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Trade in times of conflict and sanctions

A gravity model analysis on the trade between the Scandinavian countries and Russia during the Russian-Ukrainian conflict

Ingeborg Kolstad and Hanne Skyttemyr

Supervisor: Siri Isaksson

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Ingeborg Kolstad Hanne Skyttemyr

Executive summary

In this thesis we study trade flows between the Scandinavian countries Denmark, Norway and Sweden and Russia. Particularly, we investigate the trade flows in light of the Russian-Ukrainian conflict and the following sanctions against Russia imposed by the EU. We look at data on exports, imports and total trade between the Scandinavian countries and Russia and how they have developed in the period from 2012 till third quarter of 2022. Insights in this development are interesting and important, both to evaluate the effectiveness of the sanctions already imposed, and what implications these findings may have for future policy work.

To answer the research question, we have used both descriptive statistics and regression analysis. We have used an augmented gravity model when evaluating the development of trade flows. To estimate the relationship between trade flows and conflict and sanction, we have added dummy variables to the traditional gravity model that adhere to important events in the period.

Our main findings are that the exports from the Scandinavian countries to Russia tend to decrease from the first sanctions are imposed in 2014, mainly explained by the Russian import embargo on food effective from August of 2014. Further, imports from Russia have not significantly changed until second quarter of 2022, when the EU put Russia under a strict and wide-ranging sanction regime as a respond to the Russian invasion of Ukraine in February 2022. Our main explanation for why it has not decreased earlier is that the goods the Scandinavian countries imported to Russia were not directly included in the sanction programs. We do not see any change in trade in periods where new sanctions are not imposed.

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1. Introduction

In March 2014 Russia annexed the Ukrainian territory Crimea and Sevastopol which marked a new era in European history. The annexation was a break of international law, and as a response to this act, the European Union (EU) imposed the first package of sanctions against Russia. Consequently, Russia also established countersanctions (Holm-Hansen & Paulsen, 2023). Throughout the last decade the conflict has been developing, with a further escalation when Russia invaded Ukraine in February 2022. Again, the Western world responded with sanctions. Russia is now under the strictest and most comprehensive sanction regime that an economy of such size has been since the 1930s (Mulder, 2022).

Barber (1979) defines economic sanctions as “economic measures directed to political objectives”. Sanctions are means used in foreign policy, considered to be the middle ground between diplomatic and military methods. They can also be used accompanying military or diplomatic actions (Askari et al., 2003). It was first documented in use in ancient times and has been used in various forms in conflicts ever since, but the frequency has increased especially after the end of the Cold War in 1991 (Kaempfer & Lowenberg, 2007).

The initiative of sanctions generally comes from an ambition of changing the policy of the target country through use of economic means. Barber (1979) describes three levels of sanction objectives. The primary is, as mentioned, for the imposer to change the policy in the target country. The intention is that the imposer will cause some kind of pain on the target state, especially on its ruling regime. To avoid suffering, the target state will change its policies so that they comply with the demands of the sanctioning state (Kaempfer & Lowenberg, 2007). Further, by imposing sanctions, one also reduces the country’s income, and by that decreases its opportunity to finance unwanted behavior (Caprile & Delivorias, 2023).

The secondary objective relates to the imposing state, how the sanctions affect the status, behavior, and expectations of the government both domestically and internationally (Barber, 1979). According to Kaempfer and Lowenberg (2007), this objective might be as important as the first objective. For example, a domestic demand of “doing something” about the behavior of the target country can force a nation’s government to impose sanctions. The third objective is concerned with international considerations and to demonstrate the utility and power of international institutions in a broader sense (Barber, 1979).

The objectives of the first wave of sanctions by the EU and other Western countries against Russia in 2014 and 2015 was to make Russia reverse the annexation, to prevent arms and other supplies, and illegal fighters to enter Ukrainian territory from Russia, and to convince separatists in Eastern Ukraine to concede. It was also an important demand that Russia implemented the Minsk agreements of September 2014 and February 2015 (Fischer, 2015). The second wave of sanctions was imposed as a response to the Russian invasion of Ukraine in February 2022. The main target of these sanctions is to reduce Russia's ability to finance the war in Ukraine (Norwegian Ministry of Foreign Affairs, 2023).

In 2021, Russia was the 11th largest economy in the world (The World Bank, 2021a). An economy of this size has not been put under a sanction regime with such a wide array since the 1930s (Mulder, 2022). Russia's size gives them a key position in the world market, particularly when it comes to energy, due to their access to natural resources. The magnitude of the sanctions combined with an increasingly integrated and interdependent world economy, means that the effects of the sanction regime span much wider than only on the Russian economy (Gygli et al 2019; Smeets, 2019). This makes it both important and interesting to understand the consequences to as large an extent as possible.

The sanctions regime Russia have been put under has clearly had implications for the world trade. A consequence of the sanctions has been a reduction in the access to essential goods like fertilizers and energy, resulting in disrupted trade flows and an increased price level on a wide range of goods (Næringslivets Hovedorganisasjon, 2022). For instance, the price of oil increased from USD 60 per barrel in March 2021, while it May 2022 peaked at a price of USD 108 per barrel (Trading Economics, 2023). This is an example of the global implications of the conflict, and many more could have been mentioned. The sanctions are therefore not only affecting markets in the sanctioning countries and Russia, but also third-party countries have been impacted by the conflict and its following sanctions.

To us, it is natural to investigate the effects in a perspective we can relate to, namely the Scandinavian. The Scandinavian countries, Norway, Sweden, and Denmark are all playing at the globally integrated world market and are a part of the EU sanctioning program (Strategic Communications division in the European Union External Action, 2021; Norwegian Ministry of Foreign Affairs, 2023). We chose to limit our analysis to these three countries' trade with Russia. The reason is that we can achieve a more thorough understanding of individual characteristics of each country than what we could have if investigating a broader range of countries.

Since the first sanctions and countersanctions were imposed in 2014, the trade between Scandinavia and Russia has been influenced in various ways. For instance, the Norwegian salmon industry has been suffering under the regime. The Norwegian Seafood council estimated in 2019 that Norway has had a loss worth 20 billion Norwegian Kroner (NOK) since the Russian countersanctions came into force in 2014 (Nilsen, 2019). Thus, sanctions can have huge economic impact, and by that cause a loss in welfare, both for the imposing and the targeted country. Because sanctions come with a high price, it is important to understand the consequences and whether they have the intended effect.

We have seen that sanctions have economic implications on both the imposer and the target state, and it is therefore important to have a broad and correct understanding of the consequences and whether they function as intended. It is important for the imposer to track the effect of their measures, both to strike the target country as precisely as possible and to justify the necessity of the implications. This paper will mainly investigate the economics of the subject, however, there is also a question of morals and values related to this. The intention of this analysis is to increase economic understanding and contribute to the foundation of decision making for policymakers.

The sanction program following the conflict between Ukraine and Russia has had a tremendous impact on the global economy and prices. To limit the scope of the analysis, we have decided to investigate Scandinavian trade with Russia. We have therefore chosen the following research question:

How has trade between Russia and the Scandinavian countries developed in the times of the Russian-Ukrainian conflict and the following sanction program?

We will study the exports, imports and total trade between the respective Scandinavian countries and Russia during the sanction program and conflict between Ukraine and Russia. The background to the conflict can be traced back to the fall of the Soviet Union in 1991 and even further (Holm-Hansen & Paulsen, 2023). However, in this paper, when speaking of the conflict, we refer to the period from the rise in tension in the fall of 2013 and until today's war.

It can be challenging to determine a causal relationship between trade and sanctions, since it can be arduous to argue that the sanctioning program is an exogenous shock on trade. It is nonetheless interesting to investigate the research question through a correlation study, since it gives information on trade flows and how they develop in times of sanctions.

In the results of our study, we have compared the value of exports, imports, and total trade during the conflict with the period before the conflict. We find that imports have not significantly changed in the periods of sanctions between 2014 and 2021. We argue that possible explanation for this may involve dependency on Russian import, delays in trade and that the sanctions that have been in function from 2014 to 2021 is not targeting Scandinavian import goods. We do not see any change in trade if new sanctions are not implemented. Exports on the other hand, have significantly decreased after the Russian annexation of Ukrainian territory in 2014. The main cause for this finding, is the Russian import embargo in 2014. From 2022, there are significant reduction in both imports and exports, explained by the extensive EU sanction program.

1.1 Outline

To give a broader background for the further analysis we begin with a description on certain economic features, governance, and international relations of the countries in question in chapter 2. This chapter also contains a brief explanation of the relationship between trade and conflict and a summary of the development in the conflict between Russia and Ukraine and the following sanctions. In chapter 3, we have given a review of already existing literature on the subject. Chapter 4 includes the methodology used for the analysis, while chapter 5 describes the process of data retrieval. Chapter 6 contains the analysis and begins with descriptive statistics before we move to the regression results. A discussion of the results is given in chapter 7, while the conclusion can be found in chapter 8.

2. Background research

This chapter of the paper provides background information that can be helpful in further analysis and discussion, to answer the research question. We will start with a short description of the economic situation and set of governance in the Scandinavian countries and Russia, and then give an overview of their position in the global economy and their international trade. Further, the paper will provide some perspectives on trade and conflict, and what has been the common view on this in the different countries. Lastly, we will present the conflict between Russia and Ukraine and the imposed sanctions from both parts of the conflict.

2.1 Economic features

This section will first provide an overview of the economic features of the different countries in question, so that one gets an impression of their position in world trade, but also to understand how they perform relative to each other. Then it will go over to a more thorough description of each country's trade, focusing on what goods their imports and exports are made up of.

Indicator/Country	Norway	Sweden	Denmark	Russia
Population (in millions)	5.4	10.4	5.9	143.4
Total GDP (current USD)	482.17 billion	635.66 billion	398.3 billion	1.78 trillion
GDP per capita (current USD)	89 154.3	61 028.7	68 007.8	12 194.8
Total trade value (current USD in billions)	341.8	446.82	551.03	927.94
<i>Percent of GDP</i>	<i>70.9</i>	<i>86.7</i>	<i>112.2</i>	<i>52.2</i>
Exports of goods and services (current USD in billion)	200.45	237.62	289.19	548.86
<i>Percent of GDP</i>	<i>41.6</i>	<i>45.5</i>	<i>59.7</i>	<i>30.9</i>
Imports of goods and services (current USD in billion)	141.35	209.2	261.84	379.08
<i>Percent of GDP</i>	<i>29.3</i>	<i>41.2</i>	<i>52.5</i>	<i>21.3</i>
Trade balance (current USD in billion)	59.1	28.42	289.19	169.78

Table 1: Economic features of the countries in interest (The World Bank, 2021b)

In Table 1, we have made an overview of the parameters population, gross domestic product (GDP) in American dollar (USD), and different trade variables important to the analysis. The data in table 1 is from 2021 and collected from the World Bank. From the table we see that Russia is by far the largest country, both when it comes to population and GDP. Among the Scandinavian countries, Sweden is the largest regarding population, with about twice the size of Denmark and Norway. Norway has the highest value of GDP per capita. Denmark and Sweden have a value a little below Norway, while Russia only has a value of 12 194.8 thousand, less than one seventh of Norway. In a global perspective, the Scandinavian countries are all top ranked when it comes to GDP per capita, with Sweden ranked as the lowest among them as 13th in 2021. The same year Russia was ranked as number 65, with a value close to the world average on 12 236.6 thousand (The World Bank, 2021c).

When it comes to trade, we can observe in Table 1 that Russia has the highest trade value in absolute terms, and at the same time it constitutes the lowest share of GDP. Denmark, on the other hand has a total trade that equal to 112 percent of its GDP. It may seem counterintuitive that trade can exceed GDP, however, this comes from the definition of GDP, where imports are subtracted out of the total value (Bondarenko, 2023). This allows for small countries, such as Denmark, to have a value of total trade exceeding the GDP when the import value is sufficiently high.

From the table we see that all four countries have a trade surplus, meaning that the trade balance is positive. A trade surplus indicates that there is a higher demand for the countries' exported goods than their imported goods. The opposite of a trade surplus is a trade deficit. A trade surplus does not necessarily imply that the country is in a strong position economically, but it does contribute to the current account and GDP (Eurostat, 2013).

While table 1 provides data on macroeconomic indicators for each country of investigation, we will in the following section give a more in-depth description of what goods that are mainly traded for Norway, Sweden, Denmark, and Russia. The categories of goods are based on the commonly used harmony system codes (HS codes) from the World Customs Organization (2017). We will see that the main categories of goods traded for these countries are mineral products, metals, chemical products, machineries, and transport means. Mineral products mainly contain natural gas, crude oil, coal, and other petroleum products. Within the category of metals, we find raw materials like aluminum, iron, and copper. The category of chemical products includes, among a long list of other things, pharmaceuticals, and fertilizers.

Machinery involves for instance mechanical appliances, electrical machinery, and electronics. Means of transport mainly consist of cars, motor vehicles, tractors etc. The composition of trade and the biggest trading partners for Russia and the Scandinavian countries have mostly been contracted from the Observatory of Economic Complexity (OEC). It is an online tool for trade visualization, which first began as a research project at MIT, though now has spun out of the university (OEC, n.d.).

2.1.1 Russia

Russia is primarily an exporter of raw material. In 2021 petroleum products and coal constituted 53 percent of the exports. Besides that, metals, precious metals, and chemical products (mainly fertilizers) are important, which together constitute about 25 percent of the export value. Machinery only accounts for about 3.5 percent of the exports. The domination of raw materials in exports in contributing to explaining their rank as number 45 on the OECs trade economic complexity index (ECI) (OEC, 2021a). The index estimates “a country's ability to produce and export complex products that require a high level of knowledge and skills” (OEC, 2021c). The import to Russia primarily consists of machineries, transport means and chemical products, in other words, industrial goods with high degree of processing. (OEC, 2021a).

Russia's largest trading partner in 2021 was China, accounting for almost 25 percent of Russian imports and 15 percent of exports. This is an increase from 2012, where 14.6 percent of imports originated from China, and 7.6 percent of exports were directed there. Besides that, in 2021, the Netherlands (8.1 percent), the United States (US) (5.7 percent), United Kingdom (UK) (5.1 percent) and Turkey (4.2 percent) were important for Russian exports, while Germany (11.5 percent), Belarus (5.8 percent), South Korea (3.8 percent) and Poland (3.3 percent) constituted the countries Russia imported the most from. (OEC, 2021a).

According to United Nations Conference on Trade and Development (2021), Russia had a share of global exports equal to 1.9 percent in 2021. They are ranked as the 10th largest export nation in the world, explained by their position in the energy market (OEC, 2021a). When it comes to petroleum production, they play a major role in the global supply chains. According to the International Energy Agency (IEA) (2022a), Russia is the world's third largest oil producer and second largest exporter of oil to the global market. According to the Council of the European Union (2023a), Russia covered 50 percent of the EUs demand for natural gas in

2019. However, after the Russian invasion of Ukraine, Europe has reduced their imports of Russian gas to a minimum. In November 2022, only 12.9 percent of the demand was covered by Russian gas, which is quite a dramatic fall considering the time span (Council of the European Union, 2023a).

2.1.2 Norway

Similarly, to Russia, Norwegian exports mainly consist of raw materials. 66 percent of the exports are mineral products, where petroleum gas and crude oil account for 61 percent in total. Other than that, fish is an important export good, about eight percent of the total value in 2021. (OEC, 2021b).

Norway is the world's third largest gas exporter, mainly supplying the EU, covering 25 percent of their demand in 2021 (IEA, 2022b). In total, Norway is the 33rd largest export nation in the world in absolute terms, which can be explained by them being a small, but rich country depending on trade to cover their demands (OEC, 2021b). Despite being a relatively large export nation, its size considered, Norway is ranked as number 38 on the ECI (OEC, 2021c). This is explained by Norway's relative lack of complex industries since their export mainly consists of raw materials.

When it comes to Norwegian imports, machineries and transport means are the largest categories, accounting for respectively 22 and 17 percent. Further, metals and chemical products, including pharmaceuticals, constitute approximately ten percent each (OEC, 2021b).

Norway's largest sources for imports were in 2021 Sweden (17.7 percent), Germany (11.5 percent), China (10.0 percent), Denmark (6.5 percent) and the US (5.3 percent). Regarding the destination countries for Norwegian exports, the UK (20.5 percent), Germany (19.2 percent), Sweden (8.4 percent), the Netherlands (7.4 percent) and China (5.8 percent) where the main ones. In 2021, 0.32 percent of Norwegian exports were destined to Russia and 2.09 percent of imports originated from there. (OEC, 2021b)

2.1.3 Sweden

Unlike Russia and Norway who mainly export raw materials, Sweden's exports are much more diverse. The biggest category of goods is machinery, accounting for only 24 percent of total export value. The second largest category is means of transport accounting for about 14

percent of export value. This is followed by chemical products (10 percent) and paper goods with a share of about 7 percent in 2021 (OEC, 2021d). Thus, we understand that Sweden has well-developed and a broad variety in industries, which is reflected in them being ranked as number eight in the world on the ECI (OEC, 2021c). Regarding size of exports, Sweden is ranked as the 32nd largest export nation (OEC, 2021d).

Regarding imports to Sweden, about 27 percent is machineries, 12 percent is transport means and 10 percent is petroleum (OEC, 2021d). This means that, except from the petroleum, they have a high degree of intra-industry trade (Norman & Orvedal, 2012, p. 166)

The five most important destinations for Sweden's exports were in 2021 Germany (10.3 percent), Norway (9.4 percent), the US (8.2 percent), Denmark (7.9 percent) and Finland (6.5 percent). When it comes to sources for Swedish imports, Germany is the largest one, accounting for 17.6 percent of total imports, followed by the Netherlands (8.8 percent), Norway (7.9 percent), China (7.1 percent) and Denmark (6.9 percent). In 2021, 1.44 percent of Swedish exports was destined at Russia, while 0.88 percent of imports originated from there. (OEC, 2021d).

2.1.4 Denmark

Denmark's biggest exports consist of chemical and pharmaceutical goods, which accounts for about one fifth of the exports. Machineries are the second largest export group, followed by food products, which equals to about 10 percent in 2021. The main import goods of Denmark are machineries, means of transport, and pharmaceutical products. Machinery accounts for roughly 22 percent, while the two others are both approximately 11 percent. (OEC, 2021e).

We see that also Denmark's trade to a certain degree is characterized of being inter-industrial. At the same time, the relative high degree of food exports is contributing to a much lower placement on the OEC's list of countries' economic complexity. Denmark is ranked as number 27, much lower than Sweden, but higher than Norway. In a global perspective, they are ranked as the 37th largest export nation. (OEC, 2021e).

Denmark's largest trading partner in 2021 was Germany. They accounted for 20.7 percent of total imports and 13.6 percent of total exports. Further Sweden (12.2 percent), China (8.6 percent), the Netherlands (8.3 percent), and Poland (4.5 percent) where the largest sources of imports. Besides Germany, Danish exports were directed to The US (10.4 percent), Sweden

(10.0 percent), China (5.6 percent), the UK (5.8 percent) and Norway (5.3 percent). In 2021, 1.32 percent of Denmark's exports had Russia as destination, while 2.02 percent of Denmark's imports originated from Russia. (OECD, 2021e).

2.2 Governance

This section will start with a description of the governance in the different countries since decisions regarding war and sanctions often relate to the political and historical state of the countries. We have decided to describe the Scandinavian countries together, since they share many of the common features when it comes to governance and history. The governance and history of Russia is described in a separate section. Further, we have included an overview of the countries' approach to international relations.

2.2.1 Scandinavia

All the three Scandinavian countries share many of the same characteristics when it comes to governance. They are today known for their welfare states, which were developed after the Second World War. The Nordic welfare model is known for providing welfare services and financial safety nets for the population through a strong public sector. The countries also have high levels of trust in the government and people, and low levels of economic inequality and corruption (Herning, n.d.; Transparency International, 2021). It is, however, worth mentioning that income inequality and relative income poverty has increased over the last decades in all Scandinavian countries (Barth et al., 2021).

Additionally, the Scandinavian countries are all well-developed democracies and highly valuing human rights and freedom of speech. This explains them all being positioned within the top six of the Economist Intelligence Unit's democracy index and United Nation's (UN) human development index (HDI) (FN-sambandet, 2022; FN-sambandet, 2021). HDI measures life expectancy, years of schooling and gross national income per capita. This can be seen in the light of them all three being highly developed welfare states.

2.2.2 Russia

The history of the modern Russia starts with the dissolution of the Soviet Union in 1991, where the Russian Federation was built upon the ruins of what was left of the Union (Golpen & Kolstø, 2022). The dissolution marked a break from communism and the former ruling system,

at the same time much of its heritage was continued in the new state. With the dissolution, a new optimism rose among Western countries for Russia to be a democratic country built on the same values as themselves. The optimism was so dominating in the early 2000s that some even started to discuss whether Russia could be a member of NATO (Selliaas, 2003).

However, this is only one side of history. Russia was still heavily influenced by its heritage from the Soviet period and the dissolution. The 90s in Russia were rather chaotic, the transition from communism to capitalism was characterized by rapidly increasing inflation and a non-organized selloff of publicly owned resources and firms to private ownership (Borchgrevink, 2022, p. 77). Out of this chaos, Vladimir Putin, the current leader of Russia raised and came to power. His first presidential period started in 2000 and he has ever since functioned as the leader of Russia (Borchgrevink, 2022).

Putin's Russia is characterized by being autocratic and highly corrupted (Transparency International, 2021). Borchgrevink (2022) describes reign period where the society has developed into a more totalitarian direction, a development that especially has increased further after 2012, the third time he became president. Democracy, human rights, the rule of law and freedom of speech has under Putin's regime become more increasingly restricted. This, at the same time as Putin's personal power has increased. The vertical of power is a term that has been used to describe Putin's range of control. The term refers to the concept that the state, i.e., Putin and his inner circle in the Kremlin, has something to say on every matter of the country. Without Putin and his ruling elite of oligarchs' support, one is very limited in terms of doing anything (Borchgrevink, 2022, p. 211).

Nevertheless, Russia ranks 52nd out of 189 countries in the HDI index (FN-sambandet, 2021). Even though this is comparably low to the Scandinavian countries' ranking, it still places them among the countries with a *very high human development*. However, wealth and income inequality remain high, where the richest one percent earned one fifth of the national income and owned almost half of the total wealth (Pichon & Russell, 2022).

2.3 International relations

The Scandinavian countries share many of the same characteristics, nonetheless some differences exist too. These are shown clearly when it comes to foreign policy, where they all have different approaches, especially regarding international organizations. While both

Denmark and Norway have been members of NATO since the foundation of the alliance, Sweden is not a member (NATO, 2023). This has been explained by their vision of Sweden being a neutral country, which goes back all the way to 1814 (Salvesen, et al., 2023). However, this has changed after the Russian invasion of Ukraine. Due to the new security situation, in May 2022, Sweden decided to apply for membership in NATO, and still as of May 2023 has status as invitee country (Government Offices of Sweden, 2023).

On the other hand, both Denmark and Sweden are members of the EU, while Norway is not (European Union, 2023). Though, Norway is a member of The European Economic Area Agreement (EEA) meaning they, for instance, are a part of the same internal market governed by the same rules (Regjeringen, 2023).

The aspect that Norway has a common border with Russia is also contributing to their different approach to foreign policy. Because of the border, Norway has been forced to cooperate with Russia on another level than its fellow Scandinavians. One example is the joint management of fish stocks in the Barents Sea to secure sustainability, where both countries have benefitted from the cooperation (Norwegian Ministry of Climate and Environment, 2020). Another example is that both Norway and Russia have interests in the Arctics regarding military concerns since they are sharing a border (Norwegian Ministries, 2021, p. 19). Nonetheless, also Denmark and Sweden have interests in the Arctic region. Among other things, this is expressed through their membership in the Arctic Council, an intergovernmental forum for issues regarding the Arctic region (The Arctic Council, n.d.).

Regarding Russia's approach to international relations, it clearly differs from the Scandinavians'. While Western countries have gathered around the EU and NATO, Russia's relations have a stronger orientation to the East and the former Soviet republics. They still have an influence over many of them, to different degrees in the respective former Soviet republics. This influence has, among other things, resulted in the foundation of the Eurasian Economic Union (EAEU) in 2014, which consists of Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan. It is built on the same model as the EU, with free movement of goods, services, capital, and labor, however, the level of integration and functioning is not as well developed as of the EU (Dragneva et al., 2022). From the description of Russia's international trade, we saw that China has become an increasingly important trading partner for Russia since 2012. After the invasion, Russia's relation to China has strengthen even more. In May 2023,

they for instance signed an agreement which object was to “deepen investment cooperation in trade services” (Hayley, 2023).

From earlier descriptions of trade and economy, we understand that all three Scandinavian countries are small, open economies. They have a narrow resource base, small internal markets and given their position and size in the global market, their opportunities to influence international regulations and markets are very limited (Norman & Orvedal, 2012, pp. 8-9). Small, open economies also must take the prices and rules of the international markets for granted. Russia on the other hand, can be described as the opposite. Their size and volume of natural resources both gives them market power and independence from external markets. This is reflected in trade only accounting for just above 50 percent of the GDP, clearly the lowest among our countries of investigation. These factors are relevant in our further analysis since they give the terms on how to act in the international trade market. We will therefore in the next section provide a short description of what has been the prevailing view in the landscape of international trade and cooperation.

2.4 Trade and conflict

Since the Scandinavian countries are dependent on the international terms and conditions of global trade, it is interesting to investigate further what this entails. The EU itself is built upon the idea that countries trading with each other become interdependent and by that will avoid conflict (European Commission, Directorate-General for Communication, 2023). An extension of this is the idea that trade with foreign countries will not only lead to less conflict, but it will also lead to social and political change in the countries in question. This view has been championed especially of Germany, and the famous saying “Wandel durch Handel” which goes back all the way to 1963 (Bahr, 1963). Ever since, this has been a leading principle in German foreign policy. This implies that one would want to trade with countries with an approach to domestic policy that differs from your own, with an ambition to shape them towards your own ideal (Lau, 2021). Germany has not been alone with this approach to trade, in general also the rest of the Western world has pursued this, in line with the neoliberalist trade policy that has been dominating these countries the last decades (Harvey, 2005, pp. 1-2). When the EU introduced the first sanctions on Russia in 2014, it can be said to have been a breach with this approach to trade. Sanctions work in the opposite direction of cooperation, and the distance between countries increases.

2.4.1 Avoidance of sanctions

Even though economically cointegrated countries are believed to have less risk of entering an armed conflict, there are also researchers that suggest the opposite. Being aware that one is operating in an environment where sanctions are present as a potential consequence of certain behavior, one would naturally be interested in limiting the potential effect such economic measures would have. Galtung (1967) suggests a variety of ways to build such a resilience. By having a broad diversification of domestic economy and a high degree of self-sufficiency, one is less dependent on trade to cover own demands. Furthermore, having a broad range of countries one is trading with reduces the risk if a conflict would arise. This makes sanctions less effective, and thereby also less attractive as means for the imposing state. Also, putting oneself in a position where your threat of countersanctions is intimidating and powerful may be effective to avoid being sanctioned.

Those above are measures to avoid sanctions in the first place, however, one is also interested in limiting the effect of sanctions if targeted. This could be done through trading with third parties. A country's exports can be divided into exports of domestic goods and exports of foreign goods. The second one is usually referred to as re-exports. These goods are in the same state as they were when imported, meaning that no value has been added within the country (UN Statistics, 2022). If a country imposes an embargo on certain goods on another country, it is often seen that the export of the good increases in neighboring countries that are not affected by the sanctions, meaning that the embargoed goods is imported through a third country. Exemplified; after the Russian import ban on EU food products, Yeliseyeu (2017) assessed the value of products embargoed that had found their way to Russia through Belarus between 2014 and 2017 to USD 2.7 billion. One of the methods enabling this was changing the goods' country of origin.

2.5 Development of the conflict between Ukraine and Russia

This part of the paper will give a background on the conflict between Russia and Ukraine, starting from 2013, when Ukraine was in a position where they had to choose between strengthen their connections with either Russia or the EU. The section is based on the Great Norwegian Encyclopedia's description of the conflict between Russia and Ukraine (Holm-Hansen & Paulsen, 2023). In 2013, Ukraine was close to entering an association agreement

with the EU with the intention to prepare the country towards membership of the Union in long terms. For many historical reasons, which we will not go in depth of here, Russia was not supporting this, a view that was expressed clearly. From a Russian viewpoint, this meant Ukraine would distance themselves from Russia. This contradicts Russia's perception of all former Soviet Republics being in their area of interest, especially Ukraine because of its position, size, and natural resources. (Holm-Hansen & Paulsen, 2023).

Russia's disapproval resulted in Viktor Yanukovich, president of Ukraine at that time, on short notice, withdraw from the EU-negotiations, and instead entered an agreement with Russia. This led to enormous protests from the European-oriented part of the population and ended up with Yanukovich having to flee to Russia in February 2014. (Holm-Hansen & Paulsen, 2023).

With basis in an already established legal military base on Crimea, Russia took control of the peninsula in the beginning of March 2014. March 16, 2014, a referendum was held on Crimea, with the result that a huge majority voted for being incorporated into Russia. Internationally this referendum is not recognized, and by the majority of the world it is considered as an illegal annexation of Crimea. In April 2014, separatists declared the establishment of Donetsk People's Republic, and this event is viewed as the start of the War in Donbas. The war was between separatists supported with weapons from Russia and the Ukrainian government's forces. There have been several attempts for diplomatic solutions, resulting in the Minsk agreements in 2014 and 2015 (Holm-Hansen & Paulsen, 2023). The agreements included most importantly a ceasefire and withdrawal of heavy weapons and were monitored and verified by the Organization for Security and Cooperation in Europe (OSCE). Though, the success rate was limited. At the time, Moscow denied all interference in the war, and thereby also them having any legal obligations (Reuters, 2022a). The war continued in various degrees of intensity until the escalation in the spring of 2021 (Holm-Hansen & Paulsen, 2023).

In the spring of 2021 Russia started to move unusually large amounts of troops closer towards the Ukrainian border. However, weeks later, the Russian Defense Minister Sergei Shoigu announces a redeploy of the forces, averting concerns of renewed fighting and crisis. The tension increased once again in November 2021, when nearly 100 000 Russian soldiers were relocated near the border to Ukraine (Walker, 2023). Along with this came demands from Russia that Ukraine gave legal promises that they would never apply for membership in NATO, and that the US and NATO limited their influence in former Soviet Republics. In the

belief of all sovereign countries being in full control of their own foreign policy, these demands were not met. February 21, 2022, Russia recognized Donetsk and Luhansk as independent states, and three days later they started the invasion of Ukraine (Holm-Hansen & Paulsen, 2023).

February 24, 2022, Russia launched a military offensive on Ukraine, resulting in escalated violence in eight oblasts (regions), including the capital city Kyiv. This was in addition to the already war-torn regions Donetsk and Luhansk (UN News, 2023). In September 2022 Russia supported the referenda on voting for the occupied areas of Donetsk, Luhansk, Zaporizhzhia and Kherson, to join the Russian Federation (Reuters, 2022d). These referenda are strongly condemned by the EU (Council of the European Union, 2023c). The war is still ongoing, with no clear solution in the near future (Witte, 2023). The situation has caused a steep rise in humanitarian needs and civilians fleeing, both internally and outside Ukraine's borders (UN News, 2023).

2.6 Imposed sanctions

Since 2014, the EU has gradually imposed several restrictive measures against Russian aggression in Ukraine. From 2022, The Council of the European Union (2023b) states that these restrictive measures include economic, diplomatic, and individual sanctions intended to weaken Russia's economic base and their ability to act in warfare. EU sanctions have mainly been implemented following the events of the 2014 annexation of Crimea, the 2022 invasion of Ukraine and the annexation of regions Donetsk, Luhansk, Zaporizhzhia and Kherson in September later that year. The measures from 2022 have gradually increased in severity through different sanction packages. In May 2023 ten sanction packages have been implemented, while seven of them are relevant for the time period of the scope of this paper. The measures from 2014 have been extended gradually until at least May 2023 (Council of the European Union, 2023b).

Russia has also implemented countersanctions against countries they have been sanctioned by. Notably is the import embargo from 2014 on fruit, vegetables, meat, fish and milk products from Norway, the US, the EU, Australia, and Canada (NTB et al., 2014). Russia has also implemented countersanctions following the EU restrictive measures from 2022, mainly direct responses to the sanctions (Reuters, 2022b). The measures mostly adhere to a list of "unfriendly states", which includes all EU member states and Norway (Reuters, 2022c).

Sweden and Denmark are members of the EU and naturally comply with restrictive measures set by the EU (Strategic Communications division in the European Union External Action, 2021). Norway, although not being a member of the EU, has implemented most of the EU sanctions on Russian aggression (Norwegian Ministry of Foreign Affairs, 2023). Exceptions to the implementation of EU sanctions in Norway involve for instance adaptations to the port ban for Russian ships, allowing all fishing boats and often research vessels and search and rescue vessels, access to selected Norwegian ports. This is done to maintain cooperation on the management of the fish stock in the Barents Sea. The port ban only applies to the Norwegian mainland and not Svalbard (Norwegian Ministry of Trade, Industry and Fisheries, 2022).

Even though all EU member states must comply with the EU restrictive measures, the EU does not itself enforce the sanctions. The member states are internally responsible for implementing and enforcing it, in addition to evaluate whether there has been a violation of the sanctions and how to address it (Strategic Communications division in the European Union External Action, 2021). How strict the different countries are regarding the enforcement and control of the sanctions can therefore differ. For example, in Denmark the maximum personal fine for violation of the sanctions is unlimited, while Sweden has a set maximum personal fine of about 150 000 Swedish krona (SEK) (Eurojust, 2021). Norway also has lower maximum prison sentence for sanction violation, at three years, opposed to four years in Sweden and Denmark (Sanksjonsloven, 2021) (Eurojust, 2021).

A more thorough timeline (until September 2022) of important events related to the imposed sanctions and what they contain, is attached in appendix A1.

3. Literature Review

This chapter of the paper includes a discussion on relevant literature on research related to international trade and sanctions. The literature provides a good understanding of research methods that are being used on international trade, and what we already know of the effects of sanctions on international trade.

3.1 Impact of sanctions on International trade

Most relevant research on how sanctions and political disputes affect international trade uses a gravity model, but some also use a Computable General Equilibrium (CGE) modelling to understand the relationship. The standard gravity model uses distance and an economic dimension to estimate bilateral trade flow, while CGE models are “large numerical models which combine economic theory with real economic data in order to derive computationally the impacts of policies or shock in the economy” (The Scottish Government: The Office of the Chief Economic Adviser, 2016). Relevant literature on economic sanctions unfortunately often find that sanctions might not be very precise instruments in generating economic losses on target countries, as one may redirect exports to other countries or bypass sanctions by trading through a third country (Drezner, 2000; Mack & Khan, 2000).

The article *The Impact of Russia's Import Embargo on the EU Countries' Exports* by Skvarciany et al. (2020) investigates the relationship between sanctions Russia imposed on EU countries in 2014 and the exports to Russia from these countries. They cluster the European countries following average exports to Russia between 1998-2018, before they conduct a gravity model analysis. They do not investigate Norway, as it is not a member of the EU. They find positive correlation between export and GDP (European and Russian), population and whether one share a border or not, and a negative correlation between export and distance. Afterwards, they use the gravity equation to predict the exports from EU countries to Russia in the years from 2014 to 2018 and find that predicted exports were higher than actual exports. They argue that the difference can be described as the export loss due to the Russian import embargo, since the countries did not export as much as the gravity model predicts. However, they acknowledge that their models are not completely accurate. For instance, one of the models only explains 56 percent of the variation of the dependent variable, and other variables may therefore also influence the variation in export volumes. Additionally,

they find that countries that traded less with Russia before the import embargo, experienced higher losses than other countries. They suggest that this might be a result of countries less dependent on Russian trade, not seeking different solutions to recover, as it does not affect their economy to a large degree.

Another research paper on the topic, *Collateral Damage: The impact of the Russia sanctions on sanctioning countries' exports* (Crozet & Hinz, 2016), also uses the gravity model to investigate the impact of the Russian sanctions in 2014. They do, however, use dummy variables to construct distinct time periods related to when sanctions were implemented. They find that embargoed goods had a sharp decline in exports, but also non-embargoed goods were affected by the sanctions. Additionally, they calculate the global “lost trade” from the sanctions to USD 3.2 million per month, on which 83.1 percent results from non-embargoed products.

Likewise, research from Caruso (2003) that investigates the bilateral trade between the US and trading partner, uses different dummy variables for the magnitude of sanctions. They use panel data with fixed effects to estimate the gravity model and find that extensive and multilateral sanctions have a disruptive effect on bilateral trade, while moderate and limited sanctions actually show a positive correlation with trade.

Kutlina-Dimitrova (2017) in the paper *The economic impact of the Russian import ban: a CGE analysis* uses CGE modelling to assess the economic impact of the Russian import embargo on export flows, production, and welfare in 2014 in the EU, the US, Canada, Australia, and Norway. She finds that Norway was severely impacted, with a decline of 0.14 percent due to losses in the fishing sector. This may not seem like a noticeable decrease but compared with the EU's exports that only decreased by 0.02 percent, the change is considerable. The only countries whose productions decreased, was Norway's and Russia's, with a decline in production at 0.03 percent. The Norwegian fishing sector's production contracted with almost 6 percent. The most affected country in terms of welfare was Norway, with a reduction of \$190 million.

3.2 Insights from relevant literature

We find that much relevant literature already have investigated the impact of the 2014 import embargo from Russia on Western countries. We do, however, find little evidence of research

also incorporating the sanctions from 2022 as this is still very recent. Additionally, little research can be found on just the Scandinavian countries and Russia. Therefore, we believe there is a gap in the research on this topic, that we hope to contribute to reduce through this paper.

A lot of the relevant literature on the topic of the economic effect of sanctions on international trade uses the gravity model and CGE models to estimate the effect. The use of gravity model in this type of analysis is the most common, as it is considered the cornerstone of studies on international trade (van Bergeijk & Brakman, 2010). The gravity model is therefore our choice of model in the following analysis.

4. Methodology

Relevant research indicates that the gravity model is suitable for investigating sanctions' effects on trade. This chapter will therefore first include a discussion on the gravity model that is used in this paper, before we provide an overview on the logarithmic functional form. Moreover, we will present some knowledge on panel data estimation since we use cross sectional data over time. Lastly, we will include a discussion on causality and correlation in the research.

4.1 The Gravity Model of International Trade

Relevant literature on the topic of international trade and sanctions show that the gravity model is well fitted to answer our research question. This paper will therefore use an augmented gravity model approach to investigate the relationship between trade values and sanctions related to the conflict between Ukraine and Russia.

The gravity model was first formally used by Tinbergen (1962) and has for a long time been used as an important tool to describe bilateral trade between countries. It is said to be inspired by Newton's law of gravitation from 1729 (Kabir et al., 2017), where the masses of objects and the distance between them affect the gravitational pull. The model was first presented as an intuitive explanation on how to explain trade flows between countries. However, recently, theory has become an increasingly important part of the model (Shepard et al., 2019).

The intuitive gravity model predicts that the bilateral trade flow between two countries depends on the "economic" masses of the countries and the physical distance between them. The model can be expressed through equation 4.1:

$$X_{ij} = a \frac{m_i * m_j}{d_{ij}} \quad (4.1)$$

where X_{ij} is the bilateral trade flow between country i and country j , m_i is the economic mass of country i , m_j is the economic mass of country j , d_{ij} is the distance between the countries' capitals or economic centers and a is a constant term. Economic mass is often considered to be GDP when analyzing trade, but may also be expressed through population size, purchasing power or income level (Keum, 2008). Distance is used as a proxy for the "transaction costs"

of moving goods from country i to country j . In other words, a longer distance between countries means higher transaction costs, and therefore reduced trade (Shepard et.al., 2019).

One can transform equation 4.1 into its linear form by taking the logarithms, giving the following equation:

$$\log(X_{ij}) = a + \beta_1 \log(GDP_i) + \beta_2 \log(GDP_j) + \beta_3 \log(Distance) + u_{ij} \quad (4.2)$$

where $a, \beta_1, \beta_2, \beta_3$ are coefficients in the model, and u_{ij} is the error term. We have substituted the economic mass term m , with GDP. One expects a positive correlation between the GDP terms and trade flow, and a negative correlation between distance and trade flow. In this simple gravity equation, the error term would incorporate trade shocks and other unobserved effects. (Qian et al., 2019).

Shepard et.al. (2019) states that the traditional gravity model is often augmented by adding various dummy variables to the basic model. Such variables may for example include whether the countries share a land border, language, or colonial history. These dummy variables may sometimes affect trade flows, by either decreasing or increasing the costs of moving goods. These variables are therefore often incorporated, with the distance variable, into the transaction costs of the gravity model:

$$\log \tau_{ij} = \beta_1 \log(Distance) + \beta_2 contig + \beta_3 comlang + \beta_4 colony \quad (4.3)$$

where τ_{ij} is the transaction costs between country i and country j , $contig$ is a dummy variable for whether the countries share a land border, $comlang$ is a dummy variable for whether the countries share a common language, and $colony$ is a dummy variable for whether the countries share colonial history. The dummy variables equal to 1 if the countries happen to share these aspects, and 0 if not (Shepard et al., 2019).

Papers investigating the impact sanctions and conflicts have on trade typically also add dummy variables for sanctions and conflict. According to Caruso (2003), one expects a negative correlation between trade and sanctions where the dummy variables equal to 1 if there are sanctions present between the countries in the timespan investigated, and 0 if not.

4.1.1 Limitations to the model

There exist several limitations and critics of the gravity model, although it has long been considered the workhorse of studies on international trade. van Bergeijk and Brakman (2010) argue that since the model was first intuitively explained, rather than derived from theoretical micro-economic foundations, it originally had a somewhat mixed reputation. It has been adequately useful for empirical research, as it for instance successfully managed to predict trade patterns in the 1990s, but it has not been adequate from a theoretical viewpoint. However, recently, the model has become more popular due to theoretical contributions that has better established a relationship between bilateral trade and trade theory (van Bergeijk & Brakman, 2010).

Another significant limitation to the model is the observation of zero trade flows. Since the gravity model uses logarithmic values, one cannot include trade flows of zero. The standard procedure has been to add a small constant to these observations, or to omit them entirely from the sample. However, this will only lead to unbiased selection if the observations of zero are randomly distributed across the countries of investigation, which they often are not. There have been proposed different solutions to the problem of zero trade flows, but the issue is often not taken as seriously as it should (van Bergeijk & Brakman, 2010). This paper will not discuss solutions to the problem any further as the problem does not apply to data in estimations here.

Furthermore, according to van Bergeijk & Brakman (2010), the estimation of the transaction costs for bilateral trade also contributes to some concerns in gravity models. Distance between countries has to a large degree been the standard proxy for transactions costs, as one expects a longer distance to increase the transaction costs between countries. Additional dummy variables indicating borders, colonial ties, language, trading agreements and cultural differences also contribute to the estimation of transaction costs. Although this has for a long time been the standard procedure for measuring transaction costs, some studies have begun incorporating data on shipping costs. They show that distance might not be as sufficient as a proxy after all (van Bergeijk & Brakman, 2010).

4.2 Logarithmic functional form

The gravity model uses a logarithmic form, and it is therefore relevant to describe how this might affect the data and the interpretation of it. According to Wooldridge (2018, p. 187),

strictly positive variables, such as in our dataset, often tend to have heteroskedastic or skewed distributions. The logarithmic functional form can often mitigate and reduce these problems. This results in a standard norm of using logs when a variable is a positive monetary amount. (Wooldridge, 2018, p. 187).

It is important to notice that the interpretation of the beta coefficients in the estimated regression is different when using logs. When both the dependent variable and the explanatory variable are logarithmic (log-log model), one interprets the coefficient as the elasticity, by assuming that a one percentage change in the explanatory variable, equals a β percentage change in the dependent variable. Likewise, for a model where only the dependent variable is logged, one normally assumes that an increase of one unit in the explanatory variable, equals a β percentage increase in the dependent variable. However, such an approximation method becomes increasingly inaccurate as the change in $\log(y)$ increases (Wooldridge, 2018, pp. 186-187). A more precise formula for interpretation when using log-linear-models is:

$$\% \Delta \hat{y} = 100 * (e^{\hat{\beta}} - 1) \quad (4.4)$$

The procedure in equation 4.5 is also used when the $\hat{\beta}$ is the coefficient on a dummy variable and signifies the percentage difference when the dummy variable equals 1 versus when it equals 0 (Wooldridge, 2018, p. 227). The formula for interpretation when using a log-log-model is:

$$\% \Delta \hat{y} = \hat{\beta} \% \Delta x \quad (4.5)$$

4.3 Panel Data

Using a panel data approach is common when one is estimating a gravity model with cross sectional data over time. We are looking at trade data between countries from the first quarter of 2012 till the third quarter of 2022, meaning we have cross sectional data over time. Thus, panel data methods are used with our gravity model.

Wooldridge writes in his book *Introductory Econometrics* (2018) that a panel dataset is balanced when all cross-sectional entities are observed across all time periods in the data set. In other words, all data related to the cross-sectional entities start at the same time and end at

the same time. A panel dataset is unbalanced if not all cross-sectional entities are observed for all time periods (Wooldridge, 2018).

For a panel data regression to be unbiased and efficient certain assumptions must be satisfied. If the estimation is unbiased, one can assume a causal interpretation between the explanatory variables and the dependent variable. The six assumptions involve linearity, random sample, no perfect collinearity, exogeneity, no autocorrelation, and homoscedasticity and are thoroughly described in Table 2 on pages 32-33.

Wooldridge (2018) argues that a challenge when using panel data is that the endogeneity assumption is violated because it often suffers from omitted variable bias. Omitted variable bias means that unobserved factors that affect the dependent variable also correlates with another explanatory variable. This leads to a bias in the estimation of the beta coefficients in the regression model. In panel data, one can have two different types of unobserved effects, those that are constant over time but vary with cross-sectional individuals, and those that vary over time but not over cross-sectional individuals. The general unobserved effects model for two-periods then becomes:

$$y_{it} = \beta_0 + \delta_0 d2_t + \beta_1 x_{it} + \alpha_i + u_{it} \quad (4.6)$$

where α_i is the unobserved time-constant effect, u_{it} is the idiosyncratic error and $d2_t$ is a time dummy for whether $t = 1$ or $t = 2$ (Wooldridge, 2018, pp. 84-85; 447-448). α_i can for example be considered country specific effects that normally do not change over short time periods, like language, geography and comparative advantages in trade.

One of the main advantages of using panel data methods is that one may allow the unobserved effect to correlate with the explanatory variables. Two popular panel data estimations are fixed effects transformation and random effects model. The fixed effects transformation, also called within transformation, removes the unobserved effects, α_i prior the estimation, removing the issue with omitted variable bias from α_i . However, this also leads to all time-constant explanatory variables to be omitted from the regression, including the intercept. For example, the distance explanatory variable in the gravity model will be omitted from the regression, when using fixed effects transformation on panel data. After omitting the unobserved effects, α_i , the within transformed regression is unbiased if the idiosyncratic error term, u_{it} , is uncorrelated with the other explanatory variables for all the time periods that are being estimated. (Wooldridge, 2018, p. 463)

The random effects model differs from the fixed effects model by that it includes an intercept since one assumes that unobserved effect, α_i , has an expected mean of zero. This also means that one assumes that α_i is uncorrelated with all explanatory variables. The random effects estimator leaves a small portion of the unobserved effect still in the error term, while the fixed effects estimator removes all unobserved effects. (Wooldridge, 2018, pp. 469-471)

Deciding between the fixed effects model or the random effects model involves several considerations. For instance, the fixed effects model cannot estimate explanatory variables that are time-consistent, to do this one need to use the random effects model. However, if one assumes that the unobserved effect and the explanatory variables correlate with each other, the fixed effects model is necessary to not obtain biased estimators. A common method of deciding between the two estimation methods is the Hausman test. The test was made by Hausman in 1978, with a null hypothesis that both estimators are consistent. If the null hypothesis is rejected, the assumptions for the random effects model are violated, and one should use a fixed effects model. (Wooldridge, 2018, pp. 473-474).

The fixed effects estimator is unbiased when the first four assumptions, linearity, random sample, no perfect collinearity and exogeneity hold. This means that the expected values of the parameters are equal to the true value. When all six assumptions for fixed effects estimator hold, the estimator is the best linear unbiased estimator (BLUE). When all assumptions are satisfied for the random effects estimator, the estimator is consistent, and the t-statistics and usual random effects standard errors are valid. (Wooldridge, 2018, pp. 492-493). The subsequent table provides a more thorough description of the assumptions.

Assumptions for Fixed Effects	Assumptions for Random Effects
<p>Assumption 1: $y_{it} = \beta_1 x_{it1} + \dots + \beta_k x_{itk} + \alpha_i + u_{it} \quad t = 1, \dots, T$</p> <p>where α_i is the unobserved effect and β are the parameters that one estimate.</p>	<p>Assumption 1: $y_{it} = \beta_1 x_{it1} + \dots + \beta_k x_{itk} + \alpha_i + u_{it} \quad t = 1, \dots, T$</p> <p>where α_i is the unobserved effect and β are the parameters that one estimate.</p>
<p>Assumption 2: Random sample from the cross section.</p>	<p>Assumption 2: Random sample from the cross section.</p>

<p>Assumption 3: The explanatory variables vary over time, and there is no perfect linear relationship between the explanatory variables.</p>	<p>Assumption 3: No perfect linear relationship between the explanatory variables.</p>
<p>Assumption 4: For all time periods, the expected value of u_{it}, given the explanatory variables and the unobserved effect is zero:</p> $E(u_{it} X_i, a_i) = 0$	<p>Assumption 4: For all time periods, the expected value of u_{it}, given the explanatory variables and the unobserved effect is zero:</p> $E(u_{it} X_i, a_i) = 0$ <p>For all time periods, the expected value of a_i, given the explanatory variables is zero:</p> $E(u_{it} X_i) = 0$
<p>Assumption 5: The variance for u_{it}, given the explanatory variables and unobserved effect, is constant over time:</p> $Var(u_{it} X_i, a_i) = Var(u_{it}) = \sigma_u^2$	<p>Assumption 5: The variance for u_{it}, given the explanatory variables and unobserved effect, is constant over time:</p> $Var(u_{it} X_i, a_i) = Var(u_{it}) = \sigma_u^2$ <p>The variance of a_i, given the explanatory variables is constant:</p> $Var(a_i X_i) = \sigma_a^2$
<p>Assumption 6: For all time periods, the idiosyncratic error, u_{it}, is uncorrelated with explanatory variables and the unobserved effect, a_i:</p> $COV(u_{it} X_i, a_i)$	<p>Assumption 6: For all time periods, the idiosyncratic error, u_{it}, is uncorrelated with explanatory variables and the unobserved effect, a_i:</p> $COV(u_{it} X_i, a_i)$

Table 2: Assumptions for fixed and random effects (Wooldridge, 2018, pp. 491-493)

4.4 Correlation versus causation

An important aspect of observational data is to consider whether the results can be causally interpreted, or if they are correlational. Two or more variables can be considered related when a change in one variable typically is associated with a change in some other variable. The relationship can be positive; an increase in one variable is associated with an increase in another variable, or negative; an increase in one variable is associated with a decrease in another variable. When variables are related, one may say that the relationship can be interpreted as a correlation (Australian Bureau of Statistics, n.d. a). The beta coefficient in a regression analysis signifies the magnitude and direction of the correlation between the dependent and the independent variable.

Causation, on the other hand, means that a change in one variable causes a change in another variable, i.e., there is a causal relationship between them (Australian Bureau of Statistics, n.d. a). It is much more difficult to determine causality than correlation since four of the six assumptions for panel data need to be satisfied. A key aspect is that correlation does not necessarily imply causality, and it can be misleading or even dangerous to assume a causal interpretation when there only is correlation (Luca, 2021). For example, one can observe that those who cough a lot tend to get lung cancer at a higher rate than others. Does this imply that coughing causes lung cancer? No, the correlation is caused by a third confounding factor, smoking, that has a causal effect on both coughing and lung cancer. This is called a spurious correlation (Hitchcock, 1996). Spurious correlations can also occur when both the dependent and the explanatory variable trend over time.

In terms of this paper's scope on investigating the trade between Scandinavia and Russia in times of sanctions, it is unlikely that one will be able to assume a causal analysis. Not because sanctions do not necessarily have any effect on trade, but since one should assume that there are more factors affecting trade than those accounted for in this analysis, that also correlate with sanctions. For example, it is plausible to assume that production of goods changed in Russia in the time before the invasion of Ukraine in 2022, shifting the production to more military equipment and self-sufficiency, which again affects the trade. Another factor is that Russia reduced its export of natural gas from the fourth quarter of 2021, i.e., in the period before the invasion (IEA, 2022a). The 2022 invasion and the following sanctions did not come as an exogenous shock to Russian government, even though one might be able to argue that it was an exogenous shock to external parties.

There are several methods that enable one to prove causation, for example using experiments. One may conduct experiments and isolate the effect of sanctions of trade. However, this would of natural reasons be impossible for this type of research. Another method is the use of instrumental variables (IV). IV is used to control for confounding factors and measurements errors in the estimation. An IV is a variable that correlates with the endogenous explanatory variable, but not with the idiosyncratic error term. It is a popular technique to mitigate problems with endogeneity, but it can also be very arduous to find a good and appropriate IV (Ullah et al., 2021).

Angrist and Pischke (2008) mention that other tools to control for confounding factors are differences-in-differences (DID) and regression discontinuity (RD). The DID-estimation compares differences in outcomes over time between a treatment group and a comparison group. In the case on the Russian-Ukrainian conflict, the treatment group would be the sanctioning countries, while the comparison group would be countries not taking part in the sanction regime. The assumption of movement along parallel trends for both groups need to be satisfied, for the DID-estimation to be valid. The RD-estimation compares groups that are just below and just above a threshold for treatment, assuming they were similar before the treatment took effect. Common for the two estimation methods is that they assume the control group or the group below the threshold for treatment to not be subjected to the treatment and its effects (Angrist & Pischke, 2008). Russia is the biggest economy since the 1930s to have been set under such extensive sanctions, and the country is a major player in the global energy market. Therefore, we cannot assume that countries not sanctioning Russia, have not been affected by the sanctions. Hence, we are not able to prove causation through DID and RD.

Thus, we will in the following analysis only investigate the correlation between trade and sanctions, hence our research question on how the trade has developed following the sanctions regime. Although one cannot assume a causal interpretation, we believe that this research will still be interesting for the public eye. It is relevant for future policy making decisions to understand how exports, imports and total trade have changed following the sanction regime, to evaluate whether the sanctions have performed in accordance with its objectives.

5. Data Retrieval

In the methodology chapter, we described the gravity model and what types of variables are used in the estimation. In this chapter, we start by describing the variables we have used and from which data sources we have extracted them. Finally, we will explain some of the considerations and the challenges we met in the process of creating our dataset.

5.1 Data Collection

We have chosen to look at the value of imports from, exports to and total trade with Russia for the three Scandinavian countries Norway, Denmark, and Sweden. We have created the dataset by combining data from various sources. The estimation includes both continuous variables and dummy variables.

5.1.1 Continuous Variables

The gravity model can be used with different variables. The economic mass and distance are considered the basis for the model. The augmented gravity model includes additional explanatory variables, that can help better explain the variation in trade. Since we investigate trade, we have used GDP as a proxy for the economic mass, while distance is measured by the distance between the capitals. Two additional continuous explanatory variables that we have controlled for, include consumer price indices for the Scandinavian countries and the exchange rate between the Scandinavian national currencies and the USD.

Firstly, the gravity model requires a measure of economic mass. We have chosen to use GDP, since this is an accessible size and captures the size of the economy in a sufficient way (Sheiner & Dynan, 2018). The data have been retrieved from the different official providers of statistics in the respective countries. For Norwegian data this means Statistics Norway (SSB) (SSB, 2022), for the Swedish we have collected data from Statistics Sweden (SCB) (SCB, 2023a), for the Danish from Statistics Denmark (DST) (DST, 2023a) and for Russia from Federal State Statistics Service (ROSSTAT) (ROSSTAT, 2022). For the Scandinavian countries values are in current prices, since that is what is common in use of the gravity model (Bacchetta, et al., 2012). Russia's GDP is given in constant prices, with 2016 as base year, this because we were not able to find quarterly GDP for Russia until third quarter of 2022 in current prices. For the

Scandinavian countries, the official providers of statistics are all reliable sources, however data from ROSSTAT cannot be trusted the same way, a discussion we will come back to.

Furthermore, the gravity model's setup demands a measurement of "transaction cost", in practice, distance between the two countries of question. It is a common approach in the literature to use distance between capitals, since the capital typically is the economic centre of a country (Caruso, 2003). Hence, we have used the distance between the capitals in Scandinavia, Copenhagen, Stockholm and Oslo, and Moscow, the capital of Russia. We used an online map tool to calculate these values (Distance Calculator, 2023).

Moreover, we have included a control variable on consumer price indices (CPIs) for the Scandinavian countries. CPI are common proxies as measurement on inflation and describes the change in prices for goods and services in private households (SSB, 2023d). We wanted to control for inflation since prices have increased tremendously since the recovery of the Covid-19 pandemic, especially in food and energy prices (Mulder, 2022). The CPIs were retrieved from the World Bank's global database of inflation and represent the headline consumer price index inflation (Ha et al., 2021). Headline inflation includes goods with typically volatile prices, like energy and food prices (Australian Bureau of Statistics, n.d. b).

The second control variable adheres to the exchange rate between the Scandinavian national currencies and the USD. It signifies the national currency per USD. We originally wanted to control for the exchange rate between the Scandinavian currencies and the Russian ruble. This is because depreciation or appreciation of a country's currency makes goods cheaper or more expensive to import from said country. However, it was not possible to extract the exchange rate between the Scandinavian currencies and the Russian ruble, due to the sudden halt in trade in Russian rubles in March 2022 (European Central Bank, 2023). Thus, we decided to control for the exchange rate between the USD and the Scandinavian currencies since the USD is dominant in the world economy. We have extracted the quarterly exchange rates from the Organization for Economic Co-operation and Development (OECD, 2023).

The independent variables in the regressions are imports, exports and total trade between Russia and the Scandinavian countries. We define exports as goods moving from the Scandinavian countries to Russia, imports as goods moving from Russia to the Scandinavian countries and total trade is the value of exports and imports added. We have retrieved the data from the respective official providers of statistics in the countries, SSB (SSB, 2023a), SCB

(SCB, 2023b) and DST (DST, 2023b). The data are monthly observations and in national currency and current prices. For the data to be consistent we have aggregated monthly data to quarterly data.

5.1.2 Dummy variables

The gravity model also opens for the addition of different dummy variables. We have added time dummy variables cohesive with when sanctions and other important events have occurred. By estimating the related coefficients for the dummy variables, we can investigate the relationship between sanctions and the trade between the Scandinavian countries and Russia. Following relevant literature by Crozet and Hinz (2016) on the impact of the Russian sanctions, we construct dummy variables that are period based and coheres with the involvement in the conflict between Russia and Ukraine, and the EU. Appendix A1 shows a timeline of important events and sanctions related to the conflict and has been used when constructing the time periods.

Crozet and Hinz (2016) investigate the Russian sanctions from 2014 and construct three periods in their paper. These are related to when the tension started to increase between Russia and Ukraine in the fall of 2013, the first wave of sanctions starting in March 2014, and the second wave of sanctions in August 2014. We base our first three conflict dummy variables on their argumentation. This was natural as we also wanted to see how trade has changed when there was only change in the conflict, but no new additional sanctions. However, since we also want to investigate sanctions related to the Russian invasion of Ukraine in 2022, we add two additional period dummy variables to our analysis. These periods signify when tension between Russia and Ukraine increased further in March 2021, and when Russia invaded Ukraine in February 2022 followed by several restrictive measures set by the EU.

Since we use quarterly data in our analysis, the time dummy variables adhere to quarters. Period 1 starts in the fourth quarter of 2013 and ends in the first quarter of 2014. Period 2 starts in the second quarter of 2014 and ends in the third quarter of 2014. Period 3 starts with the fourth quarter of 2014 and lasts until the first quarter of 2021. Period 4 starts in the second quarter of 2021 and lasts until the end of the first quarter of 2022. Lastly, Period 5 starts in the second quarter of 2022 and lasts until the third quarter of 2022. The time periods are visualized in Figure 1. Period 0 is not a dummy variable but functions as the baseline period for the other dummy variables. The last period contains all seven sanction packages that EU implemented,

in addition to countersanctions from Russia. We have not found it meaningful to divide these sanctions into more time periods, as they are implemented over a short period.

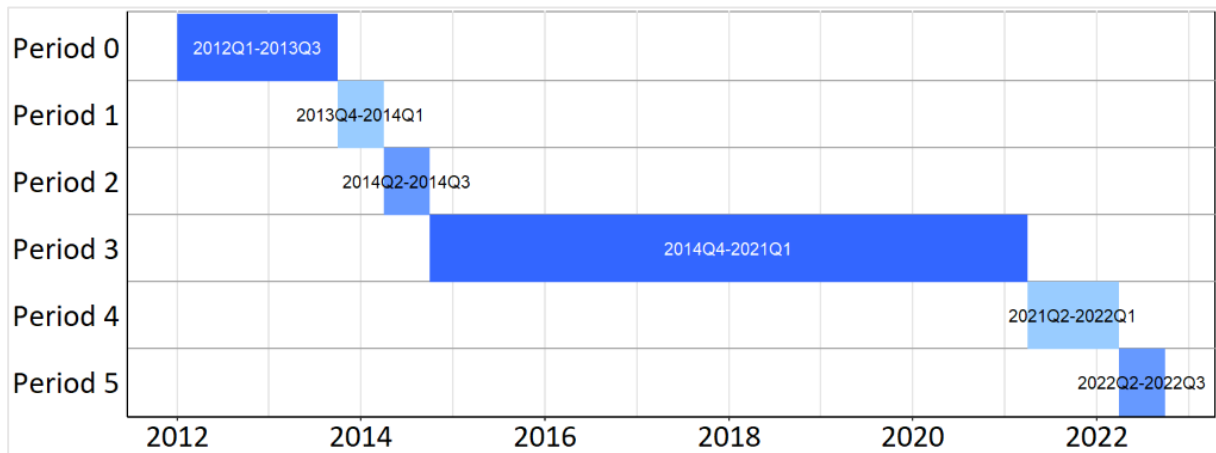


Figure 1: Division of time periods for conflict dummy variables

To control for seasonality, we have added three dummy variables for quarters, with the first quarter of each year as the baseline period. We do this because trade flows tend to be affected by events that recur every year at the same time. Factors affecting the production intensity can be climatic variations or holidays (SSB, 2020).

Furthermore, we chose to add a control dummy variable for covid, since the measures imposed to handle the pandemic heavily affected international trade (Jakobsen et al., 2020). The variable is effective from the second quarter of 2020 till the fourth quarter of 2020.

5.2 Considerations regarding data retrieval

In the process of data retrieval many considerations have been made, and we will here highlight and provide the reasoning behind some of them. First, we had to find which time span we wanted to constitute the foundation of our analysis. Since we are curious on the effects of the sanctions, it is natural to cover the time from the first sanctions were introduced. Since they are still in function, we wanted data as close to present time as possible. The newest data available on GDP for Russia was from third quarter of 2022. For the other variables, newer data was accessible, hence, we had to consider whether we wanted balanced or unbalanced panel data. We concluded that a balanced data set would be most appropriate, since the cause of missing observations would be correlated with the idiosyncratic error term. However, it is not only relevant to study trade from the period the sanctions were imposed. By studying trade

from some period before the first sanctions, we can also get an overview of the normal situation, and by that get a better understanding of what effect they have had. We therefore decided to use data from the start of 2012, which gives about two years of data on “normal” trade.

Furthermore, we have used quarterly data. It was not possible to find monthly data for all variables we wanted to control for in the analysis. Trade data can also be skewed on the monthly basis if a big amount of certain goods have been imported or exported during a specific month (Kommerskollegium, 2022b). Likewise, trade might experience a delay in transport, and it can thus end up being incidental if cargo arrives during this month or the next.

When looking at trade, one could consider both value and quantity. Using quantity can be beneficial since it is not affected by price variation. When using value, inflation is included. Therefore, there could be changes in value that are not caused by real change, but rather by changes in prices. Preferably we would therefore look at both value and quantity, nevertheless, while SSB provides both units, DST and SCB did not. We decided to use value since we depend on comparable numbers in the trade data. Additionally, this is the most common in the literature (Bacchetta, et al., 2012). We have controlled for inflation by adding a control variable for the consumer price index.

What also was a consideration in the process was the question of whether to use data on trade and GDP in national currencies or one common, the USD. If we had used a common currency, we could have compared data between countries in a more direct manner, which might have been advantageous for the descriptive statistics. At the same time, an increase in trade value would not be visible due to depreciation. All four of the currencies for the countries in question, especially the NOK, have fallen over time compared to USD. NOK has reduced its value to half of what it was 2012 the last decade (OECD, 2023). Since we are using the logarithms of trade and GDP values, this choice does not have implications for the regressions. Since we wanted to look at the consequences within the countries, we therefore chose to keep values in national currencies.

5.3 Challenges

The process of retrieving data has come with some challenges, mostly concerning the quality of Russian statistics. Russian government has for a long time had incentives to manipulate

data. This has increased especially after the invasion in February 2022, where the credibility of ROSSTAT and other public sources in Russia has been even more reduced. This problem takes two forms, firstly, the avoidance of publishing statistics (Starostina, 2022). Secondly, that the statistics published are incorrect or unreliable (Ostroukh & Winning, 2017). Sonnenfeld et. al (2022) have done a broad study on this matter. They cross-check official Russian numbers with a broad range of other sources and finds that the Russian ones give a highly unprecise image of the state of the Russian economy, that mainly speaks in favor of the Kremlin.

Therefore, to as large extent as possible, we have tried to avoid data provided from Russian official sources, and rather strived for data from other origins. Nonetheless, for values of the GDP of Russia, we had to use data from ROSSTAT. Other trustworthy data providers like the United Nations (UN) and the World Bank also rely on official statistics from the member countries (The World Bank, 2023). Thus, even when looking for reliable data from these kinds of institutions, they provide the same data as ROSSTAT.

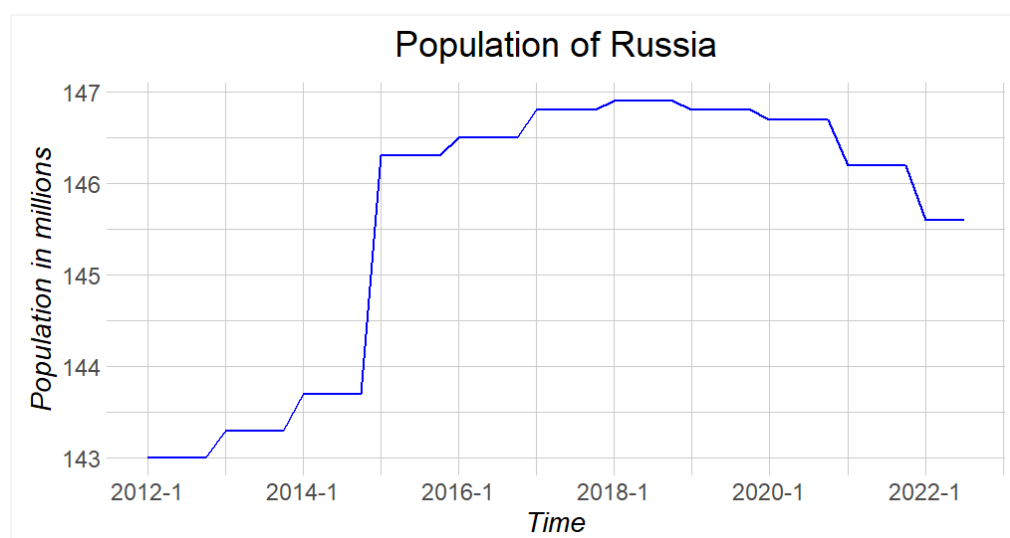


Figure 2 Development of population in Russia (ROSSTAT, 2023)

Error! Reference source not found. illustrates another reason why data from ROSSTAT is disputable. From 2014 official Russian numbers contains data also from the Autonomous Republic of Crimea and the city of Sevastopol, Ukraine, temporarily occupied by the Russian Federation (United Nations, 2023). In the figure, we can observe that the population size of Russia in 2014 rose with about three million, a growth that clearly violates the normal trend and is a direct consequence of the annexation. Additionally, Crimea has contributed to the Russian GDP since 2014 (Ballard, 2019). Studying questions regarding the Russian economic

situation demand us to investigate the numbers that lie behind the economic development. This is even if most of the world does not recognize the annexation officially (United Nations, 2014).

6. Analysis

6.1 Descriptive statistics

To have the best prerequisites for understanding the analysis, we will begin by taking a closer look at our data and explain what it shows and already provides of information. First, we have visualized the development of the GDP for all four countries. Then we have an in-depth description of our data on trade between the respective Scandinavian country and Russia in the period of investigation. The intention of this chapter is to give a clear view of what the data contains and show, and by that increase the insight in the situation that constitutes the foundation of the analysis.

6.1.1 GDP

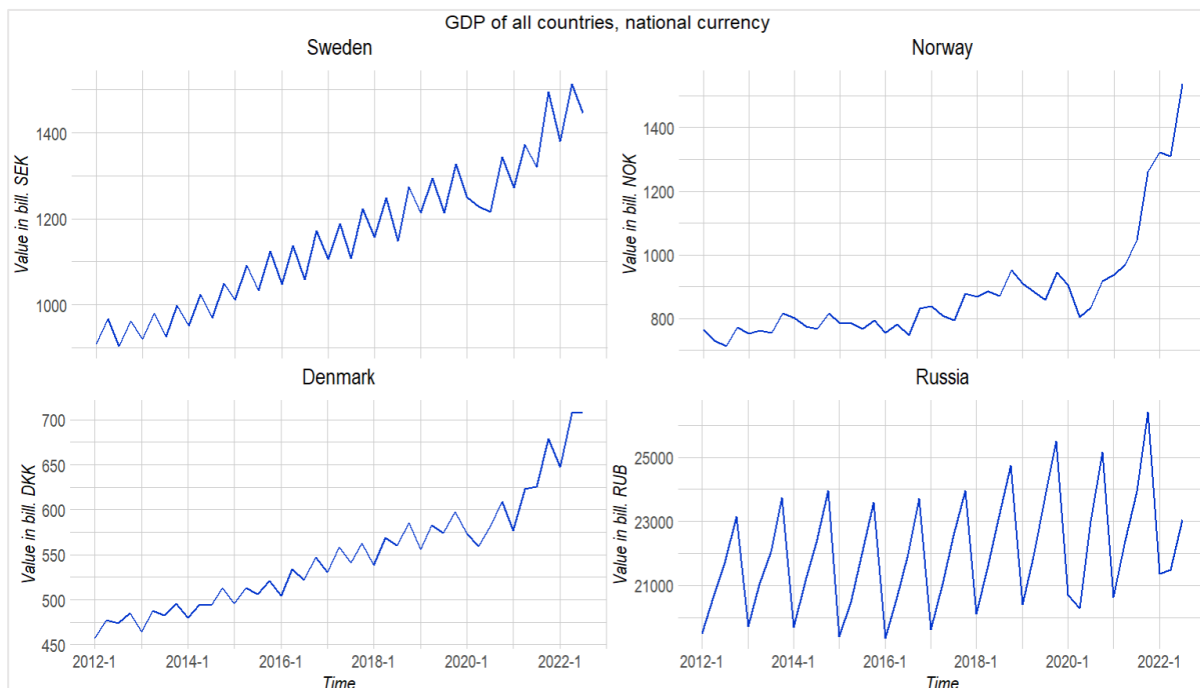


Figure 3: Quarterly GDP of all countries, national currency

First, we will start with the general statistics for the four countries. Figure 3 shows GDP for all countries from the first quarter of 2012 to the third quarter of 2022, with the value of GDP in national currency on the vertical axis and time in quarters by year on the horizontal. We want to point out that that all values are in national currencies, due to reasons explained in section 5, so one should be careful comparing them directly with each other. Since we have used quarterly data, one can observe a clear seasonal trend in the figures. Also, we can see that

there was a drop due to the covid pandemic in 2020 for all of the countries. Norway's dramatic increase in GDP from 2020 and out the period is caused by the rising energy prices in that period since Norway's exports are dominated by that.

Throughout the entire period, all four economies have been growing. From SSB (2023b) we have that the Norwegian GDP has had a yearly growth rate of about 1.7 percent the last decade. Swedish GDP has had an average yearly growth rate of about 1.6 percent from 2012 to 2020, while it in Denmark has been about 1.7 percent in the period (SCB, 2020; The World Bank, 2021d). Russia have had an average yearly growth rate of about 1.5 percent between 2012 and 2021 (The World Bank, 2021e).

6.1.2 Trade

To our study, data on trade is crucial. We will therefore present the data we have used in the analysis on exports, imports and total trade. Exports in our study are goods moving from Scandinavia to Russia, and imports are goods moving from Russia to Scandinavia. Total trade are the two values added together.

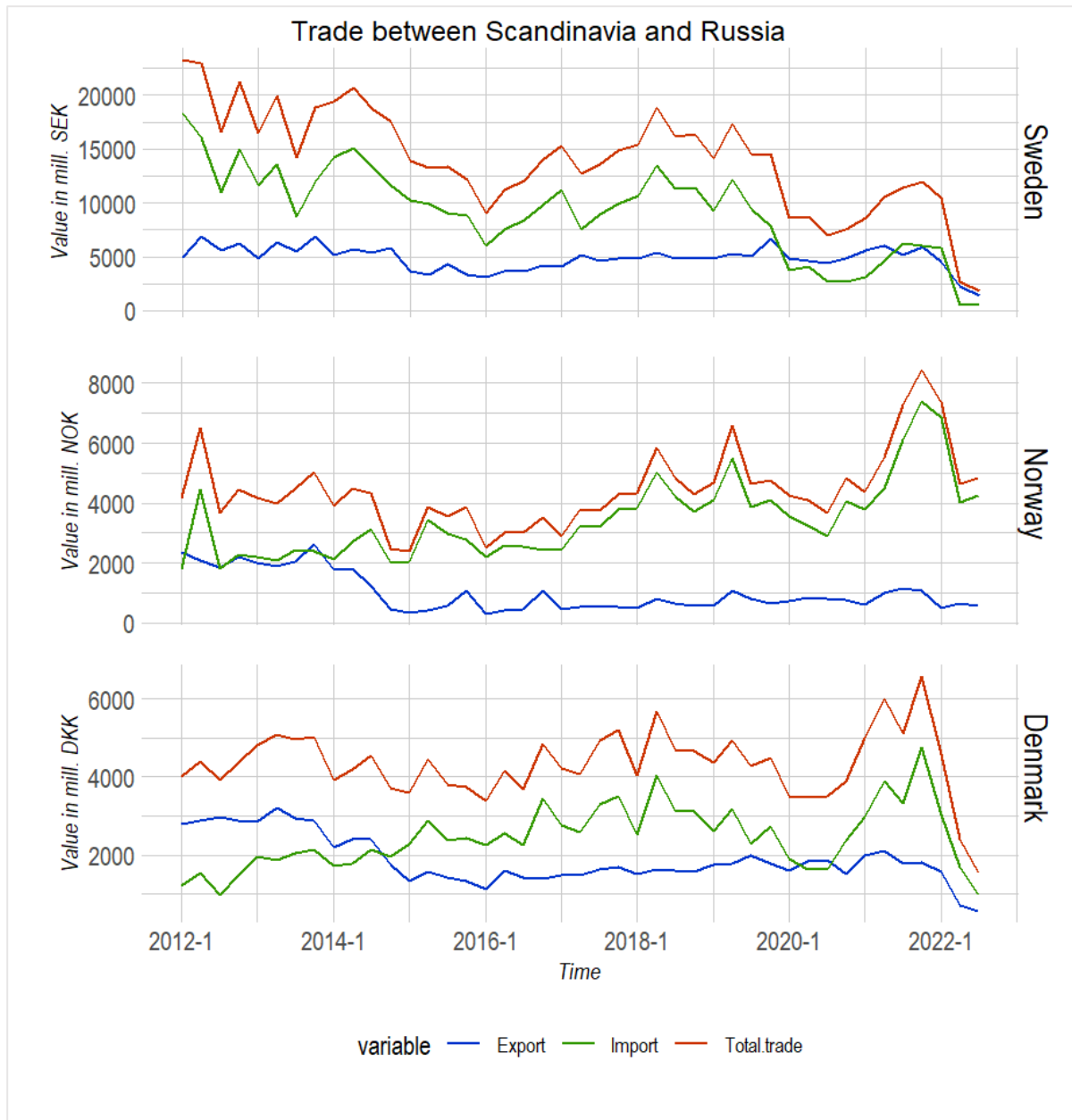


Figure 4: Trade between the Scandinavian countries and Russia

In figure 4, trade between Russia and the Scandinavian countries are presented. The upper diagram visualizes Swedish trade, the middle Norwegian and the bottom gives Denmark's. On the horizontal axis time is given as year in quarters while the vertical axis provides the value in million national currency, SEK for Sweden, NOK for Norway, and DKK for Denmark. The blue lines represent the exports, the greens imports, and total trade are represented by the red ones. Trade develops differently in all of the countries; however, we can see that commonly for all is the fall around 2020 due to the pandemic.

Sweden

The top diagram visualizes Sweden's trade with Russia. We can observe that until 2020 Sweden had a trade deficit with Russia, but afterwards it has been more balanced. In the beginning of the period, the total trade had a value of about 23 billion SEK per quarter, while in 2021, even before the last set of sanctions, it was reduced to 8 billion SEK per quarter. In 2022, it has further decreased to values around 2.5 billion SEK per quarter.

In 2012, more than three quarters of Swedish imports from Russia consisted of petroleum products. Throughout the last decade this share has been falling, and in 2021, it was equal to less than 50 percent of the imports. From 2018 to 2021 Sweden reduced its imports from Russia by about two thirds, this mainly because of reduction in petroleum imports. Instead, Sweden has increased its imports of these products from Norway (OEC, 2021f).

In 2012 Sweden's exports to Russia were primarily products with a high degree of processing, such as different machines and means of transports, in addition to chemical products, reflecting Sweden's status as a country of highly developed industry (OEC, 2021f). The level of exports has been relatively stable throughout the whole period investigated, partly explained by the fact that Sweden is not as heavily affected by the Russian food import ban in 2014, in contrast to Norway and Denmark. There was a clear fall in imports between 2014 and 2016, while exports were less affected by sanctions. This because Sweden was not a large exporter of food, the main target of the Russian import ban in 2014.

Norway

We see that for Norway, before 2014, meaning the first package of sanctions were not yet introduced, exports and imports were about the same size, a value of about two billion NOK per quarter. More than 50 percent of the exports were animal products, primarily fish in the form of salmon (OEC, 2021g). After 2014, we see a clear drop in exports from Norway to Russia, meaning that Norway has had a negative trade balance with Russia ever since. This was mainly caused by a drop in exports of fish products, in line with the Russian embargo on European food products. In 2013, Norway yearly exported salmon for a value of more than four billion NOK to Russia, while the fish export in 2015 was reduced to close to zero (SSB, 2023c).

The value of the fish exports has not been replaced, meaning that the composition of exports has changed. In the years after 2014, the Norwegian exports have for the most consisted of industrial goods, such as ships and machineries, but also raw materials like metals, and animal food (OEC, 2021g). While the composition has varied throughout the decade, the value has been quite stable until 2022, as we can see from figure 4. The decline in Norwegian exports in 2022 have mainly been machines and transport equipment, however the export of smolt¹ for fish farming has increased since March 2022 (Fossanger, 2023). Also exports of fish feed have been stable since the invasion (Brembo & Thrane, 2022).

The import on the other hand, we can see has had a slight increase, also after the sanctions in 2014. There is a small decrease in imports around 2020, before it increases again with a peak in 2021, just before the Russian invasion of Ukraine. Even if there in the first two quarters of 2022 has been a decrease, there is a slight increase in the last period. Throughout the whole period, Norway has mainly imported raw materials, in form of petroleum products, metals and rapeseed oil (OEC, 2021g).

Denmark

The bottom graph in figure 4 shows the value in million DKK of the trade between Denmark and Russia. We can see that in the first three years of the period, Denmark had a positive trade balance with Russia, and that in 2015 the exports fell at the same time as the import increased, so that it became a deficit. Throughout the whole period, the value of total trade has been quite stable with a peak in 2021. In 2012, the value of total trade was about four billion DKK per quarter, and in 2021, before the last package of sanctions against Russia, the quarterly value was about six billion DKK.

Danish imports from Russia contains mainly raw materials like metals, mainly steel and iron products and petroleum products. In 2012, these two categories made up over 85 percent of total imports, about equally distributed. The composition of imports has been quite stable throughout the whole period, with the petroleum products share varying between 42.8 percent (2012) and 77.1 percent (2018). (OEC, 2021h).

¹ “A young salmon or sea trout about two years old that is at the stage of development when it assumes the silvery colour of the adult and is ready to migrate to the sea” (Merriam-Webster, n.d.)

Throughout the whole period, Danish exports have contained for the most machineries, animal products (both meat and seafood) and chemical goods. After 2013, the share of meat and edible offal has decreased while seafood has increased, so that throughout the whole decade, these three categories together has equaled about three quarters of the exports, taking a share of about 25 percent each. (OEC, 2021h).

6.2 Regression analysis

Descriptive statistics show that trade between the Scandinavian countries, Norway, Sweden and Denmark, and Russia has varied remarkably since 2012, and that especially export from Norway and Denmark to Russia experienced a tremendous reduction from 2014. In this section we perform regressions with different logarithmic indicators of trade as dependent variables, using an augmented gravity model with sanctions.

We have different regressions with unique dependent variables, but with the same independent variables. This has been done to understand how the independent variables correlate with the dependent variables differently. Our dependent variables are total trade flow, exports from Scandinavian countries to Russia, and imports from Russia to the Scandinavian countries.

The basic gravity model predicts that trade is dependent on the transaction costs of trading and an economic dimension of the countries. Distance is often used as a proxy for transaction costs when moving goods from one country to another, while GDP is used as a measurement of the economic dimension. According to the model, we would expect a positive correlation between GDP and trade. Likewise, we expect distance to be negatively correlated with trade since a higher distance is expected to increase the transaction costs. Moreover, we anticipate that the conflict dummy variables have a negative correlation with trade. We particularly expect a decrease in trade in period 2, period 3 and period 5, which is when new sanctions were implemented. A change in trade in period 1 and period 4 would imply that increased tension is associated with a change in trade.

We will start with the intuitive gravity model and regress logarithmic variables for GDP and distance on logarithmic trade variables, showing the correlation between trade and the independent variables GDP and distance. However, we assume that other additional variables may better explain the variation in bilateral trade between Scandinavia and Russia after 2012. We are most interested in investigating the relationship between sanctions and happenings in

the Russian-Ukrainian conflict, and trade. Conflict dummy variables will therefore be added to the original gravity model regressions. Lastly, will we include additional control variables that control for Covid, inflation, seasonal variation and the exchange rate between the national Scandinavian currencies and the USD.

We use panel data since we use quarterly trade data with Russia for three different countries, Norway, Sweden, and Denmark. Additionally, it is a balanced panel data set since all observations begin and end in the same periods. When using panel data, one should control for unobserved effects for the different individuals (countries) that do not change over time. The random effects estimator is often much more efficient than the fixed effects estimator, as it also allows the use of explanatory variables that do not change over time, for example distance between capitals. However, the random effects estimator assumes that there is no correlation between the unobserved effects and the explanatory variables, while the fixed effects estimator is robust against the correlation if there is any.

We regress the dependent variables on the explanatory variables using both the fixed effects and the random effects estimator, before conducting Hausman tests to evaluate whether fixed effects or random effects are the most consistent to use.

6.2.1 The simple regression with GDP and Distance

In this section, we will regress the logarithmic values of GDP and distance on our dependent trade variables using the following functions:

$$\log Totaltrade_{ijt} = \beta_0 + \beta_1 \log GDPPartner + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + a_i + u_{ijt} \quad (6.1)$$

$$\log Export_{ijt} = \beta_0 + \beta_1 \log GDPPartner + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + a_i + u_{ijt} \quad (6.2)$$

$$\log Import_{ijt} = \beta_0 + \beta_1 \log GDPPartner + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + a_i + u_{ijt} \quad (6.3)$$

Where $\log GDPPartner$ is the logarithmic GDP for respectively Norway, Sweden, and Denmark, $\log GDPRussia$ is the GDP of Russia, and $\log Distance$ is the distance in kilometers between Oslo, Stockholm and Copenhagen, and Moscow. We have 43 observations for each country from the first quarter of 2012 till third quarter of 2022, in total 129 observations. Additionally, we use Newey-West standard errors that are robust against heteroskedasticity and serial correlation (Petersen, 2009). Not accounting for serial correlation and heteroskedasticity may result in a wrong estimate of standard errors, and hence t-statistics that

are invalid for inference. **Error! Reference source not found.** includes regressions using both fixed effects and random effects with Newey-West standard errors in parentheses. The first three regressions in the table are estimated using fixed effects (FE), while the three last regressions are estimated using random effects (RE).

The intuitive gravity model						
<i>Dependent variable:</i>						
	Export	Import	Total Trade	Export	Import	Total Trade
	FE			RE		
	(1)	(2)	(3)	(4)	(5)	(6)
GDP Russia	1.179*** (0.376)	0.936* (0.517)	0.840** (0.339)	0.941** (0.470)	0.167 (0.408)	0.318 (0.407)
GDP Country	-1.297*** (0.353)	-0.506 (0.779)	-0.592 (0.526)	-0.956*** (0.156)	0.595** (0.265)	0.155 (0.125)
Distance				-6.829*** (0.517)	-2.601*** (0.617)	-3.776*** (0.327)
Constant				68.253*** (6.985)	30.111*** (10.172)	42.581*** (7.178)
Observations	129	129	129	129	129	129
R ²	0.158	0.023	0.058	0.769	0.438	0.662
Adjusted R ²	0.131	0.000	0.028	0.764	0.425	0.654
F Statistic (df = 2; 124)	11.624***	1.483	3.825**	417.118***	97.541***	244.729***

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 3: The intuitive gravity model

We conduct Hausman tests to determine which estimation is the most consistent:

Hausman tests for the intuitive gravity model		
Dependent Variable	P-value	Conclusion
Export	0,3495	Both are consistent
Import	0,001706	Fixed effect is consistent
Total trade	0.0008168	Fixed effect is consistent

Table 4: Hausman tests for the intuitive gravity model

We reject the null hypothesis that both estimation methods are consistent for regressions with import and total trade as dependent variables. One should therefore use fixed effects estimation

for these regressions. For exports, the null hypothesis cannot be rejected since the p-value is too high. In this situation, the random model normally would have been more appropriate, as it is more efficient than the fixed effects model. However, since we want to compare the regressed results with each other, we will continue using the fixed effects model as it will still be consistent, though not as efficient. Relevant literature on the gravity model also typically considers fixed effects to be more suitable for these models, since it typically captures effects such as a country's preference for goods and historical aspects that can be difficult to quantify (Caruso, 2003). The regressions will therefore be discussed in accordance with the fixed effects models.

As we can see from table 3, the explanatory variable *Distance* is omitted when using fixed effects. This is because it does not change over time. *Distance* is still controlled for through the fixed effects estimation, but the beta coefficient will not be possible to estimate. Some research papers use *Remoteness* as variable to make *Distance* change over time and not be omitted when using fixed effects. *Remoteness* is calculated by dividing the GDP of the importing country with world GDP, multiplied with the distance between the countries. However, this has been criticized as theoretically incorrect according to the gravity model (Yotov et al., 2016). We have therefore chosen to follow the traditional approach of keeping *Distance* as it is, resulting in it not being possible to estimate.

Consistent with the literature on the gravity model, GDP of Russia is positive and significant at 1% level and 5% level for exports and total trade. It is only significant at a 10% level for imports. One percent higher level of Russian GDP therefore correlates with a 1.179 percent higher level of export from Scandinavian countries to Russia and a 0.840 percent higher level of total trade between Scandinavia and Russia. However, the GDPs of the Scandinavian countries are negative, and only significantly different from zero on a 1% level for exports. The negative correlation is not consistent with the gravity model since one, according to the model, would assume that there would be a positive relationship between GDP and trade. However, these results are not unexpected, since exports to Russia from Scandinavian countries have dropped throughout the decade we have observations for. We believe that we would have gotten a positive correlation had we included non-sanctioning countries and more quarters not affected by sanctions and over a longer time frame.

The adjusted R^2 can explain how much of the variation in the dependent variable that can be explained by the explanatory variables. As one can see from table 3 the adjusted R^2 is low for

all three regressions, specifically for imports. This implies that the explanatory variables are better at explaining the variation in exports and total trade than in imports. The low scores of adjusted R^2 are understandable, as we only have estimated two explanatory variables, GDP of Russia, and GDP of the partner country. Since we are mainly interested in the economic relationship of the dependent variables and explanatory variables, and hence the significance and coefficients of the variables, will we not discuss adjusted R^2 notably further.

6.2.2 Incorporating sanctions into the estimation

The objective of this master thesis is to see how trade has developed during times of conflict and sanctions. We therefore want to investigate the relationship between relevant time periods related to sanctions and events in the Russian-Ukrainian conflict, and Scandinavian trade with Russia. In this section of the analysis, we will incorporate conflict dummy variables into regressions from the previous section. We regress the following:

$$\log Totaltrade_{ijt} = \beta_0 + \beta_1 \log GDPPartner_{it} + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + \beta_4 Period1 + \beta_5 Period2 + \beta_6 Period3 + \beta_7 Period4 + \beta_8 Period5 + a_i + u_{ijt} \quad (6.4)$$

$$\log Export_{ijt} = \beta_0 + \beta_1 \log GDPPartner_{it} + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + \beta_4 Period1 + \beta_5 Period2 + \beta_6 Period3 + \beta_7 Period4 + \beta_8 Period5 + a_i + u_{ijt} \quad (6.5)$$

$$\log Import_{ijt} = \beta_0 + \beta_1 \log GDPPartner_{it} + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + \beta_4 Period1 + \beta_5 Period2 + \beta_6 Period3 + \beta_7 Period4 + \beta_8 Period5 + a_i + u_{ijt} \quad (6.6)$$

The reasoning behind the division of time dummy variables for sanctions and events during the conflict can be found in section 5.1.2. Period 0 from first quarter of 2012 till even the third quarter of 2013 is not estimated, and functions as the baseline period for the sanction variables. *Period1* takes the value 1 during fourth quarter of 2013 and first quarter of 2014, and 0 in all other time periods. *Period2* takes the value 1 during second and third quarter of 2014, and 0 in all other time periods, *Period3* takes the value 1 from fourth quarter of 2014 till first quarter of 2021, and 0 in all other time periods. *Period4* takes the value 1 from second quarter of 2021 till first quarter of 2022. *Period5* takes the value 1 during second and third quarter of 2022.

Following the same method as in previous sections of the analysis, we regress imports from Russia, exports from Scandinavia, and total trade using both fixed effects and random effects with Newey-West standard errors in parentheses. This can be found in Table 5. The first three

regressions are estimated using fixed effects (FE), while the three last regressions are estimated using random effects (RE).

Regressions with conflict dummy variables

	<i>Dependent variable:</i>					
	Export	Import	Total Trade	Export	Import	Total Trade
	(1)	(2)	(3)	(4)	(5)	(6)
		FE			RE	
GDP Russia	0.537 (0.342)	0.181 (0.440)	0.175 (0.265)	1.237*** (0.345)	0.115 (0.361)	0.416* (0.232)
GDP Partner	1.607*** (0.486)	0.725 (1.074)	1.258** (0.605)	-0.643*** (0.126)	0.937*** (0.216)	0.483*** (0.133)
Distance				-6.327*** (0.405)	-2.054*** (0.667)	-3.249*** (0.420)
period1	-0.106 (0.149)	0.024 (0.268)	-0.064 (0.135)	-0.020 (0.173)	0.015 (0.269)	-0.034 (0.119)
period2	-0.271*** (0.124)	0.144 (0.262)	-0.056 (0.136)	-0.197 (0.134)	0.137 (0.262)	-0.030 (0.124)
period3	-0.969*** (0.119)	-0.013 (0.213)	-0.409*** (0.112)	-0.636*** (0.115)	-0.045 (0.178)	-0.294*** (0.080)
period4	-1.118*** (0.169)	0.047 (0.414)	-0.440* (0.243)	-0.357*** (0.129)	-0.025 (0.245)	-0.178 (0.134)
period5	-2.138*** (0.290)	-1.338 (0.824)	-1.604*** (0.428)	-1.057*** (0.0223)	-1.440*** (0.635)	-1.232*** (0.357)
Constant				55.820*** (5.751)	22.442** (8.420)	32.875*** (5.146)
Observations	129	129	129	129	129	129
R ²	0.689	0.226	0.420	0.877	0.595	0.814
Adjusted R ²	0.665	0.167	0.376	0.869	0.568	0.802
F Statistic (df = 7; 119)	37.622***	4.954***	12.304***	853.389***	176.026***	525.011***

Note:

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

Table 5: Regressions with conflict dummy variables

We conduct Hausman tests to determine which estimation is the most consistent:

Hausman tests for regressions with conflict dummy variables		
Dependent Variable	P-value	Conclusion
Export	0,000000002889	Fixed effect is consistent
Import	1	Both are consistent
Total trade	0.6709	Both are consistent

Table 6: Hausman tests for regressions with conflict dummy variables

We reject the null hypothesis that both estimation methods are consistent for regression with export as dependent variable. One should therefore use fixed effects estimation for this regression. For imports and total trade, the null hypothesis cannot be rejected since the p-value is too high. We will still discuss the results through the fixed effects models, due to already explained reasons.

Table 5 shows the regression output for the three fixed effects regressions with sanctions and relevant time periods during the Russian-Ukrainian conflict as dummy variables. Period 1, when tension started before the annexation of Crimea, is not significant for either dependent variable, implying that trade did not change significantly at that point in time. One may observe that there is a significant negative correlation between the four last conflict dummy variables and exports. The most prominent is period 5, which is when Russia invaded Ukraine and consequently several new sanctions were imposed. When the *Period5* dummy variable is included in the regression, it is associated with 88.21 percent² lower exports to Russia, than before the conflict. Likewise, in period 3, when Russia counter sanctioned several countries, exports is associated with a decrease of 62.05 percent².

Furthermore, surprisingly, imports from Russia to Scandinavia do not change significantly from the base period between first quarter of 2012 and till even the third quarter of 2013. The dummy variable for total trade is significant and negative for period 3 and period 5, but only significant at a 10% level for period 4.

6.2.3 Controlling for additional variables

We believe additional variables might correlate with imports from Russia, exports from Scandinavia and total trade between Scandinavia and Russia, which can affect the estimation

² Calculations have been made using methods from section 4.2 *Logarithmic functional form*.

of our conflict dummy variables of interest. It is not possible to extract the exchange rate between the Scandinavian currencies and the Russian ruble, due to the halt in trade in Russian rubles in March 2022. We will therefore control for the exchange rate between the USD and the Scandinavian currencies since the USD is dominant in the world economy. Moreover, Covid will be controlled for through a dummy variable, as the measures imposed to handle the pandemic heavily affected international trade. There has also been an increase in inflation after the Covid-19 pandemic, and thus, the consumer price index for each Scandinavian country has been added to control for this effect. Finally, we will also control for seasonal variation since it is expected that trade follows seasonal patterns. We regress the following:

$$\begin{aligned} \log Totaltrade_{ijt} = & \beta_0 + \beta_1 \log GDPPartner_{it} + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + \beta_4 Period1 + \\ & \beta_5 Period2 + \beta_6 Period3 + \beta_7 Period4 + \beta_8 Period5 + \beta_9 CPI_{it} + \beta_{10} Covid + \beta_{11} ExchangeRate + \\ & \beta_{12} Quarter2 + \beta_{13} Quarter3 + \beta_{14} Quarter4 + a_i + u_{ijt} \end{aligned} \quad (6.7)$$

$$\begin{aligned} \log Export_{ijt} = & \beta_0 + \beta_1 \log GDPPartner_{it} + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + \beta_4 Period1 + \\ & \beta_5 Period2 + \beta_6 Period3 + \beta_7 Period4 + \beta_8 Period5 + \beta_9 CPI_{it} + \beta_{10} Covid + \beta_{11} ExchangeRate + \\ & \beta_{12} Quarter2 + \beta_{13} Quarter3 + \beta_{14} Quarter4 + a_i + u_{ijt} \end{aligned} \quad (6.8)$$

$$\begin{aligned} \log Import_{ijt} = & \beta_0 + \beta_1 \log GDPPartner_{it} + \beta_2 \log GDPRussia_{jt} + \beta_3 \log Distance_{ijt} + \beta_4 Period1 + \\ & \beta_5 Period2 + \beta_6 Period3 + \beta_7 Period4 + \beta_8 Period5 + \beta_9 CPI_{it} + \beta_{10} Covid + \beta_{11} ExchangeRate + \\ & \beta_{12} Quarter2 + \beta_{13} Quarter3 + \beta_{14} Quarter4 + a_i + u_{ijt} \end{aligned} \quad (6.9)$$

where *CPI* is the consumer price index for each respective Scandinavian country over time. *Covid* is a dummy variable equal to 1 during the four quarters of 2020, and equal to 0 for all other quarters. *ExchangeRate* is the exchange rate between the Scandinavian currencies, NOK, SEK and DKK, and the US dollar. It signifies the national currency per USD. *Quarter2*, *Quarter3* and *Quarter4* have been added to control for seasonality, they equal to 1 during the quarter they represent. It has been necessary to omit a dummy variable for the first quarter of each year, to avoid the dummy variable trap of multicollinearity. We also wanted to include whether the Scandinavian country shared a border with Russia or not, the logarithmic populations, the price of brent crude oil and the exchange rate between the Russian ruble and the US dollar. However, it has been necessary to omit these variables from the regression, as it leads to high multicollinearity with the variables of interest. Multicollinearity means that there is a relationship between the explanatory variables.

Table 7 includes regressions using both fixed effects and random effects with Newey-West standard errors in parentheses. The first three regressions in the table are estimated using fixed effects (FE), while the three last regressions are estimated using random effects (RE).

	Controlling for additional variables					
	<i>Dependent variable:</i>					
	Export FE (1)	Import FE (2)	Total Trade FE (3)	Export RE (4)	Import RE (5)	Total Trade RE (6)
GDP Russia	2.837** (1.183)	-3.602 (3.008)	-1.808 (1.619)	6.269*** (1.331)	-4.659*** (2.035)	-1.109 (1.208)
GDP Partner	2.033*** (0.546)	0.691 (1.380)	1.241 (0.758)	-0.482** (0.226)	1.467*** (0.442)	0.729*** (0.252)
Distance				-6.151*** (0.446)	-2.442*** (0.433)	-3.566*** (0.342)
Period 1	-0.035 (0.096)	-0.011 (0.182)	-0.060 (0.094)	-0.008 (0.152)	-0.020 (0.201)	-0.055 (0.082)
Period 2	-0.332*** (0.072)	0.092 (0.200)	-0.105 (0.110)	-0.295*** (0.107)	0.081 (0.212)	-0.097 (0.100)
Period 3	-0.958*** (0.113)	0.330 (0.216)	-0.256** (0.115)	-0.622*** (0.110)	0.227 (0.112)	-0.188* (0.103)
Period4	-1.029*** (0.169)	-0.092 (0.357)	-0.562*** (0.205)	-0.506*** (0.165)	-0.253 (0.257)	-0.455*** (0.136)
Period5	-1.822*** (0.335)	-1.918*** (0.830)	-2.006*** (0.415)	-0.820*** (0.292)	-2.227*** (0.624)	-1.802*** (0.313)
CPI	-0.041*** (0.012)	0.088*** (0.021)	0.048*** (0.011)	-0.023 (0.016)	0.083*** (0.023)	0.051*** (0.013)
Covid	0.114 (0.071)	-0.612*** (0.178)	-0.370*** (0.104)	0.197*** (0.067)	-0.638*** (0.184)	-0.353*** (0.096)
Exchange rate	0.061 (0.047)	-0.373*** (0.139)	-0.180** (0.074)	-0.027 (0.096)	-0.346*** (0.151)	-0.198*** (0.083)
Quarter2	0.019 (0.071)	0.361** (0.169)	0.254** (0.097)	-0.154 (0.096)	0.414*** (0.128)	0.219*** (0.074)
Quarter3	-0.185 (0.138)	0.473 (0.405)	0.279 (0.215)	-0.651*** (0.173)	0.617** (0.265)	0.184 (0.153)
Quarter4	-0.442** (0.208)	0.766 (0.543)	0.415 (0.292)	-1.010*** (0.250)	0.941** (0.390)	0.300 (0.229)
Constant				-29.696 (21.192)	92.251*** (30.621)	53.599*** (17.234)
Observations	129	129	129	129	129	129
R ²	0.747	0.417	0.568	0.905	0.692	0.865
Adjusted R ²	0.714	0.339	0.510	0.894	0.654	0.848

Table 7: Controlling for additional variables.

We conduct Hausman tests to determine whether to discuss the results in accordance with the fixed effects models or the random effects models.

Hausman tests for regressions controlling for additional variables		
Dependent Variable	P-value	Conclusion
Export	0,00002003	Fixed effect is consistent
Import	1	Both are consistent
Total trade	0.9999	Both are consistent

Table 8: Hausman tests for regressions controlling for additional variables.

We reject the null hypothesis that both estimation methods are consistent for regression with export as dependent variable. One should therefore use fixed effects estimation for this regression. Likewise with the former regressions for imports and total trade, the null hypothesis cannot be rejected since the p-value is too high. We will still discuss the results through the fixed effects models, due to already explained reasons.

According to Table 7, the inclusion of additional control variables has affected both the statistical significance and the economic significance of the estimated coefficients for the conflict dummy variables of interest. The control variable, *Covid*, is negative and significant at a 1% level for imports and total trade. This is expected, as international trade was disrupted during the pandemic. It is, however, not significant for exports. It is possible that the Scandinavian countries managed to keep up more of their production, not affecting exports negatively, to a larger degree than Russia. The consumer price index measuring the inflation in the Scandinavian countries is also significant at a 1% level for both exports, imports, and total trade. Higher prices in the Scandinavian countries are associated with higher imports and lower exports.

Compared to the former regression, *Period3* and *Period4* have larger economic significance on total trade. Moreover, the variable *Period5* now has a smaller economic significance than before in the regression with dependent variable *Export*. Hence, the control variables have controlled for effects that formerly was due to period 5. The conflict dummy variable *Period5* has on the other hand become significant for imports when controlling for other variables. Hence, imports tend to be lower in period 5 than in the baseline period. The other conflict dummy variables are still not significant for imports meaning that imports do not show any

signs of decline before 2022. Following is a table with all calculated correlations³ for significant conflict dummy variables.

	Exports	Imports	Total Trade
Period 1			
Period 2	-28.25%		
Period 3	-61.63%		-22.59%
Period 4	-64.26%		-43%
Period 5	-83.83%	-85.31%	-86,55%

Table 9: Correlations for significant conflict dummy variables.

These correlations are the estimated change in the dependent variables when the dummy variables are included, compared to the base period between first quarter of 2012 and till even third quarter of 2013. In other words, this implies that when there is no or little change between the estimated correlations for subsequent periods, trade tends to not change in the next period compared to the period before. The change in percents between the periods of estimation are therefore:

	Exports	Imports	Total Trade
Change between baseline period and period 1	0%	0%	0%
Change between period 1 and period 2	-28.25%	0%	0%
Change between period 2 and period 3	-118.16%	0%	-22.59%
Change between period 3 and period 4	-4.27%	0%	-90.35%
Change between period 4 and period 5	-30.45%	-85.31%	-101.28%

Table 10: Change between periods in the estimation.

6.3 Tests of BLUE assumptions

Further, we will check the robustness of the estimated models to investigate whether the estimated coefficients are unbiased and efficient (Wooldridge, 2018). The assumptions needed to be satisfied for a model to be unbiased and efficient have been presented in section 4.3. The first four assumptions for the fixed effects model must be satisfied to have an unbiased model with a causal interpretation. The two remaining assumptions for fixed effects models, no serial

³ Calculations have been made using methods from section 4.2 *Logarithmic functional form*.

correlation and homoskedasticity, must not be violated if one is also to have an efficient estimator. If all six assumptions are satisfied, the estimators are BLUE. The assumptions are discussed for the three fixed effects models in table 7, as we believe these explain the variation of exports, imports, and total trade best.

6.3.1 Linear model

The first assumption for the fixed effects model is that for each individual (country), the models can be explained by the equation:

$$y_{it} = \beta_1 x_{it_1} + \dots + \beta_k x_{it_k} + \alpha_i + u_{it} \quad t = 1, \dots, T \quad (6.10)$$

where α_i is the unobserved effect and β are the parameters that are estimated. This assumes that the regression models are linear in parameters, which our models are since we have estimated linear models. The unobserved effects are country specific effects that we can assume influence the dependent variable. We therefore consider the first assumption satisfied.

6.3.2 Random sample

The random sample assumption assumes that “a population model has been specified and an independent and identically distributed (i.i.d.) sample can be drawn from the population” (Wooldridge, 2012). The assumption of a random sample from the cross section can sometimes appear quite restrictive, as panel data include repeated observations on the same cross section over time. However, as we only assume random sampling in the cross-section dimension, temporal correlation is allowed (Wooldridge, 2012). We cannot argue that this assumption is satisfied since we do not randomly sample the countries we have used in the research.

6.3.3 No Perfect Collinearity

Moving on to the third assumption for fixed effects, we can establish that the explanatory variables change over time, as the variable *logDistance* is omitted from the models when using fixed effects. The third assumption also establishes that there cannot be a perfect linear relationship between the explanatory variables. To identify the magnitude of multicollinearity, we conducted a variation inflation factor (VIF) test (Wooldridge, 2018). The VIF test showed high levels of multicollinearity for *logGDPRussia*, *Quarter3* and *Quarter4* and *Exch.Partner*. This means that these variables, to a large degree, can explain the variation in each other.

According to Wooldridge (2018, p. 91), one does not have to care about the correlation between variables that are only used to control for the variables of interest. The VIF test shows low and acceptable levels of multicollinearity⁴ for the conflict dummy variables. Hence, we consider the third assumption to be satisfied.

6.3.4 Exogeneity

The fourth assumption for fixed effects assumes zero conditional mean. It indicates that the expected value of the idiosyncratic error term given the unobserved effect and the explanatory variables in all time periods is zero. This assumption is often the most important assumption to be aware of, as it is easily violated. The fixed effects estimation does reduce parts of the endogeneity issue, as it controls for time-invariant unobserved effects. However, it only removes the endogeneity issue that originates from time-invariant effects. Therefore, time-variant variables that both affect trade and correlate with the explanatory variables may still pose an issue to the endogeneity assumption. It is plausible to assume that production in Russia changed leading up to the invasion of Ukraine, by moving production towards war related industry, and therefore indirectly affecting their international trade flows. A change in Russian production would correlate with both the dependent variable and the dummy variables of interest. Hence, the sanctions and the conflict cannot be viewed as exogenous shocks to trade. Consequently, we do have omitted variable bias which is a violation of the exogeneity assumption.

6.3.5 Homoskedasticity

The fifth and sixth assumption is not necessary for a causal interpretation of the results, but it must be satisfied for the estimator to be BLUE. The fifth assumption assumes homoskedasticity, meaning that the variance is constant over time. If the variance varies over time, the data is heteroscedastic. One may check for homoskedasticity in a linear model using the Breusch-Pagan-test (Wooldridge, 2018). Heteroskedasticity was found in the models, which may lead to incorrect standard errors⁵. We used Newey-West standard errors to mitigate this violation.

⁴ See appendix A2 for VIF scores.

⁵ See appendix A3 for Breusch-Pagan test.

6.3.6 Serial correlation

The sixth assumption handles serial correlation between the idiosyncratic error term and the explanatory variables and the unobserved effect. In other words, it means that there exists a pattern between observations in time t and observations in time $t + 1$. We check for serial correlation through an autocorrelation function (ACF) plot⁶ and find that there exists serial correlation in the data. Likewise, with heteroskedasticity, serial correlation might bias the standard errors. This does not affect the biasedness of the estimation, but it can make the results less efficient (Drukker, 2003). Therefore, we use Newey-West standard errors since these are also robust against autocorrelation.

6.3.7 Conclusion

To conclude, the tests show that the estimated models do not satisfy all assumptions for an unbiased, consistent, and efficient estimation. Therefore, we cannot interpret the results as causal, only correlational. We can, however, draw conclusions based on correlations, which we still find relevant and appropriate for our research. Results show that, on average, exports were lower at times of sanctions than before, however we see little change from the period before when no sanctions were implemented (Period 4). Additionally, conflict and sanctions are only associated with lower imports after 2022, we cannot argue that imports have changed before this. This will be further discussed in the subsequent section.

⁶ See appendix A4 for ACF-plots.

7. Discussion

This part of the paper contains a discussion and possible explanations to the results in light of the research question:

How has trade between Russia and the Scandinavian countries developed in the times of the Russian-Ukrainian conflict and the following sanction program?

Afterwards, we will consider potential implications of our findings on trade policy in Norway and the rest of Scandinavia. Finally, we will discuss the limitations to the study and suggestions for future research on the topic.

7.1 Possible explanations

The results from the analysis in section 6 show that while exports to Russia have expectedly decreased in all periods from period 2, imports have surprisingly not changed at times of new sanctions, except for period 5. Whether total trade is changing depends on whether the export effect dominates the import effect. We can see that it does in the last three periods. In the next sections we look at the development in trade in the five different periods in light of what sanctions⁷ were in function at the time and suggest some reasons why we can observe the effects based on the background research and knowledge on trade flows.

7.1.1 Period 1

In period 1 one cannot observe any significant effect on either imports, exports, or total trade. These are not surprising results, since despite there were an escalating tension in Ukraine at that time, the international law had not yet been violated and thereby, yet no sanctions imposed. One would therefore not expect a change in trade flows, especially if one considers the Western countries' approach to trade at that point. "Wandel durch Handel" and a belief in Russia developing in towards increased democracy were dominating Western leaders' relationship to Russia.

⁷ See appendix A1 for a thorough timeline of implemented sanctions.

7.1.2 Period 2

In period 2, after the first Western sanctions were imposed on Russia because of their annexation, the first significant change in exports can be observed. This means that compared to the base period, trade has had a significant fall of 28 percent. This result is somewhat surprising, since sanctions at the beginning of period 2 only were imposed by the West on Russia and did not cover export goods yet. They only included travel restrictions and freeze of assets for certain Ukrainian and Russian officials. Not until June that year, the first sanctions affecting goods came in place, and they were only limited to target Crimean goods. The Russian import embargo on food and the first EU sanctions targeting European exports to Russia were introduced until August of 2014, which is quite late in the period. It is therefore not an obvious result that there is a significant decrease in exports.

Further, for imports, we cannot observe a significant change. This is not very surprising, since the restrictions regarding imports from June 2014 only included Crimean goods. Not until August were further restrictions on imports implemented and these did not target Russian goods dominating the Scandinavian imports specifically. We cannot register a significant change in total trade, which makes sense since total trade consists of both exports and imports, and the change in exports was not extensive enough to dominate the lack of change in imports.

7.1.3 Period 3

In period 3, starting in fourth quarter of 2014, the list of sanctions in function had started to increase. At this point the list of people whose assets were frozen and affected by travel restriction were further extended, and the halt in exports of equipment to Russian oil companies, all weapons and dual use goods and technology for military use had been functioning for a couple of months. August 7, 2014, the Russian import embargo on food was imposed, meaning that it at this point were sanctions in function from both sides of the conflict.

These aspects are taking part in explaining the results we have on trade in period 3. We see that exports have significantly decreased with 61.6 percent in this period, compared to the base period. It had also fallen compared to the former period, period 2, by 118.16 percent. Especially exports from Denmark and Norway were heavily impacted by the Russian food embargo, as both countries used to be exporters of food products. As we saw from the description of trade between Norway and Russia, Norwegian exports mainly consisted of salmon before 2014, and as a result of the embargo, almost completely disappeared. Sweden

was not affected tremendously by the import embargo, as they have not been a big exporter of food products. Had Sweden also been heavier affected by the Russian embargo, one could have seen a sharper decline in exports at that time for Scandinavian exports.

For imports, on the other hand, we cannot observe a significant change. This is somewhat a surprising result. At the same time, if one looks thoroughly at what goods were affected by sanctions in this period, it may not be surprising after all. At this point, Sweden's and Denmark's imports from Russia were dominated by petroleum products, which were not affected by sanctions. However, even if the effect is not captured by the analysis, we can see from the descriptive statistics that imports from Russia to Sweden have been reduced over time, especially since 2019. Kommerskollegium, the National Board of Trade Sweden, explains this with Swedish businesses viewed Russia as an unstable trading partner and therefore reduced their exposure to and dependency on Russia (Kommerskollegium, 2022a). This can be viewed in relation with Russia's autocratic development over time.

Moreover, another factor that can explain these results is the aspect of the Scandinavian countries being small, open economies that are dependent on international trade. Russia, on the other hand, is more self-sufficient with a significant size and volume of natural resources which gives them power on the world market. This becomes clear when one looks at the numbers for how much of GDP trade constitutes. For Denmark that number is 112.2 percent, while it for Russia only is 52.2 percent. Russia has also announced their objective of becoming less dependent on imports and strengthen domestic economy (Hille, 2014). It is natural to assume that Russia still had an incentive to continue their exports to other countries as it generates revenue and import less to reduce dependency on foreign goods and services.

From the descriptive statistics we can also see that Norway has had a distinct trade deficit with Russia since the trade embargo in 2014, with the import from Russia being over seven times the export in 2022. Likewise, Sweden and Denmark have also experienced a trade deficit with Russia in much of the period of interest. This is exemplified by a report from NATO Defence College (Ozawa & Iftimie, 2020). It shows that 61 percent of Denmark's imports of natural gas came from Russia in 2020, while for Russia, that only amounted to about 1% of their natural gas exports to Europe. This illustrates that Scandinavian countries tend to be much more dependent on Russia, than Russia being dependent on Scandinavia in terms of trade. This uneven relationship might affect the countries' ability to limit imports from Russia.

7.1.4 Period 4

Where period 3 was quite stable in terms of development in the Ukrainian-Russian conflict, one can again observe a rise in tension in 2021. Still, no new sanctions were yet imposed, so in legal terms the situation was a continuation of period 3. Nonetheless, the reason we added this period was to investigate whether an increased tension is associated with a change in trade flows.

In this period, the exports significantly fell with 64.3 percent compared to the base period. Meanwhile, compared to period 3, there is only a decrease of 4.3 percent. There is no significant change in imports, however, the export effect is dominating the lack of effect on imports, so there is a significant change of 43 percent on total trade compared to the base period. One would not necessarily assume that there will be a change in trade when sanctions are not adjusted. However, we have seen that there can be more objectives to sanctions. As Barber (1979) pointed out, one objective of sanctions is for the government in the imposing state to take a stand regarding the behavior of the sanctioned country. When the EU through the introduction of sanctions sends a clear signal to Russia and the global society that the Russian acts in Ukraine in 2014 were not acceptable, one could expect that the increase in tension would have consequences. However, the results of the analysis show that this effect is marginal. This may imply that increased tension between Russia and Ukraine do not have any effect on the Scandinavian countries' trade with Russia. Hence, this may further imply that only events related to sanctions have a negative relationship with trade, and trade does not tend to be reduced more until new sanctions have been implemented.

7.1.5 Period 5

Period 5, starting in April 2022, begins after the Russian invasion of Ukraine, which resulted in a wide range of new sanctions, targeted on several new aspects of the Russian economy. While the former sanctions were objected to make Russia reverse the annexation and convince separatists in Eastern Ukraine to concede, the new sanctions imposed in 2022 were objected at reducing Russia's ability to finance the war. This difference is naturally also reflected in the type of sanctions introduced. Considering the sanctions and their range, one would most definitely expect a reduction in both exports and imports.

Not surprisingly, the results of the analysis do show that there has been a significant decrease in both exports and imports, thus also total trade. Compared to the base period, exports have

significantly decreased by 83.8 percent, while imports have significantly decreased by 85.3 percent. Total trade has significantly decreased by 86.6 percent. It is also a clear reduction from the period before for all variables. This is all in line with expectations and can also be seen in the descriptive statistics. There we can see that for all three countries, there is a remarkable decline after 2022. Nevertheless, there is an exception for Norway in third quarter of 2022, where one can observe a slight increase in imports, and no change in exports.

The analytics company Corisk has compiled certain descriptive statistics in a report on trade between European countries and Russia from February 2022 till June 2022. It shows that Norway is the country in Scandinavia that has kept most of its trade with Russia, while both Sweden and Denmark has reduced their exports remarkably. They even argue that export numbers between Norway and Russia between February and June 2022 show an increase of 7.5 percent (NTB, 2022).

One of the reasons why Norwegian exports have not declined after the invasion is that for one reason, it already was at a low level. Further, for instance, the export of smolt⁸ and fish feed have continued. This has been criticized from several instances, arguing that it contributes to sustaining the conflict and Russia's plan on becoming more self-sufficient with salmon. On the other side, there are no sanctions on exports of food, including smolt, to Russia, and it is not covered by the Russian food embargo. Some also argue that due to food being a necessity, it should never be included as a tool in conflicts (Brembo & Thrane, 2022). Nevertheless, Norwegian companies may have to consider their long-term position in the international trade market and their reputation in Russian and Ukrainian markets after Putin (Bach, 2022).

A reason for the observation of a slight increase Norwegian imports in 2022 relates to the aspect of them sharing a common border with Russia. In the Finnmark region bordering Russia, the level of economic integration and dependency on cross border trade is higher than in the rest of the country (The Norwegian Government, 2022). Therefore, there are some exceptions when it comes to sanctions, to sustain employment and joint management of fish resources (Norwegian Ministry of Trade, Industry and Fisheries, 2022). According to the Norwegian Minister of Fisheries, Bjørnar Skjæran about 10 percent of fish from Russian

⁸ "A young salmon or sea trout about two years old that is at the stage of development when it assumes the silvery colour of the adult and is ready to migrate to the sea" (Merriam-Webster, n.d.)

trawlers landed in Norway is registered as imports from Russia. The total value of fish landed from Russian trawlers in Norway was about 1.2 billion NOK in the first half of 2022 (Ytreberg et al., 2022). Thus, even if the values are not enormous, it may contribute to explaining the development in imports we observe in the descriptive statistics.

7.1.6 Additional explanations

Even though one may expect trade to change substantially with events like the war between Ukraine and Russia and the following sanctions, it is important to acknowledge that change in trade flows may come slowly and with delays. For instance, Norwegian companies like Norsk Hydro and Equinor imported a substantial amount of aluminum and oil from Russia after the invasion of Ukraine in 2022. This has been claimed to be due to existing contracts entered before the invasion. Since their Russian trading partner companies were not sanctioned yet at the time, the Norwegian companies did not have legal basis to terminate the deals without it being a breach of contract (Bøe, 2022). Nils Norell from Kommerskollegium (2022b) also points out that trade for certain goods in short time periods can fluctuate if a particular big load of imports is visible through statistics. Consequently, if this study were able to investigate more time periods than to third quarter of 2022, we might have seen an even bigger decrease in imports and exports after the invasion and following sanctions explained by a potential delay in trade.

Three of our five defined periods only lasts six months, which means these delays in trade may have had an impact on the estimated coefficients for these periods. One can argue that the periods should have lasted longer, nonetheless, it is reasonable that they follow the situation and how it changes. Anyway, the delay that can occur in trade has implications for the results, and especially for the last period, we believe this is a concern one will find out more about as data on trade becomes available and the situation further develops.

Even though the analysis does not give significant results for imports in the first five periods, this does not necessarily mean that the sanctions have not had an effect. As mentioned, we do not have a causal analysis, and we have therefore no insight into how trade would have developed if there were no sanctions. Comparing with non-sanctioning countries also does not make sense, since the sanctions have had implications on the global market. The lack of increase in imports also is a result worth noticing, one can easily imagine that it would have been rising if there were not for sanctions, however, this is just speculation. This also accounts

for exports and total trade; we have no insight into how these variables would have developed else.

7.1.7 Russian sanction evasion

The objective of the Western sanctions on Russia after 2022 is to weaken their economic base and their ability to act in warfare. However, we have seen that there exist several methods to evade sanction restrictions related to trade. Galtung (1967) suggested a variety of methods to increase the resilience to sanctions, one of them to have a broad base of countries one is trading with. We have seen that since 2012, and especially after the invasion, Russia has directed their trade more towards Chinese markets, and strengthened their relationship with their neighbor in South-East. Even if this is not a broadening of trading partners, it anyway reduces Russia's dependence on European markets, and by that function as a method of avoid the implications of sanctions.

Another way of evading sanctions is through re-export of sanctioned goods. Research show that re-export of products into Russia has existed since 2014 (Yeliseyeu, 2017). There have also been signs of Russian sanctioned goods findings its way into EU countries after 2022 through non-sanctioning countries like Turkey, Kazakhstan, and Uzbekistan (Ritzau, 2023). Turkey, has for instance, been accused of selling Russian wood pellets to Denmark. Twelve percent of all wood pellets in Denmark used to be imported from Russia, but with the fifth package of EU sanctions including restrictions on imports of Russian wood pellets, the official number has been reduced to zero. In return, Turkey suddenly became an exporter of wood pellets to Denmark. (Sommer et al., 2023).

There is also reason to believe Russia is capable to acquire Western sanctioned goods, used to boost their ability to engage in war, through third countries (Spicer, 2023). Russian custom records show that about 2.6 billion USD of electronic equipment were imported into Russia between April 2022 and October 2022, and that "at least 777 million US dollars of these products were made by Western companies whose chips have been found in Russian weapons systems" (Stecklow et al., 2022). IT equipment was not under a complete export ban at the time, but dual use goods and technology for use in the Russian military industry has been under an export ban since 2014. It is therefore worrisome that these types of products have been exported to Russia. Both Turkey and Kazakhstan did restrict re-export of sanctioned goods to Russia during 2023, so this gap in the restrictions might be less prominent for

observations later than what is covered in this study (Caglayan & Spicer, 2023; Stognei & Ivanova, 2023). Perhaps less troublesome, but still an example of Russia's ability to avoid sanctions, is the aspect that they used to import Norwegian salmon after 2014, through Belarus (NTB, 2019). Hence, they have also avoided the effect of sanctions they have imposed on other countries themselves.

These different examples show how goods have moved between sanctioning countries and Russia even though restrictive measures on the products have been put in place. As a result, we anticipate that there exists trade between Scandinavia and Russia that is not registered in official statistics. This has therefore naturally not been analyzed in this study, and the estimated development in trade between Scandinavia and Russia might have been affected by this to some degree.

7.2 Possible implications to policy work

The results have shown that trade from Scandinavian countries to Russia tend to decrease when new sanctions are implemented. However, there is no statistical evidence that the level of imports changed before 2022, when it was reduced by approximately 85 percent from the baseline period of first quarter of 2012 till even the third quarter of 2013. Exports have, on the other hand, decreased in all periods from the second quarter of 2014. Neither exports nor imports have been estimated to have changed much from period 3 till period 4, probably because no new sanctions were implemented at that time. However, total trade has significantly decreased since period 3.

The main objective of the 2014 restrictions were to make Russia reverse the annexation of Crimea, while the objective after 2022 is to weaken Russia's economic base and their ability to engage in warfare. It is also reasonable to argue that one also wants to reduce Russia's reputation and satisfy the domestic demand of "doing something" against unwanted behavior. While it can be difficult to use this study to investigate whether Russia's economic base and reputation has worsened since 2014, we believe it can help evaluate future sanction policies since it can tell whether trade decreased in times of sanctions and if trade has changed when sanctions have not been implemented.

Imports of Russian goods to Scandinavia contributes as revenue to Russia, while exports of Scandinavian goods to Russia allows them to acquire goods for consumption and production,

whether it is for private use or public and military use. The exports have been reduced over time since 2014, while imports have only decreased in 2022. This may imply that Russia has been able to retain their exports to Scandinavia, and therefore their revenue, until the invasion in 2022. Since we investigate aggregate trade numbers, and only Scandinavian, we do not have any evidence to say whether the reduced exports from Scandinavia have had any effect on the types of goods Russia is able to obtain for private, public, or military use. We do not know if the reduction involves crucial goods that Russia is not able to obtain from other non-sanctioning countries. Nevertheless, we believe it is still interesting for future policy work that imports have not decreased over time as much as the exports, since imports of Russian goods to Scandinavia contributes as revenue to Russia. One may have to evaluate what goods the sanctions target if one wants to see a change in both exports and imports. Nevertheless, the estimated reduction in imports, exports and total trade from the baseline period is approximately the same in period 5.

We do not see a substantial change in trade in period 4 from period 3, implying that trade does not change unless one has imposed legal measures restricting trade, such as sanctions. Companies do not stop trading with Russia voluntarily, even though there has been sent a message that the behavior is unwanted, and the tension between Ukraine and Russia is increasing. Hence, the only thing that is effective and is associated with a change in trade patterns is sanctions. We believe this is interesting for future policy work because it can contribute to decision making when new sanctions are to be imposed. If one wants to see an economic effect, it is important to implement sanctions that strike important goods.

7.3 Limitations

There exist certain limitations for the study that may have implications for the estimated results. For instance, many gravity model approaches, but not all, use more countries than we have decided to look at in our analysis. We chose the three Scandinavian countries since this was the region we were most interested in researching. More importantly, the motivation for keeping the number of countries that low was to be able to do a thorough investigation into both economic features, governance and trade flows for each country. However, as noted in the section on evaluating assumptions in section 6, the entities are not randomly selected. This study cannot therefore be generalized to other countries in the world. Additionally, having more individuals (countries) in the estimation might increase the precision in estimation.

The study also only included observations until the third quarter of 2022, since data for later quarters were absent. As noted earlier in the discussion, this might influence the results as a change in trade can be delayed and some restrictive measures were implemented only months before the end of our study. It is possible one would have noticed an even more distinct decrease in imports and exports had later data been available.

When using the fixed effects estimation in the analysis, the trade cost term *Distance* is omitted from the regression since it does not vary over time. Therefore, the estimation includes few trade cost variables, that are not dummy variables, having a negative correlation with trade. An option could have been to extend to standard gravity model to include tariffs that the country i , imposes on imports from country j (Yotov et.al., 2016). This information was unfortunately difficult to obtain as we worked with aggregate data and tariff numbers usually apply to specific groups of goods.

Moreover, as explained earlier, one must be careful when using statistics from the ROSSTAT. ROSSTAT has been accused of incorrect data and avoidance of publishing data that mainly speaks in favor of the Kremlin. Russian GDP is the only data we have contracted from ROSSTAT to limit the data bias. It is challenging finding data on GDP that does not originally come from ROSSTAT, as all international institutions like the UN and the World Bank extract their data from official statistical services of the different countries. GDP is an important part of the gravity model approach and we have therefore decided to use this data in our estimation, despite its limitations. Hence, we have not been able to mitigate this limitation in our study.

7.4 Suggestions for future research

This master thesis study looks at the development in aggregated trade between Scandinavia and Russia from 2012 till third quarter of 2022. The nature of the study and its limitations open for future research on the topic. First, it can be interesting to break down the aggregated data and look at the development in trade at the industry level, regional level, or firm level. We know that there has been a variation in development in the trade for different goods, making it quite interesting to investigate the correlation at this level. Likewise, we assume regions within the countries differ in their trade to Russia. The Finnmark region in Norway borders Russia to the east and thus has most likely a trade that has contracted more than in regions further south. It can be interesting to evaluate how large this contraction has been.

Furthermore, as mentioned in our limitations, this study might be affected by a lack of available data further than the third quarter of 2022. It can take time to see a substantial change in the development in trade and it is still being imposed new sanction packages at the time of this study. Hence, future research looking at newer observations, perhaps also observations even after the conflict is over, can estimate and understand more of the total effect sanctions have had on trade in this conflict.

We have also established that there is a certain level of unofficial trade between Scandinavia and Russia, through re-export from non-sanctioning countries. It can be interesting to study how significant this is, and how it might affect the economy of Russia and Scandinavia. This is relevant since the sanctions have been imposed to weaken Russia's economic base. If the re-export of non-sanctioned and sanctioned goods is extensive and noticeable, the Russian economy might not weaken as much as first anticipated and intended. More thorough research on this can help future policy work on the design of sanctions on Russia.

8. Conclusion

This study investigates the development in imports, exports, and total trade between Scandinavia and Russia in times of the Ukrainian-Russian conflict and the following sanctions program through the following research question:

How has trade between Russia and the Scandinavian countries developed in the times of the Russian-Ukrainian conflict and the following sanction program?

We use aggregated quarterly data from each country between the first quarter of 2012 and third quarter of 2022 to estimate an augmented panel data gravity model with conflict dummy variables.

Through the descriptive statistics, we find that exports experience a significant drop over time for Denmark and Norway, most likely due to the Russian import embargo in 2014. Both Norway and Denmark exported products affected by this embargo. Sweden mainly exported products with a high degree of processing and chemical products and did consequently not experience such a drop in exports from 2014. We also find that exports from Sweden and Denmark decrease notably in 2022, however one cannot find a similar reduction in exports for Norway.

The import to Denmark and Norway from Russia has, on the other hand, been quite stable over time since 2012. Imports to Sweden from Russia decreases over time, much a result of a reduction in petroleum imports. However, descriptive statistics show that imports to Norway and Denmark seem to have increased in 2021. This is possibly due to increased inflation in 2021. All countries can be seen to experience a decline in imports during 2020, which can be argued to be caused by the disruption from the Covid-19 pandemic. Lastly, the descriptive statistics show that total trade mostly follows imports in its development over time. The Scandinavian countries for the most have a trade deficit with Russia, meaning they import more than they export.

We perform a regression analysis using panel data with fixed effects. We first estimate the gravity model using GDP for the Scandinavian countries and Russia, and distance. Distance is however omitted from the model due to fixed effects estimation. We then include the conflict variables of interest to estimate the relationship between trade and conflict and sanctions. Lastly, we control for additional variables that we believe correlate with the imports,

exports, and total trade. We find a negative and significant correlation between the conflict dummy variables and exports for most time periods, implying that exports tend to fall when new sanctions are imposed. Imports did, however, not change significantly in the time periods before period 5, after the invasion of Ukraine and massive restrictions were imposed on Russia. Neither imports nor exports seem to have changed between period 3 and period 4. Moreover, since total trade is the sum of imports and exports, the conflict dummy variables mostly adhere to the change that is the strongest. Total trade is seen to have a negative relationship with period 3, period 4 and period 5, implying that total trade was reduced during these time periods.

There can be several explanations for the results in our study. For instance, the lack of change in imports before period 5, can be explained by the nature of the implemented sanctions from both the EU on Russia, and from Russia on the sanction imposing countries. The sanctions at that time did not cover imported goods from Russia to the same extent as they covered the exports to Russia. Another possible explanation is that the Scandinavian countries are dependent on imports from Russia, making it more difficult to reduce imports that are not specifically covered by sanctions. This is especially relevant for gas imports.

Moreover, the reduction in exports in period 3 is likely due to the Russian import embargo that was imposed on sanctioning countries in August 2014, limiting Scandinavian exports to Russia. We do not see any change in imports or exports in period 4 from period 3, implying that one does not increase the limitation of trade when not new sanctions have been put in place, thus only sanctions is associated with a change in trade patterns, not increased tension in the conflict. Additionally, the increase in Norwegian exports to Russia in 2022, compared to other countries, can most likely be explained by that Norway typically exports goods that are not included in these sanction packages. Nevertheless, we see a sharp decrease in both exports and imports in 2022, due to the massive measures put in place after the invasion of Ukraine. The delay in the effect of sanctions on trade can also have played a part in imports not decreasing. Additionally, re-export of goods through non-sanctioning countries can also take part in explaining the results in the analysis.

It does not seem like imports and exports decrease due to a rise in tension, we do only see a change when new sanctions have been imposed. This, with the fact that imports did not change before 2022, can have implications on future policy work and how sanctions should be

conducted in the future. Good, smart and precise sanctions reducing the trade flow between the countries can be essential to reduce conflict and war in Europe.

9. Bibliography

- Angrist, J. D., & Pischke, J.-S. (2008). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton and Oxford: Princeton University Press.
- Askari, H. G., Forrer, J., Teegen, H., & Yang, J. (2003). *ECONOMIC SANCTIONS: Examining Their Philosophy and Efficiency*. Praeger.
- Australian Bureau of Statistics. (n.d. a). *The difference between correlation and causation*. Retrieved from Australian Bureau of Statistics:
<https://www.abs.gov.au/statistics/understanding-statistics/statistical-terms-and-concepts/correlation-and-causation#:~:text=A%20correlation%20between%20variables%2C%20however,relationship%20between%20the%20two%20events>.
- Australian Bureau of Statistics. (n.d. b). *Consumer Price Index FAQs*. Retrieved from Australian Bureau of Statistics:
<https://www.abs.gov.au/websitedbs/d3310114.nsf/home/consumer+price+index+faqs#Anchor1>
- Bacchetta, M., Beverelli, C., Cadot, O., Fugazza, M., Grether, J.-M., Helble, M., & Nicita, P. (2012). *A Practical Guide to Trade Policy Analysis*. Geneva: World Trade Organization & United Nations.
- Bach, D. (2022, September 11). *Fersk rapport: Eksporten til Russland har økt etter invasjonen*. Retrieved from e24.no: <https://e24.no/internasjonaloekonomi/i/wAE9LG/fersk-rapport-eksporten-til-russland-har-oekt-etter-invasjonen>
- Bahr, E. (1963, July 15). Ein Diskussionsbeitrag in Tutzing. Retrieved from https://www.1000dokumente.de/index.html?c=dokument_de&dokument=0091_bah&object=translation&st=&l=de
- Ballard, B. (2019, October 28). *Crimea doesn't pay: assessing the economic impact of Russia's annexation*. Retrieved from worldfinance.com:
<https://www.worldfinance.com/special-reports/crimea-doesnt-pay-assessing-the-economic-impact-of-russias-annexation>
- Barber, J. (1979). Economic Sanctions As a Policy Instrument. *International Affairs (Royal Institute of International Affairs 1944-)*, 367-384.

-
- Barth, E., Moene, K., & Pedersen, A. W. (2021). Rising Inequality in the Egalitarian Nordics. In *Europe's Income, Wealth, Consumption, and Inequality* (pp. 218-C6.T3). New York: Oxford Academic.
- Bondarenko, P. (2023, April 18). *gross domestic product (economics)*. Retrieved from britannica.com: <https://www.britannica.com/topic/gross-domestic-product>
- Borchgrevink, A. S. (2022). *Krigsherren i Kreml Putin og hans tid*. Kagge Forlag AS.
- Brembo, F., & Thrane, K. (2022, July 18). *Norge eksporterr laksesmolt til Russland: - Bidrar til å holde krigen gående*. Retrieved from NRK: https://www.nrk.no/nordland/norge-har-eksportert-laksesmolt-verdt-125-millioner-kroner-til-russland-i-ar_-_paradoks-1.16035480
- Bøe, E. (2022, April 19). *Norsk import fra Russland økte 90 prosent til ny rekord*. Retrieved from e24.no: <https://e24.no/internasjonaoekonomi/i/BjKerw/norsk-import-fra-russland-oekte-90-prosent-til-ny-rekord>
- Caglayan, C., & Spicer, J. (2023, March 20). *Turkey halts transit of sanctioned goods to Russia- exporter, diplomat*. Retrieved from Reuters: <https://www.reuters.com/world/middle-east/turkey-halts-transit-sanctioned-goods-russia-exporter-diplomat-2023-03-20/>
- Caprile, A., & Delivorias, A. (2023, March). EU sanctions on Russia: Overview, impact, challenges. European Parliamentary Research Service.
- Caruso, R. (2003). *The Impact of International Economic Sanctions on Trade*. Retrieved from Core: <https://core.ac.uk/download/pdf/9310993.pdf>
- Council of the European Union. (2022, June 3). *Russia's aggression against Ukraine: EU adopts sixth package of sanctions*. Retrieved from consilium.europa.eu: <https://www.consilium.europa.eu/en/press/press-releases/2022/06/03/russia-s-aggression-against-ukraine-eu-adopts-sixth-package-of-sanctions/>
- Council of the European Union. (2023a, February 7). *Infographic - Where does the EU's gas come from?* Retrieved from consilium.europa.eu: <https://www.consilium.europa.eu/en/infographics/eu-gas-supply/>
- Council of the European Union. (2023b, April 13). *EU restrictive measures against Russia over Ukraine (since 2014)*. Retrieved from consilium.europa.eu:

<https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/>

Council of the European Union. (2023c). *Timeline- EU restrictive measures against Russia over Ukraine*. Retrieved from Consilium.europa.eu:

https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/history-restrictive-measures-against-russia-over-ukraine/?fbclid=IwAR1MZaVI57rECPOp3PJl4Z_YIafEDyNVrx9iGeZQsTxYVxYwbLAz07hPbbY

Council of the European Union. (2023d). *EU response to Russia's invasion of Ukraine*.

Retrieved from consilium.europa.eu: <https://www.consilium.europa.eu/en/policies/eu-response-ukraine-invasion/>

Crozet, M., & Hinz, J. (2016, June 22). *Collateral Damage: The impact of the Russia sanctions on sanctioning countries' exports*. Retrieved from F.R.E.I.T. Forum for research in International Trade:

<https://www.freit.org/WorkingPapers/Papers/PoliticalEconomy/FREIT1126.pdf>

Distance Calculator. (2023, May 05). *Distance calculator*. Retrieved from

[distancecalculator.net: https://www.distancecalculator.net/from-oslo-to-moscow](https://www.distancecalculator.net/from-oslo-to-moscow)

Dragneva, R., Wolczuk, K., & Wallace, J. (2022, July 15). *What is the Eurasian Economic Union?* Retrieved from chathamhouse.org:

<https://www.chathamhouse.org/2022/07/what-eurasian-economic-union>

Drukker, D. M. (2003). Testing for serial correlation in linear panel-data models. *The Stata Journal*, 3 Number 2, 168-177.

DST. (2023a, March 27). *NKNI: Forsyningsbalance, bruttonationalprodukt (BNP), beskæftigelse mv. efter transaktion, prisenhed og sæsonkorrigering*. Retrieved from statistikbanken.dk: <https://www.statistikbanken.dk/20029>

DST. (2023b). *UHV7: Udenrigshandel med varer (grænsepassage) efter im- og eksport, SITC-hovedgrupper og land*. Retrieved May 27, 2023, from statistikbanken.dk:

<https://www.statistikbanken.dk/20029>

-
- Eurojust. (2021). *Prosecution of sanctions (restrictive measures) violations in national jurisdictions: A comparative analysis*. The Hague: Network for Investigation and prosecution of genocide, crimes against humanity and war crimes.
- European Central Bank. (2023, May 26). *Euro foreign exchange reference rates*. Retrieved from European Central Bank:
https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/index.en.html
- European Commission, Directorate-General for Communication. (2023). *The European Union : what it is and what it does*. Publications Office of the European Union. Retrieved from <https://data.europa.eu/doi/10.2775/5377>
- European Union. (2023, April 28). *Country Profiles*. Retrieved from /european-union.europa.eu: https://european-union.europa.eu/principles-countries-history/country-profiles_en
- Eurostat. (2013, September 2). *Glossary: Trade balance*. Retrieved from eurostat Statistics Explained: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Trade_balance
- Faulconbridge, G. (2022, May 3). *Putin puts West on notice: Moscow can terminate exports and deals*. Retrieved from reuters.com: <https://www.reuters.com/world/putin-signs-decree-new-retaliatory-sanctions-against-west-kremlin-2022-05-03/>
- Fischer, S. (2015, March). European Union Sanctions Against Russia. *SWP Comments*(26/2015).
- FN-sambandet. (2021). *HDI - indeks for menneskelig utvikling*. Retrieved from fn.no: <https://www.fn.no/Statistikk/hdi-menneskelig-utvikling>
- FN-sambandet. (2022). *Demokrati-indeksen*. Retrieved from fn.no: <https://www.fn.no/Statistikk/demokratiindeksen>
- Fossanger, K. (2023, February 23). *Norges handel med Russland og Ukraina*. Retrieved from SSB: <https://www.ssb.no/utenriksokonomi/utenrikshandel/statistikk/utenrikshandel-med-varer/artikler/norges-handel-med-russland-og-ukraina>

- Galtung, J. (1967, April). On the Effects of International Economic Sanctions: With Examples from the Case of Rhodesia. *World Politics*, 19, 378-416.
- Golpen, Å., & Kolstø, P. (2022, June 9). *Sovjetunionens historie*. Retrieved from snl.no: https://snl.no/Sovjetunionens_historie
- Government Offices of Sweden. (2023, April 05). *Sweden's path to NATO membership*. Retrieved from government.se: <https://www.government.se/government-policy/sweden-and-nato/swedens-road-to-nato/>
- Gygli, S., Haelg, F., Potrafke, N., & Sturm, J.-E. (2019). The KOF Globalisation Index – Revisited. *Review of International Organizations*, 14(3), 543-574. Retrieved from <https://doi.org/10.1007/s11558-019-09344-2>
- Ha, J. M., Ayhan, K., & Franziska, O. (2021). "One-Stop Source: A Global Database of Inflation." *Policy Research Working Paper 9737*. Washington DC: World Bank.
- Harvey, D. (2005). *A Brief History of Neoliberalism*. Oxford University Press.
- Herning, L. (n.d.). *Social policy and welfare*. Retrieved from Norden.org: <https://www.norden.org/en/information/social-policy-and-welfare>
- Hille, K. (2014, April 22). *Russia looks for economic self-reliance*. Retrieved from Financial Times: <https://www.ft.com/content/ee5d9120-ca2f-11e3-bb92-00144feabdc0>
- Hitchcock, C. R. (1996). Causal Decision Theory and Decision-Theoretic Causation. *Noûs*. Vol. 30, No. 4, 510.
- Holm-Hansen, J., & Paulsen, M. (2023, January 18). *Ukraina-konflikten*. Retrieved from snl.no: <https://snl.no/Ukraina-konflikten>
- IEA. (2022a, February). *Gas Market and Russian Supply*. Retrieved from [iea.org: https://www.iea.org/reports/russian-supplies-to-global-energy-markets/oil-market-and-russian-supply-2](https://www.iea.org/reports/russian-supplies-to-global-energy-markets/oil-market-and-russian-supply-2)
- IEA. (2022b, October 11). *Norway Natural Gas Security Policy*. Retrieved from [iea.org: https://www.iea.org/articles/norway-natural-gas-security-policy](https://www.iea.org/articles/norway-natural-gas-security-policy)
- Jakobsen, E. W., Helseth, A., & Stokke, O. (2020). *COVID-19-SITUASJONENS KONSEKVENSER FOR INDUSTRIBEDRIFTER, VAREHANDELEN OG REISELIVSNÆRINGEN*. Menon Economics.

-
- Kabir, M., Salim, R., & Al-Mawali, N. (2017). The gravity model and trade flows: Recent developments in econometric modelling and empirical evidence. *Elsevier*, 12.
- Kaempfer, W. H., & Lowenberg, A. D. (2007). THE POLITICAL ECONOMY OF ECONOMIC SANCTIONS. In T. & Sandler (Ed.), *Handbook of Defense Economics* (Vol. 2, pp. 868-905).
- Keum, K. (2008, May 26). Tourism flows and trade theory: a panel data analysis. *The Annals of Regional Science*. Retrieved from https://www.researchgate.net/profile/Kiyong-Keum/publication/227002367_Tourism_flows_and_trade_theory_A_panel_data_analysis_with_the_gravity_model/links/580c3e2508aeef1bfeeb6222/Tourism-flows-and-trade-theory-A-panel-data-analysis-with-the-gravity-model.p
- Kommerskollegium. (2022a, March 02). *Sverige mindre beroende av handel med Ryssland*. Retrieved from [kommerskollegium.se: https://www.kommerskollegium.se/om-oss/nyheter/2022/sverige-mindre-beroende-av-handel-med-ryssland/](https://www.kommerskollegium.se/om-oss/nyheter/2022/sverige-mindre-beroende-av-handel-med-ryssland/)
- Kommerskollegium. (2022b, November 3). *Sveriges handel med Ryssland i brant fall*. Retrieved from Kommerskollegium: <https://www.kommerskollegium.se/om-oss/nyheter/2022/sveriges-handel-med-ryssland-i-brant-fall/>
- Kutlina- Dimitrova, Z. (2017). The economic impact of the Russian import ban: a CGE analysis. *International Economics and Economic Policy*, 14, 537-552.
- Lau, J. (2021, September 01). *Wandel durch Handel*. Retrieved from [internationalepolitik.de: https://internationalepolitik.de/de/wandel-durch-handel-0](https://internationalepolitik.de/de/wandel-durch-handel-0)
- Luca, M. (2021, November 5). *Leaders: Stop Confusing Correlation with Causation*. Retrieved from Harvard Business Review: <https://hbr.org/2021/11/leaders-stop-confusing-correlation-with-causation>
- Merriam-Webster. (n.d.). *smolt*. Retrieved from Merriam Webster: <https://www.merriam-webster.com/dictionary/smolt>
- Mulder, N. (2022, June). *The sanctions weapon*. Retrieved from International Monetary Fund: https://www.imf.org/en/Publications/fandd/issues/2022/06/the-sanctions-weapon-mulder?fbclid=IwAR3qhjPfGEu_6y5rBbMoOOT_AGCEzpyYSKGsFV43YxJO54IpLihSufdMmAY

- Nasr, J., & Trevelyan, M. (2022, March 31). *Putin tells Europe: Pay in roubles or we'll cut off your gas*. Retrieved from Reuters.com:
<https://www.reuters.com/business/energy/russia-sets-deadline-rouble-gas-payments-europe-calls-it-blackmail-2022-03-31/>
- NATO. (2023, April 05). *Member countries*. Retrieved from nato.int:
https://www.nato.int/cps/en/natohq/topics_52044.htm
- Nilsen, A. A. (2019, January 7). *Sjømatrådet: Norsk laksenæring har tapt 20 milliarder på utestengelsen fra Russland*. Retrieved from e24.no:
<https://e24.no/naeringsliv/i/9vrzM9/sjoematraadet-norsk-laksenaering-har-tapt-20-milliarder-paa-utestengelsen-fra-russland>
- Norman, V., & Orvedal, L. (2012). *En liten, åpen økonomi*. Oslo: Gyldendal Akademisk.
- Norwegian Ministries. (2021). *The Norwegian Government's Arctic Policy*. Ministry of Foreign Affairs; Ministry of Local Government and Regional Development; Ministry of Trade Industry and Fisheries; Office of the Prime Minister.
- Norwegian Ministry of Climate and Environment. (2020). *Meld. St. 20 (2019–2020) Report to the Storting (white paper): Norway's integrated ocean management plans*.
- Norwegian Ministry of Foreign Affairs. (2023, April 5). *Sanksjoner som svar på Russlands militære aggresjon mot Ukraina- veileder for næringslivet*. Retrieved from regjeringen.no:
https://www.regjeringen.no/no/tema/utenrikssaker/Eksportkontroll/sanksjoner-og-tiltak1/sanksjoner_aggresjon/id2905102/?expand=factbox2905105
- Norwegian Ministry of Trade, Industry and Fisheries. (2022, May 9). *Havneforbudet har trådt i kraft*. Retrieved from regjeringen.no:
<https://www.regjeringen.no/no/aktuelt/havneforbudet-har-tradt-i-kraft/id2911897/>
- NTB. (2019, December 27). *Russland stopper import av norsk laks via Hviterussland*. Retrieved from e24: <https://e24.no/hav-og-sjoemat/i/b5rWzk/russland-stopper-import-av-norsk-laks-via-hviterussland>
- NTB. (2022, September 11). *Rapport: Norsk eksport til Russland har økt etter invasjonen*. Retrieved from Finansavisen:

https://www.finansavisen.no/nyheter/bors/2022/09/11/7927737/rapport-norsk-eksport-til-russland-har-okt-etter-invasjonen?zeph_r_sso_ott=fXGYZ0

NTB, Sundberg, J. D., Gjendem, C. S., & Lorentzen, M. (2014, August 7). *Russland stanser import av norske produkter*. Retrieved from e24.no: <https://e24.no/norsk-oekonomi/i/g7pm1J/russland-stanser-import-av-norske-produkter>

Næringslivets Hovedorganisasjon. (2022). *Økonomisk overblikk 1/2022. Krigen i Ukraina og norsk næringsliv. Oppdaterte utsikter 2022-2024*. Næringslivets hovedorganisasjon.

OECD. (2021a). *Russia*. Retrieved from oec.world:

<https://oec.world/en/profile/country/rus?depthSelector1=HS2Depth&yearSelector1=2021>

OECD. (2021b). *Norway*. Retrieved from oec.world:

<https://oec.world/en/profile/country/nor?depthSelector1=HS2Depth&subnationalFlowSelector=flow1&yearlyTradeFlowSelector=flow1>

OECD. (2021c). *Country Rankings (ECI)*. Retrieved from oec.world:

<https://oec.world/en/rankings/eci/hs6/hs96>

OECD. (2021d). *Sweden*. Retrieved from oec.world:

<https://oec.world/en/profile/country/swe?depthSelector1=HS2Depth>

OECD. (2021e). *Denmark*. Retrieved from oec.world:

<https://oec.world/en/profile/country/dnk?depthSelector1=HS2Depth&yearlyTradeFlowSelector=flow1>

OECD. (2021f). *Historical Data Sweden and Russia*. Retrieved from oec.world:

<https://oec.world/en/profile/bilateral-country/rus/partner/swe?depthSelector=HS2Depth&dynamicBilateralTradeSelector=year2021>

OECD. (2021g). *Historical data, Norway and Russia*. Retrieved from oec.world:

<https://oec.world/en/profile/bilateral-country/rus/partner/nor?depthSelector=HS4Depth&dynamicBilateralTradeSelector=year2012>

OECD. (2021h). *Historical Data Russia Denmark*. Retrieved from oec.world:

<https://oec.world/en/profile/bilateral->

country/rus/partner/dnk?depthSelector=HS2Depth&dynamicBilateralTradeSelector=year2018

OECD. (n.d.). *About the Site*. Retrieved from The Observatory of Economic Complexity: <https://oec.world/en/resources/about>

OECD. (2023). *Monthly Monetary and Financial Statistics (MEI): Exchange rates (USD monthly averages)*. Retrieved May 27, 2023, from OECD.stat: <https://stats.oecd.org/index.aspx?queryid=169>

Ostroukh, A., & Winning, A. (2017, April 18). *Investors see bias as Russian statistics agency revises figures*. Retrieved from reuters.com: <https://www.reuters.com/article/us-russia-statistics/investors-see-bias-as-russian-statistics-agency-revises-figures-idUSKBN17K0RP>

Ozawa, M., & Iftimie, I. A. (2020). *Europe's dependence on Russian natural gas*. NATO Defense College.

Petersen, M. A. (2009). Estimating Standard Errors in Finance Panel Data Sets: Comparing Approches. *The Review of Financial Studies, Volume 22, Issue 1*, 435-480.

Pichon, E., & Russell, M. (2022, April). *Human Development in Putin's Russia [Briefing]*. Retrieved from European Parliament: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/729375/EPRS_BRI\(2022\)729375_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/729375/EPRS_BRI(2022)729375_EN.pdf)

Qian, L., Shahriar, S., Kea, S., & Abdullahi, N. (2019, June). The gravity model of trade: A theoretical perspective. *Review of Innovation and Competitiveness*, 21-42. Retrieved from Research Gate: https://www.researchgate.net/publication/333703304_The_Gravity_Model_of_Trade_A_Theoretical_Perspective

Regjeringen. (2023, April 28). *The European Economic Area Agreement*. Retrieved from government.no: <https://www.regjeringen.no/en/topics/european-policy/eos/id115261/>

Reuters. (2022a, February 21). *Factbox: What are the Minsk agreements on the Ukraine conflict?* Retrieved from reuters.com: <https://www.reuters.com/world/europe/what-are-minsk-agreements-ukraine-conflict-2022-02-21/>

-
- Reuters. (2022b, May 13). *Factbox: Russia's response to Western sanctions*. Retrieved from Reuters: [reuters.com/world/russias-response-western-sanctions-2022-05-13/](https://www.reuters.com/world/russias-response-western-sanctions-2022-05-13/)
- Reuters. (2022c, April 4). *Russia imposes visa restrictions on citizens of "unfriendly countries"*. Retrieved from reuters.com: <https://www.reuters.com/world/russia-imposes-visa-restrictions-citizens-unfriendly-countries-2022-04-04/>
- Reuters. (2022d, September 23). *Voting begins in Russia's annexation plan for swathes of Ukraine*. Retrieved from Reuters: <https://www.reuters.com/world/europe/russia-begin-annexation-votes-ukrainian-regions-2022-09-22/>
- Rime, D. (2021, May 5). *Hvorfor skal vi bry oss om valuta?* Retrieved from bi.no: <https://www.bi.no/forskning/business-review/articles/2021/05/hvorfor-skal-vi-bry-oss-om-valuta/>
- Ritzau. (2023, May 9). *Forbud mod eksport til tredjelande er sidste udvej, siger Von der Leyen*. Retrieved from TV2 Nyheder: <https://nyheder.tv2.dk/udland/2023-05-09-forbud-mod-eksport-til-tredjelande-er-sidste-udvej-siger-von-der-leyen>
- ROSSTAT. (2022, December 30). *ВВП кварталы (с 1995 г.)*. Retrieved from rosstat.gov.ru: <https://rosstat.gov.ru/statistics/accounts>
- ROSSTAT. (2023, 04 26). *Демография - Численность населения*. Retrieved from rosstat.gov.ru: <https://rosstat.gov.ru/folder/12781#>
- Salvesen, H., Norseng, P. G., Mardal, M. A., Weidling, T. R., Giverholt, H., Tvedt, K. A., & Opsahl, E. (2023, January 17). *Sveriges historie*. Retrieved from snl.no: https://snl.no/Sveriges_historie
- Sanksjonsloven. (2021). *Lov on gjennomføring av internasjonale sanksjoner. (LOV-2021-04-16-18)*. Retrieved from <https://lovdata.no/dokument/NL/lov/2021-04-16-18>
- SCB. (2020). *Bruttonationalprodukten (BNP) årsdata 1993-*. Retrieved from scb.se: https://www.scb.se/contentassets/fec208f47a5e4ddd8c737b2ea4346a82/nr0103_2020a01_di_01_sv_bnp1994.xls
- SCB. (2023a, March 06). *GDP: (ESA 2010) expenditure approach (xlsx)*. Retrieved from <https://www.scb.se/en/finding-statistics/statistics-by-subject-area/national-accounts/national-accounts/national-accounts-quarterly-and-annual-estimates/pong/tables-and-graphs/tables/gdp-quarterly/>

- SCB. (2023b, March 27). *Imports and exports of goods. Total values by trading partner, adjusted for non response. Month 1998M01 - 2023M01*. Retrieved from statistikdatabasen.scb.se:
https://www.statistikdatabasen.scb.se/pxweb/en/ssd/START__HA__HA0201__HA0201A/OImpExpLandTotMan/
- Selliaas, A. (2003). Russisk medlemskap i NATO? *Internasjonal Politikk*, 61(3), pp. 325-338. Retrieved from <https://www.idunn.no/doi/pdf/10.18261/ISSN1891-1757-2003-03-03>
- Sheiner, L., & Dynan, K. (2018, August). GDP as a Measure of Economic Well-being. *Hutchins Center Working Paper #43*.
- Shepard, B., Doytchinova, H., & Kravchenko, A. (2019). *The Gravity Model of International Trade: A User Guide [R version]*. Bangkok: United Nations ESCAP.
- Skvarciany, V., Jurevičiene, D., & Vidžiūnaite, S. (2020). The Impact of Russia's Import Embargo on the EU Countries's Exports. *Economies*.
- Smeets, M. (2019). The theory and practise of economic sanctions. In S. Sutyryn, O. Y. Trofimenko, & A. Koval (Eds.), *Russian Trade Policy* (pp. 66-78). London: Routledge.
- Sommer, M., Elstrup, M., & Høyer, P. (2023, February 22). *Tyrkiet mistænkes for at sælge russiske træpiller til Danmark: Ekspert mistænker sanktionsbrud*. Retrieved from Børsen: https://borsen.dk/nyheder/virksomheder/tyrkiske-traepiller-vaelter-pludselig-ind-i-danmark?b_source=borsen&b_medium=row_2&b_campaign=news_3
- Sonnenfeld, J. A., Tian, S., Sokolowski, F., Wyrebkowski, M., & Kaspirowicz, M. (2022, August). Business Retreats and Sanctions Are Crippling the Russian Economy.
- Spicer, J. (2023, February 5). *U.S. warns Turkey on exports seen to boost Russia's war effort*. Retrieved from Reuters: <https://www.reuters.com/world/us-warned-turkey-exports-seen-boost-russias-war-effort-official-says-2023-02-04/>
- SSB. (2020, April). *About seasonal adjustment*. Retrieved from ssb.no:
<https://www.ssb.no/en/nasjonalregnskap-og-konjunkturer/statistikker/knr/maaned/2020-06-05?fane=sesongjustering#content>

-
- SSB. (2022, December 31). *09190: Final expenditure and gross domestic product. Unadjusted and seasonally adjusted figures 1978K1 - 2022K4*. Retrieved from ssb.no: <https://www.ssb.no/en/statbank/table/09190/>
- SSB. (2023a, April 17). *08799: External trade in goods, by commodity number (HS) and country 1988M01 - 2023M03*. Retrieved from ssb.no: <https://www.ssb.no/en/statbank/table/08799/>
- SSB. (2023b, May 03). *Fakta om norsk økonomi*. Retrieved from ssb.no: <https://www.ssb.no/nasjonalregnskap-og-konjunkturer/faktaside/norsk-okonomi>
- SSB. (2023c, 04 19). *09283: Eksport av fisk, etter varegruppe, land, statistikkvariabel og år*. Retrieved from ssb.no: <https://www.ssb.no/statbank/table/09283/chartViewColumn/>
- SSB. (2023d, May 10). *Consumer price index*. Retrieved from Statistics Norway: <https://www.ssb.no/en/priser-og-prisindekser/konsumpriser/statistikk/konsumprisindeksen>
- Starostina, Y. (2022, July 1). *Secret Economy: What Hiding the Stats Does for Russia*. Retrieved from [carnegieendowment.org](https://carnegieendowment.org/politika/87432): <https://carnegieendowment.org/politika/87432>
- Stecklow, S., Gauthier-Villars, D., & Tamman, M. (2022, December 31). *A Reuters Special Report: The supply chain that keeps tech flowing to Russia*. Retrieved from Reuters: <https://www.reuters.com/investigates/special-report/ukraine-crisis-russia-tech-middlemen/>
- Stognei, A., & Ivanova, P. (2023, March 23). *Kazakhstan to step up monitoring of goods re-exported to Russia*. Retrieved from Financial Times: <https://www.ft.com/content/b4e8c02a-adb5-4148-9b15-c0cf2845fa0f>
- Strategic Communications division in the European Union External Action. (2021, October 7). *European Union sanctions*. Retrieved from [eeas.europa.eu](https://www.eeas.europa.eu/eeas/european-union-sanctions_en): https://www.eeas.europa.eu/eeas/european-union-sanctions_en
- The Arctic Council. (n.d.). *ABOUT THE ARCTIC COUNCIL*. Retrieved from [arctic-council.org](https://arctic-council.org/about/): <https://arctic-council.org/about/>

The Norwegian Government. (2022, March 18). *Krisepakke til næringslivet i Øst-Finnmark*. Retrieved from regjeringen.no: <https://www.regjeringen.no/no/aktuelt/krisepakke-til-naringslivet-i-ost-finnmark/id2904665/>

The Scottish Government: The Office of the Chief Economic Adviser. (2016, January 6). *Computable General Equilibrium modelling: introduction*. Retrieved from [www.gov.scot: https://www.gov.scot/publications/cge-modelling-introduction/#:~:text=CGE%20models%20are%20large%20numerical,or%20shocks%20in%20the%20economy.](https://www.gov.scot/publications/cge-modelling-introduction/#:~:text=CGE%20models%20are%20large%20numerical,or%20shocks%20in%20the%20economy.)

The World Bank. (2021a). *GDP(current US\$)*. Retrieved from The World Bank: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?most_recent_value_desc=true

The World Bank. (2021b). *World Bank Open Data*. Retrieved from [data.worldbank.org: https://data.worldbank.org/](https://data.worldbank.org/)

The World Bank. (2021c). *GDP per capita (Current US\$)*. Retrieved from [data.worldbank.org: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?most_recent_value_desc=true](https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?most_recent_value_desc=true)

The World Bank. (2021d). *GDP growth (annual %) - Denmark*. Retrieved from [data.worldbank.org: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=DK](https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=DK)

The World Bank. (2021e). *GDP growth (annual %) - Russian Federation*. Retrieved from [data.worldbank.org: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2021&locations=RU&start=2012](https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2021&locations=RU&start=2012)

The World Bank. (2023, April 24). *About us*. Retrieved from [data.worldbank.org: https://data.worldbank.org/about](https://data.worldbank.org/about)

Tinbergen, J. (1962). *Shaping the world economy*. New York: The Twentieth Century Fund.

Trading Economics. (2023, May 27). *Crude oil*. Retrieved from [tradingeconomics.com: https://tradingeconomics.com/commodity/crude-oil](https://tradingeconomics.com/commodity/crude-oil)

-
- Transparency International. (2021). *Corruption Perceptions Index 2021*. Transparency International. Retrieved from Transparency International.
- Ullah, S., Ullah, F., & Zaefarian, G. (2021). How to use untrumental variables in addressing endogeneity? A step-by-step procedure for non-specialists. *Industrial Marketing Mangement, Volume 96*, A1-A6.
- UN News. (2023, May 15). *Ukraine*. Retrieved from news.un.org:
<https://news.un.org/en/focus/ukraine>
- UN Statistics. (2022, October 03). *Definition: Re-exports and Re-imports*. Retrieved from unstats.un.org: <https://unstats.un.org/wiki/display/comtrade/Definition%3A+Re-exports+and+Re-imports>
- United Nations. (2023, April 24). *Russian Federation*. Retrieved from data.un.org:
<https://data.un.org/en/iso/ru.html>
- United Nations Conference on Trade and Development. (2021, April 6). *Evolution of the world's 25 top trading nations*. Retrieved from unctad.org:
<https://unctad.org/topic/trade-analysis/chart-10-may-2021>
- van Bergeijk, P. A., & Brakman, S. (2010). *The Gravity Model in International Trade: Advances and Applications*. Cambridge: Cambridge University Press.
- Walker, N. (2023). *Conflict in Ukraine: A timeline (2014-present)*. London: House of Commons Library.
- Witte, M. d. (2023, February 17). *How will the Russia-Ukraine war end?* Retrieved from news.stanford.edu: <https://news.stanford.edu/2023/02/17/will-russia-ukraine-war-end/>
- Wooldridge, J. M. (2012). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, Massachusetts & London, England: The MIT Press.
- Wooldridge, J. M. (2018). *Introductory Econometrics A Modern Approach Seventh Edition*. Boston: Cenage.
- World Customs Organization. (2017). *Hamonized System*. Retrieved from World Customs Organization: <https://www.wcotradetools.org/en/harmonized-system/2017/en>

Yeliseyeu, A. (2017). Belarusian shrimps anyone? How EU food products make their way to Russia through Belarus. *GLOBSEC*.

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., & Larch, M. (2016). *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*. WTO & UNCTAD.

Ytreberg, R., Elvevold, L., & Johansen, R. (2022, June 26). *Russisk torsk for 1 milliard kroner i Norge: – Dette finansierer krigen*. Retrieved from e24.no:
<https://e24.no/naeringsliv/i/bGpmQB/russisk-torsk-for-1-milliard-kroner-i-norge-dette-finansierer-krigen>

Appendix

A1 Timeline over important events and implemented sanctions

Following is a timeline (until September 2022) of important events related to the imposed sanctions. Highlighted parts include imposed sanctions from EU and Russia.

November 21, 2013: Former Ukrainian President Yanukovich suspends trade and reject the association agreement with the EU. Signaling stronger economic ties to Russia. (Walker, 2023)

Nov 2013- Feb 2014: Protest against the Ukrainian government, with especially violent clashes between 18-22 February leading to several fatalities (Walker, 2023).

March 17, 2014: The **EU and the US impose sanctions** related to travel and a freeze of assets on Russian and Ukrainian officials after a referendum about joining Russia in Crimea (Walker, 2023).

March 21, 2014: President Putin formally announces Russian annexation of Crimea (Walker, 2023).

June 23, 2014: The EU adopts an **import ban on goods from Crimea** (Council of the European Union, 2023c).

August 1, 2014: Increase in **EU sanctions** against Russia, includes a halt on exports of equipment for Russian oil companies, exports of all weapons on the EU weapons list and dual use goods or technology for military use (NTB, Sundberg, Gjendem, & Lorentzen, 2014).

August 7, 2014: **Russian import embargo** on fruits, vegetables, meat, fish and milk products from Norway, the US, the EU, Australia, and Canada (NTB, Sundberg, Gjendem, & Lorentzen, 2014).

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- September 2014: The first Minsk agreement on prisoners' exchanges, withdrawal of heavy weapons and deliveries of humanitarian aid, between Ukraine and separatists in Eastern Ukraine. The agreement later broke down (Reuters, 2022a).
-
- February 2015: The second Minsk agreement between the Organization for Security and Cooperation in Europe, Russia, Ukraine, and leaders of two separatist regions. The agreement included, for instance, a ceasefire, withdrawal of heavy weapons, and restoration of Ukraine's control over the state border (Reuters, 2022a).
-
- April 2021: Tension increases between Ukraine and Russia as 110 000 Russian soldiers have been located near the border to Ukraine. Weeks later, the Russian Defense Minister Shoigu announces a redeploy of the forces, averting concerns of renewed fighting and crisis (Walker, 2023).
-
- November 13, 2021: Once again, tension increases as nearly 100 000 Russian soldiers have been located near the border to Ukraine (Walker, 2023).
-
- February 10, 2022: A large joint military exercise between Russia and Belarus is launched near border between Belarus and Ukraine. It is supposed to continue until February 20. (Walker, 2023)
-
- February 23, 2022: **First package of EU sanctions** includes restrictions on individuals and Russian access to capital and financial markets and services in the EU (Council of the European Union, 2023d).
-
- February 24, 2022: President Putin announces Russian military action towards Ukraine. War of aggression against Ukraine begins (Council of the European Union, 2023d).
-
- February 25, 2022: **Second package of EU sanctions** includes restrictions on individuals (etc. Vladimir Putin), visa facilitation provisions and

sanctions on the energy, technology, finance, and transport sectors (Council of the European Union, 2023d).

Feb 28 and Mar 2, 2022: **Third package of EU sanctions** includes a SWIFT ban for seven Russian banks, ban on transactions with the Russian Central Bank, closure of airspace over the EU for Russian aircrafts, and suspension of state-owned broadcasters Sputnik and Russia Today (Council of the European Union, 2023d).

March 15, 2022: **Fourth package of EU sanctions** includes a ban on exports of luxury goods, a ban on import of iron and steel from Russia, and prohibition on new investments in Russian energy sector (Council of the European Union, 2023d).

March 31, 2022: Putin demands foreign purchasers of Russian gas to pay with Russian rubles, boosting the currency. This would imply that foreigners must open accounts in Russian banks. (Nasr & Trevelyan, 2022).

April 8, 2022: **Fifth package of EU sanctions** includes a ban on exports of jet fuel, a ban on imports of seafood, cement, wood, liquor and coal from Russia, and a closure of ports in the EU for Russian vessels (Council of the European Union, 2023d).

May 3, 2022: The **Russian countersanctions** against sanctioning states. Includes prohibition of export of raw materials to individuals and entities on a sanction list that was to be announced (Faulconbridge, 2022)

June 3, 2022: **Sixth package of EU sanctions** include a ban on imports of crude oil and refined petroleum products (with a phase out period on 6 and 8 months), with some exceptions, and an increase in banks subjected to the SWIFT ban and Russian broadcasters suspended in the EU (Council of the European Union, 2023d; Council of the European Union, 2022).

July 21, 2022: **The “maintenance and alignment” EU sanction package** includes a ban on imports of Russian gold and increased control of export of dual-use goods (Council of the European Union, 2023d).

September 2022: Referenda on voting for the occupied areas of Donetsk, Luhansk, Zaporizhzhia and Kherson, to join the Russian Federation (Reuters, 2022d).

A2 VIF Test for Multicollinearity

VIF test checks for multicollinearity in the estimated models. Values higher than 10 indicate high multicollinearity in the models.

Variables	VIF score
logGDP.Russia	21.187866
logGDP.Partner	7.043840
logDistance	2.130966
Period1	1.305773
Period2	1.306622
Period3	4.367417
Period4	3.393820
Period5	3.174404
Covid	1.225602
CPI	9.713957
Exch.Partner	12.094626
Quarter2	3.383229
Quarter3	10.938929
Quarter4	23.298917

Table 1111: VIF scores

A3 Breusch-Pagan tests for heteroskedasticity

The Breusch-Pagan (BP) test checks for heteroskedasticity in the estimated models. The null hypothesis for the BP test is homoscedasticity, therefore, a p-value lower than 5 percent signifies that the null hypothesis homoscedasticity can be rejected. Hence, heteroskedasticity exists in the models.

Estimated model	P-value	Conclusion
Breusch-Pagan tests for fixed effects models from table 3		
Total trade	0.02365	Heteroskedasticity
Imports	0.008691	Heteroskedasticity
Exports	0.00009034	Heteroskedasticity
Breusch-Pagan tests for fixed effects models from Error! Reference source not found.		
Total trade	0.000000000007858	Heteroskedasticity
Imports	0.00000000000445	Heteroskedasticity
Exports	0.0002222	Heteroskedasticity
Breusch-Pagan tests for fixed effects models from Table 7		
Total trade	0.000000002568	Heteroskedasticity
Imports	0.00000009619	Heteroskedasticity
Exports	0.00009758	Heteroskedasticity

Table 1212: Breusch-Pagan tests for heteroskedasticity

A4 Autocorrelation plots

Autocorrelation plots to check for serial correlation in the estimated models. Lag zero always contains a correlation of 1. Subsequent lags above the significant threshold (shown as a dotted line) signifies serial correlation in the estimated model.

Figure 5: Autocorrelation plots for estimated regressions

