CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

Bachelor thesis

2020 **Karolína Maderová**

CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

Karolína Maderová

Impact of the FTA between EU and South Korea on the Czech Republic

Bachelor thesis

Prague 2020

Author: Karolína Maderová
Supervisor: Ing. Vilém Semerák M.A., Ph.D.

Academic Year: 2019/2020

Bibliographic note

MADEROVÁ, Karolína. *Impact of the FTA between EU and South Korea on the Czech Republic.* 35 p. Bachelor thesis. Charles University, Faculty of Social Sciences, Institute of Economic Studies. Supervisor Ing. Vilém Semerák M.A., Ph.D.

Abstract

In this thesis we study the effect of Free Trade Agreement (FTA) between European Union and South Korea, especially on the Czech Republic. To do so, we use gravity model. We specify three different gravity equations, each with a different set of fixed effects, and apply two estimation methods on them: Fixed Effects and Poisson Pseudo Maximum Likelihood. Apart from this, we also use traditional indicators (Herfindahl and RCA indices) to assess the changes in trade.

The results of the gravity model estimations suggest that the FTA did not have a significant impact on the bilateral trade. However, trade diversification analysis using the Herfindahl index and comparative advantage analysis using the RCA index both indicate that the bilateral trade between the Czech Republic and South Korea improved with the FTA in place.

Keywords: gravity model, FTA, South Korea, European Union, trade diversification, comparative advantage

Author's email: 61165735@fsv.cuni.cz
Supervisor's email: vilem.semerak@gmail.com

Abstrakt

V této práci zkoumáme efekt dohody o volném obchodu mezi Evropskou Unií a Jižní Koreou, především na Českou republiku. K tomu využíváme gravitační model. Určujeme tři různé gravitační rovnice, každou s jinou skupinou fixních efektů, a uplatňujeme na ně dvě metody odhadu: Fixní efekty a Poisson Pseudo Maximum Likelihood. Navíc také hodnotíme změny ve vzájemném obchodu pomocí tradiční indikátorů (Herfindahlův a RCA index).

Výsledky odhadu gravitačního modelu ukazují, že dohoda o volném obchodu neměla významný dopad na vzájemný obchod. Nicméně analýza diversifikace obchodu pomocí Herfindahlova indexu a analýza komparativních výhod pomocí RCA ukazuje, že se vzájemný obchod mezi Českou republikou a Jižní Koreou zlepšil po uplatnění dohody o volném obchodu.

Klíčová slova: gravitační model, dohoda o volném obchodu, Evropská Unie, Jižní Korea, diversifikace obchodu, komparativní výhody

Email autora: 61165735@fsv.cuni.cz

Email vedoucího: vilem.semerak@gmail.com

Range of thesis: 67 231 characters with spaces

Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague 31.7.2020 **Karolína Maderová**

Acknowledgments

I would like to express my deepest gratitude to my supervisor, Ing. Vilém Semerák M.A., Ph.D., who guided me and helped me whenever it was needed. He provided me with encouragement and great advice and I was constantly impressed by his knowledge and professionalism. This thesis would not have been realized without his support.

I would also like to thank my parents, grandparents and friends for their support and kind words. Thank you for believing in me.

Institute of Economic Studies

Bachelor thesis proposal

Author's name and surname: Karolína Maderová

Supervisor's name: Ing. Vilém Semerák M.A., Ph.D.

Proposed Topic:

Impact of the FTA between EU and South Korea on the Czech Republic

Preliminary scope of work:

Research question and motivation

What are the effects of the FTA on Czech economy?

The Free Trade Agreement (FTA) between the European Union and South Korea was signed in 2009. The FTA and its effects on both parties have been broadly discussed by media and researchers. The aim of this thesis will be to analyse these effects, focusing mainly on the Czech Republic but also providing a comparison with the EU as a whole and potentially our neighbours. The trade relations between the Czech Republic and South Korea are very strong - South Korea is our third largest business partner outside the EU. The analysis of the trade data may therefore yield very significant results, applicable also outside the academic sphere. Since the FTAs are occasionally modified and there any many possible FTAs that the EU is negotiating, it is convenient to have information about the impact of previous agreements and about the preciseness of ex ante predictions.

The main hypothesis: The Czech Republic-South Korea trade relations have strengthened considerably since the FTA application.

Contribution

Trade relations keep evolving, therefore any previous literature on this topic can be updated and specified. One of the most extensive studies on this topic was done by Association for International Affairs nearly 10 years ago and it estimated the effect of the FTA.

In this thesis I will be using the most recent data to ensure its relevance and I will compare the effects with the estimated ones. The results will show the trend of the trade relations which may then be used to predict future trade development.

Methodology

To provide the desired results I will carry out an empirical analysis using the gravity model. Gravity model is commonly used for these types of analyses, i.e. when predicting bilateral trade flows. In this case, I will also use the gravity the model to evaluate whether we can still expect any changes or if the current trade condition is what the model predicts. Besides the gravity model, a descriptive analysis of the trade and its changes will be a part of this thesis and its aim will be to assess the previous analyses of this topic. The data will be taken from more sources, e.g. Eurostat and WITS (World Integrated Trade Solution).

Outline

1) Introduction and literature review
2) Methodology
3) Data analysis
4) Empirical Results and Evaluation of the Hypothesis
5) Conclusion

List of academic literature:

Bibliography

Silva, J.m.c. Manuel Caravana Santos, and Silvana Tenreyro. "The Log of Gravity." SSRN Electronic Journal, 2003. http://personal.lse.ac.uk/tenreyro/lgw.html.

Fouquin, Michel, and Jules Hugot. "Two Centuries of Bilateral Trade and Gravity Data: 1827-2014." 2016. http://cepii.fr/PDF_PUB/wp/2016/wp2016-14.pdf.

Undefined, Undefined Undefined. The Gravity Model in International Trade Advances and Applications. By Steven Brakman and Peter A. G. Van Bergeijk. Cambridge: Cambridge University Press, 2015.

Baldwin, Richard, and Daria Taglioni. "Gravity for Dummies and Dummies for Gravity Equations." NBER WORKING PAPER SERIES, 2006.

Bacchetta, Marc, Anthony Martin, Serge Marin-Pache, and Susana Olivares. A Practical Guide to Trade Policy Analysis. New York: United Nations and World Trade Organization, 2012.

Savovová, Alice, Antonín Koukolík, Vladimír Beroun, and Šárka Baladová. "Studie Dopadů Uzavření Dohody O Volném Obchodu Mezi EU a Korejskou Republikou Na Ekonomiku ČR." 2010. https://www.mpo.cz/assets/dokumenty/42067/47656/568929/priloha001.pdf

Table of Contents

Introduction

Following the stagnation of Doha Round of WTO negotiations, both the European Union and South Korea started to pursue new trade agreements negotiations. In 2007, first talks about a Free Trade Agreement (FTA) between EU and South Korea were instigated. The FTA was ratified in 2010 and fully entered force in 2015. It is often referred to as the first of the 'new generation' of FTAs for its comprehensive content.

The motivation for conducting the study of the FTA's impact can be found in three different contexts. First, in recent past, some new FTA proposals have been presented as somewhat controversial (for example TTIP[1]), therefore it is important to understand and be able to estimate the effect of FTAs. Second, some recent estimates of the impact of FTAs (for example EU-Singapore, EU-Vietnam or EU-Japan)[2] on the Czech Republic have been quite conservative, presuming minimal changes in the bilateral trade. This paper may then be used to compare the ex-ante estimates of the EU-South Korea FTA with the actual results to evaluate the accuracy of the estimates. Third, we aim to provide a deeper analysis than some ex-post evaluations which often offer only description of the trade without an actual econometric regression.

In this thesis, we use the gravity model as well as traditional trade indicators to examine the effect of the FTA on the Czech Republic. The gravity model of international trade is an econometrical tool commonly used for bilateral trade analysis, including the effects of trade agreements on trade. The traditional, non-econometrical ways we used to analyse the trade are Herfindahl and Revealed Comparative Advantage (RCA) indices. Herfindahl index is used for trade diversification analysis and RCA index is used to measure the comparative advantage a country has for a given commodity.

In the first chapter of this thesis, we summarize the relations between EU and South Korea and the Czech Republic and South Korea. We also introduce the Free Trade Agreement and briefly describe its effect on bilateral trade.

The second chapter reviews existing literature relevant for our research. It is divided into three parts – first part outlines the history of Preferential Trade Agreements (FTAs by extension), second is dedicated to gravity model and its rigours that need to be

[1] Transatlantic Trade and Investment Partnership – proposed trade agreement between EU and USA
[2] Estimations available at https://www.mpo.cz/cz/zahranicni-obchod/spolecna-obchodni-politika-eu/dohody-o-volnem-obchodu/

taken into account during estimation, third part focuses on three papers studying trade liberalization and its effect on trade diversification.

The third chapter describes the data and variables we used for the trade analysis and gravity model estimation. The fourth chapter explains the econometrical methods which were used for the estimation – Fixed Effects and Poisson Pseudo Maximum Likelihood. In the fifth chapter, we analyse the structure of bilateral trade between the Czech Republic and South Korea using non-econometrical approach. The sixth chapter provides the results of our estimations and their comparison. Last chapter summarizes our findings and reviews the contributions of this paper.

1. Background

This chapter briefly describes the trade relations between the European Union and South Korea which resulted in the creation of free trade area between these two entities. We also provide a summary of the FTA in question and a short overview of the Czech Republic-South Korea relations.

1.1 EU and South Korea relations development

In July 1963, first diplomatic relations were established between South Korea and European Community (the predecessor of EU). At this time, South Korea was still one of the developing states and also recovering from the civil war and perceived Europe as a role model. (S. Kim 2015) Two years later, in 1965, the Permanent Mission of Republic of Korea (ROK) in EC was opened. The relations strengthened towards the end of Cold War and a separate independent Permanent Mission of ROK in EC was established in 1989. During this time, EC and ROK became strong trade partners. (Embassy of the Republic of Korea to the Kingdom of Belgium and the European Union 2019)

In the 1990s, some Asian countries, including South Korea, gained great economic power which led the European Union to launch trade agreement negotiations "in order to maintain its leading role in the world economy". (Commission of the European Communities 1994) Therefore, in 1996 EU and South Korea signed Trade and Cooperation agreement which entered force in 2001. Its foremost aim was to diversify trade and establish economic cooperation in fields of mutual interest. (European Union 2001)

One of the common goals of EU and South Korea is security in Korean Peninsula. Following the nuclear crisis in 1993-1994 and Agreed Framework between US and North Korea, Korean Peninsula Energy Development Organisation (KEDO) was founded in 1995 by South Korea, Japan and the United States of America and joined by EU in 1997. (KEDO n.d.)

During the 2000s, the trade between EU and South Korea experienced a significant growth. Since the Doha Round of Negotiations of WTO were not carried through, both parties sought to negotiate bilateral FTAs with suitable trade partners. In 2006, EU launched the 'Global Europe' trade strategy which identified the best potential FTA partners. The candidates included other trade blocs such as Mercosur or ASEAN but

also some specific countries, South Korea being one of them. (Gstöhl 2016) Simultaneously, South Korea started its own FTA negotiations. The most notable is the KORUSA FTA with United States of America which was concluded in 2007 (however, it only came into effect 5 years later in 2012). Later in 2007, EU and South Korea began their own bilateral FTA negotiations which were possibly prompted by KORUSA. In October 2010, EU and South Korea upgraded their relation to strategic partnership following the Framework Agreement signed in May 2010. In 2016, a separate Framework Agreement for the participation in EU Crisis Management Operations entered into force, allowing South Korea to participate in EU missions. (Pardo, Desmaele and Ernst 2018)

1.2 FTA between EU and South Korea

The FTA negotiations were initiated in May 2007 in Seoul, South Korea. It was signed in October 2010 in Brussels after eight rounds of talks. In July 2011, the FTA was provisionally applied and on 13 December 2015 it came into full effect after being formally ratified by all EU member states. It is considered to be the first FTA of the new generation for its more extensive scope and higher ambitions. (European Commission 2016) For EU, it was the first FTA concluded with an Asian country. For South Korea, it was the first FTA with one of its biggest trade partners (EU, US, China) to come into effect – KORUSA entered into force one year later and China-South Korea FTA in 2015. (Pardo, Desmaele and Ernst 2018)

However, the EU-South Korea FTA was met with some criticism. The main opponents were the European carmakers who feared that if Korean automobile manufactures did not face tariffs, the European car industry would suffer and many people might lose their jobs in consequence. This led Italy to threaten to veto the FTA. Eventually, Italy dropped the objections after the provisional launch was postponed by 6 months (from January to July 2001). (Lee 2010) Also, these concerns have been regarded as myths for multiple reasons. Firstly, Korean share on imported cars to EU at that time accounted for only 12%, mainly concentrated into one segment – small cars. Secondly, the FTA was believed to have positive effect on Korean auto foreign direct investment (FDI) as it is much more efficient for Korean firms to locate their production in EU due to high transportation costs. Lastly, European auto industry was bound to benefit from the FTA since Korea would not only eliminate import tariffs on car, but also other non-tariff barriers. (Erixon and Lee-Makiyama 2010)

The EU-South Korea free trade agreement comprises of 15 chapters, each specifying a different area. Perhaps the most crucial is Chapter 2 which lays out the strategy for removal of tariff and non-tariff barriers on trade in goods. Within the first 5 years since the FTA is applied, 98.7% of custom duties, which are calculated to be €1.6bn for just the EU export to South Korea, were to be eliminated. There are only a few products on which the import duties were not to be eliminated, one example being rice. The FTA also sets out goals for liberalization of trade in services, protection of intellectual property and competition rules, among others. (European Commission 2010)

In March 2019, the European Commission presented a five-year evaluation of the FTA implementation where it concluded that the FTA had been generally successful in liberalising the trade in all goods, services and investments. The evaluation also states that there was a significant increase in stock FDI resulting from the FTA. Another, rather surprising effect of the agreement was reduction of global CO_2 emissions. (European Commission 2019)

Presently, South Korea is EU's eight largest export destination and EU is South Korea's third largest export destination. The volume of bilateral trade in goods in 2018 was approximately 90 billion euro. In 2010 the EU's trade in goods deficit was €10.5bn. In 2018, it decreased to €2.2bn. EU remains in deficit, nevertheless, the trade is now more balanced compared to the pre-FTA period. The volume of trade in services was €19bn in 2018 with EU having the surplus of €3.8bn. FDI increased on both sides and EU remains South Korea's biggest foreign direct investor (€46bn in outward stocks). (European Commission 2020)

1.3 The Czech Republic-South Korea relations

First diplomatic relations between the Czech Republic and South Korea were established in March 1990. The Czech Republic has supported peace talks in Korean Peninsula and even joined KEDO in 1999. The EU-South Korea FTA was formally ratified by the Czech parliament in August 2011. (Velvyslanectví Korejské republiky v České republice n.d.)

The Czech Ministry of Industry and Trade requested the Association for International Affairs (AMO) to conduct an ex-ante analysis of the impact of the FTA on Czech economy. This study presumes that the bilateral trade will increase – Czech export by 25.9% and South Korean export by 15.1%. (Savovová, et al. 2010)

In reality, the impact on trade volume is much more substantial than AMO suggested and the changes on both sides are more balanced. Since the FTA came into effect, Czech export to South Korea grew by 62.5% and South Korean export to the Czech Republic by 63% (from 2010 to 2018). Although this rate of growth appears to be quite high, this change is also very much in line with the development of overall Czech export which increased by 62.6% during the same time period. On the other hand, overall South Korean exports increased only by 29%.[3]

In the past years, South Korean FDIs to the Czech Republic have become a significant component of the Czech economy and South Korea is currently third biggest non-EU foreign direct investor (after the USA and Japan)[4]. Hyundai Motors only has invested over 34bn CZK to the Czech Republic. (Velvyslanectví Korejské republiky v České republice n.d.) According to CzechInvest[5], there are more than 70 Korean companies operating in the Czech Republic at the moment. Those include for example Nexen Tire, Doosan, Kiswire or Hyundai Mobis.

[3] We are aware that the discrepancy between the AMO estimates and actual values may be due to the global financial crisis.
[4] According to Czech National Bank.
[5] Available at https://www.czechinvest.org/cz/Kontakty/Zahranicni-zastupci/Jizni-Korea

2. Literature review

In this chapter, we first introduce trade agreements, their history and their role in international trade. Then we summarize the development of gravity model and its use for bilateral trade estimations. Last section focuses on trade diversification in the wake of trade liberalization.

2.2 Preferential and Free Trade Agreements

While PTA (preferential trade agreement) and FTA (free trade agreement) are a very similar concept, they are not completely interchangeable. FTA is essentially a subset of PTA since PTA requires a mutual reduction but not absolute elimination of tariffs, whereas there are zero tariffs imposed in FTA. (de Melo, Panagariya and Rodrik, The New Regionalism: A Country Perspective 1993) FTA allows for free movement of goods, services and in some cases, investment. According to WTO, every PTA ought to eventually result in FTA or Custom Union (CU). The main difference between FTA and CU is that countries involved in FTA retain their tariff structure with third parties. The main goal of FTAs is to economically benefit both industries and consumers. Elimination of trade barriers allows firms to access new markets and sell more products. The increased competition leads to lower prices and wider range of goods available which is beneficial for consumers. (Grimson 2014)

Rawlinson (2001) suggests that some kind of international trade dates back to the ancient times. Egyptians imported spices from the Arabs in the Red Sea, Indian goods were being brought to Aden and Syrians were bringing gold, silver, ivory and precious stones from the East.

After the establishment of the Silk Road in 2nd century BC, international trade expanded, as goods could be transported throughout nearly the whole Eurasian continent. Although Silk Road was not a trade agreement in essence but more of a group of kingdoms and city-states connected by roads, it did foster trade among them as transportation costs were significantly reduced. A specific type of trade agreement was established among Muslims traders. All Muslims followed the same set of rules no matter their location and Muslim rulers imposed the same tax and custom rates. Also, the risk of deceit was lower since they had more respect for fellow Muslims. The Silk Road officially collapsed in 18th century. Trade also flourished during the Age of Discovery in 15th and

16th century as new sea routes were being established. In 1602 the Dutch East India Company was formed, marking a great milestone in international trade history. It was the world's largest company before going bankrupt almost two centuries later, in 1799. (Bernstein 2008)

In 1703, Methuen Treaty was signed between England and Portugal. Although it was also a military agreement, its commercial aspects were significant as Portuguese economy was dependent on trade with England. The two main products specified by the treaty were wine (exported by Portugal) and cloth (exported by England). The import duties imposed on Portuguese wine by England were lower by one third than those imposed on French wine. (Lopes and Simões 2017)

In 19th century, Great Britain's trade expanded and British industrialists started to advocate for a more open trade. In 1823, Reciprocity of duties Act was approved, easing the restrictions on the carry trade. Another milestone was the ratification of the first free trade agreement, the Cobden-Chevalier Treaty, in 1860 between Great Britain and France. It significantly reduced the tariffs imposed by both countries. This Treaty prompted the creation of more trade agreements among other European countries. (World Trade Organization 2011)

Prior to the creation of first modern-day trade agreements, Great Britain had established a complex system of so-called Imperial preferences. The main countries involved were Canada, Australia, New Zealand, South Africa and of course, Great Britain. It guaranteed preferential treatment among above-mentioned countries, for example lower tariffs. (Glickman 1947) The system remained in existence until the creation of GATT in 1948.

First modern trade agreements were established after the Second World War. After the war, the USA became an economic superpower and wanted to promote trade with other countries. Also, the United States and Great Britain agreed that an international economic system was necessary in order to avoid the political and economic difficulties that they faced in the interwar period. It is believed that the trade bloc rivalry and overall financial instability led to the WWII. In 1944, Bretton Woods conference took place with the goal to establish an efficient international monetary system. Two main institutions were established here: the International Monetary fund (IMF), which was to oversee the exchange rate system and maintain its stability, and the International Bank for Reconstruction and Development (IBRD), which was to fund post-war reconstructions. There was originally another institution proposed – the International Trade Organization,

it was meant to regulate the international trade. (World Trade Organization 2011) The negotiations on the ITO were completed in the Havana Charter but it was repeatedly rejected by the US Congress. However, a less ambitious, rather provisional version of Havana Charter was negotiated: the General Agreement on Tariffs and Trade (GATT), it was signed on 30 October 1947 by 23 countries, including Czechoslovakia, and came into effect on 1 January 1948. (Brown 2003) It remained the main agreement to regulate the world trade until the creation of WTO in 1995. According to the preamble, the GATT signatory countries committed themselves to enter "into reciprocal and mutually advantageous arrangements directed to the substantial reduction of tariffs and other barriers to trade and to the elimination of discriminatory treatment in international commerce". A crucial component of the GATT was an article XXIV, which allowed the parties to create custom unions and free trade areas[6]. It was especially Great Britain that lobbied for such exception because of previously mentioned system of Imperial preferences. The creation of GATT sparked number of negotiations for further international trade agreements. The "post-GATT" era can be divided into three waves or regionalism. (Carpenter 2009)

The first wave started with six European states[7] forming European Coal and Steel Community (ECSC) in 1952. Its main purpose was to prevent an outbreak of another war between France and Germany by creating a common authority for steel industries in all signatory countries. A more extensive organization European Economic Community (EEC), which built on ECSC, was established in 1958 by the same six states. Its initial goal was to deepen the economic relations among the countries, creating custom union and common market. EEC also planned on implementation of a common external tariff, which lead to other European countries[8] forming another supranational organization called European Free Trade Association (EFTA). It was to balance out the economic power inaugurated by the EEC. However, EFTA was far less successful and eventually all but two of the founding members left for EEC. EEC is considered to be a direct predecessor of today's European Union. (Carpenter 2009)

These successful efforts in Europe inspired other, mainly developing countries to create similar formations, for example East African Community and Central America common market. However, they eventually disintegrated in the late 1970s. (de Melo and

[6] Under the condition that trade barriers will not be raised for non-members.
[7] Belgium, France, Italy, Luxembourg, the Netherlands and West Germany
[8] Austria, Denmark, Norway, Portugal, Sweden, Switzerland, UK

Panagariya 1993) One successful example of this era is Association of Southeast Asian Nations (ASEAN) formed[9] in 1967.

The economic integration in Europe deepened as six more countries had joined the EEC by 1986 and there were plans to finalize a Single European Market. This came about in 1993 with the establishment of European Union by Maastricht Treaty. By 1995, EU consisted of 15 member states. Meanwhile, the US and Canada signed the Canada–United States Free Trade Agreement (CUSFTA) which came into force in 1988 and was superseded by a well-known North American Free Trade Agreement (NAFTA)[10] in 1994, adding Mexico as a member country.

These simultaneous events in Europe and North America started the second wave of regionalism and launched the Uruguay Round negotiations of GATT in 1986, which eventually lead to creation of World Trade Organization (WTO) in 1995. During the second wave, another significant trade bloc was formed in 1991 by Brazil, Argentina, Uruguay and Paraguay called MERCOSUR with a goal to allow for free movement of goods, people and services. Similar efforts were realized in Asia; Asia-Pacific Economic Cooperation (APEC)[11] was formed in 1989 and ASEAN members created the ASEAN Free Trade Area (AFTA) in 1992, both expanding further during the 1990s as new member countries were admitted. (Carpenter 2009)

The third wave started after the creation of the WTO. In Europe, the evolution of regionalism was mainly accession of new member states to the European Union. The two main enlargements took place in 2004 when ten countries, including the Czech Republic, entered, and in 2007 when two countries entered. The last country to join the EU was Croatia in 2013, making it a 28th member[12]. The EU also began to negotiate number of trade agreements, including FTAs, for example with Mexico in 2000 and South Korea in 2011. The trade agreements negotiated by the EU are valid for all member states and at the same time, no member can have their own trade agreement with another country. (See Appendix 1 for a list of EU trade agreements) During this period, the United States also concluded FTAs with numerous countries, including Jordan, Colombia, South Korea and Australia. AFTA concluded trade agreements with Japan, South Korea, China and India.

[9] Originally formed by Indonesia, Malaysia, the Philippines, Singapore and Thailand for security reasons, trade dimension was added later. (Carpenter 2009) Now 10 members.
[10] NAFTA was superseded by United States–Mexico–Canada Agreement (USMCA) in 2020.
[11] Founding members were Australia, Brunei, Canada, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore, Thailand and the United States. Now 21 members.
[12] Following Brexit, EU has now 27 members.

2.2 Gravity model

Gravity model is an econometrical model used to study flows between two entities, most commonly two economies and their bilateral trade flows. The name comes from the Newton's Law of Universal Gravitation – an equation that expresses how the distance between two objects and their masses influence the attractive force. The larger the mass of the objects and the smaller the distance between them, the greater the attractive force. The notion is similar for the gravity model – the relationship between large economies is stronger than between smaller ones and it tends to be stronger with less proximity. (Bergeijk and Brakman 2010)

The most basic form of the econometrical gravity equation can be written as:

$$T_{ij} = \frac{GDP_i^{\alpha} GDP_j^{\beta}}{D_{ij}^{\theta}}, \tag{2.1}$$

where T_{ij} is the volume of trade from origin country *i* to destination country *j*. GDP_i and GDP_j express the economic size of country *i* and country *j*, respectively. D_{ij} is the physical distance between the mentioned countries. α, β, θ are the gravity equation parameters (typically estimated in log-linear form of the gravity model). However, this model fails to explain the full variance in trade flows due to the lack of micro-economical foundations during the early years of research. (Bergeijk and Brakman 2010)

The first person to introduce gravity model as an economical instrument was Jan Tinbergen (1962). He believed that the main factors were supply and demand potentials (economic size of both countries - GDP) which both affect the trade volume positively but not necessarily proportionally (thus the parameters in exponents in equation above). The distance is essentially a transportation cost and affects the trade flows negatively. The then popular trade models, such as Ricardian or Heckscher-Ohlin, did not seem to provide necessary foundations for the gravity model, therefore it was viewed as only an empirical tool without proper theory to support it. However, the gravity model proved to be robust and useful for trade flows estimations which spurred further research. Pöyhönen (1963), Linnemann (1967) and Leamer and Stern (1970) also studied the gravity model but neither of them managed to provide the theoretical foundations.

First successful attempt at providing solid micro-foundation was by Anderson (1979). He defines the gravity equation as:

$$M_{ijk} = \alpha_k Y_i^{\beta_k} Y_j^{\gamma_k} N_j^{\varepsilon_k} N_j^{\epsilon_k} d_{ij}^{\mu_k} U_{ijk}, \tag{2.2}$$

where M_{ijk} is the trade flow (in dollars) of good k from origin country i to destination country j, Y_i and Y_j represent the income of both countries, N_i and N_j are the population sizes of i and j, d_{ij} the distance between i and j, and U_{ijk} is lognormally distributed error term, where $E(\ln U_{ijk}) = 0$. For this model to be valid, some assumptions have to be made: constant elasticity of substitution, each country is specialized in production of only one good and there are no perfect substitutes[13].

Anderson also defined a simpler gravity model which stems from Cobb-Douglas expenditure system. However, this model requires further assumptions: each country only produces one unique good, there are no tariffs and transportation costs and all goods are tradable. Firstly, the consumption of country i's good is defined as:

$$M_{ij} = b_j Y_i, \tag{2.3}$$

where, b_j is the share of country j income spent on the good, and Y_i represents the income in country j. Income in country i can then be specified as $Y_i = b_i(\sum_j Y_j)$. Using substitution, the simplest version of gravity model can then be written as:

$$M_{ij} = \frac{Y_i Y_j}{\sum Y_j}. \tag{2.4}$$

Due to the nature of necessary and rather unattainable assumptions, Anderson's work was not initially met with much recognition.

Bergstrand (1985) provided another set of micro-foundations for the gravity model. He included the price indices that were omitted from previous gravity model specifications, and took into account the supply side of the economy. The income of origin country is included to evaluate the supply capacity, income of destination country is included because of demand and distance is used for the transportation costs. Bergstrand (1989 and 1990) builds on his previous paper and includes factor-endowment and taste variables. He bases the gravity model on monopolistic competition, focusing on the product differentiations across firms. Each country then exports a set of products. One of the limitations of Bergstrand's work was the complexity of the price terms. Deardoff (1998) shows that in frictionless trade, gravity model on average holds for neoclassical Heckscher-Ohlin (Factor-Proportion) model. Eaton and Kortum (2002) managed to develop a Ricardian model with aspects of gravity equation.

Anderson and Wincoop (2003) build on Anderson's earlier paper on gravity model and to this day remains the most important reference for further gravity model research.

[13] This is called Armington assumption.

In this paper, Anderson and Wincoop cross-check the work of McCallum (1995). McCallum studied the importance of national borders on the example of the U.S. and Canada. He found that a Canadian province will trade by 2200% more with another province than with a U.S. state. Anderson and Wincoop point out the omitted variable bias in McCallum's work, present due to the persisting lack of theoretical foundation. After controlling for this bias, they found that a province was more likely to trade with another province, compared to a state, only by 44%, a percentage much smaller and less shocking than the initial 2200%. To help control for the omitted variable bias, Anderson and Wincoop develop another crucial component of the gravity model – multilateral trade resistance terms (MTR terms). These are essentially trade barriers that both importer and exporter face with all their trade partners, meaning that a relative trade cost is taken into account, not an absolute trade cost. This is summarized in the following equation:

$$T_{ij} = \frac{Y_i Y_j}{Y}\left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma}, \tag{2.5}$$

where T_{ij} is the trade between i and j, Y_i and Y_j represent the GDP of countries i and j, Y is the world GDP, t_{ij} is the trade cost in absolute terms, Π_i and P_j represent the MRT terms and $\sigma > 1$ is the elasticity of substitution. Baldwin and Taglioni (2006), however, point out that although fundamentally correct, the equation is rather simplified and can only be applied to cross-sectional data. Baldwin and Taglioni managed to derive a generalized gravity equation which allows for panel data as well. In this paper, the authors also identify the most common mistakes that are being made in the gravity model estimation and they offer ways to estimate these mistakes, as well as advice on how to avoid them.

Santos Silva and Tenreyo (2006) bring to light another important issue regarding the gravity model – the neglect of Jensen's inequality. One of its implications is that $E(\ln y) \neq \ln E(y)$, which is often ignored in econometrics. Silva and Tenreyo prove that under heteroskedasticity, OLS estimation of a log-linearized equation leads to biased results. Their proposed solution is using Poisson pseudo-maximum-likelihood method when a heteroskedasticity in data is suspected. This method is robust and ensures unbiased estimates of the coefficients. Moreover, the Poisson PML method naturally deals with zero observations.

Head and Mayer (2013) provide a compact toolkit for the gravity equation estimation. There are several methods consistent with the underlying theoretical

foundations, however each has its own drawbacks. For example, they discuss the estimation using proxy "remoteness" variables, but essentially rule it out for the lack of theory behind it. Possibly the most widely used method is using fixed effects which is a very robust method and leads to unbiased estimations, if the equation is specified correctly. However, when using panel data, it is necessary for the fixed effects to be time-varying, therefore estimation of a time-invariant coefficient is impossible due to perfect collinearity. Other methods mentioned by Head and Mayer (2013) include iterative structural estimation, with so-called SILS (structurally iterated least squares) estimator, and ratio-type estimation. This paper stresses the importance of "the toolkit approach" – these methods should, if possible, be used together to obtain unbiased coefficient estimations.

Baier and Bergstrand (2005) draw attention to the problem of endogeneity of FTA (or any trade agreement, for that matter) dummy variables which are often presented as exogenous in literature. This paper points out that a country's decision to sign an FTA is based on its trade level. The endogeneity may lead to biased estimates of the FTA variable. Indeed, they conclude that the effect of FTA on trade has been severely underestimated (by 75%).

Gravity model is broadly used for estimating the effect of reciprocal trade agreements (RTA), among others. Cipollina and Salvatici (2010) use meta-analysis to summarize the effects of RTAs based on existing literature. The goal of this paper is not to provide the best estimation method or an exact effect of RTAs on bilateral trade flows, but rather examine the variation of the estimated effect in previous studies. They include 85 papers with 1827 point estimates of the effect of RTA and conclude that there is a 40% increase in trade when a RTA is in place. Cardamone (2007) uses a different approach to assess the effect of RTA (or PTA, in this case). This study reviews 115 paper focusing on estimating the effect of PTA using the gravity model and provides a critical analysis for different approaches. The main conclusion is in line with Cipollina and Salvatici (2010) – the preferential trade agreements do stimulate the trade between the parties involved. However, the paper offers additional conclusions, crucial for estimating the effect of PTA using gravity model. The use of dummy variables as a proxy for PTAs can be misleading and lead to biased results since dummies also include other country-pair specific effects that might be correlated with the incentive to sign a PTA. Also, dummies do not take into account the possible heterogeneity of countries involved in PTA. The author also points out that each of the 115 papers disregards at least some of the estimation issues.

2.3 Trade diversification

Trade liberalization is a process of removing or reducing tariff or non-tariff barriers among nations. The promotion of free trade is believed to reduce the cost of goods and stimulate the economic growth. On the other hand, trade liberalization may pose a threat to developing countries which are unable to compete with other, stronger nations. In the past, there have been papers studying the effect of trade liberalization on export diversification, especially in developing countries. They suggest that once the openness of a country changes, the trade concentration is affected as well.

Volpe Martincus and Goméz (2009) studied the effect of FTA between Colombia and the US on the Colombian export diversification. Their original hypothesis, based on theory and empirical results, is that such trade agreement will foster the export diversification. They observe mainly Colombian export to the United States, taking Mexico and Chile as a benchmark. For their analysis, they use highly disaggregated data (HTS10[14]) and run econometrical regressions to assess the effect on the extensive margin of export. The final conclusion is in line with the original hypothesis – they find evidence that tariff cuts indeed led to export diversification and are expected to promote it further in the future, up to a certain point at least. Once the FTA will have been in effect for long enough, it will be up to other factors to realize additional trade diversification.

Similar analysis was performed by Kim and Kim (2012) on the case of Chilean export. They also use disaggregated panel data (5-digit SITC[15]), however, they don't focus on one destination country or one FTA. The data include exports to 150 countries, with over 56 of them being involved in an FTA with Chile. They apply standard gravity model for their estimation and conclude that while the FTAs have positive effect on intensive margin of Chilean export, the same cannot be said about the extensive margin, as the export structure became more concentrated. The authors believe that this is due to the fact that the Chilean trade was already vastly concentrated before the FTAs came into effect. This implies that the impact of FTA on trade diversification is highly dependent on the original export structure.

Osakwe, Santos-Paulino and Dogan (2018) studied the effect of trade policy (trade liberalization) on export diversification in developing countries with focus on Sub-Saharan African (SSA) countries. They find that, in general, reduction in trade barriers

[14] Harmonized Tariff Schedule with 10 digits used by U.S. International Trade Commission.
[15] Standard International Trade Classification

leads to export diversification in developing countries. However, this is not the case for SSA countries, where trade liberalization results in export concentration in the long run. This paper points out that the trade and in SSA countries was highly concentrated even prior to trade liberalization attempts. Therefore, the findings of Osakwe, Santos-Paulino and Dogan (2018) are in line with Kim and Kim (2012).

3. Data

The data we used for our empirical analysis come from The Centre d'Études Prospectives et d'Informations Internationales (CEPII), World Bank and Design of Trade (DESTA) Database[16]. The CEPII dataset, BACI, is the largest database of bilateral trade, covering over 200 countries. It consists of disaggregated yearly data on bilateral trade flows. The exports are reported on product level, using the Harmonized System (HS)[17]. HS is a standard nomenclature which classifies traded goods (approximately 5300 article descriptions) and is used by the majority of customs. The variables contained in BACI database are year, product category (expressed as a 6-digit HS code), exporter, importer, value of the trade flow (in US dollars) and quantity (in metric tons). There are more versions of BACI database, as the Harmonized System has been revised multiple times, and each version covers slightly different time period. We employ the version which spans from 1995 until 2017. The second dataset provided by CEPII comprises time invariant variables generally used for gravity model estimation. The information on importer and exporter GDP was obtained from World Bank's development indicators database - World Development Indicators. The indicator we used is called GDP (current US$). DESTA database consists of all trade agreements in force. We combined all of the above-mentioned datasets for our gravity model estimation. The variables used the gravity equation are summarized in the table below:

Table 3.1: Variables with description and source

Name	**Description**	**Source**
export	Trade flow	CEPII
GDPexporter	GDP of exporter	WDI
GDPimporter	GDP of importer	WDI
distw	Weighted distance	CEPII
contig	Contiguity	CEPII
comlang_off	Common language	CEPII
comcol	Common colonizer	CEPII
FTAs	FTA in place	DESTA

[16] Dür, Andreas, Leonardo Baccini and Manfred Elsig. 2014. "The Design of International Trade Agreements: Introducing a New Database". Review of International Organizations, 9(3): 353-375.
[17] HS was developed by World Customs Organization.

The variable *export* is the dependent variable in our gravity equation and is measured in US dollars. It covers all trade flows realized among countries, as we do not select any specific origin or destination countries for our regression. To obtain the export values, we simply aggregated the BACI data by adding all the HS6 exports together for each country and year. *GDPexporter* and *GDPimporter* are also measured in US dollars and they are generally expected to have positive effect on trade flow since larger economies tend to trade more. Distance between two countries is measured as a distance between the largest cities of each country. Mayer and Zignago (2011) define variable *distw* as the inter-city distance weighted by the share of the city in the overall country's population. The formula for calculating the weighted distance is:

$$d_{ij} = \left(\sum_{k \in i} \left(\frac{pop_k}{pop_i} \right) \sum_{l \in j} \left(\frac{pop_l}{pop_j} \right) d_{kl}^{\theta} \right)^{\frac{1}{\theta}}, \tag{3.1}$$

where d_{ij} is the weighted distance between country *i* and *j*, pop_k is the population of city *k* located in country *i*, pop_l is the population of city *l* located in country *j*, θ is a parameter measuring the sensitivity of trade flows to bilateral distance d_{kl}. To calculate *distw*, θ is set to 1. We expect the distance to have negative effect on trade flow because of transportation costs.

Variables *contig*, *comlang_off*, *comcol* and *FTAs* are dummy variables, therefore they equal either 1 or 0. Variable *contig* is equal to 1 if *i* and *j* are bordering countries, zero otherwise. Common language variable *comlang_off* is equal to 1 if countries *i* and *j* share an official or primary language. *Comcol* is equal to 1 if the countries have had a common colonizer post 1945. The last variable *FTAs* is equal to 1 if there is a trade agreement between country *i* and *j*, zero if there is no agreement. All of these dummy variables are expected to impact trade flow positively.

4. Methodology

To estimate the effect of the FTA, we use two methods recommended by literature – Fixed Effects and Poisson Pseudo Maximum Likelihood (PPML). Each method is applied to three different versions of the gravity equation.

Or models are defined as follows:

$$\begin{aligned} lnexport_{ijt} = {} & \beta_1 lnGDPexporter_{it} + \beta_2 lnGDPimporter_{jt} \\ & + \beta_3 lndistw_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} \\ & + \beta_6 comcol_{ij} + \beta_7 FTAs_{ijt} + \beta_8 RTAdummy_{ijt} \\ & + \beta_9 Tdummy_t + \beta_{10} Edummy_i + \beta_{11} Idummy_j \\ & + \epsilon_{ijt,} \end{aligned} \tag{4.1}$$

$$\begin{aligned} lnexport_{ijt} = {} & \beta_1 lnGDPexporter_{it} + \beta_2 lnGDPimporter_{jt} \\ & + \beta_3 lndistw_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} \\ & + \beta_6 comcol_{ij} + \beta_7 FTAs_{ijt} + \beta_8 RTAdummy_{ijt} \\ & + \beta_9 Tdummy_t + \beta_{10} CPdummy_{ij} + \epsilon_{ijt,} \end{aligned} \tag{4.2}$$

$$\begin{aligned} lnexport_{ijt} = {} & \beta_1 lnGDPexporter_{it} + \beta_2 lnGDPimporter_{jt} \\ & + \beta_3 lndistw_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} \\ & + \beta_6 comcol_{ij} + \beta_7 FTAs_{ijt} + \beta_8 RTAdummy_{ijt} \\ & + \beta_9 TVdummy_{ijt} + \beta_{10} CPdummy_{ij} + \epsilon_{ijt,} \end{aligned} \tag{4.3}$$

where dependent variable *export* is the trade flow. *GDPexporter* and *GDPimporter* are GDPs of origin country and destination country, respectively, expressed in US dollars, *distw* is weighted distance between the countries. *Contig*, *comlang_off*, *comcol* and *FTAs* are dummy variables. *RTAdummy* is a dummy variable expressing the FTA between EU and South Korea. It was generated so that it takes on value 1 for country pairs involved in the FTA and 0 otherwise. In other words, for the RTAdummy to be in the included in the estimation process, two conditions must be met; first, the country pair consists of South Korea and one of the EU members, and second, the FTA is in force (2011 onwards). The last the variables are sets of dummies and they differ across the equations. They are included two main reasons. Firstly, we suspect heterogeneity in our data caused by differences in country sizes. Secondly, they help us deal with Multilateral Resistance Term which may cause biased results. (Baldwin and

Taglioni 2006) *Tdummy* is a time dummy, *Edummy* and *Idummy* are exporter and importer dummies, *CPdummy* is country-pair dummy and *TVdummy* is time-varying country dummy.

We have reasons to suspect heteroskedasticity in our data and therefore include robust standard errors in all of our estimations.

4.1 Fixed Effects

Using fixed effects is a viable option for us since we are primarily interested in estimating coefficients for time-varying variables (especially the RTAdummy), not time-invariant variables (common language, contiguity, common colony, distance). Time-invariant variables cannot be estimated by FE method due to perfect collinearity and are therefore omitted from the estimation. If the model assumptions are satisfied, FE provides consistent, unbiased and efficient estimates. Another possible way to estimate the gravity equation is using random effects model. Generally speaking, RE is rarely preferred to FE, especially in cases where the time-varying variable is of interest. We performed the Hausman test which compares FE and RE estimations and concluded that, indeed, FE estimation is more suitable for our data, as RE is inconsistent. Cardamone (2007) analysed existing literature on gravity model estimations and finds that the majority of them also use FE over RE.

4.2 Pseudo Poisson Maximum Likelihood

Another method commonly used for gravity model estimation is Poisson Pseudo Maximum Likelihood (PPML). Santos Silva and Tenreyo (2006) recommend using PPML instead of OLS because it can incorporate zero trade flows which are dropped during OLS estimation (as logarithm of zero is non-existent). In the presence of heteroskedasticity in data, OLS is not a robust estimator. When using PPML, gravity equation is estimated in its multiplicative form and the dependent variable (*export*) is not in logarithm and therefore potential zero trade flows are preserved. The equations which describe the specifications can be found in Appendix 2.

5. Trade structure analysis

This chapter examines the changes in bilateral trade between the Czech Republic and South Korea. In the first section, we look at volume and structure of Czech export and how it was affected during the time the FTA came into effect. The second section provides an analysis of trade diversification using the Herfindahl index. Last section focuses on comparative advantage of the Czech-exported commodities to South Korea. We compare two years – 2007, when the FTA negotiations began and the world trade was not yet influenced by the financial crisis, and 2017, which was the latest[18] data available to us from BACI. Since we work with these two years only, we omit the time indices in all equations.

5.1 Volume of export

Figure 5.1.1. shows the evolution of South Korean share of overall Czech export. As we can see, the share surged from 2010 to 2012 and then remained relatively stable with slight fluctuations. This suggest that the trade liberalization led to an immediate reaction of Czech exporters but it was followed by stagnation.

Figure 5.1.1: South Korean share of Czech export

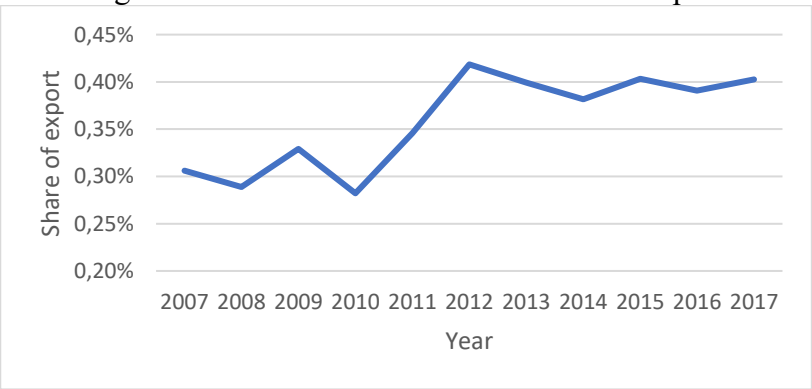


Table 5.1.1. summarizes the Czech export to South Korea for years 2007 and 2017. It was almost double in 2017 and the number of commodities exported was over 50% higher.

[18] At the time of our research, now data for 2018 are also available.

Table 5.1.1: Czech export to South Korea

	2007	2017
Czech export to KR (in millions of $)	346	660
Number of products exported to KR from CZ (on HS6 level)	819	1238

In the top twenty products with highest export for each year, there were 5 that appeared in both years. These products are listed in the Table 5.1.2 below. Export values are expressed in thousands of $ and are rounded to the nearest integer. These top 5 exported commodities made up 27.8% of the overall export in 2007 and 22.3% in 2017. The slight decrease can be explained by the fact that the number of exported products increased significantly, as mentioned above.

Table 5.1.2: Commodities with highest export

Commodity	export 2007	export 2017
Fuel pumps[19]	48023	44789
Engine parts[20]	28952	16345
Microscopes[21] diffraction apparatus	5302	70803
Taps, cocks, valves[22]	11096	7397
Electrical capacitors[23]	3427	8116

As can be seen from the table, the export volume increased for some products, and decreased for others, without an apparent trend. To see if this was also true for the rest of the products, we observed all 618 commodities that were exported in both years. The export size increased for over two thirds of these products, which indicates an upward trend.

[19] lubricating or cooling medium pumps for internal combustion piston engines
[20] parts for internal combustion piston engines (excluding spark-ignition)
[21] excluding optical microscopes
[22] for pipes, boiler shells, tanks, vats or the like, including thermostatically controlled valves
[23] fixed, tantalum

5.2 Trade diversification

Herfindahl-Hirshman index (HHI or simply HI) is a standard measure of market concentration, often used to calculate a firm's market share. However, it has other applications, including the assessment of trade concentration, as suggested by WTO (2012).

Herfindahl index can be expressed as:

$$h^i = \sum_k \left(s_k^i\right)^2, \tag{5.2.1}$$

where *i* represents a given country, *k* represents sectors and s_k^i is the share of sector *k* in country *i*'s export. For easier interpretation we will use the normalized Herfindahl index because its values are strictly within the (0,1) interval. It is calculated as:

$$nh^i = \frac{h^i - \frac{1}{K}}{1 - \frac{1}{K}}, \tag{5.2.2}$$

where h^i is the original Herfindahl index and *K* is the number of products exported.

From the construction of the (normalized) Herfindahl index, it is clear that the lower it is, the higher the diversification of the trade. Diversified trade is often a sign of a developed economy and may be linked to higher GDP. However, the relationship between the HI index and GDP is not linear and can even be non-monotonic. (WTO 2012)

The data we are using for the following trade diversification analysis come from BACI database. The data contain information about the types of products each country exports to other countries, including the volume of export. More description of the data is provided in chapter Data. We use this highly disaggregated data to calculate the Herfindahl indices in the following fashion:

1) HI for concentration by product with aggregated destination countries:

$$HI = \sum_j \left(\frac{country\ i's\ total\ export\ to\ country\ j}{country\ i's\ total\ export}\right)^2. \tag{5.2.3}$$

2) HI for concentration by destinations with aggregated products:

$$HI = \sum_k \left(\frac{country\ i's\ export\ of\ commodity\ k}{country\ i's\ total\ export}\right)^2. \tag{5.2.4}$$

3) HI for concentration by both product and destination countries:

$$HI = \sum_{j,k} \left(\frac{country\ i's\ export\ of\ commodity\ k\ to\ country\ j}{country\ i's\ total\ export} \right)^2 . \qquad (5.2.5)$$

We work mainly with the last-mentioned type of concentration. Our created dataset consists of country-pairs (indexed using the ISO country code), the (normalized) Herfindahl index and the number of products by destination for a given year.

As a first step in our analysis of the impact of the FTA, we analyse whether and how the concentration changed after the agreement came into effect. Based on literature[24], our ex-ante hypothesis is that the trade becomes more diversified in the wake of an FTA. The opposite effect may sometimes be linked to under-developed economies (Osakwe, Santos-Paulino and Dogan 2018) which neither South Korea nor the Czech Republic are. We filtered the data to obtain only the Herfindahl index values for year 2007 and 2017. From this filtered dataset some country-pairs were picked. Of course, this analysis is focused mostly on the Czech Republic and South Korea country-pair but we decided to include other countries and use them as a benchmark to mitigate the possible bias caused by overall changes in the world economy.

The HI decreased for country-pair the Czech Republic and South Korea from both import and export point of view. For the case of the exporter being South Korea, the index went down by roughly 54%, and for the case of the Czech Republic being the exporter, the index went down by 53%. These values suggest that the bilateral trade between South Korea and the Czech Republic became more diversified after the FTA came into effect. It is also apparent that the values of percentage decreases are almost identical which suggests that the changes in mutual trade diversification are somewhat balanced.

However, as mentioned before, we are aware that the effect wasn't necessarily only due to the ratification of the FTA but possibly due to some other factors that influence the world trade and its diversification as a whole. For this reason, we decided to compare the country-pair South Korea and the Czech Republic with South Korea and Israel, South Korea and Portugal, South Korea and Austria, the Czech Republic and Japan.

[24] Volpe Martincus and Gómez (2009)

First country-pair, South Korea and Israel was chosen for multiple reasons. Its population is very close to the population of the Czech Republic and the countries are similar in their economic strength. The GDP per capita in 2017 was $38,020 for the Czech Republic and $38,868 for Israel. Besides mentioned reasons, it was appropriate to also include a country that is outside of the EU and therefore is not a part of the FTA but is not too distant from EU geographically (the difference in distance from South Korea is less than 200km, in favour of Israel). Also, in 2019 Israel signed an FTA with South Korea, therefore we believe that the comparison may be useful for potential impact estimates of this particular agreement. In our opinion, including Israel solves the potential problem of endogeneity (some unobserved issues preventing a country to have an FTA with South Korea). In this case, the Herfindahl index did not decrease on both sides, only the Israeli export to South Korea became more diversified. The index was lower by 65% in 2017 when compared to 2007. On the other hand, the index increased by almost 26% for the South Korean export, meaning that it became more concentrated on certain products.

Second country-pair, South Korea and Portugal was chosen mainly for the similarities in Portuguese and Czech economies. The population is nearly identical and the GDP per capita is also similar enough to justify using Portugal as a benchmark country. Also, Czech export is almost three times the export of Portugal so it might be interesting to see whether the volume of export influences the changes in diversification. Just as in the case of the Czech Republic, the index for South Korea and Portugal country-pair declined on both sides. For the South Korea as the exporter, the index dropped by 74%, and for Portugal as the exporter by 86%. The mutual trade therefore became more diversified and even more significantly than for the Czech Republic.

So far, it would seem that the FTA might be correlated with trade diversification since for both countries involved in the FTA (the Czech Republic and Portugal) the trade became more diversified for both sides, and for the country not involved (Israel), the effect was opposite for one side. Yet, we realize that this is not enough evidence to make such conclusion and thus we add one more country which is a part of the FTA as a benchmark.

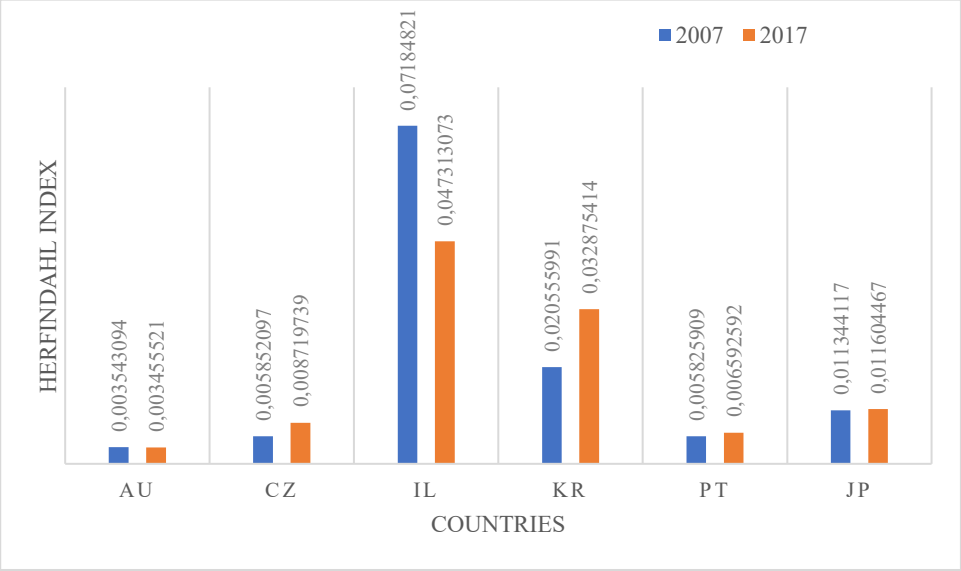
Austria was selected because of its geographical proximity to the Czech Republic, comparable population and also the volume of the export ($164B for Czechia and $149B for Austria in 2017). However, the change was not the same as for the Czech Republic or Portugal, as could have been expected. Even though the index did decrease for South

Korean export (by 56% which is similar to Czechia), it increased with even more significance for Austrian export (by 69%). The Austrian export to South Korea became more concentrated between the years 2007 and 2017.

We believe that it is appropriate to also include one country-pair that would reflect the trade relations between the Czech Republic and other countries to eliminate the possibility that the Czech Republic was simply more successful in overall trade diversification. Japan was chosen for its geographical proximity to South Korea and similarly high nontariff barriers for import. The HI for Czech export to Japan increased by 70%, indicating a more concentrated trade. On the other hand, Japanese export became less concentrated – the HI decreased by 63%.

Next graph is a comparison of Herfindahl indices for all of the above-mentioned countries. However, it is now not focused on the diversification by product for a given country-pair but on the overall export diversification by product for each country. Again, we decided to show values for the same years as before – 2007 and 2017. Herfindahl index values are depicted on the vertical axis and the countries are on the horizontal axis. The blue column represents values for year 2007, the orange column for year 2017.

Figure 5.2.1: Herfindahl indices for chosen countries.



As can be seen in the graph, the Herfindahl indices had a slight upward trend or remained virtually the same for the EU countries. Put differently, the trade in EU countries either became somewhat more concentrated over the decade (the Czech Republic, Portugal) or essentially did not change (Austria). The same can be said about Japanese trade diversification. Conversely, the changes are more prominent for the other two

countries. South Korean export became less diversified, while Israeli export more diversified.

In conclusion, the trade for the country-pair the Czech Republic and South Korea became less concentrated during the aforesaid decade which is not necessarily true for other countries, therefore we cannot conclude that the changes were only due to overall trends in the world trade. We also cannot confidently say that the trade diversification was necessarily positively affected solely by the FTA since Austrian export to South Korea became less diversified. Nevertheless, Czech export to Japan, which is not a part of the EU-South Korea FTA, was significantly more concentrated. As mentioned previously, the bilateral export for country pair South Korea-Czech Republic was more diversified in 2017 than in 2007, contrary to the overall by-product trade diversification for each country individually. In other words, both South Korea and the Czech Republic mutually exported more kinds of products in spite of the fact that globally they both exported "less diversely" in 2017 than in 2007. The Czech Republic exported 50 fewer types of products, South Korea 194 fewer types. Therefore, all of our findings combined suggest that the trade relations regarding trade concentration for this particular country-pair have strengthened with the ratification of the FTA.

5.3 Comparative advantage

To further our trade analysis, we look at comparative advantage. There are multiple possibilities for this type of analysis, such as PRODY index suggested by Hausmann, Hwang and Rodrik (2007) or estimating product's revealed factor intensities (Shirotori, Tumurchudur and Cadot 2010) but perhaps the most widely used is the Revealed comparative advantage (RCA) index and it is also most useful for analysing trade patterns. RCA is considered to be a traditional measure of identifying products with comparative advantage for a given country. This index is commonly referred to as Balassa index, as it was Balassa (1965) who first introduced it. It is linked to Ricardo's classical theory of comparative advantage.

The RCA index is defined as follows:

$$RCA_k^i = \frac{X_k^i / X^i}{X_k / X}, \tag{5.3.1}$$

where X_k^i is the volume of country i's export of product (or sector) k, X^i is the overall export of country i, X_k represents the export of product k worldwide and X the

volume of total world exports. It is said that country *i* has comparative advantage for product *k* if the index is bigger than unity.

The RCA index is sometimes substituted by so-called normalized comparative advantage index – NRCA:

$$NRCA_k^i = \frac{RCA_k^i - 1}{RCA_k^i + 1}. \quad (5.3.2)$$

Unlike the RCA, which doesn't have upper bound, the NRCA is symmetrical and its values are strictly within the (-1,1) interval. Then the country *i* is said to have comparative advantage in sector *k* if the NRCA is above zero.

In our analysis, we focus on products with the highest comparative advantage, therefore we can afford to use the regular form of RCA index, not the normalized one. The values of the NRCA index are extremely close for high comparative advantage and do not reflect the differences clearly. For example, if the RCA is equal to 50, the NRCA is equal to 0.97, and if RCA is equal to 100, the NRCA is 0.98. Therefore, we believe that the comparison would not be telling.

The data that are used for the comparative advantage analysis come from BACI database. For each country pair in a given year, the data contain the volume of export by product. The product here is expressed by its HS6 code. HS stands for Harmonised System and it is a collection of code numbers that define products. The higher the number after the HS, the more detailed the definition of a product. HS6 codes are the most detailed ones for international trade.

Again, we work years 2007 and 2017. Our aim was to see how the trade patterns of Czech exports to Korea changed with the FTA. The initial hypothesis is that the Czech Republic gained comparative advantage in more sectors during this decade.

To calculate the RCA, we did not use the values for the world exports, but the sum of exports for members of OECD[25]. Therefore, as per the formula above: X_k^{CZ} is the export to South Korea from the Czech Republic for product k, X^{CZ} is the total amount of Czech export, X_k is the sum of all exports of product *k* across OECD countries and X is their total export.

The number of products with comparative advantage (their RCA was above 1) is relatively high in both years (378 in 2007 and 561 in 2017), therefore it would be lengthy

[25] Similar approach was used by Widgrén (2005)

and ineffective to analyse them one-by-one. Instead, only interesting or extreme values are highlighted.

Firstly, products whose export were under $1 million were filtered out. Although they may have comparative advantage, it can be only due to their specific nature, not their significance within overall exports, therefore we believe this condition is justified. This action reduced the number of exported products (from the Czech Republic) with comparative advantage to 45 in 2007 and 106 in 2017.

Next, we matched RCAs for both years with the HS6 codes and we obtained 23 products that had comparative advantage in both years. In order to identify products with the highest significance in both years, we filtered all RCA index values that were above average for both years separately. There were 6 such products. The product, or rather sector, with the highest revealed comparative advantage index for both years has HS6 code 860719 and Comtrade defines it as “railway or tramway locomotives or rolling stock; parts, axles and wheels, and parts thereof”. Its export size in thousands of dollars for years 2007 and 2017 was 1462 and 2679, respectively. Other products with very high comparative advantage in both years are glass smallware, drills or microscopes. The RCA index was higher for all of the mentioned commodities in 2017 than in 2007.

Our next step was to look at products that had a great comparative advantage in one year but not the other. In order to avoid misleading results, that might occur due to the fact that the export of a product in a given year was a one-off instance, we first compared exports in 2017 with the preceding year and exports in 2007 with the succeeding year.

In year 2017, the products listed in Table 5.3.1 had the biggest comparative advantage and they met the conditions that were set out – the volume of export in both 2017 and 2016 was higher than $1 million and the comparative advantage in 2016 was significant (greater than 1). All values are rounded to the closest integer.

Table 5.3.1: Commodities with highest RCA in 2017

Commodity	**Czech export to KR (in thousands of $)**	**RCA**
Aluminium alloys with hollow profiles	3075	208
Hair clippers[26]	3434	151
Shavers[27]	33782	123

The same comparison was done for year 2007. In Table 5.3.2 are listed products with highest revealed comparative advantage index and whose export exceeded $1 million in 2007. Again, additional condition was set for year 2008 – the volume of export of $1 million or more and significance of RCA index for a given commodity. The values are rounded to the closest integer.

Table 5.3.2: Commodities with highest RCA in 2007

Commodity	**Czech export to KR (in thousands of $)**	**RCA**
Textile fabrics[28]	1082	95
Ignition or starting equipment	1727	91
Insulated electric conductors	1163	48

In conclusion, from 2007 to 2017, the Czech Republic gained comparative advantage in export to South Korea, as the RCA index was higher than one for significantly more commodities. Also, as we can see from Table 5.3.1 and 5.3.2, both the export and RCA indices have an upward trend.

[26] with a self-contained electric motor
[27] with a self-contained electric motor
[28] impregnated, coated, covered or laminated with polyvinyl chloride

6. Empirical results

As explained in chapter 4, we regress all three of our equations using the Fixed Effects and PPML[29].

6.1 Fixed Effects

The results of fixed effect estimation can be found in Table 6.1[30]. The results in the first column correspond to equation 4.1, second column to equation 4.2 and third to equation 4.3.

Table 6.1: Fixed Effects results (robust standard errors in brackets)

	Dependent variable:		
	ln_export		
	(1)	(2)	(3)
ln_GDPexporter	0.435***	0.509***	
	(0.019)	(0.018)	
ln_GDPimporter	0.672***	0.757***	
	(0.016)	(0.015)	
ln_distw	-1.473***		
	(0.016)		
contig	0.829***		
	(0.081)		
comlang_off	0.666***		
	(0.032)		
comcol	0.744***		
	(0.041)		
RTAdummy	-0.162	0.320**	-0.068
	(0.146)	(0.099)	(0.103)
FTAs	0.247***	-0.029	0.006
	(0.023)	(0.02)	(0.019)
Observations	471,469	471,469	471,469
Adjusted R^2	0.749	0.878	0.890
Note:		*p<0.1; **p<0.05; ***p<0.01	

[29] All estimations were performed in R.
[30] Hlavac, Marek (2014). stargazer: LaTeX/HTML code and ASCII text for well-formatted regression and summary statistics tables. R package version 5.1. http://CRAN.R-project.org/package=stargazer

We did not include the year dummies in the summary since the estimates themselves are not of much importance for our research. As can be seen from the Table 6.1, some explanatory variables were not estimated due to collinearity.

To illustrate the interpretation of the estimates, we use results of the linear fixed effect estimation of the equation 4.2. To interpret the estimates on the variables in logarithm, we use the rule of thumb for log-log model: $\%\Delta y = \beta 1 \%\Delta x$. For example, if exporter's GDP increases by 1%, the trade flow will increase by 0.51%. The coefficients on dummy variables require a different approach, as it is a case of log-level regression, where $\%\Delta y = 100 * (e^{\beta_i} - 1)$. The effect of, for example, FTAs dummy is then calculated as $\%\Delta export = 100 * (e^{-0.029} - 1)$. This suggests than when an FTA is in place (FTAs = 1 for a given country pair), there is a 2.6% decrease in bilateral trade flow (the coefficient is, however, statistically insignificant). As the RTAdummy is essentially a subset of the FTAs dummy, we must add them up before interpreting the RTAdummy. Its effect is then calculated as $\%\Delta export = 100 * (e^{0.320 + (-0.029)} - 1)$, which translates to 33.8% increase in trade. This positive effect is something that could be expected. However, as can be seen from the other regressions results, the RTAdummy coefficients are statistically insignificant. The results of the first regression suggest that while all FTAs do have a statistically significant and positive effect on bilateral trade flow, the EU-South Korea FTA does not stand out with comparison to other agreements. The last regression shows no significant effect of either of these two variables.

6.2 Pseudo Poisson Maximum Likelihood

The results of PPML estimation can be found in Table 6.2[31]. The results in the first column correspond to equation A.1, second column to equation A.2 and third to equation A.3. The interpretation of the coefficients is the same as for the Fixed Effects estimation. As can be seen from Table 6.2, the coefficients on variable FTAs in the first two regressions show significant effect. However, RTAdummy does not have a significant effect on the dependent variable.

[31] Hlavac, Marek (2014). stargazer: LaTeX/HTML code and ASCII text for well-formatted regression and summary statistics tables. R package version 5.1. http://CRAN.R-project.org/package=stargazer

Table 6.2: PPML results (robust standard errors in brackets)

	Dependent variable:		
	ln_export		
	(1)	(2)	(3)
ln_GDPexporter	0.435***	0.605***	
	(0.029)	(0.027)	
ln_GDPimporter	0.672***	0.653***	
	(0.025)	(0.023)	
ln_distw	-1.473***		
	(0.029)		
contig	0.829***		
	(0.064)		
comlang_off	0.666*		
	(0.055)		
comcol	0.744**		
	(0.124)		
RTAdummy	-0.162	0.06	0.055
	(0.156)	(0.074)	(0.073)
FTAs	0.247**	0.049*	-0.003
	(0.04)	(0.024)	(0.024)
Observations	471,469	471,469	471,469
Adjusted R^2	0.749	0.878	0.890
Note:		*p<0.1; **p<0.05; ***p<0.01	

6.3 Discussion of the results

To estimate the effect of the FTA between EU and South Korea, we ran six regressions. Surprisingly, the FTAs dummy (all trade agreements) did not have statistically significant coefficients in all of our regression. However, the statistically significant coefficients all show positive impact which is what we expected. Only in one of the regressions was the coefficient for the RTAdummy (EU-KOR FTA) significant which suggests that the effect of this specific FTA was not statistically significantly different from all of the other trade agreements. Therefore, we conclude that the FTA did not have as clear effect as we initially expected. We provide a possible explanation for this in chapter Conclusion. However, the effect of other explanatory variables is in line with general expectations for gravity model estimation. The coefficients of GDPs

(exporter and importer) are highly statistically significant and positive in all of our estimations. The distance variable was estimated only for two of our regression (due to collinearity), nevertheless it has the expected negative effect on the trade flow. The rest of the variables also show statistically significant effects (in cases they were estimated).

Conclusion

In this thesis we analysed the impact of the Free Trade Agreement between European Union and South Korea. To perform the empirical analysis, we used gravity model which is a standard tool for bilateral trade assessment. We used panel data for over 200 countries and 23 years (1995-2017).

We specified three gravity equations and applied two methods of estimation on them – Fixed Effects and Poisson Pseudo Maximum Likelihood (PPML). To account for potential bias, we added different sets of fixed effects to each equation.

The regression results suggest that the effect of the FTA in question was not significantly different from the effect of all other trade agreements. This finding might appear as quite surprising since the EU-South Korea FTA was depicted as highly comprehensive with ambitions for bilateral trade enhancement. Therefore, based on our findings, we can conclude that the FTA has not yet had a significant impact on export of European countries yet. The effect may still manifest in the future as it is plausible that the trade is still adapting to the FTA. We are also aware that during this period of adaptation, there were some disruptive elements that may have influenced the results. For example, the aftermath of the financial crisis or the fact that the EU has some kinds of trade agreements with most countries and therefore the trade liberalization with South Korea might not be as distinctive.

On the other hand, this finding in line with what we indicated about the trade between the Czech Republic and South Korea in the chapter Background – the percentage increase in Czech export to South Korea was almost exactly the same as for the Czech export to the rest of the world which also suggest minimal impact of the FTA.

However, we also studied the structure of the bilateral trade between the Czech Republic and South Korea. We used Herfindahl index to examine how the export diversification changed after the FTA came into effect. We found that the trade became more diversified relative to most of the other country-pairs examined. Also, the overall export of both the Czech Republic and South Korea became more concentrated. Therefore, since diversified trade is desirable, we can confidently say that the bilateral trade has improved. We also used RCA index to show the changes in comparative advantage for Czech export to South Korea, compared to the rest of OECD countries. Again, we found an improvement, as more commodities gained comparative advantage.

Bibliography

Anderson, James E. 1979. “A Theoretical Foundation for Gravity Equation.” *American Economic Review 69(1)* 106-116.

Anderson, James E., and Eric van Wincoop. 2003. “Gravity with Gravitas: A Solution to the Border Puzzle.” *American Economic Review 93(1)* 170-192.

Baier, Scott L., and Jeffrey H. Bergstrand. 2005. “Do Free Trade Agreements Actually Increase Members' International Trade?” *SSRN Electronic Journal 71(1)* 72-95.

Balassa, Bela. 1965. “Trade liberalisation and ‘revealed’ comparative advantage.” *Machester School 33* 99-123.

Baldwin, Richard, and Daria Taglioni. 2006. *Gravity for Dummies and Dummies for Gravity Equations.* Working Paper No. 12516, National Bureau of Economic Research, Inc.

Bergeijk, Peter A. G. van, and Steven Brakman. 2010. “Introduction.” In *The Gravity Model in International Trade: Advances and Applications*, 1-26. Cambridge University Press.

Bergstrand, Jeffrey H. 1989. “The Generalized Gravity Equation, Monopolistic Competition, and Empirical Evidence.” *Review of Economics and Statistics 71* 143–153.

Bergstrand, Jeffrey H. 1985. “The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence.” *The Review of Economics and Statistics 67(3)* 474-481.

Bergstrand, Jeffrey H. 1990. “The Heckscher-Ohlin-Samuelson Model, The Linder Hypothesis and the Determinants of Bilateral Intra-Industry Trade.” *The Economic Journal 100(403)* 1216-1229.

Bernstein, William J. 2008. *A Splendid Exchange: How Trade Shaped the World.* Atlantic Monthly Press.

Brown, Andrew D. 2003. *Reluctant Partners: A History of Multilateral Trade Cooperation, 1850-2000.* University of Michigan Press.

Cardamone, Paola. 2007. *A survey of the assessments of the effectiveness of Preferential Trade Agreements using gravity models.* Working paper, TRADEAG - Agricultural Trade Agreements.

Carpenter, Theresa. 2009. “A Historical Perspective on Regionalism.” In *Multilateralizing Regionalism: Challenges for the Global Trading System*, by Richard Baldwin and Patrick Low, 13-27. Cambridge University Press.

Cipollina, Maria, and Luca Salvatici. 2010. “Reciprocal Trade Agreements in Gravity Models: A Meta-analysis.” *Review of International Economics 18(1)* (TRADEAG - Agricultural Trade Agreements) 62-80.

Commission of the European Communities. 1994. *Towards a new Asia strategy: communication from the Commission to the Council.* Brussels: Commission.

de Melo, Jaime, and Arvind Panagariya. 1993. *New Dimensions in Regional Integration.* Cambridge University Press.

de Melo, Jaime, Arvind Panagariya, and Dani Rodrik Rodrik. 1993. *The New Regionalism: A Country Perspective.* Policy Research Working Papers.

Deardorff, Alan. 1998. “Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?” In *The Regionalization of the World Economy*, 7-32. University of Chicago Press.

Dür, Andreas, Leonardo Baccini and Manfred Elsig. 2014. “The Design of International Trade Agreements: Introducing a New Database”. *Review of International Organizations, 9(3)*: 353-375.

Eaton, Jonathan, and Samuel Kortum. 2002. “Technology, Geography, and Trade.” *Econometrica 70(5)* 1741-1779.

Embassy of the Republic of Korea to the Kingdom of Belgium and the European Union. 2019. *Korea-EU.* 19 September. Accessed July 10, 2020. http://overseas.mofa.go.kr/be-en/wpge/m_7448/contents.do.

Erixon, Fredrik, and Hosuk Lee-Makiyama . 2010. *Stepping into Asia’s Growth Markets: Dispelling Myths about the EU-Korea Free Trade Agreement.* European Centre for International Political Economy.

European Commission. 2016. “Annual Report on the Implementation of the EU-Korea Free Trade Agreement .” Brussels.

European Commission. 2019. “Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the committee of the regions on implementation of free trade agreements.” Brussels.

—. 2020. *South Korea - Trade - European Commission.* 23 April. Accessed July 12, 2020. https://ec.europa.eu/trade/policy/countries-and-regions/countries/south-korea/.

—. 2010. “South Korea - Trade - European Commission.” *European Commission.* October. Accessed July 12, 2020. http://trade.ec.europa.eu/doclib/docs/2009/october/tradoc_145203.pdf.

European Union. 2001. "Framework Agreement for Trade and Cooperation between the European Community and its Member States, on the one hand, and the Republic of Korea, on the other hand." *Official Journal of the European Communities.*

GATT 1947: "General Agreement on Tariffs and Trade", Oct. 30, 1947, 61 Stat. pt. 5, 55 U.N.T.S. 194

Glickman, David L. 1947. "The British Imperial Preference System." *The Quarterly Journal of Economics 61(3)* (Oxford University Press) 439-470.

Grimson, Matthew. 2014. *Free trade agreements: What is an FTA and what are the benefits?* 7 April. Accessed June 20, 2020. https://www.abc.net.au/news/2014-04-07/free-trade-agreement-explained-bilateral-fta-tpp/5371314.

Gstöhl, Sieglinde. 2016. *'Trade for All' – All for Trade? The EU's New Strategy.* College of Europe Policy Brief.

Hausmann, Ricardo, Jason Hwang, and Dani Rodrik. 2007. "What You Export Matters." *Journal of Economic Growth, Springer 12(1)* 1-25.

Head, Keith, and Thierry Mayer. 2013. *Gravity Equations: Workhorse,Toolkit, and Cookbook.* Working paper, CEPII research center.

Hlavac, Marek. 2014. stargazer: LaTeX/HTML code and ASCII text for well-formatted regression and summary statistics tables. R package version 5.1. http://CRAN.R-project.org/package=stargazer

KEDO. n.d. *About Us: Our History.* Accessed July 11, 2020. http://www.kedo.org/au_history.asp.

Kim, Min-Jung, and Chong-Sup Kim. 2012. "The Effect of Trade Liberalization on Chile's." *Asian Journal of Latin American Studies 25(2)* 115-134.

Kim, Sihong. 2015. "Korea's Strategy towards the EU: From a Strategic Partner to a Privileged Partner." In *ASIAN Countries' Strategies towards the European Union in an Inter-regionalist Context*, by Wai Ting, Michito Tsuruoka and Sihong Kim, 57-81. Taipei: National Taiwan University Press.

Leamer, Edward E., and Robert M. Stern. 1970. *Quantitative international economics.* Allyn and Bacon.

Lee, Ho-Jin. 2010. *Brookings.* 12 October. Accessed July 11, 2020. https://www.brookings.edu/opinions/the-eu-korea-fta-a-boost-to-economic-recovery-and-a-challenge-to-the-u-s/.

Linnemann, H. 1967. "An Econometric Study of International Trade Flows." *The Economic Journal 77* 366-386.

Lopes, T. S., and V. C. Simões. 2017. “Foreign investment in Portugal and knowledge spillovers: From the Methuen Treaty to the 21st century.” *Business History.*

Mayer, Thierry, and Soledad Zignago. 2011. *Notes on CEPII’s Distances Measures: The GeoDist Database.* Working paper, CEPII.

McCallum, John. 1995. “National Borders Matter: Canada-U.S. Regional Trade Patterns.” *American Economic Review 85(3)* 615-623.

Osakwe, Patrick N., Amelia U. Santos-Paulino, and Berna Dogan. 2018. “Trade dependence, liberalization, and exports diversification in developing countries.” *Journal of African Trade 5* 19-34.

Pardo, Ramon Pacheco, Linde Desmaele, and Maximilian Ernst. 2018. *EU-ROK Relations: Putting the Strategic Partnership to Work.* Brussels: KF-Korea Chair.

Pöyhönen, Pentti. 1963. “A Tentative Model for the Volume of Trade between Countries.” *Weltwirtschaftliches Archiv Bd. 90* 93-99.

Rawlinson, H. G. 2001. *Intercourse Between India and the Western World: From the Earliest Times of the Fall of Rome.* New Dehli: Asian Educational Services.

Santos Silva, João, and Silvana Tenreyro. 2006. “The Log of Gravity.” *The Review of Economics and Statistics 88(4)* 641-658.

Savovová, Alice, Antonín Koukolík, Vladimír Beroun, and Šárka Baladová. 2010. “Studie o hospodářském dopadu dohody o volném obchodu mezi EU a Korejskou republikou.” *Ministerstvo průmyslu a obchodu.* July. Accessed July 12, 2020. https://www.mpo.cz/assets/dokumenty/42067/47656/568929/priloha001.pdf.

Shirotori, Miho, Bolormaa Tumurchudur, and Olivier Cadot. 2010. “Revealed Factor Intensity Indices at the Product Level.” *UNCTAD Blue Series Papers 44* (United Nations Conference on Trade and Development).

Tinbergen, Jan. 1962. *Shaping the World Economy: Suggestions for an International Economic Policy.* Twentieth Century Fund.

Velvyslanectví Korejské republiky v České republice. n.d. *Korejsko-české vztahy.* Accessed July 13, 2020. http://overseas.mofa.go.kr/cz-cs/wpge/m_8969/contents.do.

Volpe Martincus, Christian, and Sandra Milena Gómez. 2009. *Trade Policy and Export Diversification: What Should Colombia Expect from the FTA with the United States.* Working paper, Inter-American Development Bank.

Widgrén, Mika. 2005. “Revealed Comparative Advantage in the Internal Market.” *Discussion Papers 989, The Research Institute of the Finnish Economy.*

World Trade Organization. 2011. *The World Trade Report.* World Trade Organization.

WTO. 2012. *A Practical Guide to Trade Policy Analysis.* Geneva/UN, New York: WTO.

List of appendices

Appendices

Appendix 1: EU trade agreements in place

Albania (Western Balkans)	Stabilisation and Association Agreement	In force since 2009
Algeria	Association Agreement	In force since 2005
Andorra	Customs union	In force since 1991
Antigua and Barbuda (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Armenia	Partnership and Cooperation Agreement	In force since 1999, negotiations on modernisation began in March 2019, on hold since April 2019
Azerbaijan	Partnership and Cooperation Agreement	In force since 1999, negotiations on modernisation began in 2017, on hold since 2019
Bahamas (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Barbados (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Belize (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Bosnia and Herzegovina (Western Balkans)	Stabilisation and Association Agreement	In force since 2015
Botswana (SADC)	Economic Partnership Agreement	Provisionally applied since 2016
Cameroon (Central Africa)	Interim Economic Partnership Agreement	Provisionally applied since 2014
Canada	Comprehensive Economic and Trade Agreement (CETA)	Provisionally applied since 2017
Chile	Association Agreement and Additional Protocol	In force since 2003, negotiations on

		modernisation began in 2017, on hold since 2019
Colombia (with Ecuador and Peru)	Trade Agreement	Provisionally applied since 2013
Comoros (ESA)	Interim Economic Partnership Agreement	Provisionally applied since 2019, negotiations on modernisation began in 2019
Costa Rica (Central America)	Association Agreement with a strong trade component	Provisionally applied since 2013
Côte d'Ivoire (West Africa)	Stepping stone Economic Partnership Agreement	Provisionally applied since 2016
Dominica (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Dominican Republic (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Ecuador (with Colombia and Peru)	Trade Agreement	Provisionally applied since 2013
Egypt	Association Agreement	In force since 2004
El Salvador (Central America)	Association Agreement with a strong trade component	Provisionally applied since 2013
Eswatini (SADC)	Economic Partnership Agreement	Provisionally applied since 2016
Faroe Islands	Agreement	In force since 1997
Fiji (Pacific)	Interim Partnership Agreement	Provisionally applied since 2014
Georgia	Association Agreement	In force since 2016
Ghana (West Africa)	Stepping stone Economic Partnership Agreement provisionally applied	Provisionally applied since 2016
Grenada (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Guatemala (Central America)	Association Agreement with a strong trade component	Provisionally applied since 2013

Guyana (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Honduras (Central America)	Association Agreement with a strong trade component	Provisionally applied since 2013
Iceland	Economic Area Agreement	In force since 1994
Israel	Association Agreement	In force since 2000
Iraq	Partnership and Cooperation Agreement	Provisionally applied since 2012
Jamaica (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Japan	Global agreement	In force since 2019
Jordan	Association Agreement	In force since 2002
Kazakhstan	Enhanced Partnership and Cooperation Agreement	Provisionally applied since 2016
Kosovo *	Stabilisation and Association Agreement	In force since 2016
Lebanon	Association Agreement	In force since 2006
Lesotho (SADC)	Economic Partnership Agreement	Provisionally applied since 2016
Liechtenstein	Economic Area Agreement	In force since 1995
Madagascar (ESA)	Economic Partnership Agreement	Provisionally applied since 2012, negotiations on modernisation began in 2019
Mauritius (ESA)	Economic Partnership Agreement	Provisionally applied since 2012, negotiations on modernisation began in 2019
Mexico	Global Agreement	In force since 2000, negotiations on modernisation began in 2016, ‘Agreement in principle’ on the trade part reached in 2018
Moldova	Association Agreement	In force since 2016

Montenegro (Western Balkans)	Stabilisation and Association Agreement	In force since 2010
Morocco	Association Agreement	In force since 2000, negotiations on modernisation began in 2013, on hold since 2014
Mozambique (SADC)	Economic Partnership Agreement	Provisionnaly applied since 2016
Namibia (SADC)	Economic Partnership Agreement	Provisionally applied since 2016
Nicaragua (Central America)	Association Agreement with a strong trade component	Provisionally applied since 2013
North Macedonia (Western Balkans)	Stabilisation and Association Agreement	In force since 2004
Norway	Economic Area Agreement	In force since 1994
Palestinian Authority	Interim Association Agreement	In force since 1997
Papua New Guinea (with Fiji)	Interim Partnership Agreement	Provisionally applied since 2013
Madagascar (ESA)	Economic Partnership Agreement	Provisionally applied since 2009
Peru (with Colombia and Ecuador)	Trade Agreement	Provisionally applied since 2013
Samoa (Pacific)	Economic Partnership Agreement	Provisionally applied since 2018
San Marino	Customs union	In force since 1991
Serbia (Western Balkans)	Stabilisation and Association Agreement	In force since 2013
Seychelles (ESA)	Economic Partnership Agreement	Provisionally applied since 2012, negotiations on modernisation began in 2019
Singapore	Free Trade Agreement	In force since 2019
Solomon Islands (Pacific	Economic Partnership Agreement	Provisionally applied since 2020

South Africa	Economic Partnership Agreement	Provisionally applied since 2016
South Korea	Free Trade Agreement	In force since 2015
St Kitts and Nevis (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
St Lucia (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
St Vincent and the Grenadines (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Suriname (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Switzerland	Agreement	In force since 1973
Trinidad and Tobago (CARIFORUM)	Economic Partnership Agreement	Provisionally applied since 2008
Tunisia	Association Agreement	In force since 1998, negotiations on modernisation began in 2015, on hold since 2019
Turkey	Customs union	In force since 1995
Ukraine	Deep and Comprehensive Free Trade Agreement Association Agreement	Provisionally applied since 2016
Zimbabwe (ESA)	Economic Partnership Agreement	Provisionally applied since 2012, negotiations on modernisation began in 2019

Source: European Commission

Appendix 2: PPML equations

$$E(export_{ijt}) = \exp(\beta_1 lnGDPexporter + \beta_2 lnGDPimporter + \beta_3 lndistw + (\gamma_1^{contig})_{ij} + (\gamma_2^{comlang_{off}})_{ij} + (\gamma_3^{comcol})_{ij} + (\gamma_4^{FTAs})_{ijt} + (\gamma_5^{RTAdummy})_{ijt} + (\gamma_6^{Tdummy})_t + (\gamma_7^{Edummy})_i + (\gamma_8^{Idummy})_j + \epsilon_{ijt}) \quad \text{A.1}$$

$$E(export_{ijt}) = \exp(\beta_1 lnGDPexporter + \beta_2 lnGDPimporter + \beta_3 lndistw + (\gamma_1^{contig})_{ij} + (\gamma_2^{comlang_{off}})_{ij} + (\gamma_3^{comcol})_{ij} + (\gamma_4^{FTAs})_{ijt} + (\gamma_5^{RTAdummy})_{ijt} + (\gamma_6^{Tdummy})_t + (\gamma_7^{CPdummy})_{ij} + \epsilon_{ijt}) \quad \text{A.2}$$

$$E(export_{ijt}) = \exp(\beta_1 lnGDPexporter + \beta_2 lnGDPimporter + \beta_3 lndistw + (\gamma_1^{contig})_{ij} + (\gamma_2^{comlang_{off}})_{ij} + (\gamma_3^{comcol})_{ij} + (\gamma_4^{FTAs})_{ijt} + (\gamma_5^{RTAdummy})_{ijt} + (\gamma_6^{TVdummy})_{ijt} + (\gamma_7^{CPdummy})_{ij} + \epsilon_{ijt}) \quad \text{A.3}$$