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Economic Sanctions and their Effects on Trade and Welfare“

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Abstract

Economic Sanctions are a popular and widely used tool in foreign policy. Their impositions have steadily increased over the last three decades. The aim of such impositions is to incentivise the behaviour of the targeted countries by certain costs in favour of the sender countries. The imposition of sanctions, however, is also accompanied with certain costs for the sender countries. This paper evaluates the stated costs for 29 sanctioning countries for the period between 1990 and 2016. A newly published database on economic sanctions (GSDB) allows to have a more detailed look on the economic impact of such restrictions due to its rich dimensionality. The reported results in this paper are obtained by the use of the gravity model and its latest development in the empirical application. The empirical analysis is built on two major building blocks in order to quantify the costs accordingly. First, a partial equilibrium analysis allows to obtain the direct costs of sanctions in terms of trade flows. Second, the general equilibrium analysis allows to quantify the losses in terms of welfare. The results of the partial equilibrium analysis show a highly significant and negative impact of *trade* sanctions on bilateral trade flows. The average losses for the senders can be quantified by a reduction of 12.33% in bilateral trade. *Partial* export sanctions are able to reduce bilateral trade by about 24.72% between the participating countries. The imposition of *complete* export sanctions show a loss of 64.04% in terms of trade flows between the senders and the targets. The general equilibrium analysis shows an average loss in terms of welfare by about 0.4% of real GDP, corresponding to 493.74 million US dollars, due to the imposition of *trade* sanctions for the sender countries in the year 2015.

Kurzfassung

Wirtschaftssanktionen stellen ein beliebtes und weit verbreitetes Instrument der Außenpolitik dar. Über die letzten drei Jahrzehnte nahm deren Verhängung stetig zu. Das Ziel von Sanktionen ist dabei letztlich die Herbeiführung einer Verhaltensänderung der sanktionierten Länder, unter der Abverlangung gewisser Kosten, im Sinne der sanktionierenden Länder. Die Verhängung von Sanktionen ist jedoch auch mit gewissen Kosten für die sanktionierenden Länder verbunden. Die vorliegende Arbeit evaluiert genau jene Kosten für 29 sanktionierende Länder über den Zeitraum von 1990 bis 2016. Eine erst kürzlich veröffentlichte Datenbank zu ökonomischen Sanktionen (GSDB) erlaubt mittels ihrer detaillierten Darstellung einen tieferen Einblick in die konkreten wirtschaftlichen Auswirkungen der einzelnen Sanktionsmaßnahmen. Die dokumentierten Ergebnisse in dieser Arbeit wurden mithilfe des Gravitationsmodells und dessen aktuellsten Entwicklungen in der empirischen Anwendung erzielt. Die empirische Untersuchung besteht dabei aus zwei großen Teilbereichen, um jene Kosten entsprechend quantifizieren zu können. Der erste Teilbereich stellt die partielle Gleichgewichtsanalyse dar, welche es erlaubt die direkten Kosten von Sanktionen mittels bilateralen Handelsströmen zu beziffern. Der zweite Teilbereich erlaubt unter der Anwendung einer allgemeinen Gleichgewichtsanalyse die Wohlfahrtsverluste für die sanktionierenden Länder, gemessen in realem BIP, zu quantifizieren. Die Schätzungen zeigen einen hoch signifikanten und negativen Effekt von Handelssanktionen auf die bilateralen Handelsströme der jeweiligen Länder. Die durchschnittlichen Verluste von den oben genannten Handelssanktionen gehen mit einer Reduktion der Handelsströme von bis zu 12.33%, zwischen den sanktionierenden und den sanktionierten Ländern, einher. Partielle Exportsanktionen sind fähig einen Rückgang der Handelsströme von rund 24.72% zu erklären. Die Verhängung von totalen Exportembargos können bilaterale Handelsströme zwischen den partizipierenden Länder um bis zu 64.04% reduzieren. Die allgemeine Gleichgewichtsanalyse zeigt einen durchschnittlichen Wohlfahrtsverlust von 0.4% des realen BIP. Dieser Wert entspricht einem Verlust von 493.74 Millionen US Dollar für die sanktionierenden Ländern aufgrund der Verhängung von Handelssanktionen im Jahr 2015.

Contents

Abstract	i
Kurzfassung	iii
List of Tables	vii
List of Figures	ix
1. Introduction	1
2. Related Literature	5
2.1. Approach and Contribution	10
3. Data	13
3.1. The Global Sanctions Database (GSDB)	13
3.2. The CEPII Gravity Database	14
3.3. The Structural Gravity Dataset	15
4. Theory	17
5. The Model	21
5.1. The PPML Estimator	24
6. Partial Equilibrium Analysis	27
6.1. The Approach	27
6.2. Results	28
6.2.1. Sanction Threats	33
7. General Equilibrium Analysis	35
7.1. The Approach	35
7.2. Results	36
7.3. Findings	40
8. Conclusion	43
Bibliography	45
A. Appendix	51
B. Appendix	55

List of Tables

6.1. I(4) Data Base Year 1990	30
6.2. Effects of different sanction types on bilateral trade	32
6.3. I(4) Data Base Year 1990 including Threats	34
7.1. General Equilibrium Effects	37
7.2. Summarized General Equilibrium Effects EU only	39
7.3. Welfare Effects EU only	42
B.1. I(3) Data Base Year 1990	56
B.2. I(4) Data Base Year 1990 EU only	57
B.3. I(4) Data Base Year 1990 US only	58
B.4. I(5) Data Base Year 1990	59
B.5. I(3) Data Base Year 1991	60
B.6. I(4) Data Base Year 1991	61
B.7. I(5) Data Base Year 1991	62
B.8. I(3) Data Base Year 1992	63
B.9. I(4) Data Base Year 1992	64
B.10.I(5) Data Base Year 1992	65
B.11.I(3) Data Base Year 1993	66
B.12.I(4) Data Base Year 1993	67
B.13.I(5) Data Base Year 1993	68
B.14.I(4) Data Base Year 1994	69
B.15.I(5) Data Base Year 1994	70

List of Figures

2.1. Sender Countries 2015	11
2.2. Number of Sanctions	11
6.1. Partial Equilibrium Analysis	27

1. Introduction

Economic Sanctions have been present since people started to organize states. Farmer (2000) defines sanctions as actions that a sender country takes to restrict trade, service or capital flows between itself and the targeted country to promote political goals in favour of the sender. The imposition of sanctions throughout history is highly linked with war and political conflicts and their usage goes back until the ancient Greece in 432 BC. According to Kern (2009), Pericles¹ imposed an import embargo against Greek city-states which had refused to join a military alliance during the Peloponnesian War. The Roman Government imposed trade embargoes in 232 BC by restricting any trade of silver and gold with the Gauls during their ongoing conflict. The time of the religious wars in Europe lead to impositions respectively to the threat about an implementation of sanctions in order to protect the Christian minorities. Later, in the nineteenth century sanctions were used as a strategic tool in warfare to restrict exports of specific goods and supplies needed for combat. During World War I and II Great Britain and the United States imposed export controls and financial sanctions against the Axis Powers and its supporters (Kern, 2009). The imposition of sanctions after the Second World War increased although they display more different characteristics than in recent history. The establishment of organizations such as the United Nations or the European Union lead to more coordinated impositions on a multilateral level. Moreover, the awareness that broad embargoes will cause more social costs in the targeted countries than they would contribute to the objectives of the impositions have grown. Therefore sanctions are nowadays considered to serve as "smart-sanctions" (e.g. Kern, 2009), by targeting specific goods and entities as well as restrict travelling of designated individuals, business relationships with certain enterprises or capital flows.

Thus, economic sanctions are still a popular and widely used tool in foreign policy. Especially the post-Cold War era shows a steady and gradual increase of newly imposed sanctions.² There is hardly any serious political conflict where sanctions and the threat about their imposition is not present in the public debate. Recent cases such as the ongoing sanction regime against Russia is still filling headlines. Caused by the annexation of Crimea in March 2014 and the latter involvement in the conflict in eastern Ukraine the Russian Federation got sanctioned on a multilateral level by a coalition of senders including the United States, Canada, the European Union, Switzerland, Australia and New Zealand.³ The resolution included restrictions on arms sales, financial flows, military

¹Pericles was an influential Greek statesman, orator and general during the golden age of ancient Greek; for details see Azoulay (2014).

²see Felbermayr et al. (2020).

³see Felbermayr et al. (2020) and Kirilakha et al. (2021).

1. Introduction

assistance as well as partial export and import embargoes. Connolly (2018), declares that "[t]his was the first time in the post-Cold War era that such wide-ranging sanctions had been imposed on a country as large and strategically important as Russia." Russia itself responded with the imposition of an import embargo on specific goods from European Countries, North America and Australia.⁴ Further prominent cases are the sanction regimes against North Korea or Iran⁵ due to their nuclear programs imposed by several UN security council resolutions as well as on bilateral level.⁶ In March 2021 within one week several new sanction cases got public. *The Financial Times* reports on new restrictions against Beijing imposed by the Biden Administration due to the Chinese policy of undermining Hong Kong's autonomy.⁷ Few days later, the British Newspaper *the Guardian* reports on additional sanctions against China due to their policy against the Uighur Muslims imposed by a coalition of sender countries including the United States, the European Union, Great Britain, as well as Canada.⁸ China itself responded with the imposition of a travel ban against six members of the European Parliament and four national politicians as well as restrictions against entities such as the Subcommittee on Human Rights of the European Parliament.⁹ The European Union imposed sanctions against Eritrea due to human rights violations in the same week.¹⁰ The stated examples are declaring just a fraction of hundreds of sanction cases in recent years. The newly published Global Sanctions Database (GSDB)¹¹ by Felbermayr et al. (2020) lists 729 publicly traceable, multilateral, plurilateral, and purely bilateral sanction cases between 1950 and 2016. An updated version of the GSDB by Kirilakha et al. (2021) including the years until 2019 reports 1.101 different sanction cases.¹²

Each sanction regime, however, is accompanied with official objectives, which lead to their implementation in the first place. The objectives can range from, *policy change* to *preventing war*, from supporting *human rights* and *democracy* to *end war* or *destabilize regime*. Beside the objectives, also the type and intensity of the sanction regimes differs from case to case, while they all have certain costs in common to incentivise the behaviour of the targeted country. The burden of the costs, however, do differ whether a targeted country or the actual sender country is taken into account. Moreover, the extent of the costs depend on the integration of the specific country in the world economy and the assistance by its supporters. The present thesis will put its focus on the burden carried by the sender countries for the period between 1990 and 2016 quantified by the gravity model.

⁴see Skvarciany et al. (2007).

⁵Note that the sanctions imposed by the UN were lifted in 2016 following the nuclear agreement on July 14, 2015; for details see Ianchovichina et al. (2016) and Kirilakha et al. (2021).

⁶for details see Holmes (2015), Felbermayr et al. (2019) and Kirilakha et al. (2021).

⁷see FT (2021).

⁸see Guardian (2021).

⁹see reuters (2021).

¹⁰see bloomberg (2021).

¹¹The GSDB will serve as the main source for the data on sanctions throughout this thesis; for a detailed discussion of the GSDB see Section 3.

¹²Note that only 75 cases emerged during 2016 and 2019, the remaining 306 additional cases were unrecorded by previous publications. See Kirilakha et al. (2021).

The solid theoretical foundation and empirical success of this model highly supports its application for this purpose. The gravity model can be declared as one of the most famous tools in economics to examine bilateral trade between exporting and importing countries. The literature on gravity estimation has rapidly grown over the last decades, addressing the crucial question which factors tend to increase or decrease trade between and within countries. Economic Sanctions are by their nature a serious factor able to mitigate trade between countries. The aim of this thesis will be to declare how significant and large their impact on trade and welfare actually is. Quantifying such effects does not only depend on a solid theoretical and empirical framework but also on the quality of the data. The stated database (GSDB) allows to have a more detailed look on the actual impact of different sanction types on trade and welfare due to its rich dimensionality. Such resources are welcomed, since the outcome obtained not only means a scientific advancement but also provides decision makers with vital information.

Three particular questions will be addressed in this thesis.

1. How big are the costs of different sanction types for the senders in terms of trade flows?
2. How do the effects of sanction threats differ from imposed sanctions?
3. How big are the costs of sanctions in terms of welfare?

The rest of the paper is structured as follows. Section 2 provides a brief overview of the related literature on sanctions and gravity estimation. Section 3 gives a detailed discussion about the data used throughout the thesis. Section 4 will introduce the reader to the economic theory behind the gravity model while Section 5 discusses its empirical application. Section 6 and 7 are discussing the empirical results and economic effects of imposed sanctions on trade respectively on welfare by performing a counterfactual analysis. The last Section concludes.

2. Related Literature

The scope of the literature on sanctions is as broad as their multiple applications throughout history. The procedure of the implementation is nowadays accompanied by political negotiations with the targeted countries as well as with potential partners in a coalition of senders. Different to the time of Pericles, the stated process is embedded in an institutional setting within the nation-states and especially beyond. Political scientists and jurists are showing big interest in the functional and legal form of such institutions as well as in the objectives which lead to the imposition of sanctions.¹ Another strand of the literature is focusing on the type of sanctions and the costs they cause and, moreover, how these costs are distributed throughout society.² Associated with costs, a next branch of scholars is addressing the issue under which circumstances sanctions can be effective and which factors tend to mitigate this efficiency.³ The question, however, if and when sanctions can be declared as successful is a controversial issue itself. According to Peksen (2019), the financial sanctions against the Iran imposed by the Obama Administration in 2014 can be declared as successful since Tehran agreed on the restrictions to its nuclear program. If one thinks about the multilateral sanction regime⁴ against North Korea by the United States and the United Nations a different picture arises. The mutual coalition of sender countries imposed financial restrictions, trade embargoes, travel restrictions and aid cuts against North Korea since the Cold War respectively since the post-Cold War era. As Peksen (2019) points out, "*Yet, these sanctions not only fell short of destabilizing the North Korean regime, but also failed to induce any notable change in objectionable policies of the regime such as its repressive policies and nuclear weapons program.*" Although the stated examples display a clear picture of success and failure this clarity is not present in all sanction cases, and moreover, not present by the different classifications and thresholds authors are using in order to qualify the outcome of the restrictions.

Hufbauer et al. (1990) or Baldwin (1998) for example, are suggesting that, beside a total capitulation of the targeted countries, sanctions can be still seen as effective when they were able to lead to partial concessions or settlement negotiations. Hufbauer et al. (1990), therefore, clarified sanctions as a successful tool in 35% of the cases they have been investigating. Pape (1998) challenge these findings by declaring that only 4% of the 115 sanction cases they have been examining can be seen as successful. Elliott (1998), thereafter, criticized the approach of Pape (1998) as too narrow in order

¹see Farrall (2007) or Marossi (2015).

²see Allen & Lektzian (2013) or Martin (1993).

³see Early & Spice (2015) or Heine-Ellison (2001); for a broad review see Peksen (2019).

⁴Note that the UN joined the sanction regime against North Korea after the Cold War in the year 2006; for details see Holmes (2015).

2. Related Literature

to declare for failure and success. Early (2015) investigated several sanction regimes imposed by the United States over a period of 60 years and declared that less than a third of the examined cases achieved the goals of their implementation. Felbermayr et al. (2020) are following a different approach in order to account for failure and success by relying on official government statements or indirect confirmation of authorities in the international press. In order to account for success and efficiency accordingly they define different categories such as *Partial* or *Full Success*, *Settlement by Negotiations*, *Ongoing* or *Failure*. Given the different objectives, different rates of success or failure can be seen in their data. The imposed sanctions with the objective to *End War* can be declared as full success in 43% of all cases and with a rate of failure of 15% for the period between 1950 and 2016. The sanctions imposed with the objective to support *Democracy* seemed to be more successful with a success rate of nearly 60% while the sanctions imposed to *destabilize a regime* failed in 40% of all the reported cases. The different findings of success and failure obviously do not only depend on the different definitions. A crucial explanation can be derived from the different types of sanctions, which are used to incentivize the behaviour of the targets. Moreover, can cause the imposition of sanctions backfiring reactions in the targeted countries against the objectives of the sender countries. Also, third-party countries can intervene in order to support the targets by mitigating the harm caused by the restrictions. Another issue would be the uneven share of the costs of the sanctions among the allies of sender countries which may incentivize deviations from the imposed regime in order to reduce the burden of the costs.⁵

Although the question of failure and success is not the main objective of this thesis, it is crucial for the further understanding of the effects of sanctions, that the different characteristics and types and, moreover, the environment in which the targeted countries are embedded is finally determining the impact of the restrictions by the costs they cause. This brief excursion provided an insight into the controversial and still ongoing debate over success and efficiency. To what degree sanctions can be declared as *counterproductive* or *ineffective* as Hanania (2020) proposes, might be more a question for political scientists rather than for economists. Economists, however, are able to provide scholars and decision makers with valid information over the costs by the use of theoretically founded models. The gained information is essential for any further debate over success and efficiency. And moreover, crucial for any political negotiations over the implementation of sanction regimes. Although, the controversial debate shows different approaches in the literature there can also be identified a certain pattern. According to Felbermayr et al. (2019) Morgan & Schwebach (1997) propose a theoretical and empirical framework that suggests, that the higher the costs of the sanctions for the targeted countries are, the higher the probability will be that the regime will be successful. By also taking the sender countries into account Drezner (1999) gives the full picture by proposing, that the lower the costs for the senders are, the more likely it is that the sanctions will be successful.

The model, which is widely used to quantify the stated costs is the so called gravity

⁵for details see Hufbauer et al. (2009) and Drezner (1999).

model.⁶⁷ The model was first applied in economics by Tinbergen (1962). He considered a simple version of the model, which got developed further theoretically and in its econometric application by a vast amount of studies over the last decades. The basic idea of the model proposes a positive relationship for trade between two countries regarding their economic size and a negative relationship regarding the realized trade costs between them. The crucial part in gravity estimation is the approximation of the unobservable trade costs. Tinbergen (1962) approximated the stated costs by the distance of the two trading partners to each other. Beside geographical measures like distance other indicators such as common language (e.g. Melitz & Toubal, 2014), common currency (e.g. Rose & van Wincoop, 2001) or the share of a common border (e.g. McCallum, 1995) were implemented in the model in order to account for the unobservable trade costs. Beside factors which tend to mitigate trade, also events, which tend to promote trade were included in the model, such as the prospect of a EU membership (e.g. Stack & Pentecost, 2011), the effects of trade agreements or a membership by the WTO (e.g. Tomz et al., 2007), (e.g. Dai et al., 2014). Other studies investigated the favourable effects of mega sport events (e.g. Ghaith et al., 2016) or the potential costs a visit from the leader of the Tibetan community the Dalai Lama can cause (e.g. Fuchs & Klann, 2013). Also recent events such as the Brexit and its consequences were examined by the use of the gravity model. The study by Oberhofer & Pfaffermayr (2018) assumed different counterfactual scenarios and estimated a loss in real income between 1.4% and 5.7% for the UK. The effects for the EU, however, are according to their findings negligible in magnitude and statistically not different from zero. Also institutions such as the IMF or the OECD made use of the gravity model in order to quantify and predict the impact of the referendum. The results they obtained provided crucial information for the further Brexit negotiations.⁸ Similar to the case of the Brexit, scholars provide decision makers with certain information over the effects of sanctions by commissioned work and beyond. A big amount of different studies examined the effects of sanctions on trade and welfare by the use of the gravity model.⁹

One of the first and most prominent applications of the model on the effects of sanctions was done by Hufbauer et al. (1997). Their sample comprised 88 countries for the years of 1985, 1990 and 1995. As the theory would imply, they found a strong negative impact of sanctions on bilateral trade flows. Even more notably, they have already shown in their early work the importance of distinguishing between the different sanction regimes and their intensity. They, therefore, categorized the regimes by three different groups defining *extensive*, *moderate* and *limited* sanctions. The results they obtained were overall highly statistically significant for all categories. Moreover, the intensity of the different sanction

⁶for a detailed discussion of the gravity theory see Section 4, see Section 5 for its empirical application.

⁷Note that the gravity model is also applied to other purposes, such as investigating migration flows instead of trade flows. See Lewer & Van den Berg (2008).

⁸for details see Gudgin et al. (2017).

⁹Note that also other models are used to examine the effects of sanctions. See Weber & Schneider (2020a) for a game-theoretic approach or Dizaji & van Bergeijk (2013) for the use of a autoregressive (VAR) model.

2. Related Literature

regimes were reflected by the sizes of the coefficients. According to their results they quantified a negative effect on trade flows by (-1.53) for *extensive* sanctions, (-0.402) for *moderate* and (-0.242) for *limited* sanctions for the year 1995. The stated results were obtained by a sample including all OECD countries as senders of sanctions. They also applied the same approach by a limited sample considering the United States as the only sender country and quantified the effects on US exports by (-3.452) for *extensive*, (-1.138) for *moderate* and (-0.234) for *limited* sanctions for the same year. The stated coefficients are corresponding to a loss in US exports of 15 to 19 billion US dollars due to the impositions. Caruso (2003) examined the effects of sanctions on bilateral trade between the United States and 49 targeted countries for the period of 1960 to 2000. The findings of Caruso (2003) were in line with the results by Hufbauer et al. (1997). Caruso (2003) similarly defined different groups of sanction regimes in order to account for their different intensities. He categorized two different groups of sanctions by *moderate* and *extensive*. He, moreover, defined a third category called *multilateral* to capture multilateral imposed regimes. Caruso (2003) obtained his results by the same database¹⁰ as Hufbauer et al. (1997) used in their study. He showed a slightly positive but statistically insignificant impact of *limited* sanctions on bilateral trade but a negative and statistically significant effect of *extensive* sanctions corresponding to a reduction of bilateral trade in the sample by 89% and 82% due to *multilateral* imposed regimes. Caruso (2003) additionally performed a counterfactual experiment and quantified the potential gain in bilateral trade between the U.S. and the targeted countries by 59% in the absence of the unilaterally impositions.

Yang et al. (2004) examined the effects of US imposed sanctions and trade diversion. Their results are in line with the findings by Hufbauer et al. (1997) and Caruso (2003). Yang et al. (2004) estimated an average effect in export loss by 15 billion US dollars for the years between 1989 and 1998. They, moreover, found evidence for trade diversion in some cases with an increase of trade between the targeted countries and the EU as well as Japan due to the imposition by the United States. Slavov (2007) analyzed the multilateral sanction regimes imposed by the United Nations and their effects on the neighbouring countries of the specific targets. By applying the structural gravity model of Anderson & van Wincoop (2003) and the use of annual data on 82 countries for the years between 1989 and 2000, their study showed significant evidence for a decrease in imports and exports for the neighbouring countries with the rest of the world during the sanction episode. As possible explanations for this externalities he quotes increasing transportation costs, cutting off trading routes or the disruption of established trading ties due to the imposed sanction regimes.

Recent works¹¹ are not only interested in different sanction cases but, moreover, do apply new econometric approaches in their studies. Hinz (2017), for example, investigated the effects of the multilateral sanction regimes against the Iran, the Russian Federation

¹⁰The stated database is provided by Hufbauer et al. (1990).

¹¹for a review of the latest literature on sanctions, data and analysis see Hufbauer & Jung (2020).

and Myanmar by the use of quarterly data from 48 countries over the period from 2010 to 2015. His results show a significant decreasing effect of bilateral trade flows due to sanction regimes. He estimated a loss of 0.4% of global trade in 2014 equivalent to 50 billion US-dollars by performing a counterfactual analysis. Skvarciany et al. (2007) studied the impact of the Russian import embargo on the EU Countries' exports and quantified a total loss in exports of 226,850 million US-dollars for the period between 2014 and 2018. Frank (2017) examined the direct effects of sanctions on bilateral trade flows by controlling for country pair, importer-year and exporter-year fixed effects. He made usage of the TIES data set and grouped the different types of sanctions into three main categories by *extensive* (complete embargoes), *moderate* (partial embargoes) and *limited* (e.g. travel bans) sanctions. The obtained results are showing again the importance of differentiating between the different types of sanctions. His estimates show, that most of the significant negative impact of sanctions on trade is carried by *moderate* sanction types. The estimates did not show any significant effect for *limited* sanctions while depending on the specific classification of *extensive* sanctions he obtained a significant and big effect in magnitude on bilateral trade flows. Popova & Rasoulinezhad (2016) investigated the sanction regime against Iran with special interest on trade diversion effects due to the restrictions by the European countries. They found clear evidence of such an effect by shifting the direction of trade from Iran towards Asia. They quantified a decrease in bilateral trade between Iran and the EU by 50% on average and an increase on trade between Iran and Asian Countries with 85,2% on average. Afesorgbor (2019) additionally made usage of sanction threats to determine the friction of bilateral trade flows. He obtained a positive effect on bilateral trade flows due to sanction threats and a negative effect on bilateral trade flows between the sender and the targets due to the imposition of sanctions.

Felbermayr et al. (2019) firstly made usage of the newly created database GSDB to examine the effects of sanctions on bilateral trade and welfare. The rich dimensionality of the GSDB allows to obtain the effects on the different types of sanction regimes (e.g. trade, travel ban, financial) and, moreover, of the different kind of trade sanctions such as *partial* or *complete* restrictions. Felbermayr et al. (2019) obtained their results by the structural gravity model of Anderson & van Wincoop (2003) and the Poisson Pseudo Maximum Likelihood estimator. They obtained a negative and statistically highly significant impact of *trade* sanctions by (-0.176) on bilateral trade for the period between 1950 and 2016. More notably the different kind of trade sanctions were able to negatively affect trade by (-0.449) for *partial* export and (-2.108) for *complete* export and import sanctions. In line with the stated studies above they found no statistically significant effect on bilateral trade due to *limited* sanction types such as *travel bans* or *military assistance*. By performing a counterfactual general equilibrium analysis on the sanctions on Iran they quantified a potential gain of a termination of the regime with an increase of 4.2% on the Iranian real income for the base year of 2014. The sender countries such as the UK would only gain marginally by an increase of less than 0.03% in real income.

Recent studies examine the effects of economic sanctions by the use of sectoral rather than aggregate data. Haidar (2017) used firm-level data to quantify the impact of economic

2. Related Literature

sanctions on the Iranian exporters. Larch et al. (2021) quantified the effects of economic sanctions on trade in the mining and energy sector. Borodin & Salnikov (2018) examined the effects of economic sanctions on the Russians Sunflower Oil exports.

2.1. Approach and Contribution

Each study mentioned above puts its focus on certain aspects of sanctions and their effects by the use of specific databases and different econometric approaches. The present thesis will examine the effects of sanctions on trade and welfare by the use of the newly published database (GSDB) and the latest recommendations in the empirical literature on gravity estimation with aggregate annual data for the period between 1990 and 2016. The main focus, therefore, lies on the burden of the costs carried by the sender countries. Since the United States and the European Union are the major senders of economic sanctions I will consider these countries as the only senders in the analysis. As Figure 2.1 shows the stated countries outweigh others by far in the imposition of sanctions in the year 2015 but also beyond. According to Felbermayr et al. (2019) the imposed sanctions by the United States had the potential to negatively impact 2.5% of global trade in 2015. The European Unions imposed sanction regimes even with a share of more than 3% of global trade.¹² Other big sender countries such as China or Japan as well as Russia had a potential to negatively impact global trade by 0.30% respectively 0.05%. Figure 2.2 shows the imposition of the different sanction types over the last decades. As it can be seen the imposition of different sanction regimes increased significantly after the Cold War which justifies the intention to examine the effects for this time span in particular. The aim of the thesis, therefore, is threefold. First I will perform a partial equilibrium analysis to obtain the direct effects respectively costs of the different types of sanctions for the senders between 1990 and 2016. The sample, therefore, contains 195.061 observations in total and includes 29 sender and 164 targeted countries.¹³ As a second step in the partial equilibrium analysis I will examine the difference between imposed sanctions and sanction threats with a limited sample considering the United States as the only sender of threats. Third, I will perform a general equilibrium analysis to determine the welfare effects of the imposed sanction regimes by running a counterfactual exercise for the year 2015. Since the general equilibrium analysis requires a strongly balanced panel this exercise will be performed by a limited sample with 2809 observations including 53 countries.¹⁴

The main contributions of the thesis can be summarized as follows.

- I) Deepen the gravity literature on sanctions and threats.
- II) Make usage of the newly created GSDB database and its rich dimensionality to determine the partial and general equilibrium effects.

¹²Note that these numbers correspond to the total potential impact of trade sanctions on bilateral trade that could be caused by their imposition in 2015. This means that the numbers are obtained by summing up every sanctioned trade flow from the year 2015.

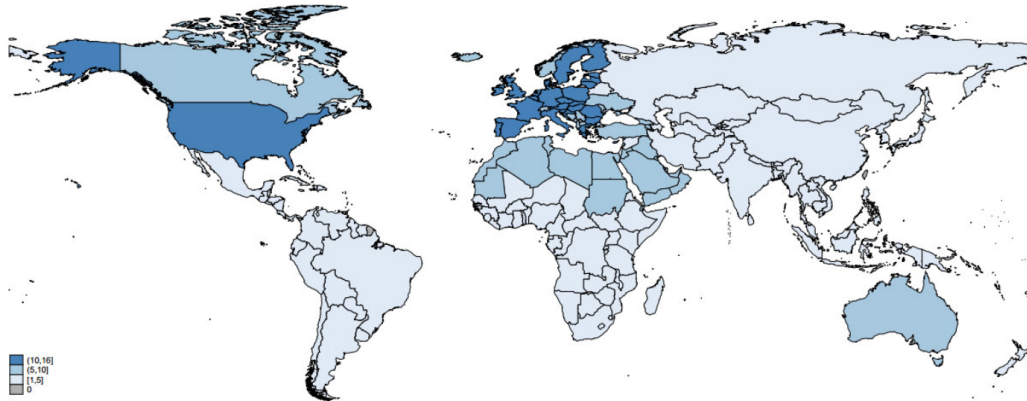
¹³for a detailed list on the sender and targeted countries included in the analysis see Appendix A.

¹⁴for details see Section 7.

2.1. Approach and Contribution

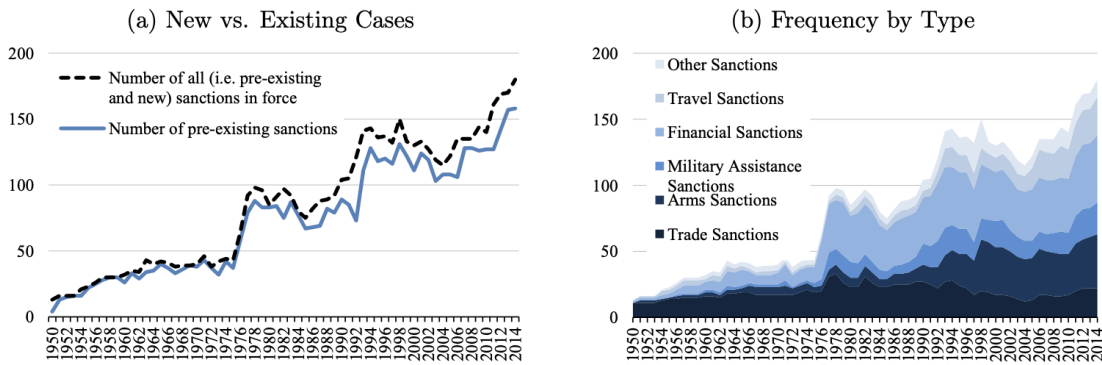
- III) Make usage of the latest econometric approaches in gravity estimation and the Poisson Maximum Likelihood (PPML) estimator.
- IV) Applying the stated approach on the specific sample of sender countries between 1990 and 2016.

Figure 2.1.: Sender Countries 2015



Source: Felbermayr et al. (2020)

Figure 2.2.: Number of Sanctions



Source: Felbermayr et al. (2020)

3. Data

The estimation with the gravity model requires the construction of a data sample defined by single country-pair observations for given years. Three different data sets served as the main sources for this purpose, which lead to nearly 200.000 individual country-pair observations. The Global Sanctions Database by Felbermayr et al. (2020) served as the source to model the different sanction variables. The CEPII Gravity Database¹ provided the information on bilateral trade flows as well as information on geographical or political variables. The Structural Gravity Dataset of Manufacturing Sector by Monteiro (2020) served as an additional source for intra-national trade data.

3.1. The Global Sanctions Database (GSDB)

The Global Sanctions Database was officially released in July 2020 and covers 729 publicly traceable, multilateral, plurilateral, and bilateral sanction cases over the years from 1950 to 2016. The GSDB extends several existing data sets on sanctions and shows its advantages among others due to its rich dimensionality. The GSDB lists each sanction case as a single country-pair event and assigns the type of sanctions as well as the objective and the success rate to each individual case. The most important aspect for this thesis, however, is the detailed information about the different kinds of trade sanctions which in turn allow a deeper and broader analysis on the effects of sanctions on bilateral trade and welfare. The sanction regimes are defined as follows:

- i) The GSDB defines different types of sanctions such as financial restrictions, arms sales, travel bans, military assistance, trade sanctions and a remaining category named other.
- ii) Depending on the direction of the trade sanctions the GSDB distinguishes between export and import restrictions as well as for sanctions that apply simultaneously to both directions.
- iii) The GSDB further distinguishes between the intensity of the sanction cases declared as partial or complete. Partial applies to regimes in which only specific sectors or goods are affected by the resolution while complete trade sanctions affect the whole economy of a given country with complete restriction over all sectors.²

¹Conte et al. (2021).

²Note that although a complete *trade* sanction regime defines a overall trade embargo, there might be exceptions, made by the authorities in certain cases, which allows trade for specific goods. See Felbermayr et al. (2020).

3. Data

- iv) Finally the GSDB lists sanction cases imposed on unilateral, plurilateral or multilateral level as single country-pair events which allow to model the mutual imposed regimes individually.

The classifications described above differ from the ones used by other data sets on sanctions like the TIES.³ Similarly to the GSDB the Threat and Imposition of Sanctions database (TIES) by Morgan et al. (2014) defines a sanction case as an event with one target but differs in its definition of the sender countries. In case of an imposition on a multilateral level, the TIES lists at most five senders and additionally a primary sender country. Since the resolutions from multilateral organizations such as the United Nations mostly comprises a big amount of participating senders the classification of the TIES does not allow to model each single sanction case on a country-pair level. A quite similar picture arises when it comes to the intensity and direction of the trade sanctions. The TIES exhibit more or less the same criteria as the GSDB by defining the different kinds of trade sanctions but is not able to list as many cases as the GSDB does. Although the TIES suffers from certain lacks regarding the dimensionality it has also an outstanding feature compared to the GSDB since the TIES also lists sanction threats additionally to imposed sanction regimes. Therefore, the task to decompose the effect of imposed sanctions and sanction threats will be done by the use of the TIES as an additional source to construct the according sample. Due to the weaknesses mentioned above, this analysis will be performed by a limited set of country-pairs.

The Data on sanction regimes has increased over the last years in terms of availability as well as by their quality. Besides economists, especially political scientists are showing effort in quantifying and classifying the big mass of sanctions regimes. For completeness the Target Sanctions Consortium (TSC)⁴ as well as the EUSANCT by Weber & Schneider (2020b) or the HSE by Hufbauer et al. (2009) should be mentioned here. Each database has its strength towards its particular purpose in politics and science and might outweigh others by their individual comprehensiveness.

3.2. The CEPII Gravity Database

The CEPII Gravity Database⁵ served as the main source for the variables on international trade flows, distance, contiguity and the presence of regional free trade agreements. CEPII refers to a French Center for research and expertise on world economy and was founded in the year 1978. It serves as a platform for debates and publications and provides researchers with specific databases. The Gravity Database therefore provides information of different determinants on international trade as well as on trade flows over the time span from 1948 to 2019. The CEPII itself uses several different sources in order to construct the gravity sample by single country-pair observations. The data on trade flows comes from the United Nations' COMTRADE database the CEPII's BACI database as well as from

³Morgan et al. (2014).

⁴Bierstecker et al. (2018).

⁵Conte et al. (2021).

the Direction of Trade Statistics (DOTS) provided by the International Monetary Found. The results reported in this paper were obtained by the use of the aggregate bilateral trade data served by the IMF.

3.3. The Structural Gravity Dataset

The Structural Gravity Dataset of Manufacturing Sector: 1980-2016 by Monteiro (2020) was the key resource for the data on domestic/intra-national trade flows. The integration of intra-national trade flows in the estimation with the gravity model is highly recommended in the literature⁶ and moreover a necessary condition in order to be able to perform the General Equilibrium Analysis. Although intra-national trade flows are crucial in order to get reliable results via the General Equilibrium Analysis both technically and theoretically, it is quite challenging to find accurate data on domestic trade on an aggregate level. This is mostly due to the fact that only a few countries are spending effort in reporting and constructing such data on an aggregate level. A traditional way in research to get data on intra-national trade was to construct domestic trade as the difference between aggregate production (GDP) and total exports. This approach, however, is misleading since GDP is measured as value-added while total exports is measured in gross-value.⁷ To overcome this issue researchers started to construct aggregate production databases measured in gross-value by the use of sectoral production data. Therefore, the intra-national trade flows in the Structural Gravity Dataset are constructed as the difference between gross output and exports of manufacturing goods. In order to construct the data on gross output Monteiro (2020) made use of several existing databases on manufacturing output and merged them into one big sample. Since the different sources do report the gross output by different ISIC⁸ industry classifications an iterative approach was used by Monteiro (2020) to translate the ISIC Rev.3 data into ISIC Rev.2 classifications. The data on total exports of manufacturing output is derived from the UN COMTRADE database expressed in Free on Board (FOB)⁹ prices.

⁶see Yotov et al. (2016).

⁷Gross-value is defined as output less intermediate consumption, while value-added also includes intermediate inputs or consumption; for details see OECD (2001) and OECD (2000).

⁸ISIC refers to the definition of the Standard Industrial Classification of All Economic Activities by the United Nations. Therefore, economic activities are grouped according to their common characteristics to make them comparable due to standardization; for details see UN (1990) and UN (2008).

⁹FOB or f.o.b defines the market price of a good at the point of uniform valuation. hence the price of a good without the internalization of any costs of transportation or insurance; for details see UN (1998).

4. Theory

The basic idea of the gravity model goes back to Newton's Law of Universal Gravity.¹ Tinbergen (1962) was first in applying this approach in economics by studying the determinants of international trade with a simple version of the gravity model as depicted in equation (4.1). He therefore considered the trade flows between country i and country j to be positively related regarding the size of the economies, measured in terms of GDP, and negatively related in terms of the distance between them. A crucial part in the gravity theory is the task to model trade costs since they are not directly observable. The first attempt of Tinbergen (1962) by approximating trade costs by distance seems quite obvious and is commonly used until today.

$$Trade_{ij} = \frac{GDP_i GDP_j}{Distance_{ij}} \quad (4.1)$$

Since the work of Tinbergen (1962) further extensions of the gravity model in economics were examined. More variables were included to approximate the unobservable trade costs and explain bilateral trade frictions on a more profound level. Besides geographical measures like distance other indicators such as common language, common currency or the share of a common border (e.g. McCallum, 1995), were implemented in the model. Although this first publications were characterized by a solid empirical performance, they all suffered from a lack of theoretical foundation (Yotov et al., 2016). Anderson (1979) closes this gap by deriving a theoretically founded gravity model under the assumption of Constant Elasticity of Substitution (CES) preferences and differentiated goods by origin, in the nature of Armington (1969). The model by Anderson (1979) is defined as a demand side model derived under the assumption of monopolistic competition/complete specialization with exogenously fixed endowment of output. Thus, supply is fixed and trade flows are driven by the demand of the representative consumers in the countries.² The demand side model of Anderson (1979) served as a basis for several further applications of the gravity equation considering fixed output. A main contribution in the gravity literature

¹Newton's Law defines the attraction force between two objects according to their masses, which enters the equation positively while the squared distances states a negative relationship.

$$F = G \frac{m_1 m_2}{r^2}$$

²Note that the gravity model can also be derived from the supply side as well as with different assumptions on the market structure. Eaton & Kortum (2002) provided a supply side version of the gravity model by deriving the gravity equation from a ricardian model of trade with a continuum of goods. According to Head & Mayer (2014) multiple authors derived the gravity equation based on the assumption of standard symmetric Dixit-Stiglitz-Krugman (DSK) monopolistic competition. Chaney (2008) derived the model by the assumption of heterogeneous firms in a Dixit-Stiglitz framework.

4. Theory

followed by the work of Anderson & van Wincoop (2003) and their implementation of the so called multilateral resistance terms in the gravity model. The introduction of this terms was crucial since it acknowledges the fact that bilateral trade between two countries does not only depend on the trade costs between each other but also on the overall trade costs they face with the rest of the world.³ The stated model by Anderson & van Wincoop (2003) will serve as the theoretical and empirical framework for this thesis. The theoretical building blocks can be summarized as follows:

First, they assume a world with complete specialization and goods differentiated by place of origin. Therefore they consider N countries where every country is specialized in producing one specific good only. The second building block is defined by the representative consumer in each single country maximizing its utility with consumption subject to its budget constraint. Anderson & van Wincoop (2003) modelled the utility function by Constant Elasticity of Substitution (CES) preferences.⁴ The utility function is depicted in equation (4.2). Therefore the consumption of the goods from country i consumed by the consumer of country j is denoted by c_{ij} . The consumer maximizes its utility by consuming a variety of different goods differentiated by origin. γ_i is a positive distribution parameter reflecting the taste of the consumer in country j over the variety of goods available. $\sigma > 1$ measures the elasticity of substitution among the different goods.

$$U_j = \sum_{n=1} \left(\gamma_i^{\frac{1-\sigma}{\sigma}} c_{ij}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma-1}{\sigma}} \quad (4.2)$$

Equation (4.3) defines the budget constraint of the consumer in country j . y_j depicts the nominal income of the consumer in country j and p_{ij} reflects the price of country i 's good for the consumer in country j . Moreover, p_{ij} is defined as $p_{ij}=p_i*t_{ij}$. This expression is crucial in understanding the gravity theory. First it shows that the burden of the costs are borne by the exporter, which will be passed on to the importer at the end. And more importantly the expression shows that the price of the good from country i differs depending on the location where it is finally consumed due to the different trade costs depicted as t_{ij} . As already mentioned these trade costs are not directly observable and Anderson & van Wincoop (2003) are describing their identification as the main objective of the empirical work with the gravity model.

$$\sum_i p_{ij} c_{ij} = y_j \quad (4.3)$$

After solving the optimization problem of the representative consumer and substituting the demand function into the market clearing condition we are finally able to derive the gravity model as a system of five equations depicted below.

³Note that the multilateral resistance terms moreover play a key role in translating the partial equilibrium effects into general equilibrium effects. See section 5.

⁴Preferences therefore are homothetic and identical across countries. Note: if σ approaches infinity goods are perfect substitutes while they work as perfect complements if σ approaches zero.

$$X_{ij,t} = \frac{Y_{i,t} E_{j,t}}{Y_t} \left(\frac{t_{ij,t}}{\Pi_{i,t} P_{j,t}} \right)^{1-\sigma} \quad (4.4)$$

$$\Pi_{i,t}^{1-\sigma} = \sum_j \left(\frac{t_{ij,t}}{P_{j,t}} \right)^{1-\sigma} \frac{E_{j,t}}{Y_t} \quad (4.5)$$

$$P_{j,t}^{1-\sigma} = \sum_i \left(\frac{t_{ij,t}}{\Pi_{i,t}} \right)^{1-\sigma} \frac{Y_{i,t}}{Y_t} \quad (4.6)$$

$$p_{j,t} = \frac{(Y_{j,t} / Y_t)^{\frac{1}{1-\sigma}}}{\gamma_j \Pi_{j,t}} \quad (4.7)$$

$$Y_{i,t} = \sum_j X_{ij,t} = \sum_j \left(\frac{\gamma_i p_{j,t} t_{ij,t}}{P_{j,t}} \right)^{1-\sigma} E_{j,t} = (\gamma_i p_{i,t})^{1-\sigma} \sum_j \frac{t_{ij,t}}{P_{j,t}}^{1-\sigma} E_{j,t}, \forall j \quad (4.8)$$

Equation (4.4) describes the gravity equation which defines the bilateral trade flows from the exporting country i to the importing country j at given time t . $Y_{i,t}$ defines the total income of the exporter country i , while $E_{j,t}$ reflects the total expenditure of the importing country j at time t . Y_t is the value of total world output. $t_{ij,t}$ defines the bilateral trade costs between the exporting country i and the importing country j . Equation (4.5) and (4.6) define the inward and outward multilateral resistance terms derived by Anderson & van Wincoop (2003). The multilateral resistance terms are capturing the remoteness of the trading partners due to any changes in bilateral trade costs. Therefore, they define the endogenous linkage of changing bilateral costs and their impact on income and trade and moreover allow to obtain the impact of any change in bilateral trade costs between country i and country j to all other trading partners. Equation (4.7) defines the factory-gate prices capturing the relationship between trade and income through the multilateral resistances terms and is derived from the market clearing condition depicted in equation (4.8). According to the theoretical definition of the gravity model an imposition of a one sided sanction regime⁵ would generate the following effects throughout the system of equations.⁶ The sanctioned country (Target) will gain from a lower outward multilateral resistance term relative to the outward multilateral resistance term of the sender country, due to lower trade costs which will result in higher factory-gate prices according to equation (4.7) and therefore in higher income depicted in equation (4.8). The sanctioning country (Sender), however, will see an increase in their multilateral resistance term relative to the outward multilateral resistance term of the targeted countries which will lower the factory-gate prices depicted in equation (4.7) and therefore decrease income through equation (4.8). The inward multilateral resistance

⁵One sided means, that the imposed sanction regimes are asymmetric in the sense that they only apply for one side hence only the trade flows from the sender to the target are affected by the imposition.

⁶The stated effect throughout the whole system will define the General Equilibrium Analysis; for more details see Section 7.

4. Theory

terms reflecting the consumer price index for a given country will tend to increase for the target due to the increase of the multilateral resistance term of the sender country i , depicted in equation (4.6) as well as due to the increase in income of the targeted country j . The sender country on the other hand will see an decrease in their consumer price index due to the decrease of the multilateral resistance term of the targeted country j as well as their decrease in income. The changes in income, factory-gate prices as well as in the multilateral resistance terms will finally affect the trade flows of the sender to the targets negatively as depicted in equation (4.4). A hypothetical removal of the sanction regimes, however, would generate the opposite effects. The removal of a one-sided sanction regime, therefore, would lower the outward multilateral resistance term for the sender countries relative to the resistance term of the targeted countries which will trigger an upward pressure on the factory-gate prices of the senders as depicted in equation (4.7) and increase their income through equation (4.8). The sanctioned country (Target) will suffer from a higher outward multilateral resistance term relative to the outward multilateral resistance term of the sender country, due to higher trade costs which will result in lower factory-gate prices according to equation (4.7) and therefore in lower income depicted in equation (4.8). They, moreover, see a relatively strong decrease in their inward multilateral resistance terms reflecting the consumer price index due to the decrease of the multilateral resistance term of the sender country i , depicted in equation (4.6) as well as due to the decrease in the income of the targeted country j . The sender country on the other hand will see only a slight reduction in their consumer price index due to the increase of the multilateral resistance term of the targeted country j as well as their increase in income. The changes in income, factory-gate prices as well as in the multilateral resistance terms will finally affect the trade flows between the countries captured in the gravity equation (4.4).

To what extent the imposition of sanctions respectively their hypothetical removal will affect the stated indexes empirically will be analyzed in great detail in Section 6 and 7. As the equations above are also indicating, the different sizes of the economies will play an important role by the final effects as well as the integration of the given countries in the world economy captured by the multilateral resistance terms.

5. The Model

The stated model in equation (5.1) is derived from the framework by Anderson & van Wincoop (2003) and refers to the empirical version of the gravity equation. Similar to the theoretical specification depicted in (4.4) the left hand side is defined by the bilateral trade flows from country i to country j at time t denoted by $X_{ij,t}$. The right hand side exhibits three explanatory variables. The first variable denoted by $GRAV_{ij,t}$ includes the commonly used variables in order to approximate for the unobservable trade costs such as distance, contiguity as well as the presence of a free trade agreement between country i and country j at time t . The second explanatory variable includes the different type of sanction regimes between country i and country j at time t denoted by $SANCT_{ij,t}$. The variable denoted by $TRADE_{ij,t}$ refers to the different kind of trade sanctions between country i and country j at time t . The set of the sanction variables as well as the gravity variables can be understood as the approximation for the unobservable trade costs.¹ The three remaining terms on the right hand side are the so called fixed effects. The use of the fixed effects is highly recommended in the gravity estimation for three main purposes. First, they allow to control for any observable and unobservable country-specific effect in the model. Second, they allow to account for any potential endogeneity problem in the model triggered by a policy variable such as a set of sanction regimes. Third, the use of fixed effects exhibits a necessary condition in order to be able to perform the general equilibrium analysis, since the multilateral resistance terms are a theoretical measure and thus not directly observable in the data (Yotov et al., 2016). Therefore, the multilateral resistance terms have to be constructed before respectively after the estimation by the use of the fixed effects. The empirical literature provides several different approaches in order to construct the multilateral resistance terms accordingly.

Head & Mayer (2014) for example proposed to estimate the gravity equation with a Structurally Iterated Least Squares (SILS) estimator and to construct the terms with a three-step approach. Anderson & Yotov (2010) constructed the multilateral resistance terms with a two-step approach and the use of the Poisson Pseudo Maximum Likelihood (PPML) estimator. Fally (2015) provides a theoretically consistent and more convenient approach that allows to construct the multilateral resistance terms by the use of the PPML estimator with fixed effects under certain conditions. The use of the PPML estimator, moreover, exhibits additional advantages when it comes to gravity estimation which will be discussed in the next Subsection. All results reported in this thesis were obtained by the use of the PPML estimator and the approach by Fally (2015) respectively Anderson

¹ $t_{ij,t} = GRAV_{ij,t} + SANCT_{ij,t} + TRADE_{ij,t}$.

5. The Model

et al. (2015).

$$X_{ij,t} = \exp[GRAV_{ij,t} \alpha + SANCT_{ij,t} \beta + TRADE_{ij,t} \gamma + \mu_{ij} + \pi_{i,t} + \chi_{j,t}] + \epsilon_{ij,t} \quad (5.1)$$

The list of the variables, which are included in the model are summarized below.² Trade flows and distance³ are measured as a string variable, while all other variables are defined as an indicator variable that take the value of one, if the given statement is realized at time t and zero otherwise.

$$X_{ij,t} = \begin{cases} \text{Nominal bilateral trade flows from exporter } i \text{ to importer } j. \end{cases}$$

$$GRAV_{ij,t} = \begin{cases} \text{Contiguity} \\ \text{Distance} \\ \text{Trade Agreements (RTA)} \end{cases}$$

$$SANCT_{ij,t} = \begin{cases} \text{Arms Sanctions} \\ \text{Financial Sanctions} \\ \text{Military Sanctions} \\ \text{Trade Sanctions} \\ \text{Travel Bans} \\ \text{Other Sanctions} \\ \text{Sanction Threats} \end{cases}$$

$$TRADE_{ij,t} = \begin{cases} \text{Partial Export Sanctions} \\ \text{Complete Export Sanctions} \end{cases}$$

The stated variables can be constructed and implemented directly from the given data sets, as described in Section 3. The fixed effects, as already mentioned, have to be constructed beforehand as the interaction terms of country dummies and year dummies respectively exporter and importer dummies.⁴ This means the model will be estimated with an exporter- and importer-time fixed effect as well as with a country pair-fixed effect. In more detail, it reads as follows:

²Note that depending on the actual application of the model in Section 6 and 7 not all of the stated variables will be used simultaneously.

³Note that trade flows are entering the model in levels, measured in millions of US-dollars while distance enters by its logarithm.

⁴Note that it is recommended to use the Stata factorial notation by specifying the fixed effects and generate them directly in the estimation command line; for details see Correia et al. (2020).

μ_{ij} : denotes the set of the country-pair fixed effects, which serve two main purposes. First, the pair fixed effects are the most comprehensive measure for any time-invariant bilateral trade costs since they absorb any observable and unobservable time-invariant bilateral determinants of trade costs (Yotov et al., 2016). And Second, according to Baier & Bergstrand (2007) the use of the country-pair fixed effects allows to mitigate endogeneity problems due to changes in the trade policy variable (e.g. the imposition of sanctions). Therefore, the country-pair fixed effects are able to absorb most of the linkages between the policy variable and the remaining error term $\epsilon_{ij,t}$.

$\pi_{i,t}$: denotes the set of time-varying exporting-country dummies, which control for the outward multilateral resistances of Anderson & van Wincoop (2003) and, moreover, for any other observable and unobservable exporter-specific characteristic that varies over time but is fixed for each exporter.

$\chi_{j,t}$: denotes the set of time-varying importing-country dummies, which control for the inward multilateral resistances of Anderson & van Wincoop (2003) and, moreover, for any other observable and unobservable importer-specific characteristics that varies over time but are fixed for each importer.

Thus, the exporter- and importer-time fixed effects will not only account for the unobservable multilateral resistance terms but will also absorb observable variables, like the size of the countries, measured in terms of GDP ($Y_{i,t}$ and $E_{j,t}$), as well as any other country-specific characteristic, which varies over the individual and time dimension. The same holds for country-pair time invariant variables like distance. Since the distance between two countries does not vary over time but is fixed regarding the individual country pairs, its impact will be absorbed by the country pair-fixed effects unless they are not included in the estimation, as it will be the case in the general equilibrium analysis. The estimates on the sanction regimes, however, will not be prevented by the pair-fixed effects since sanctions are time varying by nature (Yotov et al., 2016).

5. The Model

5.1. The PPML Estimator

The empirical literature highly recommends the use of the Poisson Pseudo Maximum Likelihood estimator in gravity estimation (e.g. Yotov et al., 2016). Recent studies by Anderson et al. (2015), Kareem et al. (2016), Hinz (2017), Heid et al. (2017), Baier et al. (2019) or Felbermayr et al. (2019) made usage of the PPML estimator and its favourable properties. A first advantage of the PPML⁵ estimator arises from its application to the multiplicative form of the empirical gravity equation as depicted in (5.1) which enables to handle heteroscedasticity as well as the presence of zero trade flows. Santos Silva & Tenreyro (2006) showed that a simple log-linearization of the gravity equation would lead to inconsistent estimates due to heteroscedasticity in the trade data. The same holds for the presence of zero trade flows. Since not all countries do trade with each other, zero trade flows are quite common in the data, which in turn means that log-linearization is not feasible and the information contained in the presence of zero trade flows would be lost. Thus, the bilateral trade flows will enter the multiplicative version of the model in levels rather than log-linearized.⁶

Second, Fally (2015) showed that the fixed effects obtained with the PPML estimator are theoretically consistent with the unobservable multilateral resistance terms and the equilibrium conditions they need to satisfy. This favourable property is due to the adding-up constraint in the model specification by Anderson & van Wincoop (2003), where the sum of trade flows is equal to the income of the single countries. As Fally (2015) points out, this result would be valid for any kind of estimator but the use of the PPML enables them to be automatically satisfied as long as exporter and importer fixed effects are used. Given the income of the countries are defined by the sum of trade, hence, $Y_i = \sum_j X_{ij}$ and $E_j = \sum_i X_{ij}$,⁷ the gravity equation depicted in (4.4) can be re-expressed with a unique set of inward and outward multilateral resistance terms satisfying (4.5) and (4.6). This condition holds as long as one country serves as a reference, which implies a normalization of $P_j = 1$. The approach by Fally (2015)⁸ allows to obtain theory-consistent general equilibrium effects by the use of the PPML with fixed effects. Relying on the framework of Anderson et al. (2015) motivated by Fally (2015) the corresponding multilateral resistance terms can be constructed by the use of the coefficients on the fixed effects as depicted in (5.2) and (5.3).

$$\widehat{\Pi_i^{1-\sigma}} = E_0 Y_i \exp^{(-\hat{\pi}_i)} \quad (5.2)$$

⁵Note that the data does not have to be poisson distributed; for details see Santos Silva & Tenreyro (2006).

⁶for details see Santos Silva & Tenreyro (2006).

⁷Note that the adding-up property does not hold in log-linearization due to Jensen's inequality. $E \ln(y) \neq \ln E(y)$; for details see Santos Silva & Tenreyro (2006).

⁸Note that Fally (2015) uses a different notation in his paper; for the purpose of consistency I maintained the notation that has been used so far.

$$\widehat{P_j^{1-\sigma}} = \frac{E_j}{E_0} \exp(-\widehat{\chi_j}) \quad (5.3)$$

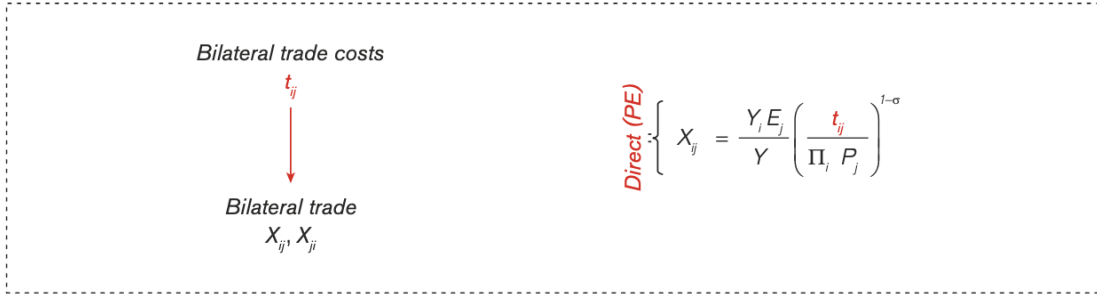
The equivalence of the theoretical terms with the empirical counterparts as demonstrated by Fally (2015) had quite important implications for the application of the gravity model. Anderson et al. (2015) provided a convenient approach in order to perform a general equilibrium analysis by relying on the stated findings. A more detailed description about the general equilibrium analysis and its application will follow in Section 7.

6. Partial Equilibrium Analysis

6.1. The Approach

The partial equilibrium analysis captures the direct effects of any changes in trade costs on bilateral trade flows while keeping income, expenditure and the multilateral resistance terms constant. As Yotov et al. (2016) point out, this analysis captures the strongest effects of any changes in trade flows due to changes in trade costs although it ignores the rich equation system of the theoretically founded gravity model by capturing the initial response only, as can be seen by Figure 6.1.

Figure 6.1.: Partial Equilibrium Analysis



Source: Yotov et al. (2016)

The limitation of the partial equilibrium analysis, however, does not allow to analyze any third-country effects triggered by a change in the trade costs between two countries. Moreover, the partial equilibrium analysis does not allow to compute any welfare effects caused by the imposition respectively by the removal of sanctions. The stated drawbacks will be taken into account by the latter general equilibrium analysis in Section 7. The model depicted in equation (5.1) will be estimated via the Poisson Pseudo Maximum Likelihood (PPML) estimator and the use of time intervals rather than consecutive-year data. The use of interval data is recommended in the empirical literature¹ since it allows for adjustments in bilateral trade flows as response to any changes in trade policy such as the imposition of sanctions.² As already mentioned above the sample for this analysis will include 29 sender countries and 164 targeted countries which gives 195.061 observations in total. The stated sample is constructed by single country-pair observations and includes

¹see for example Yotov et al. (2016).

²Note that some authors still prefer the use of consecutive-year data over intervals. See for example Egger et al. (2020).

6. Partial Equilibrium Analysis

sanctioned as well as non-sanctioned bilateral trade flows for the period between 1990 and 2016.³

6.2. Results

Table 6.1 reports the effects of economic sanctions on bilateral trade obtained by 4-year interval data. The table consists of three different models presented by individual columns. The dependent variable (*Trade*) remains the same over each model specification while the explanatory variables changes throughout the columns. By following the approach of Felbermayr et al. (2019) all models are controlling for the presence of free trade agreements (*RTA*). The model in column (1) reports the effects of the different types of sanctions while keeping the trade specific restrictions muted. As expected the presence of free trade agreements (*RTA*) have a positive and significant impact on bilateral trade. The so called *limited* sanction types such as *military* assistance or *financial* restrictions have a negative but statistically insignificant impact on bilateral trade and, moreover, exhibit a relatively small effect in their economic magnitude. The same holds for the remaining category named *other*. The sanctions imposed to restrict *travel* of citizens as well as designated individuals do not have a significant effect on bilateral flows and, moreover, are positively related with trade. Surprisingly, sanctions on arms sales (*arms*) do not have a significant impact on trade and, moreover, exhibit a positive effect although the size of the effect is negligible. This finding might be unexpected in the first place since arms sales are declaring a certain fraction of aggregate bilateral trade flows for at least some exporting countries within the EU as well as for the United States. Felbermayr et al. (2019), however, were able to estimate a significant but also positive effect of arms sales on bilateral trade for the time period between 1950 to 2016. More notably are the estimated effects of the *trade* specific sanctions. As can be seen in the table the sanctions on *trade*⁴ do have a negative and highly significant effect on bilateral trade flows and, moreover, exhibit a large impact in their economic magnitude. The estimated effect of *trade* sanctions with a coefficient of (-0.246) is equivalent to an average reduction in bilateral trade within the sample by about 21.80% while holding everything else constant.⁵ The model in column (2) distinguishes within the *trade* sanction regime over different kinds of sanctions such as *partial* and *complete* restrictions. The partial export sanctions

³Note that this means that every publicly available data on bilateral trade flows from the sender countries to any other trading partner is included in the sample. The sanctioned as well as the non-sanctioned trading partners.

⁴Note that the overall *trade* sanctions take a value of one if any kind of *trade* restriction is imposed. One-sided as well as two-sided *partial* or *complete* restrictions and zero otherwise.

⁵Note that the trade volume effects are computed straightforward by the following expression:

$$\Delta X_{ij} = \exp^{(\hat{\beta}-1)} * 100$$

(*EXP_PART_SANCT*)⁶ do have a negative and statistically highly significant effect on the bilateral trade flows of the exporting (sender) countries with a coefficient of (-0.363). The same holds for the complete export restrictions (*EXP_COMPL_SANCT*).⁷ Their impact is highly significant, negative and relatively strong in economic magnitude with a coefficient of (-1.131). The stated coefficient corresponds to an average reduction of bilateral trade within the sample by about 69.57% while holding everything else constant. Column (3) reports the estimates obtained by a combination of model (1) and (2). As can be seen the stated model (3) includes all explanatory variables except the indicator variable for the overall *trade* sanction regimes which got replaced by the specific *partial* and *complete* trade restrictions. As the model in column (3) shows neither the sign, nor the significance level or the size of the effects do change notably compared to column (1) and (2). The combined model (3), therefore, describes the heterogeneous effects of the different sanction types most precisely and, moreover, shows the importance of distinguishing between the different kind of trade sanctions in the analysis. As already shown above the implementation of the overall *trade* sanctions would only be able to explain 21.80% of the loss in trade flows while the inclusion of the *partial* export sanctions in the model are able to explain 30.44% of the reduction in trade. The implementation of the *complete* export sanctions are even able to explain 67.72% of the reduction in bilateral trade while holding everything else constant. The stated findings are in line with the results obtained by Felbermayr et al. (2019). They estimated an average effect of *trade* sanctions with a coefficient of (-0.176), (-0.449) for *partial* export sanctions and (-1.007) for complete export sanctions for the period between 1950 and 2016 with 1.268.450 observations.

To avoid any potential model misspecifications in the analysis a RESET Ramsey test⁸ was performed after each regression. As can be seen by the values in the table all models were able to pass the RESET test by failing to reject the null hypothesis for misspecification with insignificant p-values reported in the last row (RESETp).

As a further robustness check the stated models in column (1) - (3) were estimated by the use of different time intervals and base years. Table B.1 and Table B.4 in the appendix refers to the estimations obtained by 3-year respectively 5-year interval data and the

⁶Note that the GSDB apparently lists two-sided "*partial*" export and import sanctions as well. They have not been included in the analysis since they are not symmetric and, therefore, misleading in their interpretation. This means that the *EXP_IMP_PART_SANCT* take the value of one when a sanction is imposed in each direction, no matter if one side is only partially affected and the other side completely.

⁷Note that one-sided *complete* export restrictions are very rarely imposed and, moreover, not present in the sample. Since this thesis primarily focus on the effects on the senders the indicator variable *EXP_COMPL_SANCT* takes the value of one if the two-sided symmetric *complete* restrictions (export and import) are listed in the GSDB.

⁸The RESET Ramsey test is a simple F-test which tests whether a non-linear function of the explanatory variables has power in explaining the dependent variable. The null-hypothesis, therefore, states that the model is correctly specified by non-misspecification. The alternative states misspecification. In order to avoid misspecification we want to fail to reject the null-hypothesis; for details see Ramsey (1969).

6. Partial Equilibrium Analysis

Table 6.1.: I(4) Data Base Year 1990

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.103 (0.048)*	0.105 (0.048)*	0.101 (0.048)*
trade	-0.246 (0.070)**		
military	-0.049 (0.033)		-0.046 (0.034)
arms	0.004 (0.064)		0.026 (0.061)
financial	-0.040 (0.066)		-0.073 (0.058)
travel	0.065 (0.086)		0.065 (0.090)
other	-0.016 (0.152)		-0.015 (0.145)
EXP_PART_SANCT		-0.363 (0.073)**	-0.350 (0.079)**
EXP_COMPL_SANCT		-1.131 (0.175)**	-1.099 (0.175)**
Observations	33222	33222	33222
RESET	0.39	0.48	0.05
RESETp	0.5337	0.4873	0.8312

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1990, 1994, 1998, 2002, 2006, 2010, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

current base year of 1990. As the results in both tables show, the findings are similar compared to the model obtained by 4-year interval data. The signs of the coefficients stay the same over all explanatory variables. The estimated effects of the *trade* specific sanctions are in line with the one reported in table 6.1. The coefficients of the *partial* and *complete* sanctions are negative and highly significant and quite similar regarding their size. Beside the stated models in table B.1 and table B.4, the appendix contains additional output tables with different base years starting in 1991 and end in 1994. The *complete* export sanctions are highly significant throughout all models despite the current interval and base years. The same holds for the *partial* export sanctions with one exception in table B.4. The overall *trade* sanctions exhibit a negative and highly significant impact on bilateral trade throughout most of the models. Most notable is the insignificance in the base year 1992 over all time intervals.

Furthermore, table B.2 and B.3 in the appendix reports the estimates obtained by two different samples defining the European Union and the United States as the only sender countries. The repeated analysis did not show much changes compared to the estimates obtained with the whole sample over different intervals and base years. Table B.2 reports the effects obtained by defining the EU as the only set of sender countries. The coefficients of the *limited* sanction regimes such as *military*, *financial* restrictions and *arms* sales are negative but not statistically significant. The same holds for the sanctions on *travel* bans although they exhibit a positive sign in the analysis. Interestingly, the remaining category *other* is highly significant in this sub sample which is also the case for the estimates obtained with the US as the only sender country, as table B.3 shows. The *trade* sanctions as well as the *partial* and *complete* export sanctions do have a negative and statistically highly significant effect on bilateral trade of the EU member states. Their effects in economic magnitude are even bigger compared to the stated model above in table 6.1 with a coefficient of (-0.497) for *partial* and (-1.183) for *complete* restrictions. A similar finding can be drawn from the estimates obtained by the United States as the only sender country. As table B.3 shows neither the size, nor the sign and the significance change dramatically compared to the estimates with EU countries as senders only.

The effects of the sanction regimes throughout all estimated models in the analysis are summarized in table 6.2 below.

The stated volume effects in table 6.2 are obtained by the use of the average effects reported in the fourth column. Beside the imposed *trade* sanction regimes, the sanctions on *military* assistance, however, have shown the most significant and negative impact on bilateral trade flows. Within all fourteen estimated models *military* sanctions were significant in nine out of fourteen cases. This is quite notable since all other remaining sanction regimes did not show any significant impact on bilateral trade, and, moreover exhibit positive signs as well. Therefore, as expected and also confirmed by Felbermayr et al. (2019) and many other studies the *trade* specific sanctions are most effective in their impact on bilateral trade by causing significant and serious costs in terms of trade flows.

6. Partial Equilibrium Analysis

Sanction	Max	Min	Average	Volume	Tariff Equivalent
military	0.067	-0.102	-0.044	-4.03%	0.73%
arms	0.100	-0.044	0.013	+1.30%	.
financial	0.024	-0.086	-0.028	-2.76%	0.46%
travel	0.150	-0.077	0.041	+4.18%	.
other	0.013	-0.134	-0.069	-6.67%	1.14%
trade	-0.246	-0.009	-0.132	-12.36%	2.17%
EXP_PART	-0.405	-0.101	-0.284	-24.72%	4.62%
EXP_COMPL	-1.599	-0.792	-1.023	-64.04%	15.08%

Table 6.2.: Effects of different sanction types on bilateral trade

The last column in table 6.2 reports the tariff equivalent⁹ of the impact of the stated sanction regimes on bilateral trade flows. The corresponding numbers can be interpreted as an ad-valorem tariff¹⁰ which would have generated the same effect on bilateral trade as the imposed sanction regimes.¹¹

1. Question: How big are the costs of different sanction types for the senders in terms of trade flows?

Answer: The estimates did not show any significant effect of *arms* sales, *financial* restrictions, *travel* bans as well as the remaining category *other* on bilateral trade. The overall *trade* sanctions as well as the different kind of *trade* sanctions such as *partial* and *complete* restrictions exhibit highly significant and negative effects on bilateral trade. The same holds for the sanctions on *military* assistance in most of the cases. Corresponding to the volume effects reported in table 6.2 the costs in terms of losses in trade flows can be quantified as follows. The overall *trade* sanctions are capable of reducing bilateral trade between the participating countries by about 12.36%. The *partial* export sanctions have the potential to reduce trade by about 24.72% and the *complete* export sanctions by about 64.04% of bilateral trade within the sample for the sender countries.

⁹Note that the tariff equivalent are computed by the following expression:

$$\Delta X_{ij} = \exp\left(\frac{\hat{\sigma}}{\sigma} - 1\right) * 100$$

The $\hat{\sigma}$ corresponds to the value of substitution as already discussed in Section 4. The stated numbers in table 6.2 were obtained by a standard value of $\hat{\sigma} = 6$.

¹⁰Ad-valorem tariff defines a tariff rate charged as percentage of a value. See: OECD (2000).

¹¹for details see Yotov et al. (2016).

6.2.1. Sanction Threats

The estimates reported in table 6.3 relate to the second research question addressing the effects of sanction *threats* on bilateral trade. Afesorgbor (2019), as he claims, was the first author who compared the effects of threatened sanctions to that of imposed sanctions on bilateral trade. He estimated a positive and significant impact of announced sanction threats on bilateral trade and explains this findings with anticipated stockpiling effects in the targeted countries which tend to increase the demand, and therefore the trade flows, from the sender to the targets. Similar to the approach of Afesorgbor (2019) the idea of this subsection is to include sanction threats¹² in the model as well. Different to the study of Afesorgbor (2019) this analysis will combine the TIES data set to model the threatened sanctions and the GSDB to model the imposed sanction regimes. Of special interest is to see if the stated stockpiling effects are still present while the rich dimensionality of the GSDB is used simultaneously in the model.

As the first column in table 6.3 shows the effects of sanction *threats* are indeed positively related to bilateral trade flows although their impact is insignificant. The model reported in column (2) is similar to the discussed model in column (1) in table 6.1 above by taking all sanction types in consideration as well as the threatened sanctions additionally. As can be seen in column (2) the threatened sanctions remain insignificant, although their sign and size changes dramatically compared to column (1). Column (3), however, exhibits the same effects of sanction *threats* as reported in column (1) with a negative but statistically insignificant effect on trade. The model in column (4) combines the model reported in column (2) and (3) and shows again a negative but statistically insignificant effect of sanction *threats* on bilateral trade within the sample. The *trade* specific sanctions stay more or less the same compared to the models discussed above, although the inclusion of sanction *threats* changes the coefficient of the *complete* export sanctions reported in column (4) dramatically. The implementation of sanction *threats* in the model not only fails to deliver any significant impact but, furthermore, causes contradictions in the estimates compared to the models discussed above. All models, however, are able to pass the RESET Ramsey test of misspecification by failing to reject the null hypothesis.

2. Question: How do the effects of sanction threats differ from imposed sanctions?

Answer: The estimates did not show any significant effect of sanction *threats* on bilateral trade by all model specifications. The obtained effects do differ compared to imposed sanctions by showing a positive impact on bilateral trade. Nevertheless, these results do not hold in all model specifications. By including the *trade* specific sanctions the announced sanction *threats* exhibit a positive but statistically insignificant effect on bilateral trade, although this is not the case for the preferred model reported in column (4). Afesorgbor (2019) stated a positive and statistically significant effect of sanction *threats* on bilateral trade. This finding can not be confirmed by the present analysis.

¹²Note that the included sanction threats refers to threats on *trade* sanctions only.

6. Partial Equilibrium Analysis

Table 6.3.: I(4) Data Base Year 1990 including Threats

	(1)	(2)	(3)	(4)
	Trade	Trade	Trade	Trade
Threat	0.216 (0.223)	-0.460 (0.474)	0.159 (0.264)	-0.490 (0.472)
RTA		0.258 (0.124)*	0.234 (0.198)	0.254 (0.124)*
trade		-1.573 (0.399)**		
military		-0.644 (0.479)		-0.669 (0.477)
arms		0.818 (0.446)+		0.824 (0.443)+
financial		-0.721 (0.447)		-0.740 (0.446)+
travel		-2.395 (0.730)**		-2.627 (0.673)**
other		-0.739 (0.711)		-1.232 (0.329)**
EXP_PART_SANCT			-1.369 (0.279)**	-1.683 (0.331)**
EXP_COMPL_SANCT			-1.906 (0.610)**	0.475 (0.374)
Observations	8370	8370	8370	8370
RESET	0.94	1.11	2.43	1.30
RESETp	0.3333	0.2910	0.1190	0.2550

Notes: This table reports estimates of the effects of trade sanctions and threats on trade. Since the TIES dataset on sanction threats is limited in scope the sample only consists sanction threats announced by the United States between 1990 and 2012. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of sanction threats on bilateral trade. Column (2) includes threats into the model with different sanction types. Column (3) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions and additionally implements threats in the model. Column (4) combines column (2) and (3). Standard errors in parentheses and clustered by country pair. + $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1990, 1994, 1998, 2002, 2006, 2010, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

7. General Equilibrium Analysis

7.1. The Approach

The general equilibrium analysis accounts for any changes in the bilateral trade flows due to direct and indirect linkages in the economic system. It therefore endogenizes the effects of any changes in trade costs throughout all equations in the gravity model.¹ Yotov et al. (2016) declare this analysis as *full* endowment general equilibrium effects since it allows to adjust output and expenditure for a given country by allowing the factory-gate prices to respond to any changes in trade costs and the associated effects in the multilateral resistance terms.

As already mentioned the performance of the general equilibrium analysis requires a completely symmetric sample with the inclusion of intra-national trade as well. The stated analysis was performed by a sample consisting of 53 countries for the year 2015 with 2.809 observations. The results were obtained by the three step approach of Anderson et al. (2015) which allows to perform the general equilibrium analysis without the use of a non-linear equation solver. The stated approach requires to define a baseline and counterfactual model in the analysis. The baseline model², therefore, refers to the specification which was already used in the partial equilibrium analysis with the inclusion of the sanction variable on *trade*. Since the sanction regimes on *trade* showed the most significant impact on bilateral trade by the partial equilibrium analysis above only these restrictions are taken into account in the model specification for the present analysis. The counterfactual model³ on the other hand is defined by the absence of the *trade* sanction regime. Both models account for free trade agreements (*RTA*), *distance* and *contiguity* as additional variables in order to avoid major misinterpretations. Therefore, there is no *free* trade assumption in the analysis by moving from the baseline to the counterfactual model.⁴ The method by Anderson et al. (2015), moreover, requires a normalization in order to be able to solve the system of equations. Therefore one country has to be

¹For a detailed description see Section 4.

²

$$X_{ij,t}^{BLN} = \exp[RTA_{ij,t} \alpha + DIST_{ij,t} \beta + CNTG_{ij,t} \gamma + Trade_{ij,t} \delta + \pi_{i,t} + \chi_{j,t}] + \epsilon_{ij,t} \quad (7.1)$$

³

$$X_{ij,t}^{CFL} = \exp[RTA_{ij,t} \alpha + DIST_{ij,t} \beta + CNTG_{ij,t} \gamma + \pi_{i,t} + \chi_{j,t}] + \epsilon_{ij,t} \quad (7.2)$$

⁴Note that the inclusion of *distance* and *contiguity* does not allow to estimate the model with the use of country-pair fixed effects.

7. General Equilibrium Analysis

defined as a reference country by setting its inward-multilateral resistance term equal to one. Since all of the sender countries within the sample are affected by the hypothetical removal of the sanction regime, the choice was made, as recommend in the literature, conditional on the reliability of the data. Although the stated reliability seems to be given for all senders, Germany served as the reference country for this analysis. To check for robustness several models were estimated by the use of different countries as reference. The results, therefore, were only affected in absolute terms but not in relative ones. The stated method by Anderson et al. (2015) is built on three major steps in order to obtain the general equilibrium effects. As a first step the model will be estimated with the sanction variables on trade included.⁵ The predicted trade flows of the baseline model have to be used in order to construct output/income and expenditure of the exporting and importing countries. The obtained coefficients of the fixed effects have to be stored in order to construct the baseline indexes of the inward and outward multilateral resistance terms according to (5.2) and (5.3). As a second step the counterfactual model with the absence of any *trade* sanctions will be estimated. Similar to the first step, income and expenditure will be constructed by the use of the predicted trade flows from the counterfactual model. The obtained coefficients on the fixed effects have to be stored in order to construct the multilateral resistance terms of the restricted model. In a last step the general equilibrium effects will be obtained by iterating with the use of the newly created values on output, expenditure and trade flows over the whole system of equations until convergence. After the iteration process ends, the obtained results allow to construct the indexes respectively the percentage changes of the indexes between the baseline model and the counterfactual scenario. Since the micro-founded model by Anderson & van Wincoop (2003) builds on the Armington Constant Elasticity of Substitution (CES) it was required to set a value for the stated parameter. According to the literature the Constant Elasticity of Substitution was set exogenously to take a value of six. The CES preference parameter was computed endogenously by the use of the sample as the relation between expenditure and income for the given countries.

7.2. Results

Table 7.1 below reports the percentage changes of a hypothetical removal of the *trade* sanction regime. Table 7.2 and table 7.3 summarize the effects on European Countries only.⁶ The values in the table are displaying the effects of a removal on the indexes by moving from the baseline model to the counterfactual model defined by the absence of the regime.⁷ The first column indicates the percentage changes in trade flows. The second column indicates the changes in the factory-gate prices derived from the market clearing condition. Inward is measuring the percentage changes in the inward-multilateral

⁵Note that the *trade* sanction regimes within the sample are one-sided partial export sanctions only. Therefore, the stated *trade* sanctions can be interpreted as *EXP_PART_SANCT* similar to the partial equilibrium analysis.

⁶Note that Croatia, Belgium, Luxembourg and Malta is not included in the analysis due to missing data on intra-national trade.

⁷Note that the percentage changes have to be interpreted relative to the changes in the reference country.

resistance term which defines the consumer price index while outward depicts the changes in the outward-multilateral resistance term. Real GDP measures gains and losses in terms of welfare. The last column shows the percentage changes in income.

Table 7.1.: General Equilibrium Effects

Country	Trade %	Price %	IMR %	OMR %	real GDP %	Income %
Albania	-1,00	-0,53	-0,32	0,64	-0,22	-0,53
Algeria	-1,53	-0,31	-0,47	0,38	0,16	-0,31
Arab Emirates	-2,35	-0,97	-0,86	1,17	-0,11	-0,97
Austria	0,29	0,16	-0,03	-0,19	0,19	0,16
Azerbaijan	-2,06	-1,36	-0,94	1,65	-0,42	-1,36
Bahrain	-2,52	-0,89	-0,90	1,07	0,02	-0,89
Belraus	2,25	-1,52	-8,93	1,85	8,14	-1,52
Bosnia and Herz.	-0,85	-0,48	-0,22	0,58	-0,26	-0,48
Bulgaria	0,59	0,35	-0,26	-0,41	0,60	0,35
Burundi	-31,53	6,75	-8,64	-7,53	16,84	6,75
China	-1,16	-0,98	-0,96	1,19	-0,02	-0,98
Cyprus	1,30	0,26	-0,50	-0,32	0,77	0,26
Czech Republic	0,28	0,18	-0,03	-0,22	0,21	0,18
Denmark	0,36	0,18	-0,07	-0,21	0,25	0,18
Egypt	-1,97	-0,74	-0,62	0,90	-0,12	-0,74
Eritrea	-21,76	3,82	-10,46	-4,40	15,95	3,82
Estonia	1,27	0,81	-0,37	-0,96	1,18	0,81
Fiji	-2,04	-0,65	-3,36	0,78	2,81	-0,65
Finland	2,37	0,56	-0,19	-0,66	0,75	0,56
France	0,29	0,06	-0,08	-0,07	0,14	0,06
Germany	0,45	0,12	0,00	-0,14	0,12	0,12
Greece	1,54	0,07	-0,16	-0,08	0,23	0,07
Hungary	0,45	0,25	-0,08	-0,30	0,33	0,25
Indonesia	-1,18	-0,90	-0,86	1,09	-0,04	-0,90
Iran	6,52	-2,34	-4,33	2,88	2,08	-2,34
Ireland	0,24	0,04	-0,11	-0,05	0,15	0,04
Italy	0,61	0,09	-0,08	-0,11	0,17	0,09
Jordan	-1,89	-0,86	-0,68	1,05	-0,18	-0,86
Kenya	-1,71	-0,75	-0,71	0,91	-0,04	-0,75
Kuwait	-2,99	-0,99	-0,90	1,20	-0,10	-0,99
Latvia	1,24	0,69	-0,33	-0,82	1,02	0,69
Lithuania	1,05	0,71	-0,30	-0,85	1,01	0,71
Macedonia	-0,80	-0,61	-0,25	0,73	-0,36	-0,61
Moldova	-1,62	-0,98	-0,48	1,19	-0,50	-0,98
Morocco	-0,87	-0,48	-0,34	0,58	-0,14	-0,48
Netherlands	0,17	0,09	-0,01	-0,11	0,10	0,09

7. General Equilibrium Analysis

Table 7.1 continued from previous page

Country	Trade %	Price %	IMR %	OMR %	real GDP %	Income %
Oman	-2,44	-0,80	-1,10	0,97	0,31	-0,80
Poland	0,93	0,34	-0,08	-0,41	0,43	0,34
Portugal	0,42	-0,05	-0,16	0,06	0,11	-0,05
Qatar	-1,83	-1,00	-0,84	1,21	-0,16	-1,00
Romania	0,99	0,43	-0,23	-0,51	0,66	0,43
Russian Fed.	6,77	-2,28	-4,72	2,80	2,56	-2,28
Saudi Arabia	-5,04	-0,25	-1,30	0,30	1,06	-0,25
Slovakia	0,32	0,25	-0,07	-0,30	0,32	0,25
Slovenia	0,14	0,16	-0,08	-0,19	0,25	0,16
Spain	0,44	0,00	-0,14	0,00	0,13	0,00
Sweden	0,90	0,26	-0,12	-0,31	0,38	0,26
Tunisia	-0,89	-0,48	-0,30	0,58	-0,17	-0,48
Ukraine	2,63	-1,64	-7,96	2,01	6,86	-1,64
United Kingdom	0,55	0,04	-0,07	-0,04	0,11	0,04
United States	-1,47	-0,66	-0,65	0,80	-0,01	-0,66
Vietnam	-2,03	-0,74	-1,04	0,90	0,30	-0,74
Zimbabwe	-2,55	-0,55	-5,55	0,66	5,29	-0,55

Table 7.2.: Summarized General Equilibrium Effects EU only

Country	Trade %	Price %	IMR %	OMR %	real GDP %	Income %
Austria	0,29	0,16	-0,03	-0,19	0,19	0,16
Bulgaria	0,59	0,35	-0,26	-0,41	0,60	0,35
Cyprus	1,30	0,26	-0,50	-0,32	0,77	0,26
Czech Republic	0,28	0,18	-0,03	-0,22	0,21	0,18
Denmark	0,36	0,18	-0,07	-0,21	0,25	0,18
Estonia	1,27	0,81	-0,37	-0,96	1,18	0,81
Finland	2,37	0,56	-0,19	-0,66	0,75	0,56
France	0,29	0,06	-0,08	-0,07	0,14	0,06
Germany	0,45	0,12	0,00	-0,14	0,12	0,12
Greece	1,54	0,07	-0,16	-0,08	0,23	0,07
Hungary	0,45	0,25	-0,08	-0,30	0,33	0,25
Ireland	0,24	0,04	-0,11	-0,05	0,15	0,04
Italy	0,61	0,09	-0,08	-0,11	0,17	0,09
Latvia	1,24	0,69	-0,33	-0,82	1,02	0,69
Lithuania	1,05	0,71	-0,30	-0,85	1,01	0,71
Netherlands	0,17	0,09	-0,01	-0,11	0,10	0,09
Poland	0,93	0,34	-0,08	-0,41	0,43	0,34
Portugal	0,42	-0,05	-0,16	0,06	0,11	-0,05
Romania	0,99	0,43	-0,23	-0,51	0,66	0,43
Slovakia	0,32	0,25	-0,07	-0,30	0,32	0,25
Slovenia	0,14	0,16	-0,08	-0,19	0,25	0,16
Spain	0,44	0,00	-0,14	0,00	0,13	0,00
Sweden	0,90	0,26	-0,12	-0,31	0,38	0,26
United Kingdom	0,55	0,04	-0,07	-0,04	0,11	0,04

7.3. Findings

Three major findings are standing out in the general equilibrium analysis. Since the effects on the sender countries declares the main objective of this thesis the summarized findings mostly apply to their economic interpretation.

- First, we can see that smaller or low income sender countries benefit more from a hypothetical removal of the sanction regime on *trade*, in terms of real GDP, than bigger countries. This finding is in line with the gravity theory and other studies by explaining the heterogeneous effects by the size of the countries. Therefore, the larger countries are gaining less in this scenario due to larger home markets, which are not affected by the changes in trade costs.
- Second, we can see that the gains in welfare for smaller countries are mostly triggered by a relatively strong increase in trade and a larger decrease in their price index relatively to high income countries. Moreover, the decreasing effects in the outward-multilateral resistance term due to the removal of the sanction regime are relatively stronger for smaller countries. The stronger decrease in the outward-multilateral resistance terms corresponds to a relatively larger increase in their factory-gate prices and, therefore, in higher changes in income relatively to larger countries.
- Third, one can see that even with a negative change in income it is possible to gain from the removal of the sanction regime by an increase in welfare due to a decrease of the inward-multilateral resistance term respectively the decrease of the consumer price index. Therefore, the decrease in the consumer price index is larger than the decrease in income, which corresponds to a gain in real consumption or welfare. This is especially the case for some of the targeted countries since their income tends to decrease by the removal of the sanction regime due to lower factory-gate prices triggered by an increase in their outward-multilateral resistance term.

The findings above are indicating that a removal of the sanction regime on *trade* will affect the trade flows of the sender countries positively by an increase in terms of trade as well as an increase in welfare and income although this effects will be mitigated by only a slight decrease in their consumer price index, which in turn will lower the gains in welfare. The targeted countries on the other hand will suffer from a decrease in terms of trade flows as well as in income but some of them gain significantly by an increase in welfare due to a relatively large decrease in their consumer price index. The increase in welfare in the sender countries as well as in the targeted countries are moreover negatively correlated with the size of the country. Smaller countries are facing a much larger effect in terms of welfare than bigger countries. The gains in welfare due to the removal of the sanction regime holds for any sender country although this is not the case for all of the targeted countries. There are some targets which are experiencing a loss in terms of real GDP due to the removal of the sanction regime, while other targets will gain significantly by an increase of more than 2% or even above 10%.

This effect can be mostly explained by the nature of the sanction regime which only applies in one direction. Therefore, the exports from the targets to the senders as well as to any other targeted country do not face any kind of sanctions such that its removal does reflect in an increase of the outward-multilateral resistance term of the targeted countries relatively to the outward-multilateral resistance term of the sender countries. The increase of the outward-multilateral

resistance term of the targeted countries will trigger a decrease in their factory-gate prices which in turn will decrease their income. As the analysis showed the consumer price index is decreasing for all countries in the sample but given the initial value of expenditure and income this change will be smaller for some of the targeted countries than for others which will in turn end up in a welfare loss since the slight reduction of the consumer price index is not able to outweigh the reduction of trade and income. This heterogeneous effects can, moreover, be explained by the different sizes of the economies which determine the initial values of the resistance terms by the state of the equilibrium before the hypothetical removal of the sanction regime happened. Since the basic idea of the general equilibrium analysis is to compare the indexes of the baseline scenario with the counterfactual scenario the initial values do matter.

The opposite holds for the sender countries. Due to the asymmetric structure of the sanction regime, the sender countries will see a decrease in their outward-multilateral resistance terms caused by the removal of the sanction regime. Therefore, the sender countries are facing lower trade costs after the removal with their former targets. The decreasing effect in their outward-multilateral resistance terms will be internalized by the producer side of the senders with increasing factory-gate prices. The upward pressure in the factory-gate prices will further lead to an increase in income, while the decreasing effect in their price index is relatively smaller due to the increase in the factory-gate prices. The slight reduction of the consumer price index caused by the upward pressure of the increasing factory-gate prices will finally lower the gains in welfare. This allows the conclusion that the producer side⁸ benefits more from a removal of the sanction regime due to higher prices than the consumer side in the sender countries by only a slight reduction in the price index. Nevertheless, the removal of the sanction regime will result in a significant increase in welfare. Given the reported results in table 7.2 the average gain in terms of welfare for the sender countries can be quantified by 0.40% of real GDP. The maximum gain by about 1.18% and the minimum of 0.10% of real GDP. Table 7.3 below reports the welfare effects on the European countries in levels additionally. The first column shows the income of the given countries constructed in the baseline scenario. The second column corresponds to the percentage changes in welfare as already reported in table 7.2. The last column in table 7.3 displays the percentage changes of welfare in levels. The corresponding values are computed by the use of the income in column (1). The values in column (1) and (3) are measured in millions of US-dollars.

3. Question: How big are the costs of sanctions in terms of welfare?

Answer: The stated General Equilibrium Analysis shows an average loss in terms of welfare by about 0.40% due to the imposition of *trade* sanctions for the given sender countries in the sample. The maximum loss respectively hypothetical gain of a removal of the sanction regime on *trade* can be quantified by 1.18% of real GDP within the sample. Given the corresponding values for initial income in table 7.3 the losses for the senders correspond to a maximum of 1946.39 million, a minimum of 25.31 and an average of 493.74 million US dollars due to the imposition of *trade* sanctions in the year 2015.

⁸Note that the total production in each single country is assumed to be constant throughout the analysis.

7. General Equilibrium Analysis

Table 7.3.: Welfare Effects EU only

Country	Income	real GDP in %	real GDP in levels
Austria	173619,20	0,19	329,05
Bulgaria	27070,41	0,60	163,47
Cyprus	3302,15	0,77	25,31
Czech Republic	207366,13	0,21	437,02
Denmark	107025,85	0,25	266,53
Estonia	14641,26	1,18	173,05
Finland	100716,16	0,75	754,34
France	586566,30	0,14	822,29
Germany	1610289,73	0,12	1946,39
Greece	43956,18	0,23	102,78
Hungary	99021,10	0,33	326,99
Ireland	127394,80	0,15	197,01
Italy	844931,32	0,17	1421,52
Latvia	12631,88	1,02	129,37
Lithuania	26704,56	1,01	270,63
Netherlands	434906,72	0,10	445,70
Poland	278358,88	0,43	1188,50
Portugal	77426,42	0,11	86,88
Romania	75462,36	0,66	496,94
Slovakia	83631,38	0,32	266,44
Slovenia	31188,57	0,25	76,46
Spain	434779,76	0,13	583,52
Sweden	161033,56	0,38	614,88
United Kingdom	660209,30	0,11	724,86

8. Conclusion

This thesis represents a further contribution to a broad branch of literature on gravity estimations. The latest developments in the empirical application of the gravity model allow to achieve even more valid information on the different effects of any changes in trade costs on trade and welfare. The reported results in this paper were obtained by the latest recommendations in the empirical literature and are in line with most of the cited studies on sanctions, both qualitatively as well as quantitatively. Also, this study was able to explicitly show that economic sanctions are a serious factor able to mitigate trade and welfare between respectively for each of the affected countries. Since the imposition of economic sanctions seems to increase also in the near future it should not only be of scientific interest to investigate and quantify their effects on the single economies accordingly. The theoretically founded gravity model is able to quantify such effects with remarkable empirical success, although, this can only be done by the use of good and reliable data. The GSDB database on sanctions allows to obtain valid results due to its rich dimensionality. Since the stated database was officially released in July 2020 the amount of studies which are relying on their quality is still limited. Consequently, to my knowledge this paper is first in applying the GSDB to quantify the costs of sanctions for the specific set of sender countries and the time frame between 1990 and 2016. It is, moreover, the first publication which combines the GSDB database with the TIES database on sanctions in order to investigate the different effects of imposed sanctions and sanction threats. Although the findings on sanction *threats* from a previous study by Afesorgbor (2019) could not be confirmed by this paper the remaining findings of this thesis were in line with the latest studies on sanctions and their economic impact. The partial equilibrium analysis did show again the importance of distinguishing between different types of sanction regimes and especially between the different kinds of *trade* sanctions. Also, the general equilibrium analysis confirmed the heterogeneous effects on welfare over the different set of countries. Therefore, the usage of a new source on sanctions (GSDB) as well as the specific approach of this study allows to confirm the implications of the theoretically founded gravity model.

For further studies it would be of great interest to apply the stated approach of this thesis to the same time frame but take the effects on the targeted countries into account as well. This would allow to draw the whole picture over the partial equilibrium effects of sanctions on bilateral trade between 1990 and 2016. The GSDB, therefore, would allow nicely to construct such a sample by taking the two-sided sanction regimes as well as the one-sided imposed regimes over the European Countries and the United States into account. Moreover, it would be interesting to see the obtained results by the use of quarterly data instead of annual only. Although this approach may lack of reliability since the GSDB lists the imposition dates on an annual basis only. Beside all the favourable characteristics of the GSDB it would be welcomed if one could find the imposition dates at least on a quarterly basis. Even more important would be an explicit list of sectors in the economy which are directly targeted by the *partially* imposed sanction regimes. Since the quality of sectoral data on trade is notably increasing over the last years, such detailed information on the affected sectors would allow to obtain more precise and detailed information over the specific sanction regimes and their effects in the individual sectors in the economy. Moreover, it would be interesting to see if a certain threshold in terms of losses in trade or welfare can be empirically identified in order to reach the former objectives of the imposition by the

8. *Conclusion*

use of the GSDB. Such a measurement would may contribute notably to the determination of success or failure of restrictions as well as for the discussion over efficiency of economic sanctions in general.

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A. Appendix

List of all sanctioning countries (Senders):

1. Austria	2. Belgium	3. Bulgaria	4. Croatia	5. Cyprus
6. Czech Rep.	7. Denmark	8. Estonia	9. Finland	10. France
11. Germany	12. Greece	13. Hungary	14. Ireland	15. Italy
16. Latvia	17. Lithuania	18. Luxembourg	19. Malta	20. Netherlands
21. Poland	22. Portugal	23. Romania	24. Slovakia	25. Slovenia
26. Spain	27. Sweden	28. United Kingdom	29. United States	

A. Appendix

List of all sanctioned countries (Targets):

1. Afghanistan	2. Albania	3. Algeria	4. Andorra	5. Angola
6. Antigua and Barbuda	7. Argentina	8. Armenia	9. Australia	10. Austria
11. Azerbaijan	12. Bahrain	13. Bangladesh	14. Barbados	15. Belarus
16. Belgium	17. Belize	18. Benin	19. Bolivia	20. Bosnia and Herzegovina
21. Botswana	22. Brazil	23. Bulgaria	24. Burkina Faso	25. Burundi
26. Cambodia	27. Cameroon	28. Canada	29. Cape Verde	30. Central African Republic
31. Chad	32. Chile	33. China	34. Colombia	35. Comoros
36. Congo, Democratic Rep. of the	37. Congo, Rep. of the	38. Costa Rica	39. Cote d'Ivoire	40. Croatia
41. Cuba	42. Cyprus	43. Czech Rep.	44. Denmark	45. Djibouti
46. Dominican Republic	47. Ecuador	48. Egypt, Arab Rep.	49. El Salvador	50. Equatorial Guinea
51. Eritrea	52. Estonia	53. Ethiopia (exc. Eritrea)	54. Fiji	55. Finland
56. France	57. Gabon	58. Gambia, The	59. Georgia	60. Germany

61. Ghana	62. Greece	63. Guatemala	64. Guinea	65. Guinea-Bissau
66. Guyana	67. Haiti	68. Honduras	69. Hungary	70. Iceland
71. India	72. Indonesia	73. Iran	74. Iraq	75. Ireland
76. Italy	77. Kazakhstan	78. Kenya	79. Korea, North	80. Korea, South
81. Kosovo	82. Kuwait	83. Kyrgyzstan	84. Latvia	85. Lebanon
86. Lesotho	87. Liberia	88. Libya	89. Liechten- stein	90. Lithuania
91. Luxem- bourg	92. Macedonia	93. Malagasy Rep.	94. Malawi	95. Mali
96. Malta	97. Marshall Islands	98. Mauritania	99. Mauritius	100. Mexico
101. Moldova	102. Mongolia	103. Monten- egro	104. Morocco	105. Muscat and Oman
106. Myanmar	107. Namibia	108. Nauru	109. Nether- lands	110. New Zealand
111. Nicaragua	112. Niger	113. Nigeria	114. Norway	115. Pakistan
116. Palestine	117. Panama	118. Paraguay	119. Peru	120. Philippines
121. Poland	122. Portugal	123. Qatar	124. Romania	125. Russia

A. Appendix

126. Rwanda	127. Saint Lucia	128. San Marino	129. Saudi Arabia	130. Senegal
131. Serbia	132. Seychelles	133. Sierra Leone	134. Slovakia	135. Slovenia
136. Somalia	137. South Africa	138. South Sudan	139. Spain	140. Sudan
141. Suriname	142. Sweden	143. Switzerland	144. Syria	145. Tajikistan
146. Tanzania	147. Thailand	148. Togo	149. Trans-jordan	150. Trinidad and Tobago
151. Tunisia	152. Turkey	153. Turkmenistan	154. Uganda	155. Ukraine
156. United Arab Emirates	157. United Kingdom	158. Uruguay	159. Uzbekistan	160. Venezuela
161. Western Samoa	162. Yemen, North	163. Zambia	164. Zimbabwe	

B. Appendix

Table B.1.: I(3) Data Base Year 1990

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.099 (0.042)*	0.099 (0.042)*	0.098 (0.042)*
trade	-0.096 (0.079)		
military	-0.058 (0.030) ⁺		-0.056 (0.030) ⁺
arms	-0.044 (0.057)		-0.023 (0.055)
financial	-0.024 (0.061)		-0.030 (0.061)
travel	0.026 (0.063)		0.040 (0.063)
other	-0.078 (0.098)		-0.066 (0.092)
EXP_PART_SANCT		-0.223 (0.063)**	-0.193 (0.066)**
EXP_COMPL_SANCT		-1.003 (0.207)**	-0.976 (0.207)**
Observations	42602	42602	42602
RESET	0.78	0.41	2.15
RESETp	0.3761	0.5203	0.1421

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1990, 1993, 1996, 1999, 2002, 2005, 2008, 2011, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.2.: I(4) Data Base Year 1990 EU only

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.284 (0.069)**	0.287 (0.068)**	0.284 (0.069)**
trade	-0.492 (0.097)**		
military	-0.024 (0.163)		-0.002 (0.165)
arms	-0.177 (0.121)		-0.183 (0.122)
financial	0.019 (0.122)		0.028 (0.123)
travel	0.076 (0.122)		0.082 (0.122)
other	0.343 (0.087)**		0.352 (0.080)**
EXP_PART_SANCT		-0.472 (0.095)**	-0.497 (0.098)**
EXP_COMPL_SANCT		-1.097 (0.387)**	-1.183 (0.401)**
Observations	31913	31913	31913
RESET	3.10	1.08	4.93
RESETp	0.0784	0.2996	0.0263

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1990, 1994, 1998, 2002, 2006, 2010, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.3.: I(4) Data Base Year 1990 US only

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.209 (0.125) ⁺	0.209 (0.128)	0.208 (0.125) ⁺
trade	-0.584 (0.252)*		
military	0.119 (0.057)*		0.116 (0.057)*
arms	-0.025 (0.134)		-0.041 (0.126)
financial	-0.035 (0.174)		-0.039 (0.166)
travel	0.407 (0.298)		0.398 (0.281)
other	-0.457 (0.232)*		-0.499 (0.245)*
EXP_PART_SANCT		-0.456 (0.272) ⁺	-0.532 (0.279) ⁺
EXP_COMPL_SANCT		-0.924 (0.530) ⁺	-0.979 (0.583) ⁺
Observations	1309	1309	1309
RESET	0.86	3.04	2.51
RESETp	0.3529	0.0814	0.1132

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. Since the US is the only country which participates as an exporter in this sample the estimates were obtained by a time, importer and country-pair fixed effects and the PPML estimator. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1990, 1994, 1998, 2002, 2006, 2010, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.4.: I(5) Data Base Year 1990

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.078 (0.039)*	0.080 (0.039)*	0.078 (0.039)*
trade	-0.064 (0.082)		
military	-0.077 (0.035)*		-0.072 (0.035)*
arms	-0.014 (0.076)		0.006 (0.077)
financial	-0.006 (0.083)		-0.006 (0.077)
travel	0.080 (0.081)		0.079 (0.083)
other	0.013 (0.119)		0.030 (0.112)
EXP_PART_SANCT		-0.227 (0.126) ⁺	-0.182 (0.134)
EXP_COMPL_SANCT		-0.787 (0.290)**	-0.792 (0.296)**
Observations	28214	28214	28214
RESET	8.68	0.19	3.69
RESETp	0.0032	0.6643	0.0546

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1990, 1995, 2000, 2005, 2010, 2015. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.5.: I(3) Data Base Year 1991

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.109 (0.044)*	0.110 (0.044)*	0.108 (0.044)*
trade	-0.167 (0.075)*		
military	-0.067 (0.033)*		-0.064 (0.033) ⁺
arms	-0.011 (0.066)		0.013 (0.063)
financial	0.002 (0.071)		-0.017 (0.066)
travel	0.034 (0.084)		0.025 (0.085)
other	0.013 (0.120)		0.011 (0.116)
EXP_PART_SANCT		-0.317 (0.069)**	-0.300 (0.073)**
EXP_COMPL_SANCT		-1.041 (0.157)**	-1.035 (0.159)**
Observations	43776	43776	43776
RESET	4.86	0.78	0.00
RESETp	0.0275	0.3777	0.9655

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1991, 1994, 1997, 2000, 2001, 2004, 2007, 2010, 2013. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.6.: I(4) Data Base Year 1991

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.060 (0.031) ⁺	0.061 (0.031) ⁺	0.060 (0.031) ⁺
trade	0.045 (0.079)		
military	-0.082 (0.035) [*]		-0.080 (0.035) [*]
arms	0.000 (0.075)		0.018 (0.077)
financial	-0.033 (0.074)		-0.010 (0.074)
travel	0.024 (0.087)		0.034 (0.087)
other	-0.035 (0.080)		-0.020 (0.076)
EXP_PART_SANCT		-0.146 (0.105)	-0.101 (0.107)
EXP_COMPL_SANCT		-0.822 (0.192) ^{**}	-0.817 (0.197) ^{**}
Observations	33371	33371	33371
RESET	0.05	0.53	0.03
RESETp	0.8293	0.4676	0.8523

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, ^{*} $p < .05$, ^{**} $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1991, 1995, 1999, 2003, 2007, 2011, 2015. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.7.: I(5) Data Base Year 1991

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.061 (0.034) ⁺	0.063 (0.033) ⁺	0.061 (0.034) ⁺
trade	-0.009 (0.126)		
military	-0.102 (0.037)**		-0.097 (0.038)**
arms	0.086 (0.091)		0.122 (0.093)
financial	0.020 (0.074)		0.038 (0.071)
travel	-0.058 (0.102)		-0.051 (0.107)
other	-0.084 (0.096)		-0.060 (0.090)
EXP_PART_SANCT		-0.278 (0.089)**	-0.307 (0.113)**
EXP_COMPL_SANCT		-1.001 (0.236)**	-1.010 (0.248)**
Observations	28486	28486	28486
RESET	0.42	0.37	0.39
RESETp	0.5179	0.5445	0.5313

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1991, 1996, 2001, 2006, 2011, 2016. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.8.: I(3) Data Base Year 1992

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.015 (0.033)	0.022 (0.033)	0.015 (0.033)
trade	-0.126 (0.091)		
military	-0.071 (0.031)*		-0.063 (0.031)*
arms	0.100 (0.081)		0.149 (0.079)+
financial	-0.032 (0.080)		-0.042 (0.071)
travel	0.018 (0.068)		0.013 (0.070)
other	-0.067 (0.080)		-0.058 (0.077)
EXP_PART_SANCT		-0.369 (0.080)**	-0.405 (0.101)**
EXP_COMPL_SANCT		-1.053 (0.194)**	-1.053 (0.198)**
Observations	44516	44516	44516
RESET	3.20	0.54	0.01
RESETp	0.0736	0.4608	0.9112

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1992, 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.9.: I(4) Data Base Year 1992

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.037 (0.036)	0.044 (0.035)	0.038 (0.036)
trade	-0.137 (0.112)		
military	-0.067 (0.029)*		-0.064 (0.029)*
arms	0.072 (0.084)		0.113 (0.082)
financial	-0.017 (0.085)		-0.029 (0.076)
travel	0.002 (0.073)		0.005 (0.073)
other	-0.093 (0.072)		-0.085 (0.069)
EXP_PART_SANCT		-0.354 (0.113)**	-0.369 (0.127)**
EXP_COMPL_SANCT		-0.981 (0.188)**	-0.975 (0.193)**
Observations	34184	34184	34184
RESET	2.45	0.58	0.00
RESETp	0.1179	0.4451	0.9592

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1992, 1996, 2000, 2004, 2008, 2012, 2016. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.10.: I(5) Data Base Year 1992

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.038 (0.036)	0.040 (0.036)	0.037 (0.036)
trade	-0.113 (0.135)		
military	-0.053 (0.033)		-0.054 (0.033)
arms	-0.029 (0.058)		-0.018 (0.056)
financial	0.024 (0.073)		0.017 (0.066)
travel	-0.077 (0.085)		-0.065 (0.088)
other	-0.090 (0.101)		-0.113 (0.094)
EXP_PART_SANCT		-0.416 (0.182)*	-0.402 (0.182)*
EXP_COMPL_SANCT		-1.580 (0.186)**	-1.599 (0.183)**
Observations	23635	23635	23635
RESET	5.76	4.66	2.08
RESETp	0.0164	0.0308	0.1489

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1992, 1997, 2002, 2007, 2012. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.11.: I(3) Data Base Year 1993

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.084 (0.043) ⁺	0.085 (0.043)*	0.084 (0.043) ⁺
trade	-0.077 (0.080)		
military	-0.060 (0.030)*		-0.058 (0.030) ⁺
arms	-0.025 (0.057)		-0.001 (0.056)
financial	-0.048 (0.066)		-0.057 (0.067)
travel	0.086 (0.055)		0.108 (0.054)*
other	-0.134 (0.082)		-0.121 (0.081)
EXP_PART_SANCT		-0.212 (0.065)**	-0.183 (0.068)**
EXP_COMPL_SANCT		-0.956 (0.245)**	-0.944 (0.252)**
Observations	39810	39810	39810
RESET	0.98	0.29	1.26
RESETp	0.3231	0.5889	0.2620

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1993, 1996, 1999, 2002, 2005, 2008, 2011, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.12.: I(4) Data Base Year 1993

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.118 (0.057)*	0.119 (0.057)*	0.118 (0.057)*
trade	-0.171 (0.076)*		
military	-0.043 (0.032)		-0.038 (0.032)
arms	-0.028 (0.070)		-0.001 (0.064)
financial	-0.006 (0.080)		-0.022 (0.071)
travel	0.026 (0.091)		0.048 (0.090)
other	-0.107 (0.134)		-0.100 (0.128)
EXP_PART_SANCT		-0.275 (0.064)**	-0.260 (0.067)**
EXP_COMPL_SANCT		-1.337 (0.216)**	-1.316 (0.224)**
Observations	29699	29699	29699
RESET	0.10	0.78	1.37
RESETp	0.7523	0.3778	0.2417

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1993, 1997, 2001, 2005, 2009, 2013. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.13.: I(5) Data Base Year 1993

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.091 (0.057)	0.096 (0.056) ⁺	0.090 (0.057)
trade	-0.171 (0.079)*		
military	-0.030 (0.032)		-0.027 (0.032)
arms	0.050 (0.064)		0.080 (0.060)
financial	-0.086 (0.085)		-0.110 (0.078)
travel	0.050 (0.086)		0.032 (0.076)
other	-0.090 (0.124)		-0.094 (0.119)
EXP_PART_SANCT		-0.281 (0.068)**	-0.282 (0.073)**
EXP_COMPL_SANCT		-1.038 (0.208)**	-1.003 (0.192)**
Observations	24573	24573	24573
RESET	5.96	0.72	1.21
RESETp	0.0146	0.3964	0.2722

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1993, 1998, 2003, 2008, 2013. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.14.: I(4) Data Base Year 1994

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.083 (0.051)	0.086 (0.051) ⁺	0.082 (0.051)
trade	-0.238 (0.071)**		
military	-0.050 (0.034)		-0.048 (0.034)
arms	0.031 (0.064)		0.058 (0.059)
financial	-0.066 (0.071)		-0.104 (0.062) ⁺
travel	0.145 (0.078) ⁺		0.149 (0.082) ⁺
other	-0.087 (0.130)		-0.091 (0.129)
EXP_PART_SANCT		-0.357 (0.074)**	-0.349 (0.081)**
EXP_COMPL_SANCT		-0.964 (0.223)**	-0.921 (0.235)**
Observations	30446	30446	30446
RESET	0.02	0.78	0.27
RESETp	0.8914	0.3769	0.6036

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1994, 1998, 2002, 2006, 2010, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.

Table B.15.: I(5) Data Base Year 1994

	(1)	(2)	(3)
	Trade	Trade	Trade
RTA	0.122 (0.057)*	0.126 (0.057)*	0.122 (0.057)*
trade	-0.197 (0.080)*		
military	-0.035 (0.038)		-0.031 (0.038)
arms	-0.014 (0.075)		0.020 (0.069)
financial	-0.077 (0.081)		-0.112 (0.076)
travel	0.150 (0.069)*		0.157 (0.063)*
other	-0.108 (0.148)		-0.108 (0.147)
EXP_PART_SANCT		-0.310 (0.074)**	-0.296 (0.081)**
EXP_COMPL_SANCT		-0.847 (0.189)**	-0.795 (0.194)**
Observations	25169	25169	25169
RESET	1.52	0.58	0.04
RESETp	0.2181	0.4460	0.8473

Notes: This table reports estimates of the effects of trade sanctions on trade. The dependent variable *Trade* is captured in levels while the explanatory variables are modelled as dummies taken the value of one if the given statement is realized at time t and zero otherwise. All estimates were obtained with the PPML estimator and exporter-time, importer-time and country- pair fixed effects. Column (1) reports the effects of the different sanction types. Column (2) decomposes the effect of different kind of trade sanctions by *partial* and *complete* restrictions. Column (3) combines column (1) and (2). Standard errors in parentheses and clustered by country pair. ⁺ $p < 0.10$, * $p < .05$, ** $p < .01$. Given the stated time interval the estimates were obtained by the following years: 1994, 1999, 2004, 2009, 2014. The values for RESET and RESETp corresponds to the Ramsey Regression Equation Specification Error Test.