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THE TRADE EFFECTS OF THE EU-SOUTH KOREA FREE TRADE AGREEMENT IN THE AUTOMOTIVE INDUSTRY

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The Trade Effects of the EU-South Korea Free Trade Agreement in the Automotive Industry

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Abstract

The EU-South Korea FTA, enforced in 2011, represents a significant case of a trade deal signed between two major developed economies that also belong among the largest car exporters in the world. This paper examines the effects of the EU-South Korea FTA on bilateral automotive industry trade, comparing them to the changes in total bilateral trade. The empirical analysis applies the gravity model framework with its contemporary methodological advancements and estimation techniques. The empirical results show that the trade-enhancing effects of the FTA in the auto trade are substantially higher than in total trade. Additionally, EU bilateral auto exports have increased more than South Korea's exports. The dynamics of the post-FTA trade flows suggest that the removal of the automotive industry's non-tariff barriers have played an important role in trade facilitation, especially for EU exports. The enforcement of the FTA has also been followed by notable changes in the structure of EU auto exports with the share of higher value final goods increasing and input goods decreasing.

JEL Classification: F13, F14, F15, O52, O53

Keywords: trade agreements, gravity equation, auto industry trade, EU, South Korea

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1. INTRODUCTION

Regionalization of international trade has given rise to new global trade patterns. The end of the 20th century was characterized by increasing trade integration between geographically proximate groups of countries through agreements like MERCOSUR and NAFTA. This period also saw an upheaval in North-South intra-industry trade as the producers of advanced economies incorporated low-wage developing countries into their supply-chains (Baldwin and Lopez-Gonzalez 2015). Since the 2000s, the slowdown of multilateral trade liberalization through the World Trade Organization has been accompanied by a new proliferation of free trade agreements (FTAs). Among these agreements are the so-called mega-regionals or mega-bilaterals signed between major geographically-distant industrial countries (Baldwin, 2014). The FTAs pursued by global economic powerhouses like the USA or the EU deserve closer examination merely because their implications can shape the future of international trade. However, many of the recent agreements have been struck between industrialized economies that share a similar export structure and compete in the same sectors. Therefore, it is also necessary to investigate how FTAs between developed countries affect their bilateral intra-industry trade.

The automotive sector represents a classic example of an industry with a typically high level of intra-industry trade. First, most of the major car manufacturers are now part of global value chains where different stages of production take place in several countries. In this case, an input good for a final product, like a bumper produced in Thailand for a car assembled in South Korea, might be subject to tariffs each time it crosses a national border. Moreover, the mass customization process gaining momentum in the automotive industry has led to the heavy specialization of products between first and second-tier suppliers (Brabazon et al. 2010). Secondly, motor vehicles can be differentiated by various unique attributes, which address the specific needs of consumers and further foster intra-industry trade. Yet, every car producer still has to meet the standards posed by the target market. Thereby, both tariff and non-tariff trade barriers constitute a substantial problem for car exporters and the conclusion of a FTA can have substantial effects on bilateral trade flows.

The aim of this paper is to provide an ex-post assessment of the impact of the EU-South Korea FTA on the bilateral trade volumes in the automotive sector. The EU-South Korea FTA entered into force in 2011 and represents a noteworthy case of trade liberalization between two developed economies with large car industries. This agreement is remarkable solely because of the economic sizes of the signatories and the value of their total bilateral trade. More importantly, the FTA went further with the removal of bilateral trade barriers than any other similar deal signed either by the EU or South Korea (European Commission 2011).

During the trade talks, automotive industry trade could have been highlighted as one of the key issues. Several EU member states, as well as South Korea, are among the largest car exporters in the world and the goods from this industry constitute a significant share of their total bilateral trade. The agreement also focused special attention on reducing industry-specific trade barriers and created an additional precondition for boosting trade. In addition to the common practice of lowering tariff rates, the FTA tackled the non-tariff barriers related to non-applicable standards on automotive products that previously hindered bilateral trade.

The eventual signing of the agreement was preceded by several thorough ex-ante evaluations focusing on the potential effects of the FTA. Studies by Guerin et al. (2007) and Francois (2007) concluded that the South Korean automotive sector should benefit the most from the FTA and see its output increase. The widespread understanding that the EU car manufacturers

were set to lose from this deal is illustrated by the European Automobile Manufacturers Association appeal for EU member states not to ratify the agreement in 2009 (EUbusiness 2009). However, a subsequent extensive ex-ante study on the FTA anticipated a 447–481% increase in EU car exports to South Korea and a 50–131% rise in trade flows moving in the opposite direction, while the expected percentage changes in total trade remained much lower (Decreux et al. 2010). In light of the controversies surrounding the deal, there is a need for a conclusive ex-post analysis that verifies the actual results of the EU-South Korea FTA. Moreover, empirical evidence about the trade effects of this agreement can also provide insights about the possible results of other similar FTAs, such as the recently concluded deal between the EU and Canada (CETA) or the proposed EU-Japan agreement.

Prior related ex-post studies have commonly analyzed the trade effects of FTAs by applying the gravity model of trade. The works by Rose (2004), Subramanian and Wei (2007), and Baier and Bergstrand (2007) represent some of the most noteworthy examples of papers that have spurred academic discussion about the results of trade liberalization. The gravity model has also been used for assessing the impact of EU trade policy by Bergstrand et al. (2011) and Montalbano and Nenci (2014). At a sectorial level, several studies have focused on agricultural or food trade (Vollrath et al. 2009, Jean and Bureau 2016, Mujahid and Kalkuhl 2016). However, the impact of FTAs on automotive industry trade has received relatively little attention in recent literature. In this, Peridy and Abedini (2008) as well as Pelletiere and Reinart (2010) represent two relevant studies that focus exclusively on the car industry.

The main advantage of this paper is its comparative approach that simultaneously analyses the impact of trade liberalization on total and automotive industry trade, providing an initial reference point for the changes in the industry's trade flows. The empirical part of the paper applies the gravity equation of trade with its contemporary methodological advancements and estimation techniques. The data originates from the databases of the OECD and CEPII (*Centre d'Études Prospectives et d'Informations Internationales*). The main results show that the EU-South Korea FTA can be associated with substantial and statistically significant increases in bilateral automotive industry trade flows (93%), while the rise in EU exports (163%) was relatively larger than South Korean exports (63%). Supplementary findings about the timing of these trade effects imply that the removal of non-tariff barriers played a notable role in the changes of the trade flows.

The rest of the paper is organized as follows. Section 2 provides relevant information about the contents of the EU-Korea FTA and bilateral trade statistics, Section 3 reviews the methodological aspects of the gravity model of trade and the results of previous literature, Section 4 specifies the applicable gravity model, Section 5 describes the data sources, Section 6 presents the main results followed by a discussion, and Section 7 concludes.

2. BACKGROUND OF THE EU-SOUTH KOREA FTA

Even though some trade agreements have been seen as instruments for reaching various political or national security goals, the economic rationale behind trade liberalization remains straightforward. Signing an FTA can decrease trade costs by removing man-made artificial trade barriers such as tariffs, quotas or subsidies. Additionally, there exists a large variety of non-tariff barriers that relate to product-specific standards imposed by regulators. These kinds of obstacles to trade are often difficult to quantify and leave room for selective interpretation. Policy-makers have widely implemented non-tariff barriers for discreet discrimination against import goods, so the question of tackling the latter has become a hot topic in modern trade

negotiations (Anderson 2013: 327). Therefore, the trade effects of any FTA can vary significantly depending on the nature and scope of a given agreement.

Towards the end of the 20th century, the EU and South Korea directed their main attention on multilateral trade integration in the framework of the WTO (Garcia 2013: 529, Guerin et al. 2007: 55). Following the launch of the organization's Doha Development Round negotiations in 2001, the multilateral talks have failed to make tangible progress. Since then, South Korea has actively pursued a bilateral approach by signing FTAs with Chile, Singapore, EFTA, ASEAN, India, Peru and the USA. The EU followed suit in 2006 when it presented a new trade policy strategy that called for finding new and larger FTA partners that possess market potential (European Commission 2006: 11). Thereafter, the EU has started trade talks with the USA, Japan, India and ASEAN. In 2016, the bloc also finalized negotiations with Canada and the two parties signed a trade agreement named CETA.

The bilateral trade talks between the EU and South Korea began in 2007 and were concluded in 2011 with the signing of a comprehensive FTA that would remove 98.7% of duties in trade value over the course of five years (European Commission 2010: 1). Trade policy liberalization in the automotive industry proved to be one of the key debates in the negotiations. In 2011, the automotive sector formed around 14% of South Korean and 9% of EU bilateral exports, making the goods of this industry one of the largest product groups in total bilateral trade. One set of issues were related to the somewhat different objectives of the two parties. South Korea mainly focused on achieving a quick reduction of tariffs on automotive goods, while the EU prioritized tackling the non-tariff barriers of South Korea's automobile market, which were seen as the main obstacle for European exports (Andreosso-O'Callaghan 2009: 164, Guerin et al. 2007: 138).

Table 1 presents ten WTO HS Sections with the highest shares of total bilateral trade between the EU and South Korea in 2011. Prior to the FTA, food products and textiles were subject to the highest tariffs. As a whole, the initial level of protectionism could have been considered to be higher in South Korea. The remaining columns in Table 1 show the percentage of eliminated tariff lines in 2011 and 2014. In most sections the removal of tariffs was faster in the EU. The average tariff rates in Section 17, incorporating transport equipment, were between 4.9% – 5.8%. Both partners eliminated over 90% of the former tariff lines four years into the agreement and the last tariff lines on transport equipment were lost in 2016 (WTO 2012: 11–13).

More specifically, passenger cars were subject to import tariffs of 10% and 8% in the EU and South Korea, respectively. These tariffs were completely eliminated three or five years after the enforcement of the FTA, depending on the engine capacities of the specific vehicle. The 22% import tariffs on trucks in the EU and 10% in South Korea were also removed within five years. The 3% – 8% tariffs on car parts were eliminated immediately after the enforcement of the FTA (Cooper et al. 2011: 8–9). Therefore, the initial tariff rates in the automotive sector exceeded the averages of several other industries as well as the transport equipment section as a whole.

The final version of the treaty also tackled the non-tariff barriers facing bilateral car exports. The main obstacles originated from the specific South Korean safety and environmental protection standards, which complicated the entrance of European car producers to the Korean market. Many South Korean regulations were not in accordance with common international norms, meaning that in some cases the European car manufacturers would have to adjust

minor technical details like tow hooks, headlamps or tinted rear-windows in order to gain access to the South Korean market (Platzer 2010: 15).

Table 1. The Dynamics of the EU-South Korea Bilateral Tariffs

			South Korea			EU		
		Share of trade (%)	Tariff rate (%)	Removed tariff lines (%)		Tariff rate (%)	Removed tariff lines (%)	
	HS Section	2010	2010	2011	2014	2010	2011	2014
16	Machinery and electrical equipment…	37.3	5.7	91.0	97.8	2.3	97.1	98.8
17	**Vehicles, aircraft, vessels, and transport equipment**	**20.1**	**5.8**	**90.2**	**90.6**	**4.9**	**81.7**	**94.1**
6	Chemicals or allied industries	8.4	7.5	91.3	96.4	4.3	99.3	99.4
15	Base metals and articles of base metal	8.2	4.2	95	98	1.8	99	100
18	Optical, photographic, measuring instruments…	6.9	7.7	87.6	100	3.0	93.8	100
7	Plastics and articles thereof; rubber and articles thereof	4.9	6.7	82.9	93.9	4.6	92	100
5	Mineral products	3.8	3.5	93	97.7	0.8	99.5	100
11	Textiles and textile products	2.5	9.7	99.6	99.4	8.0	99.4	99.5
1	Live animals; animal products	1.2	20.9	22.8	38.2	9.0	69.6	82.9
4	Prepared foodstuffs; beverages; tobacco…	1.1	24.2	25.7	33.1	14.1	90.1	93.4

Source: WTO 2012

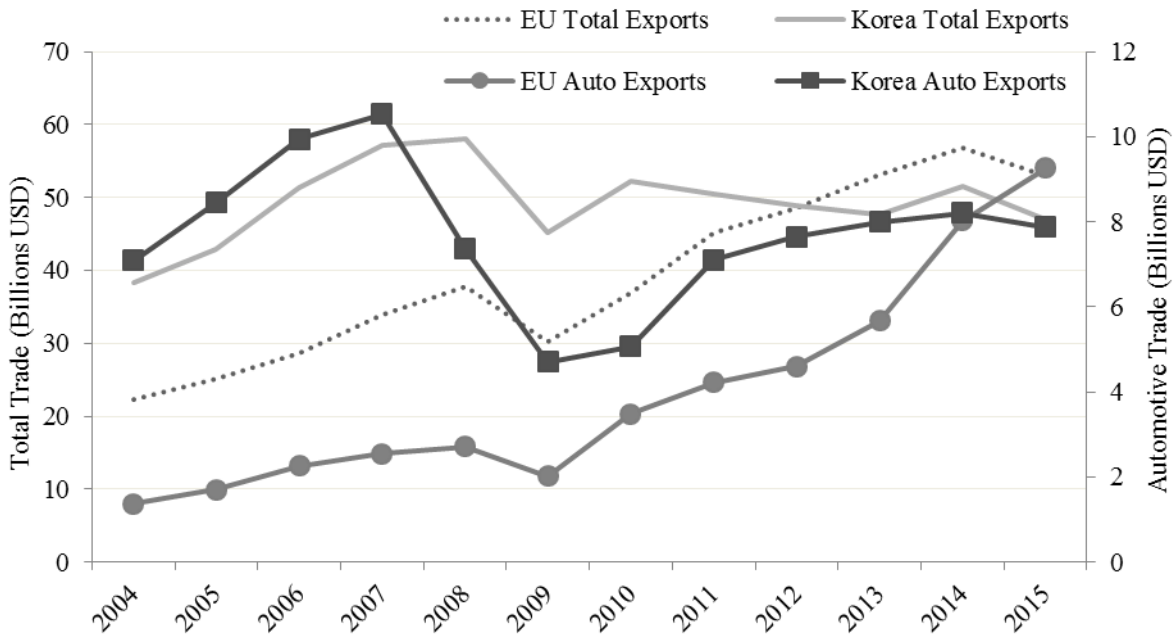
As a result of negotiations, the EU and South Korea managed to advance harmonization in the product standards of the automotive sector. South Korea agreed to recognize the safety rules set forth in the United Nations Economic Commission for Europe and to align several other regulations, including emission norms (Decreux et al. 2010: 91). In short, the regulatory compliance reduced the non-tariff barriers of the automotive sector and facilitated bilateral trade between the EU and South Korea.

Despite the differences in their economic size and the geographical distance separating them, the EU-South Korea trade relationship can be considered remarkable even on a global scale. In 2015, the EU was South Korea's third biggest trade partner, while South Korea ranked eighth for the EU. The trade partnership is even tighter in the automotive industry, where only three countries exported more to the EU than South Korea. Trade flows in the opposite direction have also increased significantly. By 2015, EU goods constituted about 60% of South Korean car imports, making it the sixth most important export market for the European car industry (UN Comtrade 2017).

Figure 1 depicts the dynamics of total and automotive industry trade between the EU and South Korea. In 2009, the rise in total bilateral trade was followed by a sharp decline, which can be related to the global financial crisis. During the following years, the EU's exports rose

steadily until 2014. Meanwhile, South Korea's exports have not reached the pre-crisis level. As a result, the EU recorded its first positive trade balance with South Korea in 2013 – two years after the FTA came into force.

Figure 1. EU and South Korea Bilateral Trade in Total Goods and the Automotive Industry 2004–2015



Note. Auto Trade is represented by the HS 2002 Classification Chapter No 87 "Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof"
Source: UN Comtrade 2017

A similar trend is evident in the trade flows of the automotive sector. In 2004–2007, South Korean bilateral exports exceeded EU exports by more than fourfold. During the crisis, South Korean exports went through an asymmetrically large decline and the subsequent growth in car exports has been faster for the EU. European exports have steadily increased since the FTA came into force, reaching growth rates of 23.4% in 2013 and 41.6% in 2014. Although South Korea reported a 40.1% increase in exports in 2011, subsequent growth has been modest. In 2015, the EU already ran a surplus in automotive industry trade.

3. THE GRAVITY MODEL OF TRADE AND ITS APPLICATIONS

Analyzing the impact of FTAs is not straightforward because the factors affecting trade flows can be complex and evolve over time. Therefore, a simple comparison between the absolute values of trade before and after the signing of an FTA provides little insight into the consequences of a specific agreement. The timing of the trade effects presents another complication. The static effects of trade are directly linked to the one-time changes in foreign commodity prices after a reduction in tariff rates. In the presence of dynamic trade effects, however, the economies of the FTA partners go through a gradual readjustment process toward a more efficient allocation of resources that can lead to a long-run growth in trade

flows and welfare. Therefore, it is important to account for both the short-term and long-term effects of FTAs.

3.1. The Gravity Framework

The empirical analysis of this paper relies on the gravity model of trade, which has become a recognized tool for ex-post trade analysis. The gravity equation first set forth by Jan Tinbergen (1962) relates bilateral trade flows to the partners' economic sizes and distance to one another, but also enables the inclusion of various dummy variables affecting trade costs and volumes. For example, the literature commonly features the geographical, historical and economic policy characteristics of countries (Eicher et al. 2008: 7). Most importantly, plugging in dummies representing specific trade policy instruments like FTAs can be used to investigate the relationship between trade liberalization and trade flows. The gravity model's ability to simultaneously verify and quantify the changes in trade flows occurring due to the enforcement of an FTA makes it the preferred empirical tool for this study.

The theoretical foundation of the originally intuitive gravity model was first supplied by Anderson (1979), who followed the Armington assumption of product differentiation across nations. The premises of the new trade theory, stating that goods can also be differentiated between producers, allowed Helpman (1987) and Bergstrand (1990) to provide the model with novel theoretical underpinnings. Turning back to the roots of trade theory, Deardorff (1998) managed to derive the gravity equation from the Heckscher-Ohlin model, while Eaton and Kortum (2002) proved the model's adaptability using the Ricardian framework. Lastly, it has been shown that the model conforms to the presence of firm heterogeneity brought forward by the "new new trade theory" (Melitz 2003, Chaney 2008). The gravity equation's compliance with all the main trade theories illustrates its universality for describing international trade flows.

A major improvement to the basic form of the gravity equation was proposed by Anderson and van Wincoop (2003), according to whom total bilateral trade costs between two countries should also take into account their trade costs with the rest of the world. The most obvious illustration of this situation would be a country pair isolated from other nations. They insisted that the exclusion of multilateral resistance terms (MRTs) that represent unobservable trade barriers can lead to biased estimates.

3.2. Literature Overview

Due to its versatility, the gravity model has been previously applied to answer a wide variety of research questions. Two thoroughly addressed topics include investigating the total trade effects of joining the WTO or FTAs (e.g. Rose 2004, Subramanian and Wei 2007, Eicher and Henn 2011). However, papers on similar topics often present contradictory results and the impact of FTAs on trade flows remains somewhat ambiguous. In an extensive study by Kohl (2014), only 44 out of 166 examined trade deals turned out to be trade enhancing. Based on a meta-analysis by Head and Mayer (2014) that averages the results of 159 prominent articles, FTAs can be associated with an 80% increase in trade flows, which even exceeds the effect of variables like common language (72%) or contingency (70%). A meta-analysis by Cipollina and Salvatici (2010) finds that the general FTA effect is around 40%. As for specific FTAs, Martinez-Zarzoso et al. (2009) conclude that between 1980–1999, NAFTA had increased intra-bloc trade by 57% and the Central American Common Market (CACM) 69%, while the EU-Mediterranean deals were not statistically significant. Carrere (2006) found that between

1962–1996, a clear trade-enhancing effect could be seen for CACM (103%) and ASEAN (144%), while the impact of NAFTA and MERCOSUR were statistically insignificant.

Another set of explanations for the contrasting results in prior works arises from the uniqueness of each trade liberalization case. Eicher and Henn (2011) and Martinez-Zarzoso (2009) find that the impact of trade integration can depend on the trade partners' level of development. At the same time, a vast amount of literature has concluded that the details of an FTA matter, and deeper deals promote trade more than narrow ones (Baier et al. 2014, Kohl 2014, Wang 2016, Saucier and Arslan 2017). The heterogeneity of FTAs is also evident when comparing trade effects between sectors. For example, Orefice and Rocha (2013) find that agreements entailing deeper integration promote trade in the production networks of capital intensive automotive and ICT industries, while the positive effects in the standardized textile industry remain limited.

The literature also contains a few studies focusing specifically on the results of the EU's trade policy. Bergstrand et al. (2011) investigate the trade effects of the bloc's FTAs signed between 1998–2003. Accordingly, FTAs had increased bilateral exports to Chile (148%), Tunisia (81%), and Morocco (79%), but imports had expanded only from Mexico (92%). Meanwhile, changes in trade flows after signing FTAs with South Africa or Jordan proved to be statistically insignificant. Studies about the results of the EU Neighborhood Policy show substantial positive trade effects with the Eastern Partnership states (Gylfason et al. 2015) while the results remain more modest and mixed with Mediterranean partners (Montalbano and Nenci 2014, Cieslik and Hamejer 2009).

The use of the gravity model at the sectorial level is less common. Agricultural trade represents one topic frequently featured in the literature due to the industry's traditionally high levels of protectionism prior to trade liberalization (e.g. Vollrath et al. 2009, Grant and Lambert 2008, Sun and Reed 2010). However, the high degree of variance in the results illustrates the importance of case-specific factors. Relying on the example of the agricultural sector, Jean and Bureau (2016) show that changes in post-FTA trade flows can significantly differ even between products belonging to the same industry.

Less attention has been turned to the impact of trade integration on automotive industry trade. Peridy and Abedini (2008) find that a 1% increase in the industry's tariffs reduces trade flows 0.1% – 0.3%, but Pelletier and Reinert (2010) do not find a statistically significant relationship between the exports of the EU or the USA and the import tariffs of the destination countries. Möhlmann et al. (2010) conclude that signing an FTA can be associated with a two-fold increase in machinery and transportation equipment trade, which is higher than for other industrial products (70%). Additionally, they find that the trade flows in the machinery and transportation equipment sector are unaffected by the increase in the cultural differences of trade partners. A study by Peridy and Abedini (2008) also reported a statistically insignificant relationship between the language dummy and car trade. Therefore, trade in the automotive industry seems to differ from total trade in that cultural characteristics play a smaller role.

4. MODEL SPECIFICATION

Constructing a trustworthy gravity model for empirical analysis requires accounting for several econometric considerations. Much like the theoretical underpinnings of the gravity framework, the econometric techniques for estimating the model have evolved over time.

Since Tinbergen (1962), the most common solution has been the log-linearisation of the equation, which makes applying the OLS method possible. However, the use of panel data, necessary for providing information about the impact of non-constant variables, raises several problems. In a panel setting, the estimates of the model are biased and inconsistent if the unobservable object-specific effects correlate with exogenous variables. At the same time, heterogeneity between countries is likely due to historical or geographical factors. The causal relationship between trade policy and trade flows represents another issue, as increased bilateral trade might not be the result of a FTA, but rather the incentive for signing one (Kohl 2014). Using the instrument variable approach could offer one solution for this situation, although finding proper instruments has proven to be complicated (Burger et al. 2009).

Baier and Bergstrand (2007) acknowledge the problems associated with the lack of suitable exogenous or instrumental variables, and propose using panel data with country or country-pair fixed effects as one possible solution. This has led to the wide use of fixed effects models that permit accounting for the presence of individual country-specific heterogeneity (Bergstrand, Egger 2013: 554). Moreover, the use of exporter and importer fixed effects can also help to account for the MRTs proposed by Anderson and van Wincoop (2003) (Feenstra 2004). In their simplest form, fixed effects can be accounted for using dummy variables that take the value of 1 whenever a given country acts as an exporter or importer or the trade flow takes place in a certain year.

The basic form of the gravity model applied in this paper is given by:

$$\ln X_{ijt}^{k} = \beta_0 + \beta lnY_{it} + \beta lnY_{jt} + \sum_{m=1}^{M} \delta_m Z_{ij(t)}^{m} + u_{ijt} + \emptyset_i + \emptyset_j + \emptyset_t, \tag{1}$$

$$Z_{ij(t)}^{m} = \ln Distance_{ij} + \delta_2 Landlocked_{ij} + \delta_3 Island_{ij} + \delta_4 Contiguity_{ij} + \delta_5 Language_{ij} + \delta_6 Colonial\ link_{ij} + \delta_7 Currency_{ijt} + \delta_8 FTA_{ijt} + \delta_9 EUKOR_{ijt}, \tag{2}$$

where X^{k}_{ijt} is the value of imports from country j to country i in year t. The superscript k notes the differentiation between the automotive industry and total trade flows. Y_{jt} and Y_{jt} represent the nominal GDPs of country *j* and country *i* in year *t*. Vector $Z_{ij(t)}$ contains various observable indicators that affect trade costs, including bilateral distance ($ln\ Distance_{ij(t)}$) and eight dummy variables (see Table 2). The coefficient δ_9 in front of the EU-South Korea dummy variable is the main focus in the analysis. u_{ijt} is the error term. Lastly, $\emptyset_i$, $\emptyset_j$, and $\emptyset_t$ symbolize importer, exporter and year dummy variables, respectively.

The common practice of evaluating a gravity model using the OLS method also has some shortcomings. First, the OLS does not allow accounting for the zero trade flows often present in trade data since the logarithm of zero is undefined. An artificial exclusion or replacement of missing values can lead to inconsistent estimates. Second, Santos Silva and Tenreyro (2006) show that the OLS also performs inadequately in the presence of heteroskedasticity.

Accordingly, a search for more suitable evaluation techniques has ensued. Gomez-Herrera (2013) offers an overview of some of the most commonly used methods such as Tobit, Heckman, Nonlinear Least Squares, and Gamma Pseudo Maximum Likelihood. However, the widely cited article by Santos, Silva and Tenreyro (2006) claims that the multiplicative form of the gravity equation should be estimated using the Poisson Pseudo Maximum Likelihood (PPML), which provides the most optimal results. In recent literature, PPML has become one of the preferred estimation techniques and has also been applied as the main method in studies

focusing on sectorial data such as in Sun and Reed (2010), Jean and Bureau (2016), and Mujahid and Kalkuhl (2016).

Therefore, an empirical model estimated on the basis of the PPML is specified as:

$$X_{ijt}^{k} = \exp\{\beta_0 + \beta lnY_{it} + \beta lnY_{jt} + \sum_{m=1}^{M} \delta_m Z_{ij(t)}^{m} + u_{ijt} + \emptyset_i + \emptyset_j + \emptyset_t\}, \quad (3)$$

where the variables are the same as in equations (1) and (2), but the bilateral exports as the dependent variable is not logarithmic. Consequently, the current paper applies the classic OLS and the recently recognized PPML estimation methods that incorporate different fixed effects. Two specifications are evaluated with the OLS: the first containing only year dummies and the second including both year and exporter-importer dummies. The model evaluated on the basis of PPML also has both year and country dummies, but is distinguished by the fact that it also takes account of observations with zero trade flows.

Table 2. Description of the Gravity Model's Variables

Variables	Name of Variable	Expected Sign
Dependent Variables		
Value of unidirectional automotive trade flows	Auto trade	
Value of total unidirectional trade flows of goods	Total trade	
Independent Variables		
Nominal value of importer's GDP	Importer GDP	+
Nominal value of exporter's GDP	Exporter GDP	+
Simple distance between exporter-importer	Distance	-
Dummy variables		
Exporter or importer has no maritime border	Landlocked	-
Exporter or importer is an island country	Island	-
Exporter and importer share a land border	Contiguity	+
Exporter and importer share common official language	Language	+
Exporter and importer have belonged under the same central rule	Colonial link	+
Exporter and importer share the same currency	Currency	+
Exporter and importer belong to the same FTA	FTA	+
Trade flows between EU members and South Korea since 2011	EUKOR	?

5. DATA

The empirical analysis is based on data from 36 countries between 2004–2015, making the total number of unique observations 15,120. The observable period begins in 2004, when the largest round of EU enlargement took place, and ends with the latest available trade data available from 2015. The given timeline also provides a sufficient interval before and after the enforcement of the EU-South Korea FTA. Previous empirical results have shown that the

factors affecting trade flows can significantly differ between developed and developing countries (Subramanian and Wei 2007, Eicher and Henn 2011, Martinez-Zarzoso et. al 2009). Considering that both the EU and South Korea are highly developed counterparts, this study only includes data from the OECD member states and the People's Republic of China. At the same time, this sample can alleviate the problem of missing data since the statistics from these countries is readily available. The inclusion of China is necessary because it has become one of the most important participants in global trade. Moreover, China as the economic powerhouse of Asia plays an important role in South Korea's trade.

Unidirectional trade flows reported by the importer are used because gathering tariff revenues has been mentioned as one of the reasons why countries gather accurate import statistics (Baldwin and Taglioni 2007: 803). The bilateral trade statistics originate from the OECD's Structural Analysis Database (OECD 2017b). The division of goods in the database follows the ISIC Rev. 3 (International Standard Industrial Classification of All Economic Activites) industry aggregates. Trade in the automotive industry is defined as all trade flows qualifying under the ISIC Rev. 3 code number 34 for "Motor vehicles, trailers and semi-trailers". In short, this code includes all motor vehicles and vehicle parts used for the transportation of people or goods (UNSTATS 2017). Total trade is defined as the sum of all bilaterally traded goods. While data is available about all the total bilateral trade flows, the automotive industry trade flows have 328 zero observations that form 2.17% of total observations.

The GDP indicators come from the OECD's national accounts database (OECD 2017a). The nominal values of GDP statistics in current prices and US dollars are used. The rest of the data – bilateral distances and dummy variables – originate from the CEPII (2017) database, which is a recognized source for gravity analysis. The simple distances between the most populated city in each country represent bilateral distance. Other variables from the CEPII database are dummies representing various characteristics of the countries or country-pairs that can affect bilateral trade costs and flows. The variable 'colony' indicates a country-pair that once in the past had a colonial link. The variable 'FTA' includes all trade-liberalizing agreements reported to the WTO, irrespective of their substantive scope (Mayer, Zignago 2011: 12).

6. RESULTS AND DISCUSSION

The following empirical analysis is based on estimates received by applying the OLS and PPML methods with different fixed effects. The first OLS model contains year dummies that reflect the time trend. The second, fixed effects OLS model additionally uses exporter and importer dummies. Lastly, the model is evaluated using PPML, which also includes both year and country dummies. Even though the dependent variable is not logarithmic in the PPML model, the interpretation of the coefficients is identical to the models evaluated using OLS.

6.1. Basic Results

Table 3 presents the general empirical results. Coming to the main focus of the study, the estimates show that the EU-South Korea FTA has had clear positive trade-enhancing effects in the automotive sector. According to the first OLS, total bilateral trade increased by 65%, while car industry trade increased more than five-fold. Both of these results are also statistically significant. Meanwhile, the coefficients of the variable 'FTA', marking other trade deals, remain low or statistically insignificant in the first model. These results contradict other models. A stronger positive relationship with trade flows could also be expected since

many sample countries belong to the economically highly integrated EU common market. An obvious explanation for the distinctive results is the inability of the first OLS to account for the MRTs due to the absence of country dummies. Thereby, the following discussion relies on the results of the last two models.

Table 3. Main Results

	OLS		**OLS fixed effects**		**PPML**	
	Auto Trade	Total Trade	Auto Trade	Total Trade	Auto Trade	Total Trade
ln_GDP importer	0.994***	0.909***	1.466***	0.872***	1.132***	0.599***
	(0.013)	(0.006)	(0.099)	(0.047)	(0.105)	(0.053)
ln_GDP exporter	1.486***	0.932***	0.523***	0.332***	0.715***	0.375***
	(0.012)	(0.005)	(0.093)	(0.045)	(0.109)	(0.049)
ln_Distance	-1.414***	-0.859***	-1.176***	-0.938***	-0.381***	-0.501***
	(0.027)	(0.011)	(0.029)	(0.014)	(0.031)	(0.015)
Landlocked	0.363***	-0.168***	-0.057	-0.182***	0.087	-0.103*
	(0.045)	(0.017)	(0.081)	(0.043)	(0.095)	(0.062)
Island	-0.398***	-0.028	-0.770***	-0.457***	-0.524***	-0.374***
	(0.045)	(0.018)	(0.086)	(0.046)	(0.107)	(0.082)
Contiguity	0.558***	0.582***	0.036	0.347***	0.681***	0.544***
	(0.075)	(0.038)	(0.062)	(0.037)	(0.049)	(0.028)
Language	-0.574***	0.189***	0.292***	0.154***	-0.228***	-0.066
	(0.067)	(0.030)	(0.057)	(0.029)	(0.062)	(0.04)
Colonial link	0.007	0.112***	-0.198***	0.268***	-0.652***	0.155***
	(0.091)	(0.041)	(0.068)	(0.038)	(0.066)	(0.033)
Currency	-0.015	-0.082***	0.176***	0.029	-0.123**	0.158***
	(0.051)	(0.019)	(0.045)	(0.021)	(0.05)	(0.03)
FTA	-0.031	0.114***	1.003***	0.644***	1.434***	0.706***
	(0.063)	(0.026)	(0.067)	(0.033)	(0.079)	(0.043)
EUKOR	**1.675*** **	**0.500*** **	**0.343*** **	**0.086**	**0.656*** **	**0.034**
	(0.126)	**(0.059)**	**(0.112)**	**(0.06)**	**(0.127)**	**(0.074)**
Constant	-38.56***	-22.11***	-29.95***	-2.16	-28.84***	1.13
	(0.58)	(0.262)	(3.291)	(2.081)	(4.444)	(2.334)
Observations	14792	15120	14792	15120	15120	15120
Exporter-importer dummies	No	No	Yes	Yes	Yes	Yes
F-statistic	1233	3488	857	1458		
p-value	0.000	0.000	0.000	0.000		
R^2	**0.635**	**0.844**	**0.858**	**0.909**	**0.893**	**0.916**

Notes. Parentheses show robust standard errors. Statistical significance: *p<0.1; **p<0.05; ***p<0.01. All models include year dummies. OLS – ordinary least squares; PPML – Poisson Pseudo-Maximum Likelihood. EU-South Korea FTA enforcement period: 2011–2015.

According to the OLS with fixed effects, enforcement of the EU-South Korea FTA has increased average bilateral automotive trade by 41% ($p<0,01$). In total trade, the increase is only 9% and remains statistically insignificant. The results of the PPML show that the industry's average trade flows have risen by 93% ($p<0,01$), while the 3.5% increase in total trade remains statistically and essentially insignificant. Therefore, the results of both methods present a clear contrast between the changes in the two types of trade flows: the EU South Korea FTA has had a strong positive impact on bilateral automotive trade, but the effects in the absolute value of trade remain modest.

All models, except for the first one, are characterized by a high level of descriptive power with R-squares falling between 0.844 and 0.916. Generally, R-squared is higher in models with total trade as the dependent variable. Thereby, the factors affecting trade in the automotive sector seem to be more complex than in total trade. All the estimates provide expected signs to the coefficients of the main explanatory variables: importer-exporter GDPs and distance, but the results somewhat differ when it comes to dummy variables. Even though the values also vary between estimation techniques, the results received using the fixed effects OLS and PPML are more alike.

The relative magnitudes of GDP elasticities in the models with total trade roughly conform to the averages found in prior empirical findings (Head and Mayer 2014: 160). As a whole, GDP elasticities take higher values in the models of automotive trade. However, both the fixed effects OLS and PPML find that car industry trade flows are more dependent on the importer's GDP. According to PPML, a 1% increase in the GDPs of importers and exporters increases bilateral trade by 1.1% and 0.71%, respectively. The coefficients received using PPML also show that the negative impact of distance is smaller in the car trade, a notion supported by the global scale of automotive industry trade.

In general, the fixed effects OLS and PPML also provide expected signs for the dummy variables. The most noteworthy exceptions appear in the models with automotive industry trade as the dependent variable. Both methods provide negative and statistically significant coefficients for the colonial link variable, while the PPML also shows that the car trade is negatively associated with common language. At the same time, the latter overlaps with the former empirical results stating that cultural or linguistic factors do not affect trade in the automotive sector as much as in total trade (Möhlmann et al. 2010, Peridy and Abedini 2008). Accordingly, these results of PPML confirm that automotive goods are relatively culture-neutral and highlight the importance of trade policy factors.

As previously mentioned, the trade-enhancing effects of other FTAs exceed those of the EU-South Korea agreement according to the OLS with fixed effects and PPML. In addition, both models show that the impact of FTAs is greater in car and smaller in total trade. This finding once again confirms the notion that trade policy liberalization is especially significant in the automotive sector. One explanation for this situation could be that the car industry has typically been subject to a relatively high level of protectionism.

The aforementioned results only tell part of the story as they are based on the sum of bilateral trade flows. Therefore, they do not allow us to make conclusions about the changes in the individual bilateral exports of the EU and South Korea. In Table 4, the former EUKOR dummy is broken in two: South Korean exports to the EU and EU exports to South Korea. Other independent variables are the same as in Table 3 and their coefficients are not presented again. For simplicity, Table 4 only includes the coefficients received by the PPML model, which is the preferred evaluation technique in this study.

The second and third columns of Table 4 provide a direct reference to previous results as they examine the full post-FTA period from 2011 to 2015. Prior empirical literature has noted that the effects of trade policy liberalization can occur after a long interval. In order to examine the short-time trade effect of the EU-South Korea FTA, a model with data only from 2011–2013 is evaluated. In essence, the last two columns of the table show the impact of the FTA on bilateral trade flows between 2011 and 2013 or during the first years of the FTA's entry into force. These short-run effects are not directly comparable with those based on a longer period due to the different number of observations. Nevertheless, this comparison offers insights into the dynamics and timing of the post-FTA trade flows.

Table 4. The effects of the EU-South Korea FTA on Bilateral Exports (PPML)

	EU - Korea FTA: 2011–2015		**EU - Korea FTA: 2011–2013**	
	Auto Trade	Total Trade	Auto Trade	Total Trade
EU exports to South Korea	0.966*** (0.195)	0.310*** (0.098)	0.728*** (0.223)	0.210* (0.118)
South Korean exports to EU	0.487*** (0.140)	-0.179** (0.081)	0.416** (0.165)	-0.190* (0.101)
R^2	0.893	0.916	0.897	0.915
Observations	15120	15120	12600	12600

Notes. Parentheses show robust standard errors. Statistical significance: *p<0.1; **p<0.05; ***p<0.01. Remaining independent variables are the same as in Table 3. All models include exporter-importer and year dummies. PPML – Poisson pseudo-maximum likelihood.

Based on the results in Table 4, it is evident that the 2011–2015 enforcement of the FTA increased exports from the EU to South Korea more than trade flows in the opposite direction. This tendency appears vividly in automotive trade, where the average bilateral exports between the EU and South Korea increased by 163% and 63%, respectively. Both of these results are also statistically significant (p<0,01). The relative changes in the trade flows of the car industry clearly exceed the shifts in total trade. The FTA can be associated with a 36% increase in EU's bilateral exports and a 16% decrease in South Korea's exports.

A similar regularity arises from the coefficients of the model investigating the short-term effects of the FTA based on data from 2011–2013. Comparing the exact point estimates with the previous results is complicated because of the influence of other time-variant factors. However, the overall trends in the trade flows of both partners still follow a similar logic. The biggest increases in South Korean automotive exports occur in the 2011–2013 period, and the growth during the following two years slows down. The initial rise of EU car exports was even larger but so was the subsequent growth in the 2014–2015 period. At the same time, the greatest changes in the total trade flows of both the EU and South Korea took place during the first years after the FTA came into force.

6.2. Discussion

The current empirical findings can be summarized as follows. The EU-South Korea FTA has had a strong positive impact on the bilateral automotive trade of the signatories. According to estimates using the PPML method, the industry's average trade flows increased by 93% between 2011 and 2015, while the agreement does not have any clear effects on the value of

total bilateral trade. This result could be related to the relatively high level of protectionism in the automotive sector both in the EU and South Korea. Since the initial tariffs on automotive goods exceeded the averages in many other industries, the trade-enhancing effects of the removal of tariffs was also greater for the automotive sector.

On the other hand, the former bilateral tariffs between the EU and South Korea were proportional, whereas the changes in bilateral trade flows were not. The notion that the FTA-related growth in exports was greater for the EU is apparent in both total and automotive trade, but it becomes especially clear in the latter. Between 2011 and 2015, the EU's bilateral car exports increased by 163%, while South Korean exports expanded by 63%. A possible reason for this mismatch derives from the pre-FTA non-tariff barriers of the South Korean automotive market that represented a major issue during the trade negotiations. It appears that the agreement's subsections dedicated to the removal of the automotive industry's non-tariff barriers turned out to be effective and trade-enhancing, supporting the EU's trade policy position that it is important to conclude comprehensive FTAs that deal with issues stretching further than tariff barriers.

The timing of changes in the bilateral trade flows is another matter illustrating the positive trade effects of removing non-tariff barriers. During the first three years of the FTA, the automotive exports of both partners increased significantly. A large portion of these changes can be accounted for the one-time effect of lowering bilateral tariffs. During the following two years, however, the growth of EU's exports clearly exceeded the growth in South Korean exports. This tendency is best explained by the removal of non-tariff barriers and their long-term trade-enhancing effects. The former non-tariff barriers of the South Korean market were mainly related to the specific standards imposed on automotive industry's imports. The harmonization of elements regulating safety or environment standards has created a precondition for the sustainable growth of EU exports.

The effects of an FTA can also involve changes in the structure of sectorial trade. Table 5 offers a comparative overview of automotive goods with the biggest share in total industry trade between the EU and South Korea before the conclusion of the FTA and four years after it had come into force. The statistics show that the composition of South Korean exports has remained fairly similar, although the importance of car parts has increased by a small margin. In regard to EU exports, the changes have been more radical with the share of passenger cars increasing by about 19% and the share of car parts decreasing by 14%, which represents a clear shift towards the export of end products.

The proportions of different vehicle types have also been altered. Two product groups containing diesel passenger cars with larger engine capacities now constitute more than a half of total EU automotive exports. Considering that diesel powered cars are relatively expensive compared to petrol vehicles, this tendency indicates another shift towards higher value added exports. Meanwhile, the changes in South Korean passenger car exports remain modest while the share of vehicles with smaller engine capacities has gone up. The rapid growth of higher value final goods in EU automotive exports is an indirect implication of dynamic trade effects and once again demonstrates that the reduction of non-tariff barriers has played a pivotal role in post-FTA trade flows.

The results of the study contradict the ex-ante evaluations by Guerin et al. (2007) and Francois (2007) that considered South Korean automotive goods to be more competitive than EU products. At the same time, the results conform to the thorough ex-ante analysis by Decreux et al. (2010), which predicted that the exports of European cars and trucks would

increase several times more than those of South Korea. The latter study was also the only one that tried to account for the impact of a reduction in non-tariff barriers. This further reinforces the notion of the non-tariff barriers playing an essential role in the changes of trade flows after the EU-South Korea FTA came into force.

Table 5. Share of selected product groups in EU-South Korea bilateral auto industry trade for 2010 and 2015

		Share of South Korea's exports (%)		Share of EU exports (%)	
HS No.	Description of HS Section	2010	2015	2010	2015
8703	Total Passenger Cars	64.01	61.02	63.87	82.93
870332	Diesel 1500cc-2500cc	32.70	29.79	10.79	35.78
870333	Diesel 2500cc-…	3.06	1.63	3.93	19.36
870324	Spark-ignition 3000cc-…	0.23	0.13	22.48	11.59
870323	Spark-ignition 1500cc-3000cc	11.76	7.47	26.44	11.49
870331	Diesel -1500cc	0.76	1.63	0.01	3.67
870322	Spark-ignition 1000cc-1500cc	9.41	13.48	0.21	0.80
870321	Spark-ignition >1000c	6.08	6.94	0	0.05
8708	Passenger Car parts	33.52	37.21	23	9.11
8704	Vehicles for goods transportation	0.61	0.34	5.9	3.89

Source: UN COMTRADE 2017

However, these interim results should not be seen as a win-lose type of situation, as the dynamic effects of trade liberalization may well extend into the future. In the long run, opening up the local market to foreign competition and gaining preferential access to a large, wealthy European market can lead to productivity gains and long-run growth effects in the South Korean auto industry. The increased competitiveness of South Korean car producers can eventually help the South Korean car industry to climb up the value ladder towards segments with higher value added products where the EU currently seems to enjoy a comparative advantage.

The findings can be generalized to some extent to other FTAs signed between economically developed countries. However, it has to be acknowledged that the EU-South Korea trade deal was not a regular tariff-lowering FTA, but a rather extensive agreement containing several specific additional clauses. Besides that, both the EU and South Korea are large car exporters, which does not hold true for all industrial countries. The most adequate comparisons to this case could be the other newer trade deals of the two counterparts (e.g. the FTAs between South Korea and the USA or the EU and Canada), which contained extensive provisions for both the tariff and non-tariff barriers facing bilateral automotive trade.

7. SUMMARY

This paper examined the effects of the EU-South Korea FTA on bilateral trade flows in the automotive sector. The effects of the FTA on auto trade were compared to the changes

occurring in total trade flows. In a broader sense, the study provides an insight into the results of trade liberalization between developed economies.

The empirical results show that during the 2011–2015 period the EU-South Korea FTA can be associated with a substantial increase in bilateral auto trade of up to 93%, while the agreement's impact on total trade remained statistically insignificant. More specifically, the bilateral exports of the EU and South Korea increased 163% and 63%, respectively. At the same time, the EU's total bilateral exports expanded by 36% and South Korea's bilateral exports declined by 16%. These results suggest that the trade-enhancing effects of the FTA were particularly significant for the automotive industry.

These findings are in accordance with the understanding that the pre-FTA bilateral trade barriers in the automotive industry were relatively high compared to many other industries. The additional results indicated that most of the growth in auto trade occurred during the first years following the enforcement of the FTA, which can be best explained by a decline in tariffs, originally nearly symmetrical between both counterparts. However, the following growth of EU exports was not only greater, but also more sustainable over a longer period. Additionally, EU auto exports went through a considerable shift towards higher value added final products, mainly passenger cars, while the South Korean export structure remained relatively invariable. Therefore, the results of the study demonstrate the relevance of non-tariff barriers as trade distorting factors.

The results also assist in anticipating the potential effects of trade liberalization between major industrial countries. It is more appropriate to generalize the results to similar FTAs with a broad scope that entail a substantial reduction in non-tariff barriers facing trade in the automotive industry. The recently concluded FTAs between the EU and Canada or the currently negotiated EU-Japan deal could be highlighted as one relevant example. In the future, the effects of the EU–South Korea FTA could also be investigated based on data from other industries, which would provide a valuable comparison. Moreover, newer trade data can provide more information about the dynamic effects of trade integration. The results could also be compared to the consequences of the FTA between South Korea and the USA, which came into force in 2012.

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KOKKUVÕTE

Euroopa Liidu ja Lõuna-Korea vabakaubanduslepingu seos autotööstuse kaubandusega

Artikli eemärgiks on välja selgitada, milline on 2011. aastal jõustunud Euroopa Liidu (EL) ja Korea Vabariigi (edaspidi Lõuna-Korea) vabakaubanduslepingu (VKL) seos kahepoolsete autotööstuse toodete kaubandusmahtudega. Antud VKL-i juures väärib autotööstuse kaubandus erilist tähelepanu, sest mõlemad osapooled kuuluvad maailma suurimate autode eksportijate hulka ning antud tööstuse tooted moodustavad märkimisväärse osa partnerite kogu kahepoolsest kaubandusest.

Lisaks pöörati lepingus autotööstuse toodete kaupadele kehtivate kaubandustõkete eemaldamisele eraldi tähelepanu. Lepinguga kaotatavad EL ja Lõuna-Korea järk-järgult kõik üksteise autotööstuse kaupadele kehtinud tollitariifid, mis ületasid varasemalt enamike teiste tööstusharude omasid. Kui lepinguosaliste tariifsed barjäärid olid algselt sarnased, siis Lõuna-Korea turu mittetariifseid barjääre võis pidada oluliselt kõrgemaks. Näiteks kehtisid sõiduautodele spetsiifilised turvalisus- ja keskkonnasäästlikkuse nõuded, mis takistasid importtoodete turule sisenemist. Kuna lepingujärgselt toimus autotööstuse toodete standardite ühtlustamine, langesid ühtlasi ka mittetariifsed barjäärid.

Töö empiiriline analüüs tugineb kaubanduse gravitatsioonimudelil, mis võimaldab eristada erinevate kaubanduspoliitiliste tegurite, sh vabakaubanduslepingute, seost kaubandusmahtudega. Erinevate spetsifikatsioonidega gravitatsioonimudelite hindamine viiakse läbi nii kogu kui autotööstuse toodete kaubanduse lõikes, võimaldades kahe kaubandusvoo osas toimunud muutuste kõrvutamist. Valimisse kuuluvad OECD liikmesriigid ja Hiina Rahvavabariik ning vaatlusalune periood hõlmab aastaid 2004–2015. Andmed kaubandusmahtude kohta pärinevad Majanduskoostöö ja Arengu Organisatsiooni (OECD) andmebaasidest.

Tulemuste esitamisel eelistatud *PPML* (*Poisson pseudo-maximum likelihood*) hindamismeetodi kohaselt tõstis VKL-i jõustumine bilateraalset autotööstuse kaubandust keskmiselt 93%. Vaatlusaluse lepingu ja kogu toodete kaubanduse vahel statistiliselt olulist seost ei leitud. Sellised järeldused on kooskõlas arusaamaga, mille kohaselt olid lepingueelsed autotööstuse kaupadele kehtinud kaubandustõkked enamike teiste tööstusharude omadest ulatuslikumad.

Lepinguosaliste lõikes suurenes EL-i autotööstuse toodete eksport Lõuna-Koreasse keskmiselt 163% ning Korea eksport EL-i 63%. Toodete kaubanduses tervikuna võis täheldada EL-i ekspordi 36% tõusu ning Korea ekspordi 16% langust. Täiendavad tulemused viitasid sellele, et suur osa mõlema partneri autotööstuse toodete ekspordi kasvust toimus esimestel aastatel pärast lepingu jõustumist, mida saab seostada tollitariifide languse mõjuga.

Erinevalt Lõuna-Koreast jätkus EL-i ekspordi kiire tõus ka pikema perioodi vältel. Peale selle toimusid EL-i autotööstuse toodete ekspordistruktuuris märgatav nihe kõrgema lisandväärtusega lõpptoodete ehk suurema mootorimahuga diiselautode suunas, samas kui muutused Lõuna-Korea ekspordistruktuuris olid oluliselt väiksemad. EL-i bilateraalse ekspordi muutuste taga saab näha mittetariifsete kaubandustõkete kaotamise mõju. Seega demonstreerivad töö tulemused ühtlasi mittetariifsete barjääride kui rahvusvahelist kaubandust piiravate tegurite olulisust.

Lisaks annavad analüüsi tulemused aimu teiste arenenud riikide vahel sõlmitavate VKL-de potentsiaalsete tagajärgede kohta, abistades ühtlasi kaubanduspoliitika kujundamise protsessi. Tulemusi on kohasem üldistada sarnastele ulatusliku sisuga lepingutele, millega kaasneb autotööstuse toodete kaubanduse mittetariifsete barjääride langus. Siinkohal saab näiteks tuua EL-i ja Kanada VKL-i, mille läbirääkimised lõppesid hiljuti. Peale selle võiks tulemusi kõrvutada Lõuna-Korea ja USA 2012. aastal jõustunud VKL-i omadega.