WISEflow
Europe/Oslo(CEST)
30 Jun 2022

Handelshøyskolen BI

GRA 19703 Master Thesis

Thesis Master of Science 100% - W

Predefinert informasjon

Startdato:	16-01-2022 09:00	**Termin:**	202210
Sluttdato:	01-07-2022 12:00	**Vurderingsform:**	Norsk 6-trinns skala (A-F)
Eksamensform:	T		
Flowkode:	202210||10936||IN00||W||T		
Intern sensor:	(Anonymisert)		

Deltaker

Navn:	Oscar Grieg Toyomasu og Ørjan Yggeseth Kjos

Informasjon fra deltaker

Tittel *:	Free Trade Agreement between China & Norway
Navn på veileder *:	Per Botolf Maurseth

Inneholder besvarelsen konfidensielt materiale?:	Nei	**Kan besvarelsen offentliggjøres?:**	Ja

Gruppe

Gruppenavn:	(Anonymisert)
Gruppenummer:	221
Andre medlemmer i gruppen:	

Free Trade Agreement between China & Norway

An Empirical Study on the Effect of a Free Trade Agreement between Norway and China

GRA 19703 – Master Thesis

Study program: MSc in Business, Major in Economics

Supervisor: Per Botolf Maurseth

June 2022

This thesis concludes our MSc in Business (Major in Economics) degree at the BI Norwegian Business School. Major thanks to our supervisor Per Botolf Maurseth, Associate Professor at the Department of Economics at BI, for supporting us throughout the process with his expertise in international trade. We also wish to thank PhD Candidate Max-Emil Mohn King for valuable feedback and comments.

Abstract

This master thesis investigates the potential effects of the proposed free trade agreement implemented between China and Norway on bilateral trade flows. A fixed-effect regression technique with a basis in the gravity equation of trade serves as a workhorse for estimating the impact of free trade agreements. Individual predictions based on the two countries' previously implemented free trade agreements show that China usually benefits from a 37 percent increase in bilateral trade. At the same time, Norway has a surprisingly negative 9 percent decrease in bilateral trade. The study is then nuanced by categorising bilateral trade flows of countries to measure the effects of different country sizes on trade. We also use a regression discontinuity design where exports and imports are individualized. Deviating results of Norwegian free trade agreements in relation to those of others, including China, indicate a difference in the content of the treaties and ways of implementation. The results suggest that individual differences in free trade agreements make it unsuitable to treat them as equal and emphasize that Norway negotiates most of the agreements with the EFTA countries and not individually, as in the case of China. This study finds evidence that a free trade agreement would yield an increase in the bilateral trade flows between Norway and China, but raises concern about the effect on the trade balance. Since Chinese free trade agreements tend to increase exports relative to imports, this could amplify the deficit in the Norwegian trade balance in relation with China.

Contents

"For the only way in which a durable peace can be created is by world-wide restoration of economic activity and international trade."

- *James Forrestal, First United States Secretary of Defence*

1 Introduction and motivation

As we write this thesis, the world is recovering from the covid-19 pandemic, where national lockdowns and border restrictions have plagued us worldwide for the last two years. In the year 2020, when the pandemic hit, the world experienced some of the most significant reductions in international trade and output volumes since World War II (Organisation for Economic Co-operation and Development (OECD), 2022). Few could have predicted this phase change for a somewhat optimistic and continuously growing global trading and economic cooperation environment. Despite the setbacks, in February, the United Nation predicted 2022 to be a record-setting year for international trade with volumes from and above the pre-pandemic levels. However, an unfortunate humanitarian crisis in the shape of a war in Ukraine has created some new uncertainties in later times. The nations worldwide are showing a strong willingness to explore new trade opportunities and strengthen bilateral trade.

The perhaps most prominent elements in the recent history of international trade are the economic rise of the East Asian economies. First, the Japanese economic boom in the post-war stage of the 20th century, and today the rapidly growing China that some predict will become the world's largest economy. Following the rise, a traditionally western dominated world of international trade is now being challenged by the powerful nations in Asia. Today China has established itself as a global top manufacturer with goods ranging from clothes to electronics and has become one of the most significant trade partners of many western countries. Interactions with China are practically unavoidable today for any industrial country. It is natural for governments to take a stand on this relationship to strengthen their bonds or set limits.

In a trend of globalisation where traditional barriers between countries are gradually erased, international trade has become a highly relevant topic concerning economic development and progress. The relationship between the traditionally dominant countries in the west and the new powerful countries in East Asia is perhaps the most interesting to follow in the years to come, motivating further research. In this thesis, we want to look at the proposed free trade agreement that can be implemented with China, and the relatively small but well-developed country in the Northern-Europe, Norway. Although creating free trade agreements to increase benefits from foreign trade has become increasingly popular, as we will see in this thesis, it remains to understand the actual effect it proposes on the trade flow between the countries involved. Norway is a country dependent on income from its exports, and its trade relation with China is already of considerable significance. With this in mind, in this thesis, we want to investigate the following research problem:

What could be the effect of the proposed Free Trade Agreement (FTA) between Norway and China on trade flows?

The paper is structured as follows. In the 2nd chapter, we look further into the negotiations between Norway and China, explaining a free trade agreement, its historical use, and the characteristics of the two countries' trade relations. In the 3rd chapter, the underlying theoretical concept of the gravity equation is introduced and its historical flourishing together with previous empirical studies and evidence. In the 4th chapter, we present the data and the econometric model. In the 5th chapter, we give our research results and findings. In the 6th chapter, we discuss and interpret the top results and highlight potential weaknesses and biases in the results. Lastly, chapter 7th, we present a conclusion highlighting our findings and some suggestions for future research.

2 Background

2.1 The Free Trade Negotiations between Norway and China

In 2007 the governments of Norway and China decided to launch a Joint Feasibility Study to explore the potential advantages of implementing a free trade agreement between the two countries. As will be described more in detail in this chapter, trade between the two countries has rapidly increased in recent times, and China has arguably become one of Norway's most important trade partners. This development caused willingness in both countries to consider ways to strengthen the relationship further, and as a result, the Joint Feasibility Study was initiated. After approximately half a year of studies, the final report suggested that existing trade barriers such as customs and other regulations hindered and limited potential growth in trade between the two countries. It suggests that a free trade agreement could potentially strengthen economic cooperation and trade, and benefit both countries' economic development.

The first negotiation meetings started in 2008 after the Norwegian Minister of Trade and Industry, Sylvia Brustad, and the Chinese Deputy Minister of Trade, Hong Qui, signed a “Memorandum of Understanding”. The ongoing negotiations were postponed after Liu Xiaobo received the Nobel Peace Prize in 2010 because of protests from China. The negotiations were not resumed until the 7th of April 2017, when representatives from both countries signed a new Memorandum of Understanding (Norwegian Government, 2022).

By September 2019, a total of 16 rounds of negotiation meetings had been arranged between Norway and China, but shortly after the process was interrupted by the covid-19 pandemic. The situation made it difficult to conduct meetings, although digital meetings were arranged to some extent. There has also been an ongoing debate in Norway regarding the relationship with China because of dissent in political and humanitarian views. Despite the interruptions, both countries officially signal willingness and commitment to completing the negotiations and implementing the free trade agreement as soon as possible.

Although the agreement's specifications remain to be decided, the deal's content is to be based on the recommendations of the Joint Feasibility Study. In the report, it is recommended that the free trade agreement should remove or reduce tariffs on industrial goods, as well as on agricultural goods (including fish). The study also states that the service sector is becoming a more critical component of trade between Norway and China, and the free trade agreement should further strengthen and promote bilateral trade in services. The area of investment flows between Norway and China is considered relatively modest compared to trade. Still, it is also stated that it is growing fast, and the free trade agreement should facilitate increased levels of investment.

2.2 Free trade Agreement

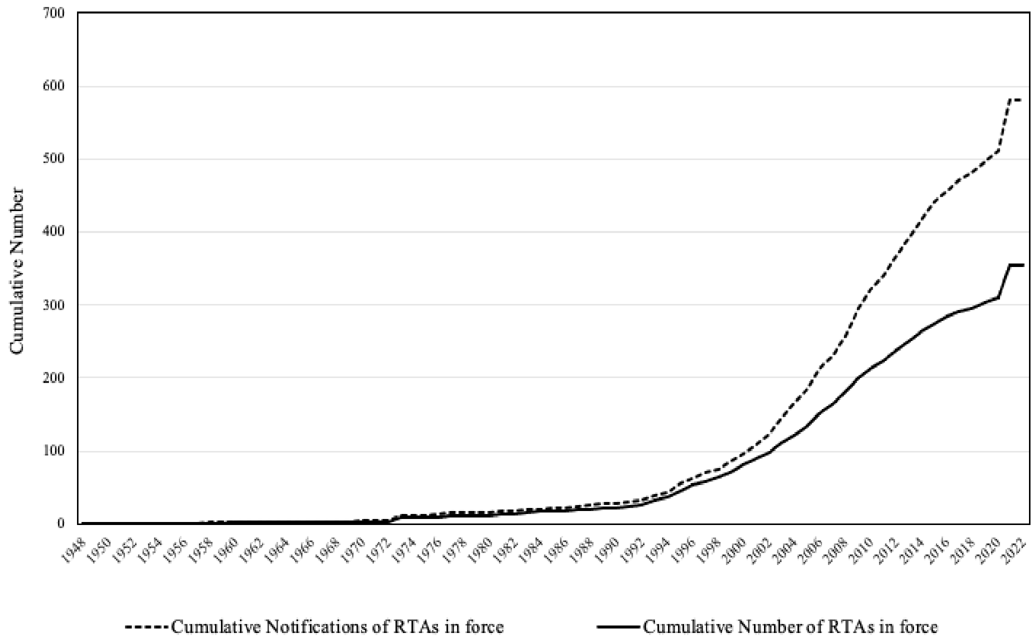
Free Trade Agreement is denoted FTA and is used interchangeable throughout the paper. And in this section, we use RTA, the general term describing trade agreements[1]. The term RTA is only included here to illustrate the interesting nature of trade agreements through time. In negotiations for an FTA, the parties involved try to discuss and come to a deal to allow for as much free trade as possible and enhance the relationship in many other aspects. There are many benefits for the exporting-importing countries and consumers of implementing an FTA. Firstly, reduction or elimination of tariffs - improves competitiveness in the global market; secondly, Intellectual property protection - protects and secures countries' intellectual property rights abroad; thirdly, Product standards - contribute to a high quality of products. Other benefits of an FTA regarding government procurements, political factors, and bilateral investment will not be discussed in detail in this thesis. Potential implications of constructing an FTA are many, and differences in trade policies and less custom declaration revenue for the government are some of them (International Trade Administration, Trade.gov, 2022)

In Graph 1 below the dotted line illustrates Regional Trade Agreements (RTAs) currently in force. While the solid line represents the cumulative number of notifications of RTAs in force from 1948 to 2022 reported to the WTO and GATT prior to 1995, before WTO was founded. The number of accumulated RTA in force

[1] Regional Trade Agreements is a broad term describing treaties implemented between countries that encourage free movements of goods and services across the borders.

is 355, while 580 RTAs notified in force as of 2022 (WTO, 2022a). Before the Great Depression in 2008, the trend of RTAs implemented indicated an upward solid sloping trend. The crisis had severe and long-term effects, which caused a slower development in RTAs in force and notifications of RTAs in force. In 2020 there was a jump in implemented RTAs and new ones in negotiation. In the early days, FTA was popular in North and South America, Europe, and Africa before Asian regions established FTAs with other areas from around 2000 onwards. The development of RTAs through time highlights the increasing wish to be part of the global trade system. In this study, bilateral FTA between two countries is the FTA of interest.

Graph 1: RTAs in force and notification of RTAs in force, 1948 - 2022



Note: The solid line indicates the culumative number of RTAs implemented and in force (for goods and service). While the dotted line indicates the culumative number of RTAs (goods and service) that are notified to the World Trade Organization. This data is extracted from WTO and modified. It does not illustrate the distribution of RTAs regarding goods or service per year. Data is updated 8th of June from WTO Secretariat, and full reference can be found in References

Since 2016, WTO has had 164 member countries with at least one RTA; some countries have more than 20 contracting RTAs (WTO, 2022b). In developing a trade agreement, the aim is to grant more favourable conditions for trade. WTO has sets of rules that must be fulfilled—firstly, departing from the guiding principle of non-discrimination defined in the GATT and The General Agreement on Trade in Services (GATS). For RTAs on goods, *Paragraphs 4 to 10 of Article XXIV of GATT 1994* guide the formation and operation of RTA. Secondly, *Enabling Clause* refers to preferential trade arrangements in goods of developing countries. Lastly, *the Transparency Mechanism* initiated under the Doha Development Agenda; provides insight into the early announcement of RTAs. The committee on Regional Trade Agreements (CRTA) function is to carry out RTAs on behalf of the WTO (WTO, 2022c). That is roughly an overview of the process and principles included to emphasize the construction of an RTA. All RTAs are unique and independently designed for different objectives across countries, and the rules above are the bare minimum to be recognized as an RTA under WTO´s register.

2.3 Norway and China as Trading Nations Today and FTAs

2.3.1 Norway

Despite its relatively small-sized economy with a GDP of approximately 362 billion USD, Norway has established itself as one of the largest exporter nations within some segments of trading goods (Statistics Norway, 2022). In 2020 Norway was the second-largest exporter of fish products globally and the tenth-largest exporter of oil (Statista, 2021; Twin, 2022). Although most trade is with other countries in Europe and within the European Economic Area (EEA), trade with nations from different continents has grown and become increasingly more significant (Fossanger, 2022). This has led to the consideration of new trade agreements in other parts of the world to strengthen the position of its products outside of Europe. Sustaining and increasing the country's market position in international markets within natural resources and agricultural products such as seafood remains one of the government's priorities (Vetre, 2022).

Norway is currently involved in 27 FTAs covering 38 countries outside the EU with countries from Europe, Africa - the Middle East, North- and South America, and Asia - Pacific (Norwegian Customs, 2020). Appendix A includes a complete list of Norway´s FTAs. There are also several FTAs currently under negotiation. Furthermore, Norway is a member of the European Economic Area (EEA) and has benefited by following the whole acquis communautaire to the four freedoms (free movement of persons, goods, capital, and services). That has resulted in a high degree of economic integration, government procurement competition rules, etc. Norway is also part of the European Free Trade Association (EFTA), making it possible to establish FTAs within the EFTA framework with other countries

(European Commission, 2022). Even though the members of EFTA negotiate FTAs together, each nation defends its sovereignty and negotiates on its premises.

2.3.2 China

China has had a historical development in its economy in recent times, going from being a relatively poor and closed country to being one of the arguably most influential and significant economic players in the world. After World War II, China was a closed economy with relatively little economic connection to other nations (The World Bank, 2022a). In the 1970s, the Chinese Communist Party initiated a comprehensive economic reform toward moving the country away from its traditional socialist policy and allowing for a free market. China became a member of the World Trade Organisation (WTO) in 2001, marking a change in course for the country. The country is today the world's second-largest economy measured in GDP with an approximated value of over 17 trillion USD in 2021 and is now the world's largest exporting country (Silver, 2021; Szmigiera, 2022; Textor, 2022).

The Chinese Government assesses FTAs as a new platform to further open up to the outside and integrate into the global economy. Strengthen economic cooperation and contribute to the multilateral trading system. Today, China maintains 17 free trade agreements, and another 24 are under construction (Ministry of Commerce, PRC, 2022). These signed FTAs are geographically spread worldwide, with the majority in Asia, some in South America, Africa, and Oceania. Switzerland and Iceland are the only countries in Europe with a signed and implemented FTA with China today.

2.4 Sino-Norwegian Trade Relations

In this section, we look into key data on trade between Norway and China to understand the importance and characteristics of the current bilateral relationship between the two countries. According to Norwegian Authorities, China is today Norway's third-largest trading partner after the US and the European Union, as well as the largest trading partner in Asia (Norwegian Government, 2022).

Table 1 below represents Trading Economics reported trade data from the United Nations Comtrade database in 2020. Panel A shows Norway's top five import nations, and Panel B shows Norway's top five export nations. A total of 9.81 billion dollars of goods was imported to Norway from China in 2020, which was approximately a 20 percent increase from 2019, according to Statistics Norway (2022). That made up 12 percent of all Norwegian imports. For comparison, a total of 9.33 billion dollars of goods was imported to Norway from the second biggest partner Germany, and 8.69 billion dollars of goods from the neighboring country Sweden.

Table 1: Trade flows for Norway in 2020

Panel A: Norway Imports by Country in 2020

	Value
China	$9.81B
Germany	$9.33B
Sweden	$8.69B
United States	$5.51B
United Kingdom	$4.43B

Panel B: Norway Exports by Country in 2020

	Value
United Kingdom	$14.41B
Germany	$9.63B
Netherlands	$8.18B
Sweden	$8.17B
China	$6.42B

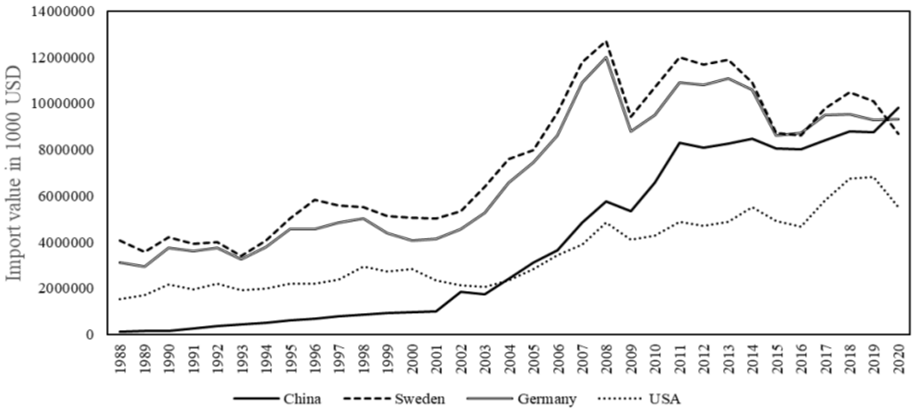
Notes: The data is reported in nominal USD and retrieved from the Trading Economics. Full reference can be found under References.

When considering exports, China was also the largest receiver of goods from Norway outside of Europe and among the largest importers in the world. We see from Table 1, Panel B that in 2020 the exports of Norwegian goods to China will equal around 6.42 billion dollars. That equals approximately 7.8 percent of all Norwegian exports.

The graphs below visualise the historical development of trade from 1988 to 2020 between Norway and China and also with some of Norway's other large trading partners. (Sweden, Germany, and the US). Graph 2 shows imports to Norway, and Graph 3 shows exports from Norway to the respective trading partners. The solid black line representing China shows how the trade with Norway has rapidly increased over the last few decades and caught up with other Norwegian top trading partners. One explanation for the steeper trend of Chinese imports to Norway is

China's decision to join the WTO and open up to the global trade system. Despite being a special year impacted by the covid-19 pandemic, China was for the first time the largest exporting nation to Norway in 2020. It should also be noticed that Norway is running a significant trading deficit with China, meaning that the imports are larger than the exports to China.

Graph 2: Imports to Norway



Graph 3: Exports from Norway

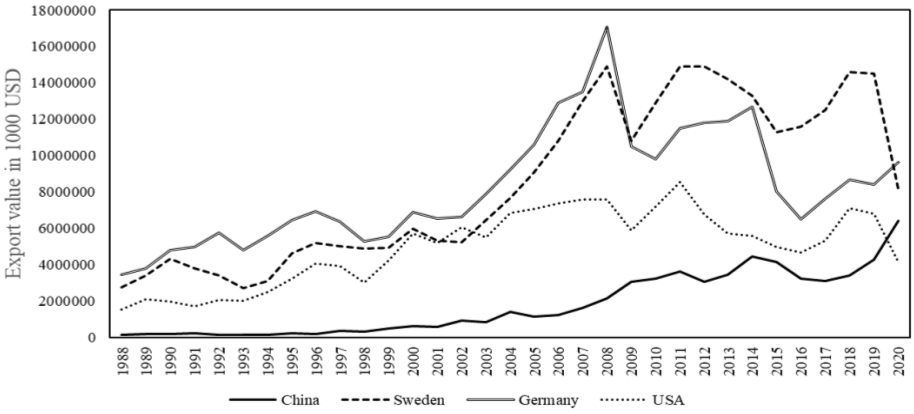


Table 2 breaks down the goods traded between Norway and China into product categories. Panel A shows the most imported types of goods to Norway from China, and Panel B shows the most exported categories of goods from Norway to China. The most prominent import from China was electronics, which among others, includes phones and computer components. According to SSB (2022), almost 1 out of 4 phones imported to Norway originated in China and over 90 percent of the imported portable computers. Other machines, vehicles, interiors, and clothes also made up a substantial part of the imports. Imports of vehicles were the segment that increased the most with 300 percent as a result of the increasing demand for Chinese cars.

Table 2: Sino-Norwegian trading by sector

Panel A: China Exports to Norway in 2020

	Value
Electrical, electronic equipment	$461.11M
Vehicles oterh than railway, tramway	$454.95M
Machinery, nuclear reactrs, boilers	$416.20M
Ships, boats, and other floating structures	$401.06M
Furniture, lighting signs, prefabricated buildings	$258.79M
Articles of appareal, not knit or crocheted	$202.50M
Articles of iron or steel	$196.01M
Other made textile articles, sets, worn clothing	$133.88M

Panel B: Norway Exports to China in 2020

	Value
Mineral fuels, oils, distillation products	$3.99B
Organic chemicals	$740.93M
Fish, crustaceans, molluscs, aquatics invertebrates	$411.72M

Notes: Data on Norwegian export and Chinese export in 2020 broken down into sectors is retrieved from the Trading Economics, and full reference can be found under References. The row of organic chemicals include carbon based products as gasoline, paint, asphalt and natural gas.

The most exported category of goods from Norway to China was mineral fuels, including oil and gas. Approximately 3.99 billion dollars of mineral fuels were shipped from Norway to China in 2020. China received 15.5 percent of all oil exported from Norway, and there was a 200 percent increase in the crude oil export from 2019, according to SSB (2022). Oil and gas are the most important export for Norway, with a share of 42.2 percent of total exports. Fish exports such as salmon and other seafood made up a substantial part of the exports from Norway, with a slight decrease from previous years because of temporary Chinese food import regulations caused by the covid pandemic.

The key data presented in this section makes it clear that the Sino-Norwegian trading relationship is growing and becoming more important for both countries. From a Norwegian point of view, China is one of the prominent importers of the country's primary goods. This can justify the urgent need to explore options that can further strengthen and extract more benefits from this bilateral trading relationship. Implementing an FTA that eliminates and reduces tariffs and promotes other economic activities have become increasingly popular in recent years for this exact purpose. However, it remains to understand and estimate the potential effect an FTA will have on bilateral trade. In the next chapter, we introduce a theoretical framework that is recognized among trade economists and used in empirical studies to estimate the effect of trade policies on trade flows.

3 The Gravity Framework and Empirical Evidence

In this chapter, we introduce the theory and empirical evidence of the gravity equation. This chapter aims to give a picture of gravity´s history, the equation, and the feature of gravity on trade data. As this study is an empirical approach, elaborating on the theoretical micro-foundation of gravity will be limited. Still, we highlight its importance in international trade and use it as the primary tool to answer the research equation.

3.1 The History of the Gravity Equation of Trade

Estimating gravity equations have become a workhorse within the field of international economics to explain trade flows for more than 60 years. In 1962, Jan Tinbergen was the first economist to introduce the gravity equation, which is analogically similar to Newton´s "Law of Universal Gravitation" from 1687 and is presented in equation (1) in the next section (Head, 2003, pg. 2). The gravity equation was, for many years, subject to skepticism, criticism, and lack of foundation in already well-established international trading theory. However, this was a breeding ground for the critics, who suggested that the gravity equation was more a physics analogy than an economic analysis (Edward & Levinsohn, 1995, pg. 134). Anderson (1979) provided an economic model of gravity, which was seen as an attempt to give a theoretical foundation that seemed too complex to be part of our everyday toolkit, according to Leamer and Levinsohn (1995).

Head and Mayer (2014) called the year 1995 admission year for gravity research. Trefler (1995) introduced the concept of "*Missing trade"*, which in the Heckscher-Ohlin-Vanek model estimated much more trade in factor services (goods generated by using factors as land, labor, natural resources, etc.) compared to the actual data. This problem was linked to the "*Home bias"* rather than distance as an explanatory factor. Hence, he understood the importance of understanding the impediments of trade. Moreover, Leamer and Levinsohn (1995) wondered why trade economists did not admit the effect of distance when explaining international trade, as gravity models "*have produced some of the clearest and most robust findings in economics".* The empirical evidence flourished, and economists were increasingly engaging in the discussion. Krugman (1995) argued that the fact that bilateral distance cannot be the only thing that matters in the gravity equation, as he considered the intuition of remoteness, which originated from Anderson (1979) and was popularised by Anderson and Wincoop (2003). The story's irony was that economists “discovered” the empirical importance of distance and borderline as some prominent consultants and journalists had dismissed these factors as anachronisms. They were proclaiming the “borderless world” and “the death of distance” in the media, while economists proved them wrong (Head & Thierry, 2014, pg. 135). A study by McCallum (1995) found evidence that border effects still had economic relevance. Neighboring countries trade naturally more compared to countries with long distances.

The criticism that gravity models lacked micro-foundations was dismissed with the publication of Eaton and Kortum (2002) and Anderson and Wincoop (2003). None of the models requires increasing returns or imperfect competition, and there was no longer reason to believe that the gravity equation only applied to a smaller sample of countries (Head & Thierry, 2014, pg. 136). These papers pointed towards estimation techniques in terms of the structure of the models. Feenstra (2004) and Redding and Venables (2004) made it clear that it was possible to capture the multilateral resistance term by exporter- and importer-fixed effects, which turned out to be valid in different theoretical models. The discovery of being consistent with the theoretical foundation and easy to implement led to increased empirical studies of gravity equations. The period between 2002 and 2004 was the MR/fixed-effect revolution, as Head and Mayer characterized it. Meaning, that all factors causing friction for trade, explained by the multilateral resistance (MR) term, was captured with fixed-effects estimation techniques.

The year 2008 was the third most important time in the history of gravity research. Three papers by Chaney (2008), Helpman et al. (2008), and Melitz and Ottaviano (2008) discovered and united the fact that heterogeneous firms are compatible with gravity (Kepaptsoglou et al., 2010). In Chaney´s (2008) article, he shows that the effect of distance on the numbers of exporters and average exports depends on key parameters characterizing the elements of market structure (entry barriers, product differentiation, etc.). It has proved to be a helpful tool in measuring trade shocks' intensive and extensive margins. Hence, measuring the effects of trade diversion and trade creation. In the field of international trade that has historically been purely theoretical, the not-so-warm welcome of the gravity equation has turned out not to be a “dubious” approach as most trade economists first thought.

3.1.2 Empirical Evidence on the Effect of an FTA on Trade Flows

In the 60 years the gravity equation has existed, various specifications and estimations techniques have been conducted to explain different aspects of international trade. In particular, studies of estimating the effect of an FTA have been a hot topic amongst trade economists. According to Kepaptsoglou et al., (2010), for the past decade, more than 75 empirical studies have either tried to analyse the effect of trade policies or improve their performance of them. Improving performance means identifying control variables to deal with trade policy variables that are affected by unobservable factors.

The empirical findings of implementing an FTA have differed amongst studies. After World War II, there was a wish for peace and hope that history would never be repeated. This drove and created an ambition of a united global economic system. Finally, after tough negotiations, The General Agreement on Tariffs and Trade (GATT) was established in 1948. Providing rules to support world trade resulted in high growth rates in international commerce (World Trade Organization, 2022). In the years to come, several agreements between regions and countries were made to allow trade to flow more freely. In the paper of Aitken (1973), the European Economic Community (EEC) and the European Free Trade Association (EFTA) have experienced accumulative growth in the trade creation among the country's members. Fitzgerald (2001) analyses the effects of the North American Free Trade Agreement (NAFTA), implemented with Canada and Mexico in 1994. He shows that trade flows increased as a result of the agreement. Baier and Bergstrand (2002) conducted an interesting study addressing the endogeneity of FTAs. In contrast to instrumental and control variable approaches, panel approaches perform better in adjusting for endogeneity as an FTA is not an exogenous variable. This is because instruments and control variables do not perfectly eliminate factors that should make the FTA exogenous. They found, on average, that two countries' bilateral trade flows *double* after ten years after implementing an FTA.

On the other hand, there have been cases where the expected effects of an FTA did not meet the expectation ex-ante. For instance, the Singapore-Japan FTA is not considered to result in the expected outcome. A paper studying the trade effects of the EU-Mexico FTA by Slootmaekers (2004) shows that implementing an FTA contributed to positive trade creation effects for imports. Still, there is no evidence of trade diversion[2]. The impact of an FTA has been contractionary, as some studies indicated trade creation and diversion, while others do not. However, the potential of including interaction effects of an FTA may give a clearer view (Kepaptsoglou et al., 2010, pg. 12).

3.2 The Feature of Gravity on Trade Tata

Now we look at the feature of the gravity equation on actual trade data by visualising what has been discussed above. We introduce Head´s (2003) presentation of the simplest functional form of the gravity equation, which is the following:

$$F_{ij} = R\frac{M_i^{\alpha}M_j^{\beta}}{D_{ij}^{\theta}} \quad (1),$$

where, F_{ij} is the bilateral trade flow between country *i* and country *j*; M_i and M_j are relevant economic masses in the respective countries, often referred to as gross domestic product; D_{ij} is the distance between two countries' centers; R is the so-called remoteness term[3] The gravity equation can be thought of as representing a system explaining supply and demand forces. Let's say country *i* is the origin, and M_i represents the total amount of goods they are willing to supply, while M_j represents the destination country *j* and the total amount of goods they are willing to demand. Then D_{ij} can be thought of as trade costs, and in particular, transportation costs which lower the equilibrium of trade flows (Head, 2003, pg. 3). Logarithmically transforming equation (1) leads to an estimation model of the functional form of gravity equation, as shown below:

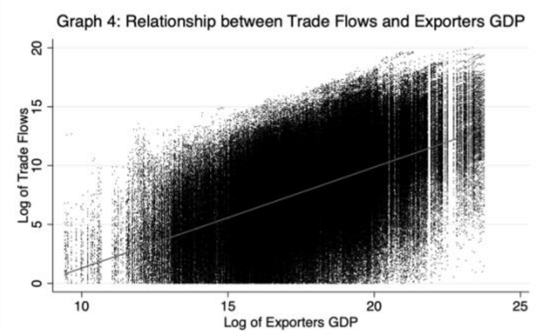
$$lnF_{ij} = \alpha\ lnM_i + \beta\ lnM_j - \theta\ lnD_{ij} +\ \varepsilon_{ij} \quad (2)$$

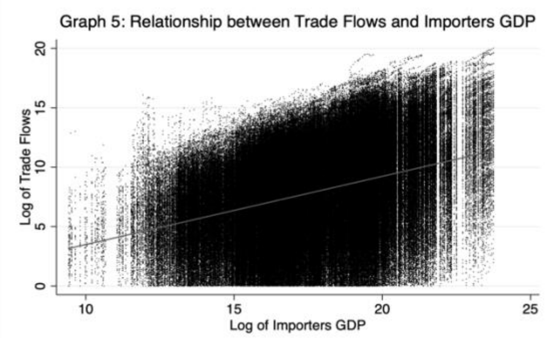
The interpretation of these variables is the same as above. By looking at the signs of these terms, we anticipate in what direction these variables affect trade flows, but not at what size. In the *Handbook of International Economics*, Head and Mayer

[2] Trade creation is according to the theory of comparative advantage, reducing or eliminating trade barriers allows greater specialisation, thus can trade increase and prices declines. Trade diversion is when reducing or eliminating trade barriers only within an area or union, trade can shift from less efficient producers outside of the area or union, to more efficient producer within the area or union (Triple A Learning, 2022)

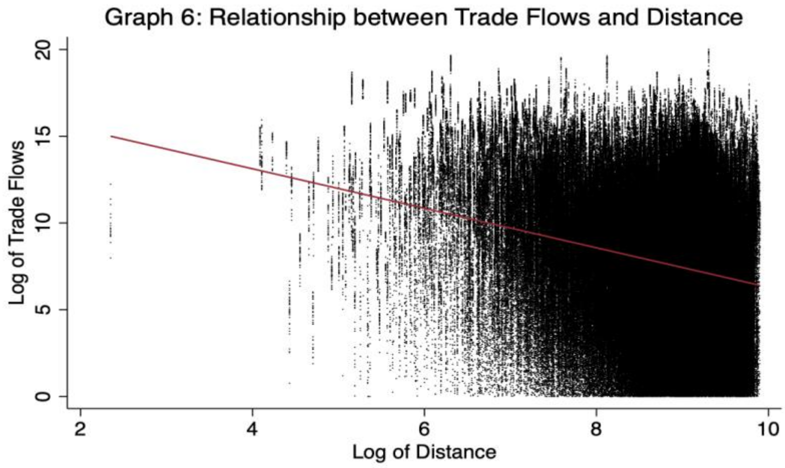
[3] We will not discuss the remoteness term in this thesis. In most studies remoteness is assumed to be constant and becomes part of the intercept (Head, 2003).

(2014), chapter three illustrates graphically the relationship that exports are increasing in economic size. Using the EU and Japan as an illustration, EU countries have the similar characteristics to Japan in terms of equal trade policies, not sharing a common language, no colonial history, and so forth. They find that for Japan's export, GDP elasticity is 1.00 and 1.03 for Japan's imports, which indicates a nearly perfect positive correlation between GDP and trade flow (Head & Thierry, 2014, pg. 133). In Graph 4, the data used is not restricted, and all countries are included. As anticipated, there is a positive relationship between trade flow and exporters' GDP, consistent with empirical findings as Head and Mayer (2014) found. The same inference holds for the relationship between trade flow and GDP for importers, illustrated in Graph 5.





Furthermore, the second key empirical relationship embodied in the gravity equation is that the bilateral physical distance between country *i* and country *j* negatively correlates with trade flows. As highlighted, Leamer and Levinsohn (1995) point out that the identification of distance effects on bilateral trade is one of the "*clearest and most robust empirical findings in economics*". The sign suggests an inversely proportional relationship by looking at the equation (2) estimation model. Keith Head and Anne-Celia Disdier of the University of Paris directed a meta-analysis of 595 gravity equations in 35 research papers between 1928 and 1995. They found the coefficient of distance to be 0.94. A doubling in the distance would half trade (Head, 2003, pg. 5).



In Graph 6, the log of trade flows is on the vertical axis, and the log of distance is on the horizontal axis. This illustration supports previous empirical evidence and follows equation (2), that distance decreases bilateral trade as the distance between country-pairs increases. In *Gravity for Beginners*, Head (2003) summarises several potential explanations for why distance matters. Firstly, distance is a proxy for transportation costs, which economists are not agreeing on. For example, David Hummels (2007) argues that shipping costs (freight charges and insurance) can explain why distance matters to a certain extent, while Martínez-Zarzoso and Nowak-Lehmann (2007) are arguing for the opposite. Secondly, distance measures the time elapsed during transportation. This means the probability of goods surviving intact at the final destination decreases as time in transit increases. The potential risk goods are exposed to is 1) loss of goods due to mishandling or rough weather, 2) spoiling organic materials due to bad conditions, or 3) friction in terms of unwillingness to pay, defaulting payment, etc. Other explanations could be synchronization costs, communication costs, transaction costs, "cultural distance" and so forth.

4 Econometrics & Data

4.1 Data

This chapter contains a detailed description and overview of data, and a presentation of models on this thesis is built upon. The goal of this chapter is to communicate clearly how the data gathered, and the choice of models is connected to the theoretical framework to estimate solid and credible results in the next chapter. How the datasets are structured, and the usage of all variables will be justified and explained.

We use a dataset called *The CEPII Gravity Dataset*, provided by a French center for research and expertise within several disciplines, where international trade is one of their expertise (Conte et al., 2022). The dataset contains over 4.5 million aggregated exporter-importer-year observations of 252 countries between 1948 to 2019, also known as panel data. The variables in the dataset are static, allowing for full identification and even tracking territorial changes. The dataset appears credible as it collects data from different highly reliable institutional sources.

For bilateral trade flows, we use *tradeflow_baci* as our dependent variable extracted from the April 2020 version of BACI. The UN Comtrade database provides the raw data here. Each country reports exports and imports, measured in thousands of USD, to the UN, resulting in duplicated trade flows. However, exports from the origin country do not always match the amount the receiving country reports as imports to the UN. There are two reasons for this, 1) imports are reported as CIF (cost, insurance, and freight), while export is reported as FOB (free on board), and 2) mistakes are made due to uncertainty regarding the final destination of exports, mishandling, loss of the market, etc. (Gaulier & Zignago, 2010). BACI solves this problem by reconciling the trade flows with a harmonized procedure[4]. Trade flows reported by BACI consist of more than 5000 products and does not account for

[4] Exports are reported as Free on Board (FOB), while imports are reported as Cost of Insurance and Freight (CIF). The export from the origin country i, should match with the reported imports by the destination country j, except for the additional CIF costs. In practice, this is not always the case, for reasons we will not discuss in this thesis. However, the so-called harmonized procedure estimates the CIF costs and removes this from import values, such that all values are FOB. Then the two reporters´ reliability is assessed according to a product-specific world median unit value. The more reliable a reporter is, the more weight is assigned to that party. Lastly, the reconciliation is done by taking the average of the two reported values (Gaulier, & Zignago, 2010).

services traded. Measuring the trade of services is complicated and time-consuming and will be disregarded here.

Macroeconomic variables such as gross domestic product and population are provided by the World Bank's Development Indicators (WDI) and merged with the CEPII *Gravity dataset.* The GDP variables for both the exporting and importing country are assumed to be an adequate proxy for economic size, as discussed in the chapter above. This variable is measured in thousands of USD. In general, estimates of GDP based on a production approach are more reliable than estimates based on expenditure or income side guidelines. Countries use different techniques, reporting standards, and methods, making discrepancies in GDP estimates. However, staff at WDI control the quality of the estimated values of GDP and sometimes adjust following international standards (The World Bank, 2022b).

For geographical variables, we use *dist* for distance and *contig* for contiguity. These variables are initially retrieved from CEPII's GeoDist database (Mayer & Zignago, 2011). The distance variable is measured by the great circle formula, which uses the latitudes and longitudes of two countries' most important cities, measured by population[5]. Using the most populated cities as the center of trade, it is reasonable to use the city that contributes to most trade, as a large share of the workforce and activity is located there. As discussed above, distance is empirically shown to be a good proxy for transportation costs and correlates negatively with trade. Continuity is a dummy variable equal to 1 if countries share the same border and zero otherwise. As mentioned above, neighboring countries are more likely to trade more, which explains the opposite of the distance variable. In addition to geographical variables, a dummy for a common language is included, and equal to 1 if countries share an official or primary language, zero otherwise.

To measure the effect of a free trade agreement, we introduce a dummy for FTA. This binary variable takes on the value 1 if there exists and is implemented a free

[5] Bilateral distance in kilometres between two countries' most populated cities, measured by population. To calculate the great circle formula, we need the longitude and latitude of each country in the dataset. The following formula measure the distance in kilometres:

$$D_{ij} = 3962.6 arccos([sin(Y_i) * sin(Y_j)] + [cos(Y_i) * cos(Y_j) * cos(X_i - X_j)]),$$

where X is longitude in degrees multiplied by 57.3 to convert it to radians and Y is latitude multiplied by -57.3 (assumed it is measured in degrees West) (Head, 2003, pg. 5).

trade agreement between two countries, and zero if there is no free trade agreement in place. To capture the isolated effect of an FTA, the dummy variable is constructed by discerning the impact of already facilitated trade agreements. The gravity dataset reports eight types of trade agreements, categorised by different sets of criteria developed by WTO. The distribution of different kinds of trade agreements in the dataset can be found in Diagram 1 in Appendix B. Almost 89.76 percent of all countries in the dataset have a Partial Scope Agreement (PSA). Such an agreement is, to our knowledge, only agreed on to establish some diplomatic and political relationship with another country. And is a starting point to see if there exist potential benefits of implementing more advanced trade agreements at a later stage. Therefore, in this thesis, we treat PSA as not having a trade agreement.

There are other trade agreements in the dataset that we need to control. Besides FTA and PSA, 3.54 percent of the observations consist of custom unions, economic integration agreements, and a combination of more than one agreement. As we are not interested in the effect of these, we introduce a binary variable "trade agreement" that has unity 1 if country-pairs have a trade agreement that is not an FTA and zero otherwise. By controlling for all other trade agreements, we can be certain of the estimates of the FTA dummy only to capture the effect of having an FTA implemented. Thus, we are now controlling for countries with 1) other trade agreements besides FTA and 2) having an FTA, and 3) no trade agreements.

We use the entire gravity dataset with the selected variables discussed above for our main analysis. The modified dataset contains 235 countries and 55 255 country-pair observations for 25 years between 1995 and 2019, which result in 1 374 750 observations, given that we have a perfectly balanced panel[6]. From a statistical point of view, it is better to include as many countries as possible. However, in the Gravity dataset, the term “country” also includes territories and configurations that are not formally independent, which means that there are cases where either origin or destination does not exist due to merges or splits of countries throughout history. One reason to restrict the dataset from 1995 was to avoid mergers and splits of countries. A dummy variable was made to easily eliminate countries that did not exist at a point within our period. This action aimed to reduce the baseline to mainly contain trading partners that traded throughout the chosen period. Another

[6] Total number of observation is calculated by $T * ((N-1) * N) \rightarrow 25*234*235 = 1\ 374\ 750.$

modification was to deal with observations where trading did not exceed an amount of 1000 USD at any point in time. This decision was based on the fact that country-pairs of such kind will not contribute substantially to the estimates due to a lack of solid trading relations and missing values, and constitutes approximately 28 000 observations.

However, after modifying the dataset, it is still a really good representation of the population where all independent countries in the world are represented. It is reasonable to assume there is no sampling error present here, and estimates are expected to be a good representation of the true population. Descriptive statistics of the data are presented in Table 3 below. According to the theoretical framework and the estimation model shown below, the logarithmic transformation of the variables is used in the regression model. As shown in Panel A, there are approximately 60 percent missing observations of trade flow out of 1 374 750 observations[7]. The unbalance in trade flows compared to the explanatory variables is plausible due to unreported trade on average among 32 000 country-pairs over 25 years. If trade flows were fully balanced, there would be reported trade of 54 990 country-pairs each year. However, this can indicate that 1) not all countries trade with each other, 2) some trade flows were not reported to the UN Comtrade and hence counted as a missing value, or 3) errors when reporting trade to the UN. Hence, we cannot be certain how big the share of missing values is. We can easily truncate the sample if the zero values are randomly distributed. As more than 60 percent of trade flow data is missing, we cannot treat these as zero values since this will result in inconsistent estimates. Nevertheless, in the analysis, we assume that the missing value is due to no trade between a country-pair, as only 223 zero-observations of trade exist.

[7] It is not likely that a country trades with each and every country in the world. The optimal situation would be to have observations of trade flows for every country concerned, for each year which would result in 1 374 750 observations of trade flow.

Table 3: Descriptive Statistics of main variables

Panel A: Descriptive variables

	Observations	Mean	Std. Dev.	Min.	Max.
lnTradeflow	560 672	7.75	3.83	0	20.02
$lnGDP_i$	1 121 328	16.75	2.46	9.31	23.80
$lnGDP_j$	1 121 328	16.75	2.46	9.31	23.80
$lnDistance_{ij}$	1 215 500	8.83	0.77	2.35	9.90
$lnPOP_i$	1 244 880	8.13	2.49	1.22	14.15
$lnPOP_j$	1 244 880	8.13	2.49	1.22	14.15
Contiguity	1 215 500	0.12	0.11	0	1
Comlang_off	1 215 500	0.18	0.38	0	1

Panel B: Correlation matrix

	lnTradeflow	$lnGDP_i$	$lnGDP_j$	$lnDistance_{ij}$	$lnPOP_i$	$lnPOP_j$	Contiguity	Comlang_off
lnTradeflow	1							
lnGDPi	0.55	1						
lnGDPj	0.40	-0.18	1					
lnDistanceij	-0.24	0.05	0.03	1				
lnPOPi	0.39	0.73	-0.14	0.05	1			
lnPOPj	0.29	-0.14	0.75	0.03	-0.09	1		
Contiguity	0.16	0.01	0.02	-0.36	0.05	0.06	1	
Comlang_off	0.01	-0.10	-0.09	-0.13	-0.07	-0.07	0.11	1

Note: lnTradeflow is the logged bilateral trade flow. LnGDP is the logged gross domestic product for the exporter country *i*, and importer country *j*. LnDistance is the logged bilateral distance between two countries most populated cities. LnPOP is the logged population for the exporter country *i*, and importer country *j*. Contiguity indicates whether a country-pair share borders or not. Comlang_off indicate whether a country-pair share primary or official language.

Furthermore, out of 1 374 750 (total) observations, all independent variables are strongly balanced, where only 13 percent of the observations are missing. In Panel B, the correlation matrix is reported, and there is no problem with multicollinearity for the main variables. We cross-check this by running an in-built variance inflation factor (VIF) test in STATA that confirms no problem regarding multicollinearity among the explanatory variables (VIF)[8]. The difference in observations between the dependent and independent variables will not be a problem for the analysis as the regression commands used for the analysis in STATA omits rows in the calculation where there are no values for all variables between a specific country-pair in a given year. However, this results in fewer observations to run regression estimation on. Even though we would like to have a fully balanced dataset, we expect the estimates to return valid and good estimations still further below, as marginal exporters and importers now are not counted for in the analysis. In Chapter 3, the dependent variables are plotted against the traditional gravity variables, which shows a relationship consistent with the literature, as discussed in the chapter above.

[8] Variance Inflation Factor (VIF) measure of the amount of multicollinearity in a set of multiple regression variables, looking at the ratio of the overall model variance to the variance of each individual variable. A high VIF indicates a high collinearity with other variables in the model (Investopedia, 2021).

The discussion in this chapter on this point is based on modifications of the gravity dataset, its variables, and additional binary variables in the preparation of the analysis and the estimation models below. Lastly, this chapter introduces the methods with relevant statistical tests necessary to yield reliable and valid results to answer our research question.

4.2 Fixed Effect Model

In this section, we build the econometric model with country-pair fixed-effects. Looking at cross-sectional estimation regarding the partial effect of a binary variable (FTA) on a continuous variable, trade flows, falls under the treatment effect of the econometrics literature (Baier & Bergstrand, 2002, pg. 6). With this specific model, we can measure the variation that exists within each country-pair. This model has several benefits, which will be discussed below. The model is presented in equation (3).

$$ln\, T_{ijt} = \alpha_{ij} + \beta X_{ijt} + \tau_t + \sum_i \sum_j \left[\gamma_1\left(c_i TA_t c_j\right) + \gamma_2\left(c_i FTA_t c_j\right) + \gamma_3\left(c_i FTA_{t,China} c_j\right) + \gamma_4\left(c_i FTA_{t,Norway} c_j\right)\right] + \varepsilon_{ijt} \qquad (3),$$

where T_{ijt} is the bilateral trade flow of 1000 nominal USD from country i and country j in time t; α_{ij} is the time-invariant country-pair component, which in comparison to a random-effect model would have included the time-invariant variables described above, but in this model, the fixed-effects are entirely captured by this term[9]. Thus, we avoid using distance as a proxy for transportation costs; $X_{ijt} = (lny_{it}, lny_{jt}, lnp_{it}, lnp_{jt})$, is a vector of the time-varying variables, with GDP for the exporting and importing country, as well as population respectively. The following, $\Sigma_i \Sigma_j (c_i TA_t c_j)$ capture the percentage change in bilateral trade flow of having a trade agreement between the exporting country i, c_i, and the importing country j, c_j; $\Sigma_i \Sigma_j (c_i FTA_t c_j)$ capture the percentage change in bilateral trade flow of having an FTA between the exporting country i, c_i, and the importing country j, c_j; $\Sigma_i \Sigma_j (c_i FTA_{t,China} c_j)$ is quite interesting, as we capture the percentage change in bilateral trade flow of having an FTA with China. For this research, we obtain an

[9] In the fixed-effect model, the time-invariant variables are not included because they are omitted by STATA when using the fixed-effect technique. This includes the variable for distance, continuity, and common language. However, they are included in the random-effect model.

indication of the effect of forming an FTA with China in contribution to bilateral trade flow; $\Sigma_i\Sigma_j(c_iFTA_{t,Norway}c_j)$ capture the percentage change in bilateral trade flow of having an FTA implemented with Norway; τ_t is a vector of *T-1* time dummies which is switched on and off, and if switched on, it captures the global time-fixed effects. The intention of including time-fixed effects is to control for macroeconomic shocks through time. GDP is volatile to macroeconomic shocks and usually is controlled for in the gravity literature and previous empirical research.

As the model is logarithmically transformed, we can capture the elasticities of the dependent variable and the independent variables. The interpretation is how much bilateral trade flow changes to a one percent change in one of the independent variables. The interpretation will be elaborated in greater terms below. One of the benefits of using a fixed-effect model is the relaxed condition on the endogeneity of the regressors as α_{ij} is permitted to be correlated with X_{ijt} (Cameron & Trivedi, 2010, pg. 237). We use cluster robust standard errors, which are independent across individuals, and that $N \rightarrow \infty$, which is fulfilled with $N = 55\ 225$. That permits the trade flows to be correlated within each country-pair but not between each country-pair[10] (Cameron & Trivedi, 2010, pg. 239). However, using fixed-effects models out the higher-level variance and makes the correlation between higher-level variance and the regressors irrelevant. Considerations regarding endogeneity are less important, practically speaking. This is beneficial as we study the effect of trade policy on trade flows, which in some cases suffer from reverse causality. In some country-pairs, it might be that an FTA has been implemented as a result of facilitating the already large level of trade. If that is the case, an FTA will be correlated with the error term due to unobserved factors that explain the large trade flows and, at the same time, why they form an FTA (Bacchetta et al., 2012). Omitting an upper percentile of the sample can sort out unwanted reverse causality of large trading partners forming an FTA to facilitate trade flow even more, which will be tested in the next chapter.

Furthermore, we run statistical tests to confirm that the choice of model is appropriate to our data, which can be found in Appendix B. The purpose of running

[10] The condition that satisfies this is, $E(\varepsilon_{it}\varepsilon_{js}) = 0$ for $i \neq j$, $E(\varepsilon_{it}\varepsilon_{is}) = 0$ is unrestricted, and ε_{it} may be heteroskedastic.

several tests is to check whether a fixed-effect model is better suited than a random-effect model or not. Firstly, we ran a Breusch Pagan Lagrangian Multiplier test, testing whether the variance of the fixed-effects, $Var(\alpha_{ij}) = 0$, or not. If the null hypothesis is rejected, it indicates that the pooled OLS is inappropriate, and the random-effect model is better suited for our data. However, in this case, we reject the null hypothesis that the variance of the fixed-effects, $Var(\alpha_{ij}) = 0$, is in favour of a random-effect specification. Nevertheless, this test alone is not sufficient enough to tell whether the random-effect model is better or not.

Secondly, the Hausman specification test is a commonly used test to validate the choice of estimation technique. Under the null hypothesis, the individual effects are random and should return consistent estimates in both cases for a fixed-effect or random-effect model. While under the alternative hypothesis, the estimates are statistically different[11] (Cameron & Trivedi, 2010, pg. 267). This test detects if there are any endogenous regressors in the system, which makes the fixed-effect specification favourable. The results of running the Hausman's test on our data favour using a fixed-effect specification as there are statistically significant differences between the estimates. This indicates that one or more of the regressors are endogenous, violating one of the crucial assumptions of using random-effect models (Bell & Jones, 2014, pg. 5).

From the characteristics of the data and the statistical tests, the decision to use a fixed-effect model as a base for the main analysis is justified. Compared to the fixed-effect, the random-effect model considers the effects from the time-invariant variables. From the gravity literature, the bilateral distance between two countries has been acknowledged and used as an approximation for transportation costs. We include estimates for the random-effect model for consistency and comparison, but economic inference will be based on the fixed-effect model.

[11] For the Hausman test the null and alternative hypothesis can be written:
H_0: There are no differences in the values generated from the two estimations (favouring the random-effect model) H_a: There are differences in the values generated from the two estimations (favouring the fixed-effect model)

4.3 Random Effect Model

The random-effect model is presented in equation (4) below,

$$ln\ T_{ijt} = \delta D_{ij} + \beta X_{ijt} + \tau_t + \sum_i \sum_j \left[\gamma_1\left(c_i TA_t c_j\right) + \gamma_2\left(c_i FTA_t c_j\right) + \gamma_3\left(c_i FTA_{t,China} c_j\right) + \gamma_4\left(c_i FTA_{t,Norway} c_j\right)\right] + v_{ijt} \quad (4)$$

Introducing the random-effect model allows us to run estimates that return the coefficient of all variables discussed above. Inclusion of the first term δD_{ij} is the only adjustment from the fixed-effect model. The intention is to estimate the effect of the time-invariant variables, which are captured as fixed-effects in the fixed-effect specification above. According to the gravity literature, the bilateral distance between two countries is used as an approximation for transportation costs, which we can estimate with a random-effect model. $D_{ij} = (lnd_{ij}, b_{ij}, c_{ij})$ is a vector of time-invariant variables, where lnd_{ij} is the logged distance between each country-pair; b_{ij} is a dummy variable that takes the value of unity when a country-pair share a common border and c_{ij} is a dummy variable for whether two countries share a common official or primary language or not; $v_{ijt} = \alpha_{ij} + \varepsilon_{ijt}$ is the composite error term of the idiosyncratic error, ε_{ijt}, and the fixed-effects, α_{ij}. In the random-effect model, these two terms are assumed to be uncorrelated with the other regressors. The remaining terms have the same interpretation as in the fixed-effect model.

According to Baier and Bergstrand (2002), using fixed-effects approaches is an alternative and simple way of treating multilateral resistance. There is consensus among researchers that fixed-effects techniques have returned robust and consistent results. Random-effect estimation should be considered if the estimates are adequately consistent and there is interest in estimating the effects of time-invariant variables (Egger, 2008). The intention of including the random-effect model is to capture the relationship of main variables of the gravity literature that we cannot estimate using the fixed-effect model. However, the assumptions that rely on random-effect techniques are not sufficiently met.

4.4 Regression Discontinuity Design

Furthermore, we want to use the historical data on trading to visualise the effects of previously implemented free trade agreements with Norway and China. This will be done using a regression discontinuity design model, which will be referred to as RDD from this point. The RDD will be used as a supplement to the previously used fixed-effect regression model to understand the immediate effect of the FTA and the immediate effect in the first few years after the implementation. RDD is a non-experimental method for evaluating causal effects, meaning that the variables are measured just as they occur in our dataset. This observational method can give a closer real-life representation of the results that can be more easily interpreted.

The RDD design aims to determine the causal effect of a treatment or interference by making individual measurements on the variable of interest before and after the treatment is given. A cut-off point on an assignment value or running variable marks where the treatment is given and observations exceeding this point are considered to have received the treatment. By comparing the observations before and after the cut-off point, we can estimate the average effect of the treatment. When the probability of treatment being assigned goes from 0 to 1 at the cut-off point, the version called "sharp" regression discontinuity design is appropriate. This is different from the "fuzzy" design, where the probability of receiving treatment increases towards the cut-off point. In this thesis, the "sharp" design is appropriate, and from this point, only this version will be described further and used for the estimations.

$$w_i = \beta_0 + \beta_1 Z_i + \beta_2 \boldsymbol{x_i} + \varepsilon_i \tag{5}$$

$$Z_i = \begin{cases} 1, & \boldsymbol{x_i} \geq \boldsymbol{x_c} \\ 0, & \boldsymbol{x_i} < \boldsymbol{x_c} \end{cases}$$

A parametric estimation model of the treatment effect using OLS is represented in equation (5). w_i is the variable of interest we want to measure the effect of treatment on trade flow; x_i is the running variable representing time, where x_c marks the cut-off point where treatment is assigned; Z_i is a dummy variable indicating if treatment in the form of an FTA is assigned or not. Before the cutoff point Z_i is 0, and afterward, it is 1. The coefficient β_1 is hence the estimate of the treatment effect.

$\beta_2 \boldsymbol{x}_i$ is the function of the running variable and should be exogenous from the treatment effect at the cut-off point to find the isolated effect of treatment in β_1.

The results are interpreted from the resulting visual RDD graph and the estimation of the coefficient β_1 . If the regression line is steeper after the treatment than before, it implies that the variable is increasing more than before. That would mean the β_1 is positive, hence a positive effect of treatment. Conversely, if the regression line after the threshold is less steep, it implies that the growth in the variable has decreased and the β_1 is negative. If there is a sudden gap in the cutoff point between the two OLS regression lines, it indicates an immediate effect of treatment on trade flow w_i from the FTA treatment.

The RDD design is helpful when the treatment effect cannot be considered randomized, as with FTA's. One benefit of using RDD is the possibility of assuming that country-pairs have other observed and unobserved characteristics that are likely more similar right before implementing an FTA. Hence, we isolate the treatment's effect by comparing the observations before and after the cut-off point.

5 Results

5.1 Introduction to Results

In this chapter, we present the regression results and the various specifications to capture the effect of an FTA. As Norway does not have an FTA with China at this point, we use qualitative and quantitative data to analyse and interpret whether there exists a path of how bilateral trade evolves after the two countries have implemented an FTA. More precisely, we try to understand how bilateral trade change when a country implements an FTA with Norway and China. A combination of gravity results and visualisation of data together with qualitative data is anticipated to give a good indication of what potential effect an FTA will have on bilateral trade between Norway and China.

5.1.1 The Gravity Results

We present the results of the fixed-effect model from equation (3) above. Random-effects results from equation (4) above are included for comparison. The coefficients γ_2, γ_3, and γ_4 are of most interest and are presented in Table 4 below. The remaining estimated coefficients can be found in Appendix B. The fixed-effects model will be modified with different specifications and control for three types of fixed-effects. The purpose of other specifications is set to test out different hypotheses to cross-validate the results and challenge statistical problems the data suffers from.

The gravity equation estimates are presented in Panel A below. The four first columns, (a) - (d), are the fixed-effect coefficients, whereas the three last columns, (e) - (g), are the random-effect estimates. At first glance, we observe that the majority of both estimation techniques yield estimates of the same sign and are statistically significant. Looking at column (a), the within estimate suggests a *positive percentage change in bilateral trade of 24 percent* when an FTA is implemented. Meaning, that exchange of goods between an arbitrarily country-pair increase by 24 percent when an FTA is implemented. It strongly indicates that implementing an FTA positively affects bilateral trade. As almost all trading data in the world between 1995 and 2019 are used, this result should reflect the true population relatively well.

Table 4: Results Gravity Regression

	Fixed Effects				Random Effects		
Dependent Variable: Log of BACI Bilateral Trade flow	(a)	(b)	(c)	(d)	(e)	(f)	(g)
FTA dummy	0.24***	0.23***	0.26***	0.26***	0.36***	0.41***	0.45***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
FTA dummy x CHN		0.14	0.11	0.12		-0.14	-0.17*
		(0.10)	(0.10)	(0.10)		(0.10)	(0.10)
FTA dummy x NOR			-0.35***	-0.34***			-0.40***
			(0.10)	(0.09)			(0.09)
Country-Pair Fixed Effects	YES	YES	YES	YES			
First-order Interaction Effects		YES	YES	YES		YES	YES
Time Fixed Effect	YES	YES		YES		YES	YES
Cluster Robust Standard Errors	YES	YES	YES	YES	YES	YES	YES
R^2 within	0.20	0.20	0.20	0.20	0.20	0.20	0.20
R^2 between	0.49	0.49	0.49	0.45	0.68	0.71	0.71
R^2 Overall	0.44	0.44	0.44	0.41	0.63	0.66	0.66
Observations	488 425	488 425	488 425	488 425	484 980	484 980	484 980

Note: Each column represents a individual regression. In column (a) - (d), the fixed-effect model and equation (3) from section 4.2 is used, while column (e) - (g) use the random-effect model and equation (4) specified in section 4.3. The columns differ due to combinations of time fixed-effects and first order interation terms turned on and off. Only the coefficients of interest are included, while the other variables can be found in Table 6 in Appendix B. *** p < 0.001, ** p < 0.05, * p < 0.10

In column (b), the inclusion of the first-order interaction term of countries having an FTA implemented with China indicates a *positive percentage change of bilateral trade of 37 percent*. However, we cannot put too much weight and confidence in the coefficient of having an FTA implemented with China as it returns statistically insignificant estimates. Running various regressions of the fixed-effect model in columns (a) - (d), yields approximately the same results, but observe the great deviation from the random-effect model. The two estimation techniques estimate similar coefficients for the interaction terms of having an FTA with either China or Norway, but quite large differences regarding the general FTA variable. One possible explanation for the larger effect is that the random-effect model uses partial pooling. That means there are country-pairs where an FTA was recently implemented, resulting in few data points to run regression on. With partial regression, these country-pairs will be estimated partially based on other country-pairs where an FTA has been in place for a longer time. Combination of this, together with the violation of strict assumptions of using random-effects techniques and the statistical tests above, no valid inference based on the random-effects can be made in this study.

According to Head (2003, pg. 11), implementing an FTA has raised trade by 50 percent on average. However, the probability of obtaining similar estimates to other empirical studies is small due to many factors that make this study unique. In previous empirical studies, the effect of an FTA is measured in different ways. We look at the percentage change in bilateral trade flow on aggregated trade flows. That implies we cannot disaggregate the data to capture the effect of an FTA on trade creation and trade diversion for each product category. The potential of including first-order interaction terms makes the picture somewhat clearer (Kepaptsoglou et al., 2010, pg. 13).

When considering Norway, the dummy indicates a negative effect on trade volume when an FTA is implemented. Including a first-order interaction term of all countries that have an FTA with Norway, results in a *negative percentage change of 9 percent on bilateral trade*. When global time-fixed effects are turned on, there is a *negative percentage change of 8 percent on bilateral trade*. This can indicate there exist observable and unobservable differences in the time unit of the data. This supports our intention of controlling for global time-fixed effects as some variables, such as GDP, will be affected by different states of the global economy. However, there is a tiny effect resulting from the time-fixed effects turned on.

Furthermore, in the lower part of Table 4, we have reported the three different R^2 generated using panel data. We would expect this goodness-of-fit measure to yield higher values by running the fixed-effect model. Here, 20 percent of the regressors explain the variation within each country-pair. Nevertheless, comparing R^2 of the two estimation techniques is not valid, because in the fixed-effect model the α_{ij} are considered as explanatory variables, whereas in the random-effect model it is considered as part of the composite error term. The uniqueness of the study determines whether this goodness-of-fit measurement is good enough or not. Despite having a low within R^2, the economic inference is not deemed to give invalid interpretations as long as it is justified and is a common phenomenon in the specific field. A reason causing the low R^2 in this study could be the case of not restricting the dataset more, mainly focusing on a smaller sample of countries with more similar volumes in trade flows and other similar characteristics. Hence, we are prone to allowing the within R^2 to be low, given that we operate with almost all trade data for every country. Lastly, R^2 between, measures sample variation between country-pairs in the dependent variable that are explained by the independent variables, which in the fixed-effect model is estimated to be 45 percent. However, the within goodness-of-fit is the one of interest as fixed-effects are included. According to Wooldridge (2015), one should not put too much weight on R^2 in econometric models.

5.1.2 Gravity Estimates with other Specifications

We use the fixed-effect model from equation (3) with different sub-samples of the dataset. The dataset is now divided into five sections based on log of bilateral trade flows. The roof is set to the highest volume of trade between 1995 and 2019, which was exports from China to the US in 2018 of 497 billion USD. This corresponds to 20.02 in logarithmically transformed trade flows. Bilateral trade flows are distributed from the lowest in section (1) to the largest in section (5). The log of bilateral trade flows is distributed as shown in Table 5 below:

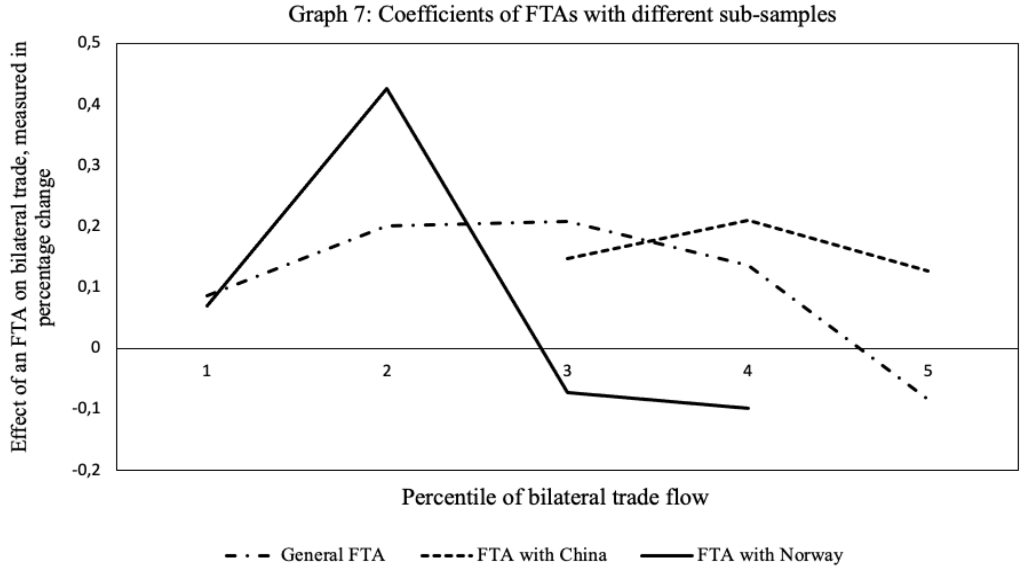
Table 5 : Log of bilateral trade in sections

Section	Start	Stop	Observations
1	0	4.004992	81.510
2	4.004992	8.009984	183.626
3	8.009984	12.01497	173.490
4	12.014976	16.01996	73.574
5	16.019968	20.02496	5.571

Note: The table show how the five section is defined. The decision to use five sections gives us abundant of data within each section to run regressions on. If one wishes to expand with more sections, they could suffer from poorly estimated coefficients of the FTA, as there are limitations of FTAs implemented relative to all other observations

Here we run five regressions using the fixed-effect model from equation (3). This is called pooling, where we have defined five intervals/sections such that we can find how the regressors react to different sub-samples of the dataset. More precisely, we can say something about the effect of FTA on different volumes of bilateral trade. However, we cannot assume, for example, that Norway only trades volumes within section (3). All countries can potentially lie within all sections. This will depend on the characteristics that each country-pair has. The information we get from this part of the analysis is that we can find the effect of an FTA on the average log of bilateral trade that China or Norway has with other countries within each section, and compare this with the average log of bilateral trade that Norway and China have together. This means if Norway and China have an average log of bilateral trade of 14.45 (section 4), we can compare this to what Norway and China individually perform with already implemented FTAs within the same section.

Graph 7: Coefficients of FTAs with different sub-samples



The x-axis is defined for the five intervals/sections as discussed in Table 5 above. While on the y-axis is the estimated percentage change effect of an FTA on bilateral trade. The lines going through the five estimated coefficients for the respective FTA-dummy-line are just for illustration and cannot be interpreted as increasing or decreasing by going from one section to the next.

The solid line represents the effect of having an FTA implemented with Norway for each section. Norway benefits the most from an FTA within section (2). This indicates that the effect of implementing an FTA with Norway increases trade flows by 42 percent. Moreover, Norway and China have a historical average bilateral trade of 14.45, which is qualified in section (4). And Norway´s FTA partners that trade within section (4) have the lowest effect of an FTA on bilateral trade. Despite running regressions on sub-samples, the coefficient for the FTA interaction effect with Norway is still statistically significant. Norway does not have an active FTA with countries that trade within section (5).

Furthermore, the evenly dotted line indicates the estimated effect of having an FTA with China. This line only indicates effects within sections (3) - (4), as China does not have an FTA in force with countries of trade flows in sections (1) - (2). China benefits the most from an FTA when the amount of trade is defined within section (4), with an increase of 21 percent in bilateral trade. There are smaller effects when the trade volume is described in sections (3) and (5). However, the estimated interaction effect of an FTA with China is not statistically significant. Lastly, the "General FTA" in Graph 7, including all FTAs in force between 1995 and 2019, implies that the effect of an FTA on bilateral trade is largest when trading amounts lie in sections (3) and (4). It assumes the effect of an FTA decreases when trade volumes increase.

5.2.1 Visualisation of Trade Development by using RDD

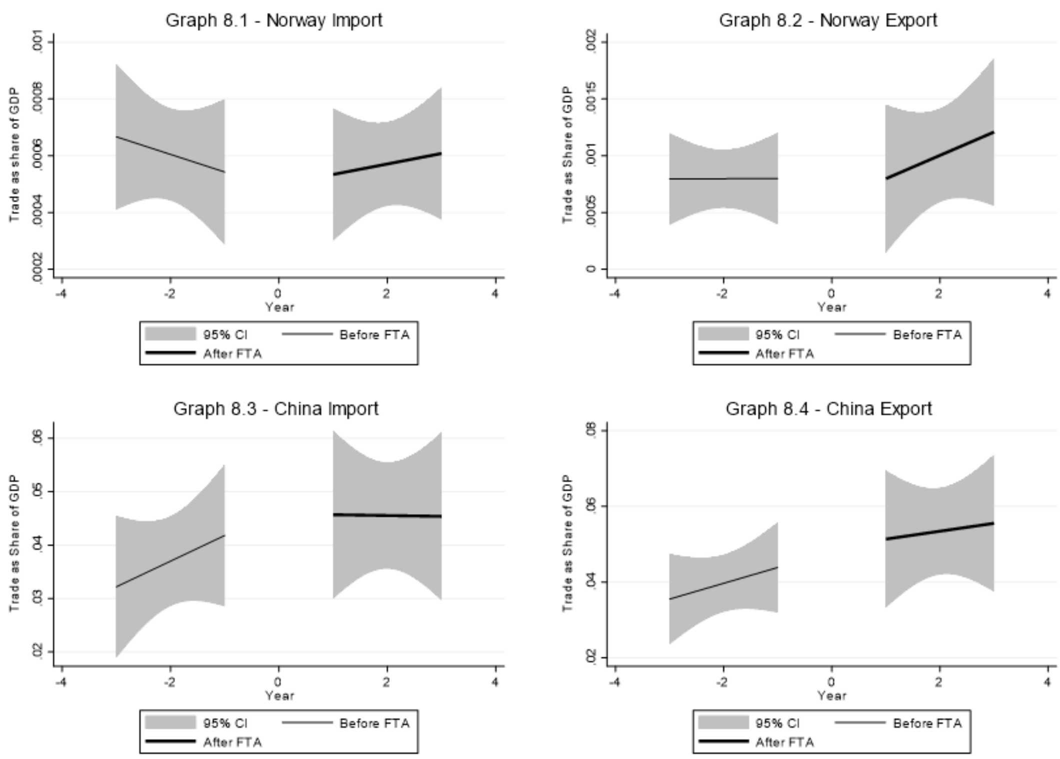
This section presents the results from the regression discontinuity design (RDD). Until this point, we have looked at bilateral trade for all countries without separating imports and exports. Now the RDD aims to gain insight on exporting and importing individually to check for effects on the trade balance. For the RDD analysis, Norway and China have been investigated separately with only their respective

FTA partners, and all other observations are excluded from the data in this section. Also, some countries with FTAs have been excluded for individual reasons reviewed at the end of this chapter. This means that instead of considering all countries, a more selective sample of more relevant countries is observed. For consistency and comparison, the data used in the RDD model is the same presented in section 4.1 and for the fixed- and random-effect model.

Since countries have implemented an FTA at different times throughout history, the time of treatment has been normalised to the year 0 for all samples. The probability of receiving treatment (FTA) goes from 0 to 1 at the cut-off point in year 0. All countries concerned are treated, as discussed in section 4.4. As importing and exporting trade flows are aggregated and reported annually, there will be a minor measurement error because we do not have trade data of the exact implementation date of each FTA in the specific year. The running variable x representing years does not mark exactly one year from treatment. It rather gives an approximation that should still be sufficient for the purpose of this section, since our main interest is the development over time and not the immediate effect on trade flows. This means we exclude year zero since we cannot pinpoint the exact date for each and every FTA. However, this leaves out the immediate effect of receiving treatment (FTA) in year 0, but we avoid the problem regarding some observations being on the wrong side of the cut-off point when running the OLS regression, as there are different dates for when an FTA is implemented.

Some specific considerations and adjustments were made for using the regression discontinuity for this purpose. We have identified two main problems with using the RDD model with this data. The first one is the spread of economic sizes (GDP) in the sample, which naturally implies a large spread in the trade volumes. Since the OLS regression treats the observations equally, this would cause skewness where larger countries have a higher trading volume being weighted more. This issue has been counteracted by looking at trade flows as a share of GDP. That means we look at the development of the trade flows (imports and exports) relative to the GDP of Norway and China's trade partners.

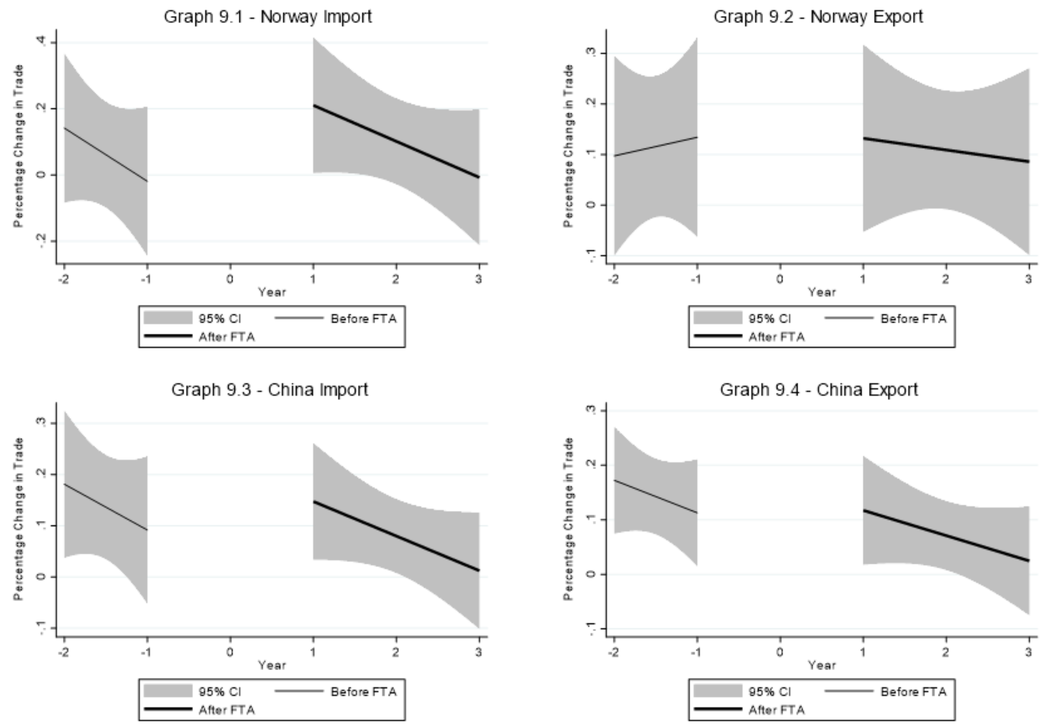
The second challenge is that there is insufficient data from some of the countries to include them in this model. Some of the FTAs have been implemented in recent years, which resulted in few observations after the FTA was implemented. This limits the countries that give sufficient data to consider a longer perspective in an already narrow selection of countries. Because of this issue, the observations used in the RDD are limited to three years before and three years after the FTAs are implemented. This means in the RDD model we get a short-term perspective, which could potentially deviate from a longer time perspective. Since our dataset only includes trade data until 2019, countries that implemented an FTA later than 2017 have been excluded from the RDD analysis. There is also a lack of data for some trading partners because of country-specific circumstances that have led to exclusion, for example, Palestine.



The RDD results in Graphs 8.1 to 8.4 look at trade as a share of the FTA partners' GDP. The thin line is the regression of the three years before the FTA was implemented, and the thick line is the regression estimate for the three years after. The cut-off point in year 0 is excluded, as previously discussed. The grey area marks the 95 percent confidence intervals.

In the case of Norwegian imports and exports visualised in Graphs 8.1 and 8.2, the regression line is steeper and upward sloping after treatment. This implies that FTAs Norway has implemented have resulted in a positive effect of similar size for exports and imports. The time frame indicates that the effects of the FTAs for Norway have had a positive effect in the first few years after their implementation. For Chinese imports and exports, visualised in Graphs 8.3 and 8.4, the effect is more unclear, and a coefficient measuring the slope of the OLS regression line has been used for clarity. The slope of the regression line for imports before treatment is 4.8 per mille and -0.15 per mille afterward, indicating a slightly negative effect on the import share of China's FTA partners' GDP. In the case of exports, the slope after treatment is 2.08 per mille against a steeper slope of 4.17 per mille before treatment, implying a negative effect of an FTA on the exports share of China's FTA trading partners´ GDP. Isolated, this indicates that FTAs implemented with China led to a change in the trade balance in China’s favour, since exports tend to increase more than imports.

One additional concern when using the trade share of GDP as the measure for trade development is that countries starting with a higher trade relative to GDP also will be weighted more in the OLS regression. Because of this, we have also made an RDD with the same data looking at percentage changes instead of trade share of GDP. The value measured on the y-axis for each year is now the percentage change in the volume of exporting and importing flows from the year before. This could give a more balanced view on the development of the trade flows with FTA partners where they are weighted equally. Since we look at percentage change, the first observation is lost. It is important to note that for the same reasons as before, that the trade flow data is aggregated, reported annually, and FTAs are implemented at different dates, year 0 has been excluded. Looking at growth rates year to year in trade flows, the line illustrates whether or not the trend is increasing or decreasing. The trend in the growth can from here be expressed as the growth rate. The results are presented below.



The results are slightly different when using percentage change instead of trade share of GDP. In Norway’s perspective on imports in Graph 9.1, we now see a gap between the regression lines at the cut-off point, while the steepness of the regression lines is roughly equal. This indicates that most FTAs have been implemented with trade partners with increasing trade patterns before the FTA, although the growth rate of imports to Norway has been declining. The Norwegian export in Graph 9.2 shows little treatment effect, but there is a slightly declining growth. The growth of the trading goes from slightly increasing to slightly decreasing. From China's perspective, there is a gap between the regression line before and after the FTA for both imports and exports, though the steepness is similar to before treatment. This indicates a positive effect of the FTAs, though the declining development of trade growth over time did not see a larger change. Using trade as a share of GDP gives a noticeably stronger effect than when looking at percentage changes. Estimates using trade as a share of GDP are more weighted by trade partners with a trade that constitutes a larger share of their own GDP. This could indicate that FTAs are more impactful for well-established trade partners.

Exclusion of countries

Because of the challenges with the data previously listed, some trade relations of both Norway and China have been excluded from the RDD model. In the case of

Norway, the trade relations excluded because the agreement was made too recently to obtain sufficient data is Great Britain, Ecuador, and Indonesia. Also, Norway's free trade agreements with other trade unions are excluded, since they are mainly negotiated by the EU and are not country-specific. This means the South African Customs Union (SACU), the Gulf Cooperation Council (GCC), the European Union, and the European Economic Area. Palestine was excluded because of missing and inconsistent reporting of trade data. Out of China’s trading partners, Cambodia, Maldives, Mauritius, and Georgia were excluded because the FTAs were implemented too recently, and sufficient data is yet to be reported. The specially administered regions of China, Hong Kong and Macao, are also excluded because of the special circumstances of their trade relation to mainland China.

Although these countries have been excluded from the RDD model and not all free trade agreements have been used, the vast majority is still represented. Norway has a total of 30 free trade agreements, and China has 17 as of the beginning of 2022. An overview of this is included in Appendix A.

6 Discussion

In this chapter, we dig deeper into the meaning of the results and provide intuition, evaluation and interpretation of the study to find plausible answers to the research question. The gravity literature has been well established as part of the toolkit for analysing trade flow patterns in international trade. While regression discontinuity design, on the other hand, has not been used in this context and is considered an experimental technique. However, it highlights a more nuanced picture of the effects an FTA has had on trade flows for Norway and China but is not without flaws. It is important to highlight not only the strength, but also the challenges and limitations of this thesis.

6.1 Data and Gravity Results

The gravity dataset provided by CEPII is robust and is a good representation of the population. Even though the dataset contains trade flows for all countries in the world for more than 70 years and is reported to the United Nations´ COMTRADE, there are issues. The problem of missing observations due to unknown reasons has led to the exclusion of "scary" observations[12]. Having an unbalanced panel may be one of the biggest concerns. However, what is exactly defined as the population in international trade? The true population should be defined as countries that have been trading or trade with someone at any point in time. The gravity dataset includes all countries and territorial changes (splits and merges) in the last 70 years, and expecting all countries to trade with everyone is unrealistic. The results will suffer from problems with an unbalanced panel, but we believe we handle this problem with caution. Furthermore, if one had narrowed down the dataset to only study a specific selection of countries, it would be possible to identify trade flows that should be removed due to measurement errors and treat the rest of the zero-observations as there is no trade between country-pairs. Heckman's procedure treats zero-observations as if a country-pair does not trade, but then observations due to measurement errors must be manually removed. Hence, Heckman's procedure is too time-consuming and comprehensive to conduct in this thesis.

Finding the exact effect of an FTA between Norway and China is nearly impossible before it potentially happens. Still, we can estimate and do several exercises based on knowledge of other already implemented FTAs together with other empirical findings and confidently make inferences. However, as Baier and Bergstrand (2002) discussed, the FTA effect suffers from endogeneity and is underestimated mainly due to simultaneity, measurement errors, and omitted variable bias. It is obvious that all existing FTAs are unique, and there are factors present that are impossible to control. Hence, a fixed-effect technique was the most suitable for our purpose. The benefit of fixed-effects is that we capture all unobserved and observed time-invariant factors such as distance, common language, and adjacency between country-pairs in the fixed-effect term α_{ij} and obtain estimates of time-varying factors within the country-pairs. Moreover, the multilateral resistance term, which we denote as remoteness, R_{ij}, is captured in the intercept as it is considered constant. This is beneficial because measuring the theoretical correct remoteness term is complex and can be problematic if miscalculated.

[12] By defining observations as "scary" we mean observations that are omitted in the analysis. It can be several reasons for omitting variables as discussed in Chapter 4. Calling observations "scary" is just to describe the uncertainty around them and that there are reasons for us to omit them.

Moving on, we now look at the interpretation and discuss the gravity results obtained from the fixed-effect model in more detail. From the perspective of China and its already established FTAs, we found that having a free trade agreement in force with China suggests an increase of 37 percent in bilateral trade flow. We interpret this result as a 37 percent increase in the exchange of goods between two countries. The different specifications of the fixed-effect model did not contribute significantly to the results. Even though Norway and China do not have an FTA implemented today, the average effect estimated on all available data of the population could indicate to some extent what to expect if the two countries agree and implement a free trade agreement. As mentioned above in the background, the potential gains featured in the Joint Feasibility Study and observations of the Sino-Norwegian relationship indicate positive outcomes of such an agreement.

From Norway´s perspective, the countries that have an FTA in force with Norway suggest a decrease of 8 or 9 percent on bilateral trade flow when either global time-fixed effects are switched on or off, respectively. Again, the interpretation is the same for China. Surprisingly, the effect of FTA in force with Norway suggests a negative impact on bilateral trade flows. One should intuitively think that negotiations and the decision to sign an FTA would increase bilateral trade flows by eliminating tariffs and barriers to trade. This seems not to be the case for Norway and its FTA partners when running regressions on the whole dataset. The effect of an FTA with either China or Norway has opposite effects, which is somewhat surprising as we anticipated Norway also to have a positive effect from an FTA. In the fixed-effect model, we use a dummy for whether there is an FTA or not, well aware that all FTAs are unique and cannot be considered uniformly in reality. As a mid-sized economy, Norway has other prerequisites and bargaining power in the negotiations of an FTA in contrast to China, which is the second-largest economy with greater bargaining power and impact of getting through their own interests.

We tried to nuance the picture further by running sub-samples where we split the log of bilateral trade flows into sections from lowest to largest volumes to see if an FTA had various effects on different amounts of trade. This means we ran regressions on specific intervals of bilateral trade flows to measure how good an FTA will perform on different levels of trade. Norway and China have bilateral trade on average that goes within section (4). What can be interpreted from this?

From the results, we saw that having an FTA with China had the greatest effect on average bilateral trade within section (4). Although we cannot categorise countries into different sections, we know that Norway has average bilateral trade with China of 14.45, which lies in section (4). This implies that if Norway had an FTA with China, the effect, on average, could increase bilateral trade by 20.9 percent. However, the interaction effect of having an FTA with China is not statically significant due to insufficient observations to run regression on. From the perspective of Norway (solid line in Graph 7), the average bilateral trade within section (2) has the largest effect of an FTA with Norway. However, this section also includes fewer observations and is not statistically significant. As mentioned above, Norway and China have an average bilateral trade of 14.45. This implies if China had an FTA with Norway, bilateral trade would decrease by 9.8 percent.

We know from the feature of gravity on trade data that larger countries trade more. Relating that to this part of the analysis, it would indicate that Norway has greater benefits from an FTA with countries that are smaller than itself. In contrast, China seems to benefit the most from an FTA with countries larger than Norway.

For Norway and China, an economic inference about what would happen from a potential FTA would give ambiguous results. China has experienced an average increase in bilateral trade with trade flows of the same size as Norway and China´s average trade, while Norway has experienced the opposite. One concern when considering the results of Norway is that we treat every FTA as equal, even though Norway separates from China in the way many of its FTAs have been created. Norway is a part of EFTA that negotiates many agreements on behalf of the member countries, with or without necessarily having a personal interest of each member nation. This could be a potential explanation of why many of the Norwegian FTAs seem to be less impactful.

6.2 Comparing with a Relevant Selection of Countries

The regression discontinuity model used in this thesis is based on a more selective sample of countries that can be considered more relevant to some degree. As concerned, Norway, together with EFTA, has implemented many FTAs with other countries, as well as with trade unions, that is not negotiated from a Norwegian personal interest. This makes many of the FTAs considered in the fixed-effect model less efficient for predicting the actual outcome of agreements made out of Norwegian personal interests and more self-involved negotiations. A relevant example is the free trade agreement from 2006 between EFTA and South Korea, where major parts of the deal were negotiated individually by the two countries. According to the Norwegian Government (2020), exports increased by 178 percent, and imports increased by 208 percent by 2020. This individual example is contradictory to the predictions of the fixed-effect regression model. Looking away from the countries in the Persian Gulf, Middle America, and South Africa trade unions, the RDD model indicates a positive effect of implementing an FTA where exports and imports are increasing on average. The interpretation from this is that there are differences in each FTA in the way it has been formed and negotiated, which is not considered in the fixed-effect regression model relying on the gravity equation variables. There are also differences in the degree to which FTAs eliminate trade barriers and customs, as well as other variations in the content of such agreements.

When considering the RDD results of China, the results are also divergent. The fixed-effect model predicts a large effect of the FTA on bilateral trade, yet the RDD shows a smaller negative effect. Unlike Norway, China is not part of any trade unions and negotiates trade agreements directly on its own. It is important to note that the RDD result does not mean that trading with China is decreasing, but rather that trading relative to the other country's GDP is decreasing. This could be troubling since GDP correlates with trade flow according to the previous investigations related to the gravity model. Although running the RDD estimates by looking at percentage change removes the issue where already well-established trading partners are weighted more heavily, there is still a weakness in the short period of data available. There are fewer observations used than in the fixed-effect regression model, so the estimates are more sensitive to other potential variables affecting the trading in the particular years used, and the entire observed effect is likely not entitled to the FTA. There is also a possibility that these free trade agreements have long-term effects that cannot be seen within a short time frame. For instance, in some free trade agreements, some initiatives are not implemented immediately, but within a deadline after a set number of years. This analysis can only give a rough estimate of the short timespan around the implementation year of an FTA, without providing any concrete or significant results that can be interpreted with confidence. A more credible visualisation of the development of the trend in trade flows following an FTA could be achieved with more years of data available in the future.

7 Conclusion

The ongoing negotiations regarding a free trade agreement between Norway and China have been a dispute process since the first negotiations started in 2008, including setbacks related to political controversies, a global pandemic, and disagreements among Norwegian politicians. However, the economic motivation to fulfil the agreement remains strong for both nations. China has proven itself to become a prominent nation in international trade and is today among the most sought-after markets for export nations like Norway. The Sino-Norwegian relationship has improved, and bilateral trade flows have grown. In recent years, the large markets in China have led to increasing demand for Norwegian goods such as petroleum products and seafood, making China one of our largest customers. Furthermore, Chinese goods make up the largest share of the total import to Norway. The motivation for studying this topic is to measure and say something about the potential effect of a free trade agreement on Sino-Norwegian bilateral trade. Previous research on how trade policies impact trade flows has returned divergent results, making comparison nearly impossible because each study is unique.

In the main analysis, the gravity equation of trade served as a workhorse for measuring the effect of free trade agreements on bilateral trade flow. The suggested results have given us good estimates of what could potentially be the case for Norway and China. Using a fixed-effect technique is suitable here for the reasons discussed above, such that economic inferences are drawn with confidence. Typically, the free trade agreements China signed with other countries indicate an average increase of 37 percent in bilateral trade flows. While there seems to be a positive effect for China entering a free trade agreement, this result is not statistically significant. In the case of Norway, the effect of their free trade agreements with partners suggests a negative effect of 9 percent on bilateral trade flows. Although this result is statistically significant, it is surprising. This led to estimation using sub-samples of different volumes of bilateral trade, predicting an average increase of 13.6 percent following an FTA based on average bilateral trade corresponding to the one of Norway and China.

The RDD model, implemented initially to observe the development of imports and exports individually in the years after an FTA implementation in our countries, also gave us extra insight because of a more limited selection of relevant countries. The visual representation provided by the RDD shows a clear positive effect of the implemented FTAs for Norway, contradictory to the results of the fixed-effect estimation. This amplified our concern that treating all free trade agreements equally makes the coefficient less efficient in predicting some countries. A noticeable difference between Norway and China's creation of free trade agreements lies in how they are initiated and negotiated. While China creates FTAs individually as a large country with bargaining power, Norway negotiates many of the FTAs together with the EFTA organisation. This means that Norway potentially has varying interests and involvement in the agreements with different countries. The RDD with a more limited sample of FTA partners with more similar characteristics to Norway-China, as well as some individual examples, evince a difference in the effect of an FTA based on the circumstances of its implementation.

In sum, our thesis finds indications of positive effects on bilateral trade flow if Norway and China come to an agreement and implement a Free Trade Agreement. The exact effect on bilateral trade in percentage change is unknown at this point. Moreover, it seems China tends to export more than it imports by implementing an FTA, hence a concern for the Norwegian trade balance.

For future studies, we suggest looking deeper into distinctive content that varies between FTAs by considering how they are implemented and the underlying interest of the negotiating countries. This could give interesting results for considering FTA in relation to specific countries of interest. Since Norway and China have implemented many FTAs recently, a longer time frame of available observations would give a more reliable estimation.

References

Aitken, N. D. (1973). The Effect of the EEC and EFTA on European Trade: A Temporal Cross-Section Analysis. The American Economic Review, 63(5), 881–892. http://www.jstor.org/stable/1813911

Anderson, J. E. (1979). A Theoretical Foundation for the Gravity Equation. The American Economic Review, 69(1), 106–116. http://www.jstor.org/stable/1802501

Anderson, J. E., & van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. American Economic Review, 93(1), 170–192.

Bacchetta, M., Beverelli, C., Cadot, O., Fugazza, M., Grether, J., Helble, M., Nicita, A., & Piermartini, R. (2012). Analyzing bilateral trade using the gravity equation. In A Practical Guide to Trade Policy Analysis (Vol. 1, pp. 105–135). UNCTAD/WTO.

Baier, S. L., & Bergstrand, J. H. (2002). On the endogeneity of international trade flows and free trade agreements. New York: Mimeo. http://sites.nd.edu/jeffrey-bergstrand/files/2021/02/Endogeneity_Aug2002.pdf

Bell, A., & Jones, K. (2014). Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data. Political Science Research and Methods, 3(1), 133–153. https://doi.org/10.1017/psrm.2014.7

Cameron, A. C., & Trivedi, P. K. (2010). Microeconometrics Using Stata (Rev. ed.). Stata Press.

Chaney, T. (2008). Distorted gravity: heterogeneous firms, market structure, and the geography of international trade. American Economic Review, 98(4), 1707–1721. https://www.aeaweb.org/articles?id=10.1257/aer.98.4.1707

Conte, M., Cotterlaz, P., & Mayer, T. (26.05.22). The CEPII Gravity Database (October 2020) [Raw material for analysis]. CEPII. http://www.cepii.fr/CEPII/en/cepii/cepii.asp

Eaton, J., & Kortum, S. (2002). Technology, geography, and trade. Econometrica. 70(5), 1741–1779.

Edward, E. L., & Levinsohn, J. (1995). Chapter 26 International trade theory: The evidence. In Handbook of International Economics (Vol. 3, pp. 1339–

1394). Elsevier. https://www.sciencedirect.com/science/article/abs/pii/S1573440405800061

Egger, P. (2008). On the role of distance for bilateral trade. World Economy, 31(5), 653–662. https://onlinelibrary.wiley.com/doi/full/10.1111/j.1467-9701.2008.01098.x

European Commission. (2022). EU trade relations with Norway. European Commission. https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/norway_en

Fakta om norsk økonomi. (2022). Statistics Norway (SSB). https://www.ssb.no/nasjonalregnskap-og-konjunkturer/faktaside/norsk-okonomi

Feenstra, R., & Kee, H. L. (2004). Export Variety and Country Productivity. National Bureau of Economic Research. https://doi.org/10.3386/w10830

Fitzgerald, S. (2001). The Effects of NAFTA on Exports, Jobs, and the Environment: Myth vs. Reality. The Heritage Foundation. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=288389

Fossanger, K. (2022, March 2). Norges viktigste handelspartnere. Statistics Norway (SSB). https://www.ssb.no/utenriksokonomi/utenrikshandel/statistikk/utenrikshandel-med-varer/artikler/norges-viktigste-handelspartnere

International Trade Administration, Trade.gov. (2022). *Free Trade Agreement Overview*. https://www.trade.gov/free-trade-agreement-overview

Gaulier, G., & Zignago, S. (2010). BACI: International Trade Database at the Product-Level. CEPII Working Paper. http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=37

Head, K. (2003). Gravity for Beginners. Faculty of Commerce, University of British Columbia, 2–11. http://pioneer.netserv.chula.ac.th/~kkornkar/inter%20trade%20undergrad/term%20paper/gravity%202.pdf

Head, K., & Thierry, M. (2014). Chapter 3 - Gravity Equations: Workhorse, Toolkit, and Cookbook. In G. Gopinath, E. Helpman, & K. Rogoff (Eds.), Handbook of International Economics (Vol. 4, pp. 131–195). Elsevier B.V. https://doi.org/10.1016/B978-0-444-54314-1.00003-3

Helpman, E., Melitz, M., & Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. The Quarterly Journal of Economics, 123(2), 441–487. https://academic.oup.com/qje/article/123/2/441/1930

Hummels, D. (2007). Transportation costs and international trade in the second era of globalization. Journal of Economic Perspectives, 21(3), 131–154. https://www.aeaweb.org/articles?id=10.1257/jep.21.3.131

Investopedia. (2021, October 31). Variance Inflation Factor (VIF). Investopedia. https://www.investopedia.com/terms/v/variance-inflation-factor.asp

Kepaptsoglou, K., Karlaftis, M. G., & Tsamboulas, D. (2010). The gravity model specification for modeling international trade flows and free trade agreement effects: a 10-year review of empirical studies. The Open Economics Journal, 3(1). https://benthamopen.com/ABSTRACT/TOECONSJ-3-1

Krugman, P. (1995). Chapter 24 Increasing returns, imperfect competition and the positive theory of international trade. In Handbook of International Economics (Vol. 3, pp. 1243–1277). Elsevier Gezondheidszorg.

Martínez-Zarzoso, I., & Nowak-Lehmann, F. D. (2007). Is distance a good proxy for transport costs? The case of competing transport modes. The Journal of International Trade & Economic Development, 16(3), 411–434. https://doi.org/10.1080/09638190701527186

Mayer, T., & Zignago, S. (2011). Notes on CEPII's distances measures: The GeoDist database (No. 2011–25). CEPII. http://www.cepii.fr/PDF_PUB/wp/2011/wp2011-25.pdf

McCallum, J. (1995). National Borders Matter: Canada-U.S. Regional Trade Patterns. The American Economic Review, 85(3), 615–623. http://www.jstor.org/stable/2118191

Melitz, M. J., & Ottaviano, G. I. (2008). Market size, trade, and productivity. The Review of Economic Studies, 75(1), 295–316. https://academic.oup.com/restud/article/75/1/295/1629450?login=true

Ministry of Commerce, PRC. (2022). China FTA Network. http://fta.mofcom.gov.cn/english/index.shtml

Norwegian Customs. (2020, February 3). Free trade agreements - Norwegian Customs. Toll.no. https://www.toll.no/en/services/regulations/trade-agreement-and-conventions/free-trade-agreements/

Organisation for Economic Co-operation and Development (OECD). (2022, March 12). International trade during the COVID-19 pandemic: Big shifts and uncertainty. OECD. https://www.oecd.org/coronavirus/policy-responses/international-trade-during-the-covid-19-pandemic-big-shifts-and-uncertainty-d1131663/

Redding, S., & Venables, A. J. (2004). Economic geography and international inequality. Journal of International Economics, 62(1), 53–82. https://doi.org/10.1016/j.jinteco.2003.07.001

Norwegian Government. (2020, January 10). Sør-Korea - frihandelsavtale. Regjeringen.no. https://www.regjeringen.no/no/tema/naringsliv/handel/nfd---innsiktsartikler/frihandelsavtaler/partner-land/sor-korea/id438856/

Norwegian Government. (2022, May 12). Kina - frihandelsavtale. Regjeringen.no. https://www.regjeringen.no/no/tema/naringsliv/handel/nfd---innsiktsartikler/frihandelsavtaler/partner-land/kina/id457436/

Silver, C. (2021, December 22). The Top 25 Economies in the World. Investopedia. https://www.investopedia.com/insights/worlds-top-economies/

Slootmaekers, V. (2004). Trade Effects of the EU-Mexico Free Trade Agreement. Inst. of World Economics. https://www.etsg.org/ETSG2004/Papers/slootmaekers.pdf

Statista. (2021, August 25). Main exporting countries of fish and fishery products worldwide 2020. https://www.statista.com/statistics/268269/top-10-exporting-countries-of-fish-and-fishery-products/

Szmigiera, M. (2022, May 5). Leading export countries worldwide 2021. Statista. https://www.statista.com/statistics/264623/leading-export-countries-worldwide/

Textor, C. (2022, April 20). *Gross domestic product (GDP) of China 1985–2027*. Statista. https://www.statista.com/statistics/263770/gross-domestic-product-gdp-of-china/

The World Bank. (2022a, April 12). The World Bank in China: Overview. https://www.worldbank.org/en/country/china/overview#1

The World Bank. (2022b). GDP (current US$) | Data. Retrieved 16 April 2022, from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

Triple A Learning. (2022). Trade creation and trade diversion. Retrieved 16 July 2022, from http://www.sanandres.esc.edu.ar/secondary/economics%20packs/international_economics/page_35.htm

Twin, A. (2022, April 15). Biggest Oil Exporters: Top 10 Oil-Exporting Countries. Investopedia. https://www.investopedia.com/articles/company-insights/082316/worlds-top-10-oil-exporters.asp

Vetre, J. K. (2022, March 19). Næringsministeren presenterer «Hele Norge eksporterer». Regjeringen.no. https://www.regjeringen.no/no/aktuelt/naringsministeren-presenterer-hele-norge-eksporterer/id2903588/

Wooldridge, J. M. (2015). Introductory econometrics: A modern approach (5th ed.). Cengage learning.

WTO. (2022a). Regional Trade Agreements Information System. Regional Trade Agreement Database, WTO. https://rtais.wto.org/UserGuide/RTAIS_USER_GUIDE_EN.html#_Toc503517720

WTO. (2022b). RTA Tracker. WTO. http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx

WTO. (2022c). WTO | The history of multilateral trading system. World Trade Organization. https://www.wto.org/english/thewto_e/history_e/history_e.htm

Appendices

Appendix A

List of Norway´s FTAs in force

Albania	North Macedonia
Bosnia and Herzegovina	Mercosur*
Canada	Mexico
Central American Sates	Montenegro
Chile	Morocco
Colombia	Palestinian Authority
Ecuador	Peru
Egypt	Philippines
Georgia	Serbia
Gulf Cooperation Council*	Singapore
Hong Kong, China	Southern African CU*
Israel	Tunisia
Jordan	Turkey
Korea, Republic of	Ukraine
Lebanon	

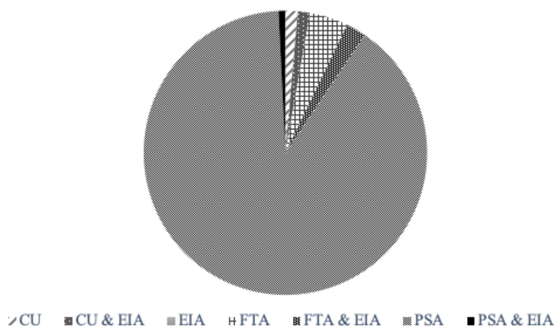
*Note: Mercosur consists of Argentina, Brazil, Paraguay, Uruguay. GCC consists of Suadi Arabia, Kuwait, The United Arab Emirates, Qatar, Bahrain and Omen. Southern African CU consists of Botswana, Lesotho, South Africa, Swaziland

List of China´s FTAs in force

Australia	Mauritius
Brunei	Malaysia
Cambodia	Macao
Chile	Myanmar
Costa Rico	New Zealand
Georgia	Peru
Hong Kong	Philippines
Iceland	Pakistan
Indonesia	Singapore
Korea, Republic of	Switzerland
Laos	Thailand
Maldives	Vietnam

Appendix B

Diagram 1: Distribution of RTA types (all obs.)



Percentage shares of RTA types

CU	1,41 %
CU & EIA	1,37 %
EIA	0,01 %
FTA	4,38 %
FTA & EIA	2,29 %
PSA	89,76 %
PSA & EIA	0,75 %
None	0,03 %
Sum	**100,00 %**

Table 6: Results Gravity Regression, all other variables

Dependent Variable: Log of BACI Bilateral Trade flow	Fixed Effects (a)	(b)	(c)	(d)	Random Effects (e)	(f)	(g)
$lnGDP_i$	0.50***	0.51***	0.50***	0.50***	0.69***	0.90***	0.91***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
$lnGDP_j$	0.69***	0.70***	0.70***	0.70***	0.57***	0.78***	0.78***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
$lnDistance_{ij}$					-1.07***	-1.05***	-1.05***
					(0.02)	(0.01)	(0.02)
$lnPOP_i$	-0.03	-0.03	-0.08	-0.03	0.21***	0.07***	0.07***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.00)	(0.00)	(0.00)
$lnPOP_j$	0.28***	0.28***	0.22***	0.28***	0.16***	0.04***	0.03***
	(0.044)	(0.04)	(0.04)	(0.04)	(0.00)	(0.00)	(0.00)
Trade agreement	0.28***	0.28***	0.30***	0.28***	0.49***	0.45***	0.45***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Contiguity					1.32***	1.33***	1.33***
					(0.09)	(0.09)	(0.09)
Comlang_off					0.79***	0.95***	0.95***
					(0.03)	(0.03)	(0..03)
Country-Pair Fixed Effects	YES	YES	YES	YES			
First-order Interaction Effects		YES	YES	YES		YES	YES
Time Fixed Effect	YES	YES		YES		YES	YES
Cluster Robust Standard Errors	YES	YES	YES	YES	YES	YES	YES
R^2 within	0.20	0.20	0.20	0.20	0.20	0.20	0.20
R^2 between	0.49	0.49	0.49	0.45	0.68	0.71	0.71
R^2 Overall	0.44	0.44	0.44	0.41	0.63	0.66	0.66
Observations	488 425	488 425	488 425	488 425	484 980	484 980	484 980

Note: Each column represents a individual regression. In column (a) - (d), the fixed effect model and equation (3) from section 4.2 is used, while column (e) - (g) use the random effect model and equation (4) specified in section 4.3. The columns differ due to combinations of time fixed effects and first order interation terms turned on and off. This table contains the remaining estimated coefficient from the gravity results in Chapter 5. *** p < 0.001, ** p < 0.05, * p < 0.10

Table 7: Statistical tests

Test 1: Hausman Specification test (Random effects vs Fixed)

H_0: $\alpha_{12} = \alpha_{13}$=...=$\alpha_{ij}$ $\quad \chi^2 = 4277.85 \quad P - value = 0.00$

Test 2: Breusch and Pagan LM test for Random Effects

H_o: $Var(\alpha_{ij}) = 0 \quad \bar{\chi}^2 = 1.6e + 06 \quad P - value = 0.00$