and its partners in order to isolate them from the impacts of sanctions:

1) Foreign Direct Investment (FDI)

The globalized framework of the world economy has enabled investors to purchase assets and engage in business in countries other than their own. This resulted in foreign capital flowing in distant countries promoting economic growth. Another positive effect associated with foreign direct investments is the diffusion of new technologies in the economy of host countries. Technological diffusion has proven to be an important factor influencing productivity levels in the industries that are absorbed (Keller, 2004), while this in turn increases international competitiveness and subsequently trade (Xu and Wang, 2000). Thus, controlling for FDI is of paramount importance when examining the bilateral trade two countries. FDI data have been extracted from the Central Bank of Russia as it provides both inward and outward investment flows. The values of FDI are presented in million US dollars ($)

2) Free Trade Agreement (FTA)

Controlling for international trade agreements is another important step in isolating the effects of trade sanctions in our regression equation. This is because such agreements influence cross-border trade to a large extent as they can be responsible for a reduction in the level of tariffs eliminate trade barriers, and promote international trade (Hayakawa and Kimura, 2015). Baier and

Bergstrand (2007) go as far as to infer that FTAs can lead to a 100% increase in bilateral trade between two member countries in a span of a decade. So by controlling for FTAs, we can account for these routes by which bilateral trade is influenced and therefore yield a more reliable estimate of the effect of sanctions on Russian bilateral trade.

ITC database provides a list of free trade agreements signed between the Russian Federation and other countries therefore we use this insight to note down which countries are members of FTAs involving Russia. FTAs enter our model in the form of a dummy variable.

3) Effectively Applied Tariff

Following the same rationale as FTAs, the effectively applied tariffs can also affect the volume of trade between two partner countries. It is widely understood that a higher level of tariffs means a higher cost of importing products for the host nation. The same applies to the demand for imported Russian mineral fuels hence, the need to control for such factors it's apparent in our research.

Once again ITC database help us identify the level of the effectively applied tariff (as a percentage) for the bilateral trade between the Russian Federation and the countries in our sample.

4) Geographical Distance

Geographical distance is another important variable to consider in our model. In fact, the first used gravity model in the field of economics that was originally instigated by Tinbergen (1962), included this variable in order to capture the costs of transportation that are likely to affect cross-border trade. The intuition behind this is that the greater the distance between two trading partners is then the higher the cost of transportation would be. In turn, higher transport costs are passed on to the consumers in the form of higher prices hence reducing international trade. Numerous research papers have incorporated geographical distance as an independent variable so as to better investigate the bilateral flow of trade between countries (Sapir, 2001), (Thorpe and Zhang, 2005), (Melitz J. , 2007) so we are also following this example.

Data regarding the geographical distance were taken from an online measuring tool (Geodatos, 2023) which calculates the distance in kilometres (km) between the capital cities of the Russian Federation and its various trade partners. The capital city is considered to be the center of economic activity and is widely used as a proxy for trade matters in the international economics literature.

5) Common Land Border

Echoing the effects of geographical distance, countries that share a common land border are often benefited from easier access to neighboring country markets. The presence of a common border can facilitate trade links through different infrastructure projects or migration which in turn enhances bilateral trade between the two adjoining regions (Helliwell, 1997). Especially when it comes down to natural gas trade, where the transportation of this commodity requires long underground pipelines to reach the importing countries, having a common land border makes it relatively cheaper than transportation via sea routes i.e. liquified natural gas form (Molnar, 2022).

The presence of common land borders between Russia and the rest of the countries in our sample was noted down after inspecting this on Google Maps.

6) Openness to Trade

The accelerating globalization trends of the past few decades have seen more and more countries opening up their economies for business with foreign partners. Research on new-new trade theory signifies the existence of an additional source of gains for countries engaging in trade liberalization policies, as the removal of trade barriers allowed economic resources to be allocated according to the countries' comparative advantage giving rise to economies of scale and improvements in aggregate productivity (Melitz, 2003) (Bernard et al., 2007). Therefore, the level of trade openness has a profound effect on international trade so it should be taken into account for our research purpose relating to the cross-border trade of countries.

In regard to the trade openness for all countries under consideration, we have extracted data via the World Bank which shows the level of openness in terms of imports ratio to GDP.

7) GDP

Arguably the most important determinant for a country's involvement in the global market is its economic size (Krugman et al., 1995). Countries with sheerer economic sizes demand greater volumes of imported products to supply the domestic markets. By the same token, larger countries tend to have more advanced economies and resources which is translated into better quality and quantity of products to be exported to foreign trade partners (Kojima, 1964). Hence, in our case larger economies are more likely to be in greater need for Russian energy to operate their

economies at full capacity therefore we need to consider the economic size of Russia and its trade partners in our specification for the relationship between sanctions and mineral fuel trade.

GDP data were again drawn out from the world development indicators of the World Bank database and are quantified in US dollars $.

8) Yearly Commodity Price

There is no doubt that the price of crude oil is the leading indicator for the price of all the energy related commodities we are considering in our research. Several papers in the literature regarding the implications of the trade sanctions on the Russian economy have expressed their voice of concern about the direct influence of oil price fluctuations in their findings. Dreyer and Popescu (2014) emphasized these concerns by explaining that a reduction in the price of oil from $115 to $65 during the year of 2014 played an important role in the economic downfall of Russia. Ahn and Ludema (2017) emphasize that disentangling the effects of oil price drops from sanctions effects is of utmost importance to evaluate the extent to which trade restrictions have brought about damage to the Russian economy. To complement this, Dreger et al., (2015) also indicate that oil prices are the main driver for the failing economy while sanctions are just exacerbating this already ongoing phenomenon.

To take into account oil prices, we accessed economic data from the research department of the Federal Reserve Bank of St. Louis (FRED, 2023) which provided us with the price index of the mineral fuels, mineral oil, and the products of their distillations which is in the exact same harmonized system code (HS 27) as our traded mineral fuels under consideration.

# CHAPTER 4 - METHODOLOGY

In order to examine the effects of economic sanctions on the Energy Trade between the Russian Federation and its partners we have chosen to employ the gravity model equation. This is because it is widely considered to be the workhorse analytical tool in international trade literature when it comes down to evaluating the bilateral flow of trade between two trading countries. Therefore, this is essential for our research since, in our pursuit to detect any sanction impacts, we first need to trace down any statistically significant shifts in the cross-border flows of these traded commodities.

Stemming out from the Newtonian physics' gravity theory, the primal form of the gravity equation first used in economics-related concepts was expressing a relationship regarding the trade flows between two countries compared to their economic size and geographical distance, showing a positive relationship with the former and a negative with the latter (Tinbergen, 1962).

$$Trade_{ij} = C\ GDP_i^{\beta_1} GDP_j^{\beta_2} Dist_{ij}^{\beta_3} \varepsilon_{ij}$$

Where the term $Trade_{ij}$ accounts for the value of trade flows from an exporting country (i.e. Russia) towards an importing country j (i.e. EU). GDPi and GDPj refer to the gross domestic product of country i and country j respectively. Then $Dist_{ij}$ describes the geographical distance between the two trading countries in a way that reflects transportation costs that influence this cross-country trade. In the original physics gravity equation, the term C is called the gravity constant but in econometrics terms, it can be labeled as the regressor constant. Lastly, term ε reflects the error term which is associated with any unobserved or unaccounted variables that potentially affect our dependent variable of Trade.

Due to the multiplicative formation of the gravity equation, a better-suited method to interpret the relationship between the dependent and independent variables is through the use of natural logarithms which result in a log-log specification as follows:

$$\ln(Trade_{ij}) = \ln(C) + \ln(GDP_i^{\beta_1}) + \ln(GDP_j^{\beta_2}) + \ln(Dist_{ij}^{\beta_3}) + \ln \varepsilon_{ij}$$

$$\ln Trade_{ij} = c + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln Dist_{ij} + \varepsilon_{ij}$$

Subsequent extensions of this model allowed for more determinants affecting trade to be incorporated like policy interventions (i.e. sanctions). Therefore, this model is optimal for our research purpose since in order to examine any potential disruptions in the energy trade, as a consequence of the 'trade-sanction' policy, we first need to control for other variables determining trade and then integrate a sanction variable to assess the impact of sanction while holding all other effects on trade fixed. In fact, many other researchers employed the gravity model to evaluate the impacts of economic sanctions on bilateral trade (Hufbauer et al., 1997) (Crozet & Hinz, 2016) (Larch et al., 2022).

We therefore follow in line with other studies (Caruso, 2003) (Nguyen and Do, 2021) by expanding the number of variables in the original gravity model with several other factors that potentially affect the level of international trade between the Russian Federation and its partners. More precisely, we accounted for a list of control that, as presented in the Data section, includes FDI, Tariffs, Openness to trade, Common border, Free trade agreements and Oil Price.

With the aforementioned variables applied in our regression equation, the model denoting the bilateral trade flows between the Russian Federation and its partners is formed as follows:

$$\begin{aligned}\ln Exports_{rjt} = {} & \beta_0 \\ & + \beta_1 \ln GDP\_RF_{rt} \\ & + \beta_2 \ln GDP\_PR_{jt} \\ & + \beta_3 \ln \mathrm{NetFDI}_{rt} \\ & + \beta_4 \ln Dist_{rj} \\ & + \beta_5 \ln Open\_RF_{rt} \\ & + \beta_6 \ln Open\_PR_{jt} + \beta_7 \ln OilPrice_t + \beta_8 \ln Tariff_{rjt} + \beta_9 Border_{rj} + \beta_{10} FTA_{rjt} \\ & + +\beta_x Sanctions_j + \gamma_x Time_t + \delta_x Sanctions_j * Time_t + \varepsilon_{rjt}\end{aligned}$$

Where $\mathrm{Exports}_{rjt}$ indicates the values of mineral fuels exported from the Russian Federation to the specified partner country j at time t. $\mathrm{GDP\_RF}_{rt}$ and $\mathrm{GDP\_PR}_{jt}$ indicate the gross domestic product of the Russian Federation and its' trading partner j respectively at time period t. $\mathrm{NetFDI}_{rt}$ accounts for the values of net foreign direct investment of Russia during year t. Then $\mathrm{Dist}_{rj}$ counts the distance between the capital cities of the Russian Federation and the specific j partner while $\mathrm{Tariff}_{rjt}$ refers to the percentage of effectively applied tariff between those two countries in period t. $\mathrm{Open\_RT}_{rt}$ and $\mathrm{Open\_PR}_{jt}$ account for the trade openness of the Russian Federation and its partners as a ratio between a country's total trade and its GDP. The variable $\mathrm{Border}_{rj}$ is a dummy variable indicating whether a common land border exists between the Russian Federation with each one of

its trading partners. The same applies to the dummy variable $FTA_{rjt}$ which takes the value of 1 if Russia and the partner under consideration have a free trade agreement active during period t. Lastly, $OilPrice_t$ refers to the average price of mineral fuel commodities in that specific t year.

The ultimate scope of this research is to identify and possibly infer whether the sanction shock had any statistically significant changes in the traded volumes of these mineral fuels from the Russian Federation. In order to examine this query, we use the 'difference-in-difference' (DiD) statistical technique. Difference-in-difference is used to assess the effect of a treatment on an outcome over time. In our case, the treatment effect is the imposition of sanctions by a group of countries in the year of 2014 as a consequence of the Russian annexation of Crimea. By analysing the group of sanctioning countries alone will provide little insight into the causal effects of trade sanctions as many factors other than the treatment can contribute to the changes in the bilateral energy trade between two countries. Under DiD, however, a control group of non-sanctioning countries is also analyzed for the same period of time as the sanctioning group. By doing so, the difference-in-difference calculation will be able to deduce the differences in two outcomes:

1) The differences in the mineral fuels traded before and after the imposition of sanctions
2) The differences between the sanctioning (treated) and the non-sanctioning (control) groups.

The advantage that this approach has on causal inference relies on a very important assumption named the 'Parallel Trend Assumption'. This assumption refers to the fact that the control and treatment groups share similar trends prior to the imposition of sanctions regarding the imported energy commodities from Russia. This is important because by assuming parallel trends hold before the enaction of sanctions, we can be clear of any variations between the two groups arising from unknown factors hence any differences identified in the post-treatment period can only be attributed to the treatment effect. This is because, in the absence of trade sanctions, these common trends would have be carried on in the post-sanction period allowing us in a way to construct the counterfactual level of trade for the sanctioning countries by relating their imported values with the values of the non-sanction group of countries that share the same trends with. Thereafter, the difference-in-difference will calculate the difference between the counterfactual arising from the common trends and the actual observed trade values to deduce the real impacts of sanctions on bilateral trade.

In our empirical model, the dummy variable $Sanctions_j$ accounts for the differences in the traded volumes between sanctioning (treated) and non-sanctioning (control) countries with the Russian Federation as it takes the value of 1 if a country j has imposed sanctions on Russian and value of 0 otherwise. The dummy variable $Time_t$ accounts for the differences between the export values of Russian mineral fuels before and after the trade sanction was imposed by taking the value of 1 for all the years after the implementation of the sanction (i.e. 2014 until 2021) and the value of 0 otherwise. The variable of interest is composed by the interaction of those two terms and takes the form of $sanctions_j$*$time_t$. This is the term that captures the 'difference-in-difference', meaning that it expresses the differences in the average traded commodities between the sanctioning and non-sanctioning groups before and after the implementation of economic sanctions. Thus, the coefficient $\delta_x$ is the one that will determine the analysis of this paper as it estimates the impacts of sanctions on the exports of mineral fuels from the Russian Federation. This is labeled as the difference-in-difference (DiD) estimator.

To enhance the accuracy of our model we added random effects in our regression equation. Random effects account for the fact that some factors affecting trade between Russia and its partners vary randomly across individual countries and therefore it is difficult to be taken into account. For example, some countries are in favor of a green energy transition like Germany therefore despite its economic size, the country might tend to demand relatively less Russian oil than countries of similar size and characteristics. At the same time, other countries like the USA are less concerned about climate change which became evident in 2017 when President Trump withdrew from the Paris Agreement so the demand for oil might be relatively higher for them compared to their counterparts. Such political or geopolitical traits differ from country to country and have the potential to affect the dependent variable via alternative routes not taken into consideration by our control variables in the model. Therefore, by employing random effects we hope to eliminate some variation arising through this channel. Also, fixed effects were not suited for this experiment as this would have removed variables that do not change over time, meaning that our control variables of geographical distance and free trade agreements would have been omitted from the regression.

To further ensure the suitability of random effects estimation in our model we carry out Hausman test as well as Breusch–Pagan test. The result of the Hausman test suggests that the random effects

model is preferred over the fixed effects for the given data while Breusch-Pagan test indicates that, in comparison to a simple OLS estimation, the random effects are more suitable for our experiment. Both test results are presented in the appendices.

Moreover, there are reasonable grounds for concern regarding the collinearity between our independent variables. The problem of collinearity refers to the fact that two explanatory variables might be correlated with each other giving rise to imprecisions as to which one is responsible for the effects on the outcome variable of interest, hence producing misleading results. In our case for example, the influence on the exports of mineral fuels by the effectively applied tariff variable and trade openness or free trade agreement variables might be interconnected. The degree by which a country is open to trade is related to the trade barriers involved between two trading partners and therefore the level of tariff on foreign products can be considered to be one of those barriers. The same applies for the existence of free trade agreement which promotes openness to trade. To ensure that our independent variables are not significantly corelated we have perform statistical tests to examine the level of collinearity between all pairs of our independent variables but also compute the Variance Inflation Factor (VIF) to check the level of multicollinearity. The results, suggest that the correlation coefficient for most pairs of our independent variables is below 0.5 meaning that no significant correlation is found. The only pair that is shown to have significant relationship (0.8 coefficient) is the interaction between the average oil price and the GDP of Russia but given the fact that Russia's economy is heavily dependent on the export of this commodity, it is rational to have this kind of connection. The test for the variance inflation factor yields similar outcomes which are all presented in the appendices.

# CHAPTER 5 – RESULTS

## 5.1 Effects of Sanctions on Mineral Fuel Trade

After running our regression model through Stata, we acquired some interesting and statistically significant conclusions about the impact of trade sanctions on the bilateral trade of mineral fuels between the Russian Federation and its partners. These results are presented in Table 2.

First, as predicted by the gravity model theory, the size of a country's economy has a substantial influence over international trade (Anderson, 1979) (Kabir et al., 2017). Simply countries with bigger economies demand a greater quantity of products imported from foreign countries just like in our case of Mineral Fuels. More precisely, the regression analysis shows that 1% increase in the GDP of a partner country of the Russian Federation leads to a 0.97% increase in Russian mineral fuel imports for that country. This result appears to be significant at a 1% level.

Second, geographical proximity also appears to play an important role in the bilateral trade between two trading partners. Countries that are geographically closer to the Russian Federation tend to be more willing to buy Russian fossil fuels while the opposite holds for countries farther away. The figure suggests, that 1% increase in the distance between the Russian Federation and a trade partner results in a 1.22% decrease in the values of mineral fuels traded. Larch et al., (2022)

*Table 2: Factors affecting the trade flow values of mineral fuel exports from the Russian Federation*

| lnMineralFuelsExport | Coef. | St.Err. | t-value | p-value | [95% Conf | Interval] |
|---|---|---|---|---|---|---|
| ***lnGDP Partner*** | .9715*** | .149 | 6.54 | 0.000 | .6802 | 1.263 |
| ***lnGDP Russia*** | - .1123 | .925 | -0.12 | 0.903 | -1.926 | 1.701 |
| ***lnDistance*** | - 1.224*** | .458 | -2.68 | 0.007 | -2.121 | -.3273 |
| ***lnFDI Net*** | - .5221*** | .105 | -4.97 | 0.000 | -.7282 | -.3160 |
| ***lnTariffs*** | - .0959 | .431 | -0.22 | 0.824 | -.9406 | .7488 |
| ***lnOpeness Partner*** | .3503 | .429 | 0.82 | 0.414 | -.4909 | 1.191 |
| ***lnOpeness Russia*** | - .9250 | 1.976 | -0.47 | 0.640 | -4.798 | 2.948 |
| ***lnOilPrice*** | 1.189 | .857 | 1.39 | 0.165 | -.4909 | 2.870 |
| ***Border*** | 1.562** | .735 | 2.12 | 0.034 | .1212 | 3.002 |
| ***FTA*** | .0355 | .355 | 0.10 | 0.920 | -.6607 | .7317 |
| ***Sanctions*** | - .6418 | .656 | -0.98 | 0.328 | -1.927 | .6435 |
| ***Time*** | .5010* | .27 | 1.85 | 0.064 | -.0288 | 1.031 |
| ***Sanction*Time*** | - .6078** | .262 | -2.32 | 0.020 | -1.121 | -.0946 |
| ***Constant*** | 8.375 | 27.457 | 0.31 | 0.760 | -45.441 | 62.19 |
| Mean dependent var | 20.375 | SD dependent var | 3.239 | | | |
| Overall r-squared | 0.324 | Number of obs | 798 | | | |
| Chi-square | 114.909 | Prob > chi2 | 0.000 | | | |
| R-squared within | 0.084 | R-squared between | 0.387 | | | |

****** p<.01, ** p<.05, * p<.1***

revealed a very similar effect of distance on the energy trade of Russia by showing this trade reduction to be around 1.3%. Additionally, this finding is not only supported by the Russian sanctions related literature but also from the energy market dynamics (Bahgat, 2006) (Omonbude, 2009). In that regard, it is shown that transportation costs of such products make up an important

fraction of their price, hence, greatly influencing demand. This is because in order to transport products like natural gas, high capital costs are required to attain the necessary infrastructure projects needed for transportation i.e. underground gas pipelines.

Sharing the same rationale with geographic proximity and transportation costs, a common land border significantly affects the decision of countries to trade mineral fuels with the Russian Federation. The regression has shown at a 5% significance level that the presence of a common land border can lead to a positive increase of 1.56% in the mineral fuel exported from Russia. Other gravity-model-based papers examining bilateral trade, indicate an analogous increase in trade flows given the existence of a common border between two trading partners. For example, Egger and Pfaffermayr (2003) after studying the international trade relationship between 11 countries members of the Asian Pacific Economic Cooperation bloc, infer a statistically significant effect of the common land border on trade that contributed to a positive impact of around 1.28% on export flows. Hence, our model accurately depicts the bilateral trade between our sample countries.

Regarding the other control variables in our specification model, we can see no considerable effects on the bilateral trade between the Russian Federation and its partners. The ratio of trade openness of countries, whether that is Russia or the countries that trade with it, plays no important role in explaining the variation in our response variable of Mineral Fuel exports. Likewise, the imposition of tariffs although exhibiting a negative tendency towards bilateral trade, it is not supported by statistically significant evidence as the p-value lies way above the 5% or even 10% significance levels. The same reasoning applies to the positive, yet insignificant effects shown in our regressor related to the existence of a free trade agreement between the Russian Federation and its associates. These results come in agreement with the findings of Nguyen and Do (2021) who have shown that this selection of variables is insignificant in explaining the variation in the exports of Russian oil products.

It is noteworthy that in contrast with expectations, the average commodity prices of mineral fuels for the time period under consideration are linked with a positive impact on bilateral trade. Particularly, the results show that an increase of 1% in the average price of mineral fuels (HS:24 code) can bring about a 1.19% increase in the exported values of mineral fuels from the Russian Federation. This positive and linear relationship confirms the claims of Tuzova and Qayum (2016)

who indicated that falling oil prices have caused a decline in the GDP and export revenue for the Russian Federation due to the country's heavy dependence on that commodity. Nevertheless, due to the fact that this effect is statistically insignificant, it goes against the statements of other researchers who voice the idea that oil prices volatility is ahead of trade sanctions as the most important factor in the macroeconomic downfall of the Russian economy and trade (Dreger et al., 2015) (Ahn and Ludema, 2017) (Klinova and Sidorova, 2019). Instead, our model shows that with a p-value around 0.17, although it's at a much better position relative to the FTA and tariffs variables, the effect of oil price on the exports of mineral fuels is still considered to be statistically insignificant. This can be considered peculiar at first glance but given the price-inelastic nature of fossil fuels and the lack of close substitutes, it makes sense that the demand for these products remains high even when prices are swinging. Moreover, our finding regarding the extent to which oil prices affect the Russian exports of mineral fuels allow us to be clear of any ambiguity seen in the literature regarding the hidden effects of oil prices that cause misleading evidence for the impact of sanctions on the Russian economy (Fritz et al., 2017) (Russel, 2022).

Lastly, the most important factor in our specification that examines the potential impacts of trade sanctions on the bilateral trade flows of mineral fuels is captured through the Sanction*Time variable. That is the difference-in-difference estimator which measures the difference in the average change in bilateral trade before and after the imposition of sanctions in 2014, for both cases, the sanctioning (treatment) group and the non-sanctioning (control) group of countries. Thereafter it accounts for the differences within those differences, meaning that after deducing the differences in the average values of trade flows for the sanctioning group before and after sanction shock, we subtract it from the equivalent finding for the non-sanctioning group. The empirical result for this variable shows a significant negative effect of sanctions on bilateral trade. At a 5% significance level, the implementation of trade restrictions is revealed to explain a 47% reduction in bilateral trade of mineral fuels between the Russian Federation and sanction-sending countries. Similar effects of trade sanctions on the international trade of mineral fuels have also been identified from the research of Nguyen and Do (2021) that implied a 36.56% reduction in exported values of oil products from the Russian Federation to sanctioning countries. Further evidence in that regard is presented by Larch et al., (2022) who analyze the effects of economic sanctions on the mining trade between Russia and sanction-sending countries, indicating a statistically significant reduction in trade of around 44% while Doornich and Raspotnik (2020) further

emhpasise the signigicant loss in trade as a reuslt of Western sanctions on Russia.. Hence, there is a clear convergence of evidence in the literature with our findings concerning the impact of trade sanctions on the bilateral energy trade between the Russian Federation and its partners. Lastly, due to the log-linear relationship of this variable with the dependent variable we have employed a mathematical approach first introduced by Halvorsen and Palmquist (1980) to convert the coefficient of this sanction*time dummy variable into the more intuitive 'impact term' of 47% using the formula: $100 \times (e^{coef.\ sanction*time)} - 1)$.

## 5.2 Effects of Sanctions on Non-Mineral Fuel Trade

To further bolster the idea of sanctions' negative influence over the energy-related trade flows we have completed a similar regression analysis about the bilateral trade of all other Russian exports not related to mineral fuels. By doing so we are able to observe the aggregate effects of sanctions on trade and check whether indeed the economic sanctions were the focal point of reference in the reduction of the energy trade.

*Table 3: Factors affecting the trade flow values of non-mineral fuel exports from the Russian Federation*

| lnNonMineral | Coef. | St.Err. | t-value | p-value | [95% Conf | Interval] |
|---|---|---|---|---|---|---|
| ***lnGDP Partner*** | .8323*** | .049 | 16.86 | .000 | .736 | .929 |
| ***lnGDP Russia*** | .5985*** | .214 | 2.80 | .005 | .179 | 1.018 |
| ***lnFDI Net*** | - .0040 | .024 | -0.17 | .868 | -.051 | .043 |
| ***lnDistance*** | - 1.121*** | .163 | -6.86 | .000 | -1.442 | -.801 |
| ***lnTariffs*** | - .1106 | .156 | -0.71 | .480 | -.417 | .196 |
| ***lnOpeness Partner*** | .5796*** | .116 | 5.01 | .000 | .353 | .806 |
| ***lnOpeness Russia*** | 2.187*** | .454 | 4.82 | .000 | 1.298 | 3.076 |
| ***lnOilPrice*** | - .3067 | .196 | -1.57 | .117 | -.69 | .077 |
| ***Border*** | 1.065*** | .267 | 3.99 | .000 | .542 | 1.588 |
| ***FTA*** | .2645*** | .082 | 3.21 | .001 | .103 | .426 |
| ***Sanctions*** | - 2.068*** | .235 | -8.78 | .000 | -2.529 | -1.606 |
| ***Time*** | - .1065* | .062 | -1.73 | .084 | -.228 | .014 |
| ***SanctionTime*** | .0843 | .06 | 1.40 | .161 | -.034 | .202 |
| ***Constant*** | -17.442*** | 6.325 | -2.76 | .006 | -29.84 | -5.044 |
| Mean dependent var | | 20.372 | SD dependent var | | | 1.897 |
| Overall r-squared | | 0.793 | Number of obs | | | 798 |
| Chi-square | | 598.748 | Prob > chi2 | | | 0.000 |
| R-squared within | | 0.275 | R-squared between | | | 0.814 |

****** p<.01, ** p<.05, * p<.1***

Table 3 presents the findings related to our new regression equation with non-mineral fuels as our dependent variable. In this case, we can see that the difference-in-difference coefficient is positive unlike in the case of mineral fuels. Added to that, the influence of trade sanctions on those products is not statistically significant implying that we cannot deduce any causal effect of trade sanction in the trade flows of non-mineral fuels. This finding adds ups to the ambiguity of evidence seen in the literature regarding the overall effects of sanctions on the bilateral trade of Russia. On the one side of the literature, there are researchers like Borisov et al., (2020) who study the bilateral trade flows of Russia with its 40 biggest trade partners and implied that the overall trade between the Russian Federation and developed economies, most of which are sanction-sending countries, was insignificantly impacted by the trade sanctions. On the same line, Ahl & Lundmark (2021) find no causal effects of economic sanctions when examining the Russian total trade as a whole while Nguyen and Do (2021) research show no statistically significant evidence for the impacts of trade restrictions on the trade of non-oil related products from Russia. On the other hand, however, other research papers suggest statistically significant adverse effects of sanctions on both the economy and trade of the Russian Federation (Kholodilin and Netsunajev, 2016) (Ahn and Ludema, 2017) (Doornich and Raspotnik, 2020)

Moreover, contemporary literature regarding the impact of trade sanctions on Russia is intermixed with the deteriorating macroeconomic effects that coincide during the same period of the sanction shock (Klinova and Sidorova, 2019) (Welt et al., 2020). The drop in the price of oil in 2014, is shown to have negative effects on the Russian Ruble (Dreger et al., 2015) and with a weaker currency international demand for Russian products is affected according to the forces of the exchange rate mechanisms. Moreover, whether sanctions were to be imposed or not, during geopolitical conflict periods like the Crimean Annexation the volatility of capital markets is on the rise (Lee, 2019), leading to capital outflows further destabilizing the Russian currency (Dreyer and Popescu, 2014) (Smeets, 2018). Given this macroeconomic outlook, if there were such effects impacting the Russian economy that will have been uniformly spread in the bilateral trade of the Russian Federation as a whole. This means that capital flights and the depreciation of Russian currency should affect the ability of the Russian Federation to export all products and not only mineral fuel products. Nevertheless, due to our positive and statistically insignificant finding over the non-mineral fuel trade flows we can now ensure that such effects are unlikely to have an influence over our difference-in-difference variable to such an extent of causing misleading

inference over the impact of trade sanctions on bilateral energy trade. This further implies that our model does a good job in isolating the effects of trade sanctions since it hints at a disposition that if any effects on bilateral trade were made possible as a result of this trade war, this is channelled through the energy-related sanctions.

## 5.3 Parallel Trends Assumption

That being said, in order for the causal inference of difference-in-difference analysis to hold, it presumes that the sanctioning and the control groups exhibit parallel trends in their demand for

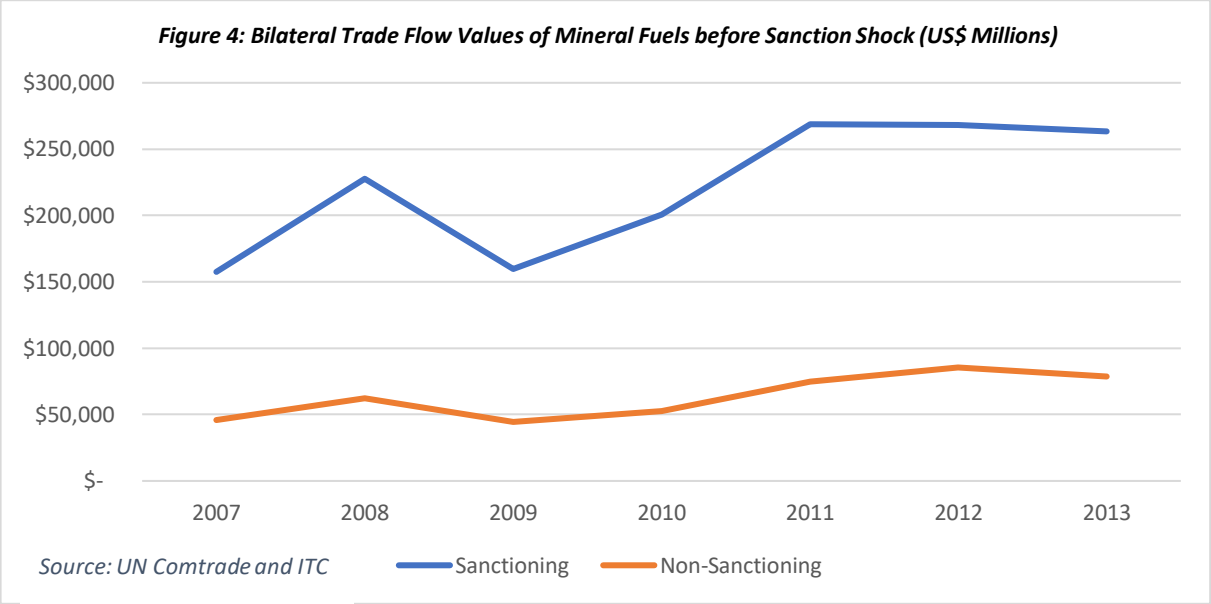
***Table 4: Growth of Mineral Fuel Trade Flows over time (US$ Millions)***

| YEAR | SANCTIONING | % Change | NON-SANCTIONING | % Change |
|---|---|---|---|---|
| **2007** | 157.535 | - | 45.835 | - |
| **2008** | 227.793 | 45% | 62.452 | 36% |
| **2009** | 159.881 | -30% | 44.459 | -29% |
| **2010** | 200.803 | 26% | 52.641 | 18% |
| **2011** | 268.777 | 34% | 74.655 | 42% |
| **2012** | 268.153 | 0% | 85.488 | 15% |
| **2013** | 263.447 | -2% | 78.579 | -8% |
| **AVERAGE** | 220.913 | 12.04% | 63.445 | 12.35% |
| **2014** | 221.894 | -16% | 81.510 | 4% |
| **2015** | 136.988 | -38% | 57.315 | -30% |
| **2016** | 106.032 | -23% | 46.735 | -18% |
| **2017** | 127.164 | 20% | 66.705 | 43% |
| **2018** | 159.589 | 25% | 91.725 | 38% |
| **2019** | 149.948 | -6% | 89.251 | -3% |
| **2020** | 93.712 | -38% | 64.794 | -27% |
| **2021** | 159.761 | 70% | 100.887 | 56% |
| **AVERAGE** | 144.386 | -0.01% | 74.866 | 0.08% |

*Source: UN Comtrade and ITC*

Russian mineral fuels prior to the sanction shock. This is because common tendencies in the demand for Russian energy commodities imply that there are no underlying factors responsible for the variation observed between the imported volumes by the treatment group when compared to the control group. If instead the sanctioning and non-sanctioning group of countries have already demonstrated unparallel trends before the imposition of sanctions, then any differences observed between them in the after-sanction period can be attributed to these pre-existing variations rather than the trade policy itself. Nevertheless, if the trends are parallel before sanctions were enacted, then any significant changes identified in the mineral fuel trade post-sanctions is more likely to have been triggered by the sanction policy.

Thereafter, we examine trends arising from the bilateral trade flows of mineral fuels during the years before the implementation of sanctions, for both sanctioning and non-sanctioning group of countries. As shown in Table 4, in order to identify these trends, we calculate the average rate of change in imported Russian mineral fuels in the pre-sanction period.

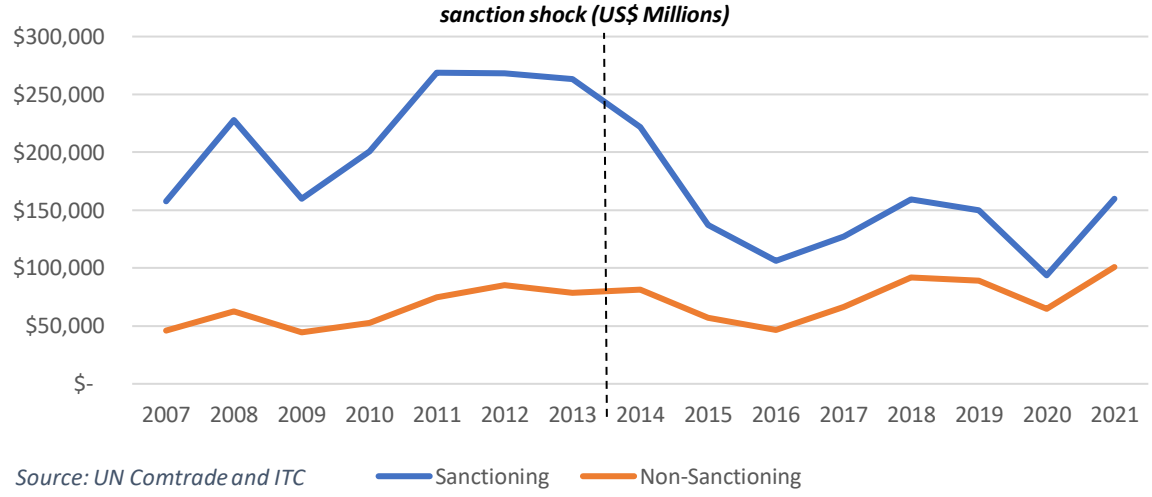



The results show that countries of the treated group possess a very similar trend with the control group of non-sanctioning countries. Considering all the years in our sample before the trade sanctions were enacted, the sanction-sending countries had on average 12.04% annual increase in Russian energy imports. This figure for the non-sanction-sending countries stands at 12.35%. The ratio between those two numbers suggests that for every 1% increase in the imported mineral fuels for the non- sanction countries, there was an increase of 0.97% in imports of the same commodities by the sanction-sending countries. The parallels between the treatment and the control groups are evident here. Added to this, a graphical illustration of the patterns of trade is presented in Figure 4. Both the trajectory and curvature of the two lines have a striking resemblance. Beginning in 2007 there is a parallel increase in the imports of mineral fuels for the two group of countries until 2008. Then again, a parallel decrease of about 30% for both groups in the following year before making a full recovery by 2011. The pre-sanction trade ends up with a stagnating demand for all countries just before the trade shock inbound.

The parallel trend assumption also dictates that the treatment must have no effect over the control group. This means that the treatment effect needs to be unique on its impact to the sanction-sending

countries otherwise it would be impossible to make causal claims regarding the influence of the sanction policy. This is because parallel trends from the non-sanction countries provide us with the ability to deduce what would have been the values of imported mineral fuels for the sanction-sending countries in the absence of sanctions since it assumes that it would follow the same trends with the non-sanction sending countries just like it manifested in the years prior to the trade shock. So, by having a treatment affected control group in the post-sanction period, it will compromise this ability as it will be no longer possible to draw accurate parallels to create the counterfactual value of trade for the sanction-sending group. With no accurate counterfactual for the treatment group the difference-in-difference application would detect a biased estimate after comparing it with the observed values .

***Figure 5: Comparisson of the bilateral trade flows values of mineral fuels before and after the sanction shock (US$ Millions)***




*Source: UN Comtrade and ITC*

In Figure 5, after plotting our data for all the years in our sample, we can clearly notice that, unlike the sanction-sending countries, the non-sanction sending ones follow the same parallel trend as the years before sanctions were implemented. This indicates that the control group has not been affected by the treatment effects. On the contrary, the treatment group has experienced a sharp reduction in the imported values of mineral fuels from Russia after the trade shocks. A closer examination of this figure shows that, although trade diminishes for both groups in the year succeeding the trade sanction, the trade of non-sanctioning countries manage to recover to the levels of the pre-shock period after 3 years in 2017. The trade between Russia and the sanctioning countries, however, seems to have never recovered even 7 years after the shock since it appears to be around half of the trade size of the pre-sanction period.

These findings are supported by related research papers on the subject. The reduction in the traded values of mineral fuels observed for both groups of countries after the sanction shock is also associated with the drop in oil prices in 2014 (Dreger et al., 2015) which has brought about severe consequences to the Russian economy and trade (Gurvich and Prilepskiy, 2015) (Tuzova and Qayum, 2016). It is also highlighted that following the stabilization of oil prices the Russian economy managed to rebound after 2016 (Welt et al., 2020). Althought the trade with non-sanctioning countries recovered relatively quickly, the bilateral trade of Russia with sanction-sending countries suffered permanent damage (Havlik, 2014) (Doornich and Raspotnik, 2020). Altogether, these findings are aligned with our evaluations in this paper which further support our affirmative statements over the validity and existence of the parallel trend assumption in this experiment. Besides, Bělín and Hanousek, (2021) have also identified that the parallel trend assumption does indeed hold for the case of Russian Federation sanctions which furher reinforced our findings on the impacts of sanctions in the energy trade of Russia.

# CHAPTER 6 – CONCLUSION

Economic sanctions have been one of the most popular foreign policy tools used by countries in recent times to exercise soft power over international matters. The core aim of trade sanctions is to coerce a change in the political stance of a targeted nation without the need for military confrontation. Having said that, the unfolding series of catastrophic events between the Russian Federation and Ukraine have seen the EU imposing already the $10^{th}$ sanction package against Russia in hope to stop the ongoing conflict, giving rise to a popular opinion questioning the success of such policies. As a matter of fact, the effectiveness of trade sanctions is debated not only by politicians but also from the academic community which finds inconclusive evidence over the impacts of this measure.

In this paper, we examine the impacts of trade sanctions imposed by a group of Western countries against the Russian Federation as a consequence of the Russian annexation of Crimea in 2014. Data regarding the bilateral trade flows between Russian and 57 of its trade partners are gathered through UN Comtrade and ITC databases for the period between 2008-2021. We then employ a

gravity model to examine the long-term impacts of sanctions on the export values of mineral-fuel trade flows from the Russian Federation to a group of sanction-sending countries and a group of non-sanctioning countries. This is done so by applying the difference-in-difference statistical technique which compares the difference between average traded values of those 2 groups, before and after the imposition of economic sanctions in order to identify the causal effects of sanctions on bilateral trade.

Our results suggest that sanctions were able to achieve a statistically significant reduction in the energy trade between Russia and the sanction-sending countries. More specifically, our empirical results indicate that sanctions are responsible for a 47% reduction in the bilateral mineral fuel trade of the Russian Federation with these countries. This finding is supported by related research on the subject which has shown that sanctions have indeed succeeded to a certain degree in restricting Russia's energy-related trade (Larch et al., 2022), (Nguyen and Do, 2021) (Bělín and Hanousek, 2021). Moreover, this analysis apart from supporting the notion of sanctions' adverse effects on the bilateral trade of Russia, it also enriches the existing literature in other ways.

First, we close the gap relating to the long-term impacts of sanctions as most research papers used data over a short period of time to identify either the short-term effects of sanctions or the medium-term effects of sanctions. This is very important as there are statements made in the literature manifesting that sanctions only had a short-term impact on the Russian economy (Gaur et al., 2023) as Russian exports seem to recover in depth of time (Doornich and Raspotnik, 2020) due to the fact that sanctioned economies eventually adapt to the trade shocks (Garashchuk et al, 2022) and Russian exporters finding alternative routes to trade (Borisov et al., 2020).

Second, due to the uncertainty found in the literature regarding oil price fluctuations contaminating the evidence for the impacts of sanctions on the Russian economy (Gurvich and Prilepskiy, 2015), (Tuzova and Qayum, 2016), (Ahn and Ludema, 2017) we adapted our model to account for the price of crude oil. In addition to the ambiguity of evidence resulting from oil price volatility, many papers also point out that other macroeconomic shocks taking place during the Crimean crisis, such as the depreciation of the Russian currency and the substantial capital outflows from the Russian Federation, have also taken their toll in the bilateral trade dynamics (Havlik, 2014), (Kholodilin and Netsunajev, 2016). Thus, disentangling these effects from the effects of sanctions on the mineral fuel trade is considered to be of utmost importance for a proper evaluation of the

economic sanctions' impact. In that regard, our analysis has also considered the influence of trade sanctions on the overall, non-mineral fuel trade, between the Russian Federation and its partners. Given that if such macro-level shocks interfere with the impact of sanctions on trade, then the consequences of the trade restriction should be felt in the trade of products from all sectors of the economy and not only on the trade of mineral fuels. Nevertheless, our regression finds that sanctions have a positive and insignificant impact on the bilateral trade of non-mineral fuels further reinforcing the idea that sanctions were the focal point of reference for the reduction in energy trade flows.

Lastly, our research accounts for a large number of trade partner countries of the Russian Federation that make up on average over 95% of the total Russian mineral fuel trade. This set aside from a number of other papers that investigate the impacts of sanctions on Russia vis-à-vis the EU (Giumelli, 2017) (Bali, 2018) or single partner counties (Fedoseeva and Herrmann, 2019). In this way, we can get a wider picture of the effects of sanctions from a worldwide energy-trade point of view as Russia is the number one supplier of these energy commodities in the world.

Having said that, a number of areas can be improved in our paper. For example, in this analysis, it was not possible to apply country fixed-effects estimations as this would have compromised our independent variables that remain fixed over time like geographical distance between countries and more importantly our dummy variables. This means that we were unable to take account for unobserved and time-invariant factors affecting bilateral trade that are hidden in the error term. Such variables may include cultural ties as countries with more anti-Russian sentiment, like Poland or the Baltic states that are in fear of sharing the same fate as Ukraine given their affiliation with Russia's Soviet past, might be less willing to be dependent on Russian energy. Whereas trade partners like China and Germany that seek to have the most cost-efficient way to supply energy to their industries are more willing to engage in business with Russia. Added to that, some countries have more advanced technologies and infrastructure to utilize energy commodities, like in the case of Spain which has the most liquified natural gas (LNG) terminals in Europe, therefore there is an increasing likelihood for those countries to demand higher volumes of these specific mineral fuels.

An additional input for this paper could have been the consideration of the trade sanctions' impact on more sectors of the Russian trade. By examining the implication of sanctions on a number of individual sectors rather than just the mineral fuels and the aggregate non-mineral ones, it will be

possible to deduce whether sanctions effects were unique to the energy trade. Also, the trade sanctions on mineral fuels were imposed on products with 4-digit level in the harmonized system, whereas in this research we only have data regarding the products at 2-digit level. This means that we have considered the effects of trade restrictions on certain mineral fuels not subject to sanctions. Therefore, a research based on the exact mineral fuel categories under the punishment scheme can surely provide a better estimation for the impacts of sanctions on bilateral trade.

Another point of reference for future research on the subject is the disaggregation of the trade sanctions impact on bilateral trade from other various macroeconomic factors. Accounting for commodity price fluctuation and currency depreciation in our analysis would help to yield a more accurate inference regarding the impacts of sanctions on trade as these factors directly influence the demand for mineral fuels and are very volatile during the period under consideration. Lastly, although sanctions were initiated in the year of 2014, they have been imposed on the Russian Federation at different points of time ever since. By assessing the impact of sanctions on a few years lag period might further boost the validity of our findings.

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# APPENDICES

## Appendix 1: Pairwise correlations

| Variables | (1) lnGDP | (2) lnGDP_Ru | (3) lnFDI_N | (4) lnDist | (5) lnTariff | (6) Border | (7) FTA | (8) lnOpen | (9) lnOpenR | (10) lnOil |
|---|---|---|---|---|---|---|---|---|---|---|
| ***(1) lnGDP*** | 1.000 | | | | | | | | | |
| ***(2) lnGDP_Ru*** | 0.023 | 1.000 | | | | | | | | |
| ***(3) lnFDI_N*** | 0.048 | 0.048 | 1.000 | | | | | | | |
| ***(4) lnDist*** | 0.388 | 0.000 | 0.001 | 1.000 | | | | | | |
| ***(5) lnTariff*** | 0.118 | 0.000 | -0.005 | 0.307 | 1.000 | | | | | |
| ***(6) Border*** | -0.192 | 0.000 | 0.001 | -0.401 | -0.102 | 1.000 | | | | |
| ***(7) FTA*** | -0.278 | 0.029 | -0.002 | -0.121 | -0.194 | 0.260 | 1.000 | | | |
| ***(8) lnOpen*** | -0.549 | 0.051 | -0.087 | -0.428 | -0.013 | 0.053 | -0.012 | 1.000 | | |
| ***(9) lnOpen_Ru*** | 0.004 | -0.094 | 0.033 | 0.000 | 0.000 | 0.000 | -0.058 | 0.022 | 1.000 | |
| ***(10) lnOil*** | 0.002 | 0.832 | 0.090 | 0.000 | 0.000 | 0.000 | -0.049 | 0.034 | 0.280 | 1.000 |

## Appendix 2: Variance Inflation Factor

| | VIF | 1/VIF |
|---|---|---|
| AverageOilPrices | 15.331 | .065 |
| GDP Russia | 10.551 | .095 |
| Time | 5.664 | .177 |
| Sanction*Time | 5.206 | .192 |
| Openness RU | 2.561 | .391 |
| Sanctions | 2.523 | .396 |
| Distance | 1.416 | .706 |
| FTA | 1.376 | .727 |
| Openess | 1.26 | .793 |
| GDP Partner | 1.218 | .821 |
| Border | 1.155 | .866 |
| FDI Net | 1.053 | .95 |
| Tariffs | 1.039 | .962 |
| Mean VIF | 3.873 | . |

## Appendix 3: Hausman Test

| | Coefficients (b) fixed | (B) random | (b-B) Difference | sqrt(diag(V_b-V_B)) Std. err. |
|---|---|---|---|---|
| lnGDP | .8520977 | .9715324 | -.1194348 | .4131386 |
| lnGDP_RU | -.3477343 | -.1122749 | -.2354594 | .3955606 |
| lnFDI_Net | -.5418784 | -.5221305 | -.0197479 | . |
| FTA | -.0479559 | .0355018 | -.0834578 | .0703228 |
| lnOpeness | 1.772355 | .3502889 | 1.422066 | .4126309 |
| lnOpeness_Ru | -1.445177 | -.9250322 | -.5201446 | .5862113 |
| lnOilPrice | 1.199009 | 1.189491 | .0095177 | .1596076 |
| Time | .6277449 | .5010198 | .1267251 | .0385286 |
| SanctionTime | -.8593605 | -.6076991 | -.2516615 | .0453663 |

b = Consistent under H0 and Ha; obtained from **xtreg**.
B = Inconsistent under Ha, efficient under H0; obtained from **xtreg**.

Test of H0: Difference in coefficients not systematic

chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 16.22
Prob > chi2 = 0.0624
(V_b-V_B is not positive definite)

## Appendix 4: Breusch and Pagan Lagrangian Multiplier: Test for random effects

lnMineralFuelsExports[country,t] = Xb + u[country] + e[country,t]

Estimated results:

| | Var | SD = sqrt(Var) |
|---|---|---|
| lnMiner~s | 10.49383 | 3.239419 |
| e | 2.13384 | 1.460767 |
| u | 3.308805 | 1.819012 |

Test: Var(u) = 0
chibar2(01) = 2179.77
Prob > chibar2 = 0.0000

## Appendix 5: Distinguishing between sanction and non-sanction countries

| | | Countries | Official Statements | NATO | Unfriendly List | UN General Assembly Vote |
|---|---|---|---|---|---|---|
| **Sanctioning (41)** | ***EU*** | Austria | ✓ | ✗ | ✓ | ✓ |
| | | Belgium | ✓ | ✓ | ✓ | ✓ |
| | | Bulgaria | ✓ | ✓ | ✓ | ✓ |
| | | Croatia | ✓ | ✓ | ✓ | ✓ |
| | | Cyprus | ✓ | ✗ | ✓ | ✓ |
| | | Czechia | ✓ | ✓ | ✓ | ✓ |
| | | Denmark | ✓ | ✓ | ✓ | ✓ |
| | | Estonia | ✓ | ✓ | ✓ | ✓ |
| | | Finland | ✓ | ✗ | ✓ | ✓ |
| | | France | ✓ | ✓ | ✓ | ✓ |
| | | Germany | ✓ | ✓ | ✓ | ✓ |
| | | Greece | ✓ | ✓ | ✓ | ✓ |
| | | Hungary | ✓ | ✓ | ✓ | ✓ |
| | | Ireland | ✓ | ✗ | ✓ | ✓ |
| | | Italy | ✓ | ✓ | ✓ | ✓ |
| | | Latvia | ✓ | ✓ | ✓ | ✓ |
| | | Lithuania | ✓ | ✓ | ✓ | ✓ |
| | | Luxemburg | ✓ | ✓ | ✓ | ✓ |
| | | Malta | ✓ | ✗ | ✓ | ✓ |
| | | Netherlands | ✓ | ✓ | ✓ | ✓ |
| | | Poland | ✓ | ✓ | ✓ | ✓ |
| | | Portugal | ✓ | ✓ | ✓ | ✓ |
| | | Romania | ✓ | ✓ | ✓ | ✓ |
| | | Slovakia | ✓ | ✓ | ✓ | ✓ |
| | | Slovenia | ✓ | ✓ | ✓ | ✓ |
| | | Spain | ✓ | ✓ | ✓ | ✓ |
| | | Sweden | ✓ | ✗ | ✓ | ✓ |
| | ***Non-EU*** | Albania | - | ✓ | ✓ | ✓ |
| | | Canada | ✓ | ✓ | ✓ | ✓ |
| | | Iceland | ✓ | ✓ | ✓ | ✓ |
| | | Montenegro | ✓ | ✓ | ✓ | ✓ |
| | | North Macedonia | - | ✓ | ✓ | ✓ |
| | | Norway | ✓ | ✓ | ✓ | ✓ |
| | | United Kingdom | ✓ | ✓ | ✓ | ✓ |
| | | United States | ✓ | ✓ | ✓ | ✓ |
| | | Australia | ✓ | ✗ | ✓ | ✓ |
| | | Georgia | ✓ | ✗ | ✗ | ✓ |
| | | Japan | ✓ | ✗ | ✓ | ✓ |
| | | New Zealand | ✓ | ✗ | ✓ | ✓ |
| | | Switzerland | ✓ | ✗ | ✓ | ✓ |
| | | Ukraine | ✓ | ✗ | ✓ | ✓ |
| **Non-Sanctioning (16)** | ***EAEU*** | Armenia | ✗ | ✗ | ✗ | ✗ |
| | | Belarus | ✗ | ✗ | ✗ | ✗ |
| | | Kazakhstan | ✗ | ✗ | ✗ | ✗ |
| | | Kyrgyzstan | - | ✗ | ✗ | ✗ |
| | ***Non-EAEU*** | Brazil | ✗ | ✗ | ✗ | ✗ |
| | | China | ✗ | ✗ | ✗ | ✗ |
| | | India | ✗ | ✗ | ✗ | ✗ |
| | | Indonesia | ✗ | ✗ | ✗ | ✓ |
| | | Korea, Republic of | ✗ | ✗ | ✓ | ✓ |
| | | Malaysia | ✗ | ✗ | ✗ | ✓ |
| | | Mongolia | ✗ | ✗ | ✗ | ✗ |
| | | Thailand | ✗ | ✗ | ✗ | ✓ |
| | | Turkey | ✗ | ✓ | ✗ | ✓ |
| | | United Arab Emirates | ✗ | ✗ | ✗ | ✗ |
| | | Uzbekistan | - | ✗ | ✗ | ✗ |
| | | Viet Nam | ✗ | ✗ | ✗ | ✗ |

**Abbreviations and Notes**

EU: European Union

EAEU: Eurasian Economic Union

Official Statements: ✓ = official statements in favor of sanctions

\- = no official statements either in favor or against sanctions

✗ = official statements against sanctions

NATO: ✓ = member of the North Atlantic Treaty Organization

✗ = not a member of the North Atlantic Treaty Organization

Unfriendly List: ✓ = country listed as unfriendly country by the Russian government

✗ = country not listed as unfriendly country by the Russian government

UN General Assembly Vote: ✓= country voted in favor of the territorial integrity of Ukraine and against the recognition of Crimean Annexation Referendum

✗ = country not voted in favor of the territorial integrity of Ukraine and did not condemn the recognition of Crimean Annexation Referendum

*Sources: various including European Council, European Parliament, US Congress, US state department, United Nations*