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RESEARCH ARTICLE

The Effects of Dispute Settlement Body of The World Trade Organization on International Trade[1]

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Abstract

This study examines the effects of the Dispute Settlement Body (DSB), a sub-unit of the World Trade Organization (WTO) that acts as a global umbrella in economic integrations, on both world trade and the foreign trade of some selected countries. This study introduces a new explanatory variable (DISPUTE) in the literature by analyzing the data from the use of the DSB by the WTO's member countries from 1995 to 2018. This variable was modeled using the gravity model and the Poisson Pseudo Maximum Likelihood estimator (PPML). As a result of analysis, the DSB positively affects world trade, that is, the WTO contributes to the increasing world trade. The use of this mechanism by the trade partners of the selected countries affects these countries' exports and imports in different ways. As another important result, contrary to expectations, the use of this mechanism by the trade partners of developed economies, which have been accused of lobbying in the WTO, does not affect the foreign trade of developed economies positively.

Keywords: *Dispute Settlement Body, Gravity Model, WTO*

Jel Codes: *F13, F42, J51.*

Dünya Ticaret Örgütü'nün Anlaşmazlıkların Halli Mekanizmasının Uluslararası Ticarete Etkileri

Özet

Bu çalışma ekonomik entegrasyonlarda küresel çatı görevi üstlenen Dünya Ticaret Örgütü'nün alt birimi olan Anlaşmazlıkların Halli Organı Mekanizmasının, dünya ve seçilmiş bazı ülkelerin dış ticaretleri üzerindeki etkisini araştırmaktadır. Anlaşmazlıkların Halli Mekanizmasının, Dünya Ticaret Örgütü'ne üye ülkelerce 1995 – 2018 yılları arasında kullanılmasından elde edilen veriler yarımıyla literatüre bu çalışma ile kazandırılan yeni bir açıklayıcı değişken (DISPUTE) oluşturulmuştur. Söz konusu değişken, Çekim Modeli ve Pseudo Poisson Maximum Likehood tahmincisi kullanılarak modellenmiştir. Elde edilen bulgular; Anlaşmazlıkların Halli Mekanizmasının dünya ticaretini pozitif etkilediğini, yani Dünya Ticaret Örgütü'nün dünya ticaretini artırmaya katkı sağladığını göstermektedir. Ayrıca bu çalışmada söz konusu mekanizmanın, seçili bazı ülkelerin ve dünyanın dış ticaretine olan etkileri de araştırılmıştır. Bu kapsamda; seçilen ülkelerin ticari partnerlerinin söz konusu mekanizmayı kullanılmalarının, bu ülkelerin ihracat ve ithalatlarını farklı yönlerde etkilediği tespit edilmiştir. Yapılan araştırmada öne çıkan bir diğer önemli husus da Dünya Ticaret Örgütü nezdinde lobicilikle suçlanan gelişmiş ekonomilerin, partnerlerinin söz konusu mekanizmayı kullanıyor olmalarının, beklentinin aksine, genel anlamda gelişmiş ekonomilerin dış ticaretlerini olumlu yönde etkilememiş olmasıdır.

Anahtar kelimeler: *Anlaşmazlıkların Halli Mekanizması, Çekim Modeli, DTÖ*

Jel Kodu: *F13, F42, J51.*

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1. INTRODUCTION

Since its establishment, the basic principle of the World Trade Organization (WTO) has been to provide countries with a fair, equitable, and perfectly competitive (lack of monopolization) trade climate by eliminating all trade barriers and unfair competition between countries (Matsushita et al., 2004). The WTO acts as a ruler, observer, arbitrator, and sanction practitioner by providing ideal international trade conditions and operating the necessary mechanisms to achieve its objective (WTO, 2015). With their WTO membership, countries are considered to have accepted the rules of the multilateral trade system established by the WTO in accordance with its purpose in retrospective (WTO, 2020). The WTO aims to increase world trade and welfare and eliminate all trade barriers (WTO, 2011).

Despite the expectation that being a member of the WTO will positively affect a country's foreign trade, international economists have not reached a definite consensus on this issue, so the discussion is still ongoing. The discussion started with the findings of Subramanian and Wei (2007) about the effect of the WTO on world trade, which were contrary to those of Rose (2004). Rose (2004) found that the expansion of the Generalized System of Preferences (GSP), which were selected by importers and offered to exporters, was effective in increasing global foreign trade, but GATT[1]/WTO membership did not have a similar effect. Contrary to this view, Subramanian and Wei (2007) provided evidence that GATT/WTO membership had positive but unequal effects across countries and sectors. In another recent study, Limao (2016) showed that WTO membership had a broad and positive impact on former members. Reich (2017) stated that the WTO's dispute resolution system, although seen as the "Jewel of the Crown", could not work effectively due to the density of applications. Kim and Hoffman (2017) stated that the WTO's conflict resolution process is not generally effective in recovering lost trade between countries, and trade flows continue to decline even if the disputes between countries are resolved in the legal field. In addition, they stated that the protectionist attitudes and powers of the interlocutor countries are decisive in the disputed issues, and that even though the trade wars of these states seem to have been resolved within the WTO, the trade disputes continue permanently over invisible obstacles. Palacioglu (2018) stated that the USA and China have reduced the effectiveness of the WTO with their attitudes and their aggressive policies prioritizing their own interests in foreign trade. Petersmann (2018) stated that, -the USA - China trade wars risk undermining the world trade system and constitutional democracies. Adekola (2019) examined the USA-China trade war and its consequences for the maintenance of the multilateral trade system, he stated that these two rival countries disregard the WTO as an arbitrator in trade disputes and try to solve their problems in their own way, however, he stated that this had harmful effects on world trade with mutual tariff increases and quotas. Hirsh (2019) stated that the WTO's Appeal Body was unable to fulfill its real responsibilities due to excessive applications from member states. He also stated that in order to increase the effectiveness of the DSB, it is necessary to force the decision on appeals within 90 days, not to bring matters that do not fall within the scope of the DSB's duties and responsibilities to this board, and to empower the DSB to expand or narrow the scope of the agreement provisions or to fill the gaps in the agreements. Hart and Murrill (2021) stated that the Appeals Body, which works within the WTO in order to find solutions to conflict problems, also failed to show the expected performance. Deng (2021) stated that the ongoing currency war between China and the USA since the 2010s turned into a trade war in 2018 and the WTO could not produce an effective solution in this process. Vurdu (2022), in his study in which he stated that the WTO did not resolve the disputes between countries in a short time and therefore could not fulfill its task of promoting global trade, stated that the currently clogged Dispute Settlement Mechanism is

[1] This structure, which was called General Agreement on Tariffs and Trade (GATT) until 1995, was renamed World Trade Organization (WTO) in 1995.

the most urgent issue that needs to be reformed. It can be deduced from the current literature that the debates on the effects of multilateral trade negotiations performed under the auspices of GATT/WTO on international foreign trade are not over yet. Empirical studies about how the WTO affects world trade and countries are still ongoing (Chemutai & Escaith, 2017; Bernier & Schlandt, 2018; Bekkers & Teh, 2019). Although these discussions are supported by different methodological studies, various models, and advances in databases, they require more empirical research (Pyne & Roy, 2018).

This study examines the effects of the Dispute Settlement Body (DSB), whose sanction and arbitration mechanisms are operated by the WTO, on foreign trade in some selected countries and across the world. Rule violations in foreign trade are resolved by the DSB. This research is a novel study to empirically investigate how this frequently operated mechanism of the WTO affects global trade. In the present study, the effects of the sanctions imposed by the DSB on both some selected countries and throughout the world are revealed. In this respect, this study differs from those in the literature and examines the effects of the WTO on global trade from a different perspective. A new explanatory variable (DISPUTE), which is obtained from the DSB, is introduced in the second section of this study. The third section explains the methodology used in the data modeling. In the fourth section, a robustness test is performed using the estimation results, and the results of the study are discussed in the concluding remarks.

2. DISPUTE SETTLEMENT BODY MECHANISM AND DISPUTE EXPLANATORY VARIABLE

In the literature, there is no explanatory variable for international trade law. So, a search has been undertaken in this regard. In this research, it has been observed that companies and financial institutions apply to the International Chamber of Commerce (ICC) to seek legal remedies on international trade disputes, whereas countries apply to the DSB. This study analyzes the effects of countries' right-seeking applications to the DSB on foreign trade.

2.1 Mechanism of Dispute Settlement Body

The liberalization of trade between the member countries through several policies, such as avoiding unfair competition, dumped exports, and monopolies as well as promoting export incentives and protectionism, and barriers to foreign trade in countries were extensively discussed in the Uruguay Round from 1986 to 1993. These regulations have been put into practice under the scope of the Final Act as WTO rules, which were accepted in retrospect by countries with WTO membership. As stated in Article 3.3 of the Understanding on Rules and Procedures Governing the Settlement of Disputes (URPGSD), which is among the sub-agreements reached by the WTO in the Uruguay Rounds, if a WTO member considers that any benefits accruing to it directly or indirectly under the covered agreements are being impaired by measures taken by another member, it shall apply to the WTO to resolve the issue.

According to the URPGSD regulations, the WTO's member states can apply to the DSB as a "complaining country," claiming that the economic and commercial policies of other members have a narrowing effect on their foreign trade or economy or are contrary to one of the WTO agreements. Like the arguments of a complaining country, other members that believe that their interests are negatively affected by the policies of the "responding country" can be included in the process as a "third country". The WTO assumes that a breach of its agreements has an adverse effect on its members. It is the responsibility of the responding country to prove otherwise. The URPGSD grouped the DSB process into four steps—negotiation, mediation in good faith, panel, and appeal (Akman & Yaman, 2008).

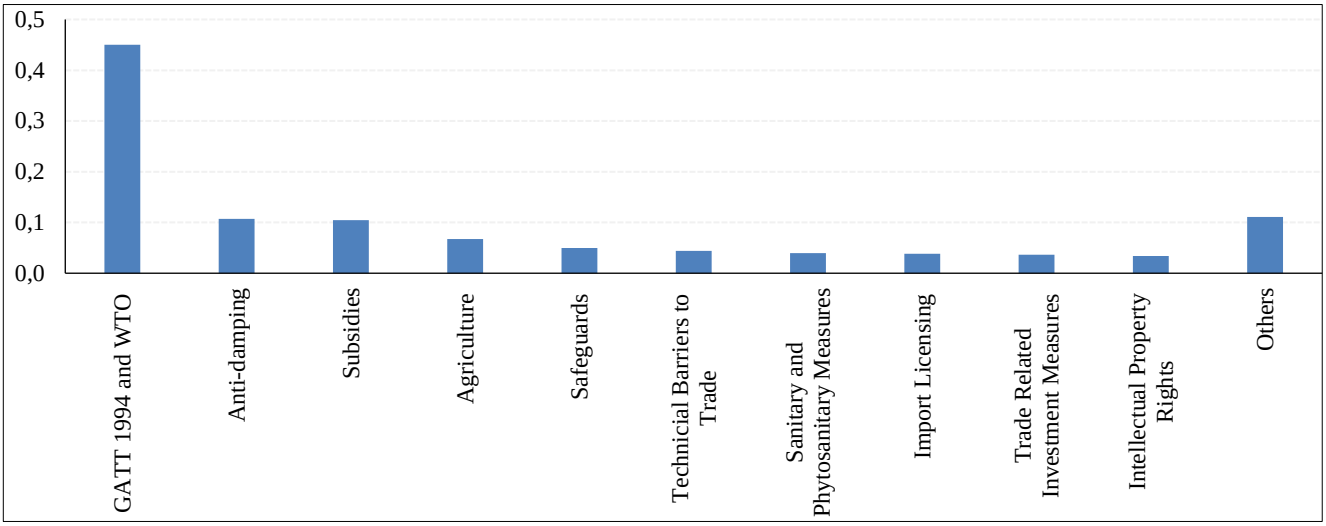
If the consultations between the parties and the good offices, reconciliation or mediation efforts of the WTO, acting in an ex officio capacity, fail to settle a dispute, the process is continued with a "panel" as stated in Article[1] 4.7. The delegation to arbitrate the panel comprises the arbitration committee appointed by the WTO secretariat, the representatives of the complaining and responding countries, and the experts appointed by the WTO based on the nature of the dispute. As stated on the official website of the WTO about the DSB, a total of 120 dispute applications were made during the GATT (pre-WTO) period (from 1948 to 1994) and 574 during the WTO period (from 1995 to 2018), suggesting that WTO member countries are using this mechanism effectively. Undoubtedly, the fact that the dynamic panel processes underlying the motivation to operate this mechanism by the members are scheduled as specified in Article 8 and that other members adversely affected by the dispute can be included in the panel as a third country highlight the sanction power of panel decisions. The ability of third countries to participate in panels increases the transparency of cases and adversely affects the lobbying activities of strong economies. Finally, in Article 17, the parties have the right to appeal the decisions of the panel. Ultimately, if the decisions of the panel or appeal are not followed, the parties can agree on a compensation. If the compensation becomes disputed between the parties, with the consent of the DSB, the winning party may suspend the concessions and obligations arising from the WTO agreements (Article 22).

As an alternative solution to the disputes of the member states, an arbitration mechanism has also been established under the umbrella of the DSB (Article 25), but the members mostly prefer the panel process. In addition, the scope of the panel process can be expanded by allowing other members to participate in the panel process as a “third party”. As Busch and Reinhardt (2004) stated, countries involved in the panel proceedings as third parties may be on the side of the complaining or responding country, depending on their interests in the dispute. In addition, empirical results from their study indicate that the participation of third parties does not have a significant impact on the panel’s decisions. In the present study, an explanatory variable, DISPUTE, is created, and estimations are made using the data obtained from the DSB’s panel process since it provides more data and allows more countries to be included in the process.

The WTO data indicate that the disputes in commodity trade, which is the subject of this study, are mostly about food products, iron-steel, transportation vehicles, clothing/accessories, chemicals, wood products, energy, cigarettes and tobacco products, electronics, services and agricultural products, livestock equipment, and building materials. Figure 1 summarizes the proportional distribution of the DSB panel applications of the WTO members based on the 1995 to 2018 WTO data.

[1] The Articles in this section are the international names given to the guidelines containing the rules published by the WTO to regulate world trade.

Fig. 1 Proportional Distribution of Complaints from 1995 to 2018



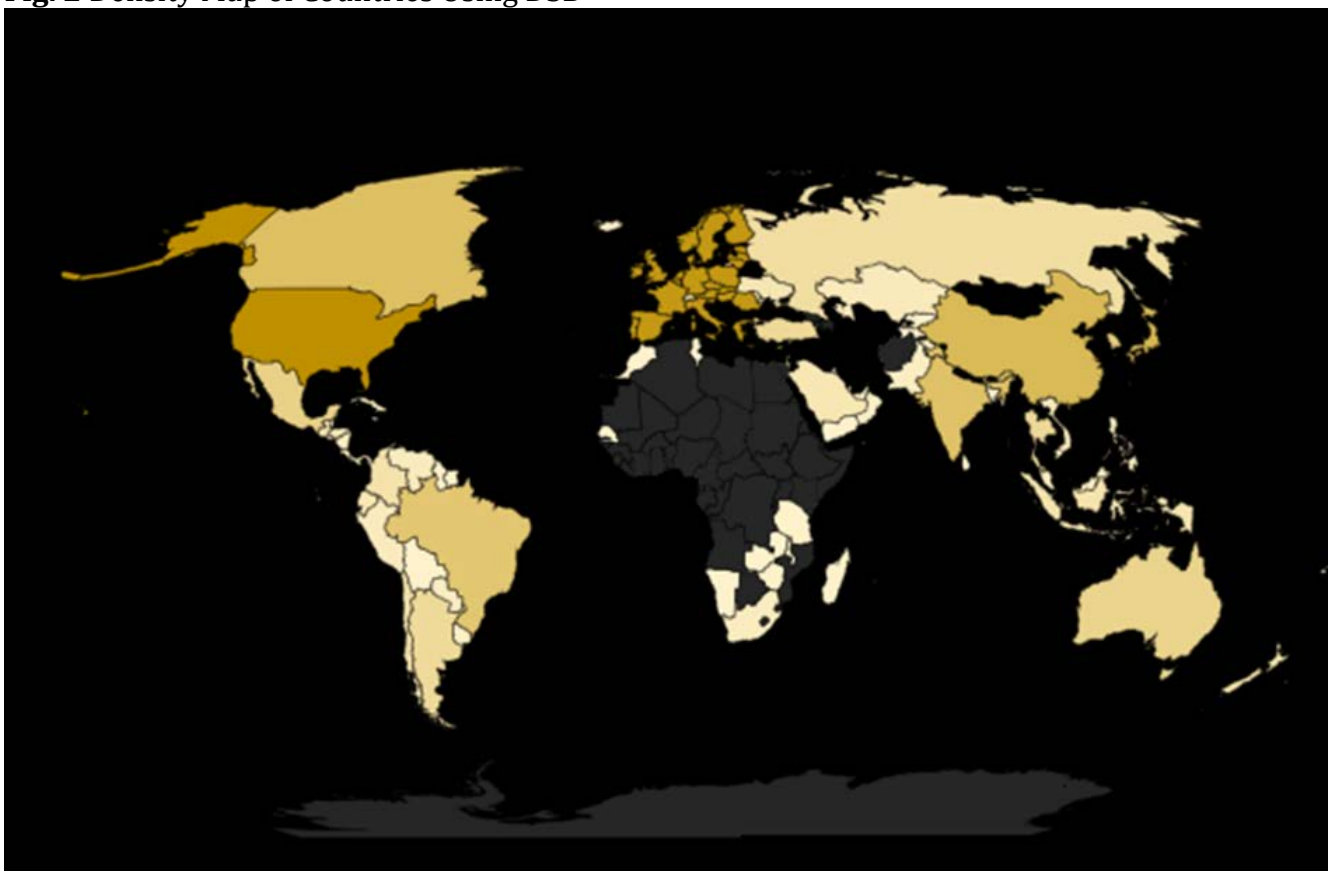
Source: Created by the author using WTO (2020) data.

The complaints of the member states are mostly (45%) about the violations of GATT 1994 and WTO agreements, followed by disputes about anti-dumping, subsidies, agriculture, protection measures, technical barriers, sanitary and phytosanitary measures, import licensing measures, trade investment measures, intellectual property, and other subjects, including rules of origin, preloading surveillance, and customs valuation. The "others", located on the far right of the figure, are specified in Appendix 1.

2.2 Participation in the Dispute Settlement Body by Numbers

As stated in the previous section, members can join the WTO panels as complainants, complainees, and third parties. Out of the 164 members of the WTO, 109 countries have used the DSB as a complainant, complainee, or third party, resulting in a total of 3,945 cases. This study scanned the number of cases obtained from the panel processes in the WTO records and used these data to show the frequencies of countries using the DSB through a world density map depicted in Figure 2.

Fig. 2 Density Map of Countries Using DSB



Source: Created by the author using the WTO (2020) database

On the density map, seas and countries that have never used the Dispute Settlement Mechanism are shown in black, and countries that have used the mechanism are depicted in light yellow to dark yellow in proportion to their usage intensity. As depicted in the figure, the top 10 countries that use this mechanism are the USA (423 cases), the EU (383 cases), Japan (253 cases), the People's Republic of China (244 cases), Canada (218 cases), India (208 cases), Brazil (188 cases), South Korea (165 cases), Australia (132 cases), Mexico (143 cases), and Taipei (128 cases). The mechanism is used most effectively by the USA and European Union (EU) countries. As shown in the DSB data, although like the USA and the EU, China also uses the mechanism very often, it is not at the top of the list because it did not join the WTO early—it joined it at the end of 2001. With the entry of China into the WTO, the economic growth of both this country and the world has accelerated (Simsek, 2005). However, this membership has brought with it an increase in trade disputes to which China is a party (Simayi, 2014). Choukroune (2012) stated that one of every two dispute applications made to the WTO related to China. China has been involved in 65 disputes involving 9 economies since its WTO entry in 2001 until 2019. China has been a complainant 21 times and a defendant 44 times (CSIS, 2020).

2.3 Variable of Participation in the DSB: DISPUTE

By creating an explanatory variable that considers panel processes in the gravity model, this study empirically demonstrates how the DSB affects world trade and the foreign trade of some selected countries, which is a novel contribution to the literature and introduces an independent variable to the gravity model.

In this study, the DSB, which was created by the WTO to increase international trade volume by ensuring reliable and predictable international trade, has been examined holistically. This study

investigates whether the countries' participation in DSB panel processes is for negative or positive reasons or how their involvement in the DSB affects world trade and the foreign trade of some selected countries. Therefore, instead of investigating the effects of being a complaining or responding country or a third party in both country and world trade, this study adopts a holistic approach to the entire system and reveals its institutional effects[1]. The specific issues mentioned above are considered the subject of another study.

The DISPUTE variable was created to determine the extent to which each country (84 countries[2]) used the DSB in a given year. This variable ranges from 0 to 0.24, depending on how often the countries use the DSB. Compared with those that use it less, the values of countries that use the DSB more often are closer to 0.24. The value of this variable is calculated by dividing the total number of DSB applications made by each responding, complaining, and third-party country for each year by the total number of DSB applications made by all countries in a given year, and it refers to the extent which each country used the DSB in that year. These values, which vary by country and year, are included in the econometric models as the DISPUTE variable.

3. EMPIRICAL METHODOLOGY

In this study, the effects of the DISPUTE variable on the foreign trade of countries were examined using the gravity model. Leamer and Levinsohn (1995) stated that the gravity model makes it possible to obtain the most clear and robust results when analyzing international trade flows.

The empirical application of the gravity model to explain foreign trade was first modeled in 1962 by a group of Dutch economists led by Jan Tinbergen (1962a) and Newton's laws of motion were transformed into the analogy in Equation (1) (Golovko, 2014, p. 86-90).

$$Trade_{ij} = \alpha_0 \frac{Y_i^{\alpha_1} \; Y_j^{\alpha_2}}{D_{ij}^{\alpha_3}} \tag{1}$$

Where $Trade_{ij}$ denotes the foreign trade (import or export) from country i to j; Y_i represents the GDP of country i; Y_j represents the GDP of country j; D_{ij} represents the distance between country i and j; and α_0, α_1, α_2, and α_3 are the model parameters.

The model shows that the higher the GDP of the countries, the higher the result obtained from the product of Y_i and Y_j and thus the higher the foreign trade of the countries. By contrast, an increase in the distance between two countries, that is D_{ij}, is expected to decrease the foreign trade between them as it reduces the result of the product of Y_i and Y_j. Tinberger (1962) used this analogy in multiplicative form as shown in Equation (2).

$$T_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} (u_{ij}) \tag{2}$$

[1] In addition, the effects of the complaining and responding countries' data on world trade were modeled separately, but the results were not statistically significant. Undoubtedly, the main reason for this is that the relevant data does not contain enough information.

[2] While creating the DISPUTE variable in this study, countries such as Namibia, Kyrgyzstan, Saint Lucia, which rarely used the DSB in the period under consideration or whose data on exports, imports, and GDP are not consistently available in the databases, were not included in the calculations. In addition, the 28 member countries of the European Union (EU) were evaluated under the EU roof (the UK was also an EU member during the analysis period). Numerically, 84 countries that make up the DISPUTE explanatory variable are 97% of those that have used the DSB. The list of countries used to create the DISPUTE variable is included in Appendix 2.

In Equation (2), T_{ij} refers to the imports or exports between two countries; Y_i and Y_j denote GDPs, which represent the magnitude of economic activities, as in Equation (1); D_{ij} denotes geographical distances between two countries, and $\alpha_0,\ \alpha_1,\ \alpha_2, and\ \alpha_3$ are the model parameters. Since the model has parameters, there is no absolute proportion between the explained variable, T_{ij}, and the explanatory variables, Y_i, Y_j, and D_{ij}. An absolute ratio will only be valid if each parameter is equal to 1 ($\alpha_0 = \alpha_1 = \alpha_2 = \alpha_3 = 1$). In the model, export or import has a constant elasticity relationship with the explanatory variables. In other words, a 1% increase in Y_j causes an increase of α_2% in T_{ij}, which corresponds to an increase in the exports of country i (Tinberger, 1962, p. 264). The main difference between Newton's and Tinbergen's (1962b) laws of motion is that, the coefficient D_{ij}, referring to the distance between two countries, is defined as α_3 instead of square (2)[1]. As Anderson (1979) pointed out, determining $\alpha_0 = \alpha_1 = \alpha_2 = 1\ and\ \alpha_3 = 2$ by adhering to Newton's model will not produce appropriate results in modeling international trade, so these parameters are replaced with those that would provide real-life results. An error term, (u_{ij}), is added to make it an econometric model.

3.1 Augmented Gravity Model

If only the distance between countries is used to estimate trade flows between neighbouring countries, it becomes difficult when there is a high foreign trade intensity between them. Thus, an explanatory variable of trade policy (preferential trade arrangement (PTA, WTO membership) is added to the model to eliminate this deficiency (Salvatici, 2014: 3). Thus, empirical studies have expanded the model by adding new explanatory variables. Although there are similarities between the gravity models used in the literature in terms of basic variables, such as income and distance, applied researchers add other explanatory variables in order to achieve the purpose of their study (Shepherd, Doytchinova, & Karavchenko, 2019: 13). Thus, in accordance with the purpose of the existing studies, several variables have been added to the gravity model, including contiguity, access to the sea, colonial history, the administrative system, race, common language, religion, membership in the same economic or political union, WTO membership, foreign trade policies, trade openness, and institutional quality; thus, the model is called the "extended gravity model" (Demiroglu, 2019).

3.2 Structural Gravity Model

The structural gravity model, which was introduced by Anderson and Van Wincoop (2003), has contributed to the theory of the gravity model by addressing the costs of trade between countries. When explaining the average trade resistance that all countries are exposed to with a concept they call "multilateral trade resistance", the authors associated trade costs with "*trade resistance"*[2]*.* Adding multilateral trade resistances to the model is of particular importance for accurately predicting bilateral trade flows with the gravity model. In the literature, Baldwin and Taglioni (2006) defined studies that excluded multilateral trade resistances as *"gold medal mistake".* Trade costs can be observed, whereas multilateral trade resistances cannot be observed. Since no statistical price index can replace this observation, a method is needed to predict trade resistances (Shepherd, Doytchinova & Karavchenko, 2019: 27-28). Therefore, Anderson and Van Wincoop (2003) highlight that it is necessary to generate estimates by adding $2xNxT$ dummy variables to include unit (N) and time (T) effects to the model in order to estimate multilateral trade resistances. However, it is not always

[1] In Newton's gravitational equation; the square of the distance has been used.
[2] Trade resistance refers to all factors that increase the costs of trade between countries. This concept includes several visible and invisible factors, such as customs tariffs, distance, transportation facilities, and transportation costs.

possible to predict the gravity model using $2xNxT$ dummy variables in each model.[1] Since variables such as GDP and the quality of infrastructure and institutions in exporting and importing countries are associated with those included in the error term, the random effects model cannot be used for the estimations, so the estimations should be made using the fixed effects model (Yerdelen Tatoglu, 2020, p. 105).

3.3 Problems in the Gravity Model and Suggested Solutions

As stated by Silva and Tenreyro (2006), countries' bilateral trade values have some distinctive features when compared with other data sets. First, trade flows between countries should never have negative values. Second, the bilateral trade (T_{ij}) of countries that have low income (Y_i, Y_j) and are far from each other (D_{ij}) takes either 0 or values close to 0 ($(E = T_{ij}|Y_i, Y_j, D_{ij}) = 0$). Since the logarithm of zero is undefined[2], it is difficult to generate estimates with ordinary least squares (OLS) for countries that have no trade (zero value) with each other. Excluding countries with zero foreign trade from the sample will cause a deviation in the sampling. However, including small and distant countries and large and close countries in the analysis will cause heteroscedasticity. Thus, Silva and Tenreyro (2006) argued that heteroscedasticity can be detected even visually. This is a critical problem in the gravity model.

Gomez-Herrera (2009) showed that there were deviations between alternative estimators in datasets with heteroscedasticity and zero-valued observations. The estimations will not be effective even when fixed effects are used or when there are no zero values for the dependent variable. By using Monte Carlo simulations, Silva and Tenreyro (2006) determined that the error term violated the assumption of constant variance when the standard gravity model was linearized. Westerlund and Wilhemmson (2009) suggest that the estimation of the logarithmic linear model is biased, so the Poisson fixed effects estimator can be used instead. In this case, the proposed Poisson Maximum Likelihood (PML) estimator does not take the logarithm of the dependent variable and uses Equation (3) instead of Equation (2).

$$T_{ijt} = exp(\beta_0 + \beta_1 LogY_{it} + \beta_2 LogY_{jt} + \beta_3 LogD_{ij})u_{ijt} \quad (3)$$

$$(i = 1, j = 1, \dots, N, t = 1, \dots, T)$$

This model is based on the PML estimation of the gravity model. By using Monte Carlo simulations, Silva and Tenreyro (2006) have concluded that the PML estimator has a smaller deviation than OLS-based estimators and performs better in small samples. In cases where the logarithm of the dependent variable cannot be obtained, the Poisson Pseudo Maximum Likelihood (PPML) method can be used since it does not cause any loss of observation, does not exclude time-invariant variables from the model, and is resistant to heteroscedasticity (Silva & Tenreyro, 2006). Therefore, in this study, it is preferred to use the PPML estimator.

In accordance with the purpose of the study, Equation (3) is arranged as Equations (4) and (5) for exports and imports, respectively, and estimated using the PPML method, as follows:

[1] Since the model has to include several parameters, it reduces the degree of freedom of the estimates. In addition, when dummy variables, such as country pair constant effects, are added to the model, these variables can cause all other variables to be excluded from the model, including "distance," which does not change over time.

[2] In addition, the logarithm of foreign trade values in the range of 0-1 is negative, which will result in a situation that is incompatible with real life, such as negative exports and imports.

$$Ex_{ijt} = exp(\beta_0 + \beta_1 LogGDP_{it} + \beta_2 LogGDP_{jt} + \beta_3 Logdist_{ij} + \beta_4 Dispute_{it} + \beta_5 Dispute_{jt} + \beta_6 D_{ijt})u_{ijt} \quad (4)$$

$$Imp_{ijt} = exp(\beta_0 + \beta_1 LogGDP_{it} + \beta_2 LogGDP_{jt} + \beta_3 Logdist_{ij} + \beta_4 Dispute_{it} + \beta_5 Dispute_{jt} + \beta_6 D_{ijt})u_{ijt} \quad (5)$$

$$(i = 1, \dots, N;\ j = 1, \dots, N;\ t = 1, \dots, T)$$

Since the model is based on the fixed effects specification, the endogeneity from the correlation of the unit effect in the error term with the independent variables is also controlled. Studies on trade also include the estimation of the gravity model based on the random effects model (Egger, 2002; Carrere, 2006). However, the random effects model requires very restrictive assumptions to produce consistent estimates. For example, multilateral resistance conditions should be derived from a normal distribution. However, there is no support for this assumption in economic theory (Shepherd, 2012). The fixed effects model does not restrict the distribution of multilateral resistance conditions. Therefore, the models in the study were not estimated using the random effects method.

Baldwin and Taglioni (2007) addressed the following three main problems of estimating the gravity model using panel data; (i) accounting for multilateral trade resistance, (ii) incorrectly averaging trade values, and (iii) incorrectly conceiving trade and economic rates. The results they obtained can be summarized as follows. The solution to the first problem has been discussed in the previous sections. The second and third problems can be solved by using nominal trade values and nominal GDP, including time dummies in the regressions, and using one-way trade values, such as exports from i to j and exports from j to i (also imports of i from j and imports of j from i). Therefore, all models for both exports and imports are established separately.

Finally, since trade policy variables to a certain extent, represent countries' integration into international markets, careful consideration should be given when including trade policy variables in the gravity model (Shepherd et al. 2019: 13). Bacchetta et al. (2012) argued that trade policy explanatory variables, especially variables such as regional trade agreements (RTA), foreign trade openness level (openness), and institutional quality may cause endogeneity due to their reverse causality relationships. Therefore, in the regression analysis included in the application section of this study, trade policy variables, such as openness, quality of institutions, customs union agreement (CU), and RTA, are not included in the same model.

3.4 Sample and Data Set

In this study, 84 countries that use the DSB and have consistent data are included in the analysis. These countries represent about 97% of world trade[1]. Their bilateral trade data from 1995 to 2018 was used in the study. An excel data set with 156,273 lines was created. The 84 countries (listed in Appendix 2) and 24 years constituted the unit and time dimensions of the analysis, respectively.

Regarding the bilateral export (ex) and import (imp) data of each country included in the sample, the IMF's Directions of Trade Statistics (DOT) and official databases of the countries were analyzed comparatively. The IMF's DOT database is preferable due to the consistency and frequency of updates in the data. In addition to the variables of $Contig_{ij}$, $Clony_{ij}$, CU_{ijt}, RTA_{ijt}, $Landlock_i$ and $Landlock_j$, the presence of CU, which shows the RTA between countries i and j, was also included as a dummy variable under D_{ijt} in the models. These data are from the database of the Universitat Bayreuth[2]. The

[1] Calculated using the WTO database.
[2] https://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html

other explanatory variables of the model are from Le Centre d'etudes prospectives et d'informations (CEPII)[1], including the distance between countries ($Logdist_{ij}$), the logarithm of the distance between the most populated cities of the two countries (km), the presence of a common border between the countries ($Contig_{ij}$), the historical colonial bond between the countries ($Colony_{ij}$), and the explanatory variables of $Landlock_i$ and $Landlock_j$, which indicate countries that do not have sea border. The GDP of countries are from the World Bank's website[2].

3.5 Empirical Results

In this part of the study, the effect of DISPUTE on world trade was estimated using the multidimensional panel data analysis method, and the effect of DISPUTE on selected countries' foreign trade was estimated using the two-dimensional panel data analysis method. To test the significance of the country (exporter and importer) and time (year) effects in both the multidimensional and two-dimensional models, Likelihood Ratio (LR) tests were performed on the main hypotheses of $H_0: \sigma_\mu = \sigma_\lambda = 0$ (no unit and time effect), $H_0: \sigma_\mu = 0$ (no unit effect), and $H_0: \sigma_\lambda = 0$ (no time effect). To test for the presence of unit and time effects, unit and/or time effects were included in both export and import models based on the results of the combined and separate LR tests.

3.6 The Effect of the DISPUTE Variable on World Trade

In addition to the models (5) and (6) PPML estimator, the fixed effects model of the pooled panel OLS was also estimated using the versions in which autocorrelation and heteroscedasticity problems[3] were not present, and a robustness test was performed on the results obtained. The results are presented in Table 1.

Table 1 Estimation results

			Robustness Check			
	PPML-FE (Robust)		OLS (Robust)		FE (Robust)	
Variables	$\boldsymbol{Ex_{ijt}}$	$\boldsymbol{Imp_{ijt}}$	$\boldsymbol{Ex_{ijt}}$	$\boldsymbol{Imp_{ijt}}$	$\boldsymbol{Ex_{ijt}}$	$\boldsymbol{Imp_{ijt}}$
$\boldsymbol{Logdist_{ij}}$	-0.675*	-0.649*	-1.074*	-1.036*	-1.478*	-1.393*
$\boldsymbol{LogGDP_{it}}$	0.603*	0.616*	1.168*	0.924*	0.315*	0.716*
$\boldsymbol{LogGDP_{jt}}$	0.517*	0.507*	0.828*	1.107*	0.559*	0.315*
$\boldsymbol{Dispute_{it}}$	0.348**	0.085	4.214*	0.712*	2.516*	-0.571*
$\boldsymbol{Dispute_{jt}}$	0.256	0.433**	1.201*	4.243*	0.837*	2.115*
$\boldsymbol{Contig_{ij}}$	0.563*	0.473*	1.146*	1.057*	0.391*	0.363*
$\boldsymbol{Colony_{ij}}$	0.202*	0.219*	0.701*	0.676*	0.946*	0.919*
$\boldsymbol{CU_{ijt}}$	0.351*	0.504*	-0.053*	-0.108*	-0.152*	-0.125*
$\boldsymbol{RTA_{ijt}}$	0.337*	0.199*	0.388*	0.365*	0.444*	0.371*
$\boldsymbol{Landlock_i}$	-2.002*	-1.136*	-0.052*	-0.573*	-7.158*	-2.896*
$\boldsymbol{Landlock_j}$	-2.842*	-0.880*	-0.783*	-0.414*	-3.713*	-7.647*
Constant	-1.744*	-2.012*	-25.025*	-26.074*	12.749*	7.741*
$\boldsymbol{R^2}$	0.891	0.886	0.637	0.661	0.761	0.768
$\boldsymbol{F}$	-	-	23537.54*	26962.41*	2430.64*	2544.00*

[1] http://www.cepii.fr/CEPII/en/bdd_modele/presentation. asp?id=8

[2] https://databank.worldbank.org/reportsaspx?source=2aeries=NY:GDP.MKTP.CD=#)org/reports.aspx?source=2&series=NY.GDP.MKTP.CD& country=#

[3] This equation of $lnTrade_{ijt} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDIST_{ij} + \beta_4 DISPUTE_{it} + \beta_5 DISPUTE_{jt} + \beta_6 D_{ijt} + u_{ijt}$ is used separately for the OLS method, where $(i = 1, \dots, N;\ j = 1, \dots, N, t = 1, \dots, T)$.

Unit (μ) effects of imports LR test	17647.88*	41750.76*	-	-	17647.88*	41750.76*
Unit (μ) effects of exports LR test	18158.44*	18886.59*	-	-	18158.44*	18886.59*
Time (λ) effects LR test	8234.09*	9668.81*	-	-	8234.09*	9668.81*
Average VIF	9.174	8.771	1.35	1.35	4.184	4.310
Number of Observations	147642	152465	147642	152465	147642	152465

*p<0.01; **p<0.05

The first two columns of Table 1 show the results of the PPML estimation in which both unit and time effects of importing and exporting countries are added. According to the estimation results, R^2 is high and significant for both OLS export and import models. The results of the OLS method and R^2 values of the fixed effects estimation also show that the models have high explanatory power. Here, the variance inflation factor (VIF) criterion is used to show that there is no multicollinearity problem. Since this value is less than 10, it indicates that there is no multicollinearity in the model (Yerdelen Tatoglu, 2020: 115). Heteroscedasticity and autocorrelation are not present in both estimators used in the analysis.

Therefore, while the effect of other variables is constant, a 1% increase in the GDP of the host country increases its exports by 0.603%, and a 1% increase in the GDP of the partner countries increases their exports by approximately 0.517%. A 1% increase in the distance between the host and partner countries reduces the exports of these countries by 0.675%. A 1% increase in the DISPUTE variable of the host country increases its exports by 0.348%. Being a member of the CU and having a free trade agreement have a positive effect on exports. Countries that are members of the CU have 42% more exports than those that are not, whereas those that have a RTA have 40% more exports than those that do not. Neighboring countries have approximately 76% more exports than non-neighboring countries, whereas countries with colonial relationships have 22% more exports than those without colonial relationships. If the host and partner countries are landlocked countries, their exports will be 86% and 94% less than those of coastal countries, respectively. [1]

Whereas the effects of other variables are constant, a 1% increase in the GDP of the host country increases its import by approximately 0.616%, and a 1% increase in the GDP of the partner countries increases its import by approximately 0.507%. A 1% increase in the distance between the host and partner countries reduces the imports from these countries by approximately 0.649%. A 1% increase in the DISPUTE variable of the partner country increases the import of the host country by approximately 0.433%. Being a member of the CU and having a RTA have a positive effect on imports. Countries that are members of the CU have approximately 66% more imports than non-members, and those that have RTAs have 22% more imports than those that do not. Whereas neighboring countries have approximately 60% higher imports than non-neighboring countries, countries with colonial relations have 24% more imports than those without. If the host and partner countries are landlocked countries, their exports are 68% and 59% less than those of the coastal countries, respectively.

The results indicate that the exporting country's DISPUTE score increases its exports, and the partner country's DISPUTE score increases the host country's imports. It has been observed that the DISPUTE values of the partner country are not significant for exports, and those of the host country are not

[1] This formula, $\%\Delta = 100 * [exp(\beta) - 1]$, was used to calculate the estimates used to interpret the dummy variables in this study (Silva and Tenreyro, 2006)).

significant for imports. These results indicate that the WTO's DSB has an increasing effect on world trade.

Being neighboring countries has a higher effect on their exports than their imports. This is due to the high elasticity of imported goods. Moreover, although being a member of the CU has a higher effect on countries' imports than their exports, having RTAs affects their exports more than their imports. In these analyses, although the OLS and fixed effects methods could not accurately detect the effects of CU, the PPML method could detect these effects accurately (as expected), which also shows that the PPML method is a more effective estimator. In addition, if both the host and partner countries are landlocked countries, it affects their exports more than their imports.

3.7 The Effects of the DISPUTE Variable on Foreign Trade of Selected Countries and World Trade

By examining the effects of the DSB on the foreign trade of selected countries and world trade, this study aims to address the subject from a broader perspective[1]. To achieve the objective of this study, the summary results of the estimates made for the G7, BRIC, and selected countries are presented in Table 2.

Table 2 The effect of the DSB on foreign trade of some countries

Country Group	Country	Export	Import
G-7 Countries	USA	Worsens	No Impact
	Germany	Improves	Improves
	France	Negative	No Impact
	Italy	Negative	Worsens
	Japan	No Impact	Positive
	Canada	No Impact	No Impact
	UK	No Impact	Improves
BRIC	Brazil	No Impact	Improves
	Russia	No Impact	No Impact
	India	Worsens	No Impact
	China	Worsens	No Impact
Selected Countries	Israel	Worsens	No Impact
	Netherlands	Improves	Worsens
	Korea	Worsens	No Impact
	Turkey	Worsens	No Impact

According to the results in Table 2, an increase in the use of the DSB by trade partners positively affected Germany's foreign trade, whereas it negatively affected Italy's foreign trade. The use of this mechanism negatively affected the exports of the USA, France, India, China, Israel, South Korea, and Turkey, whereas it positively affected the exports of the Netherlands and negatively affected its imports. However, an increase in the intensity of using the DSB has positively affected the world's foreign trade through both export and import. In this case, although the Pareto Optimum, which is the best option for the world, has been reached, countries such as the USA and China, which have implemented protectionist policies, are in the Nash equilibrium, which is the second-best option, and

[1] The equation of $Trade_{ijt} = exp(\beta_0 + \beta_1 LogGDP_{jt} + \beta_2 LogDIST_{ij} + \beta_3 DISPUTE_{jt} + \beta_4 D_{ijt})u_{ijt}$ was used separately for exports and imports in the country-specific two-dimensional panel data modeling, where ($i = 1$; $j = 1, \dots, N$; $t = 1, \dots, T$).

have partially suffered from the DSB. Therefore, the WTO should continue its efforts to establish free foreign trade to maximize the welfare of all countries. Although countries may suffer individually from these practices, this mechanism positively affects the foreign trade and welfare of countries around the world. These results are also very important since they reveal that the belief that developed countries, such as the USA, gain advantages in world trade by exerting pressure on the WTO or by lobbying the WTO is not true.

4. CONCLUDING REMARKS

The aim of this study is to model the effect of the WTO, a global institution of economic integrations, on world trade from a different perspective. Based on empirical research that discusses whether the WTO has positive effects on world trade, this study examines the WTO's institutions and practices and the DSB.

In this study, the gravity model methods were used due to their high empirical power in explaining foreign trade flows, and a panel data analysis was performed since it allowed us to estimate the effects of both country (units) and time variances on the variables. We wanted to add versatile trade resistances to our mathematical models. However, in cases where multilateral trade resistances were included in the models in both two-dimensional and multi-dimensional panel data analyses, multilateral trade resistances could not be evaluated in all established models because (i) there were unit-invariant variables, such as GDP and DISPUTE, and (ii) the explanatory variables were associated with unit and time effects.

The result of the multi-dimensional panel data analysis using the gravity model shows that the DSB positively affects imports and exports in world trade; in other words, it increases global foreign trade. However, the DSB has either negatively affected or did not have any effect on the foreign trade of some countries such as the USA, China, Korea, and Italy. Undoubtedly, one of the reasons for the different effects of DISPUTE on the foreign trade of countries, which is contrary to its positive effects on world trade, is the different export and import demand elasticities of the goods of these countries. For example, the use of the DBS by the trade partners of Russia and Brazil does not have any effect on the exports of these two countries. This may be because these two countries are energy and raw material exporters.

Examining the reasons for the different effects of the DISPUTE variable by country and its dynamics in future studies will contribute to the literature. In addition, since the DSB is sufficient in providing more practical implications due to the increase in the number of countries using the DSB, it will be possible to model the effects of this mechanism on the foreign trade of complaining, responding, and third-party countries separately.

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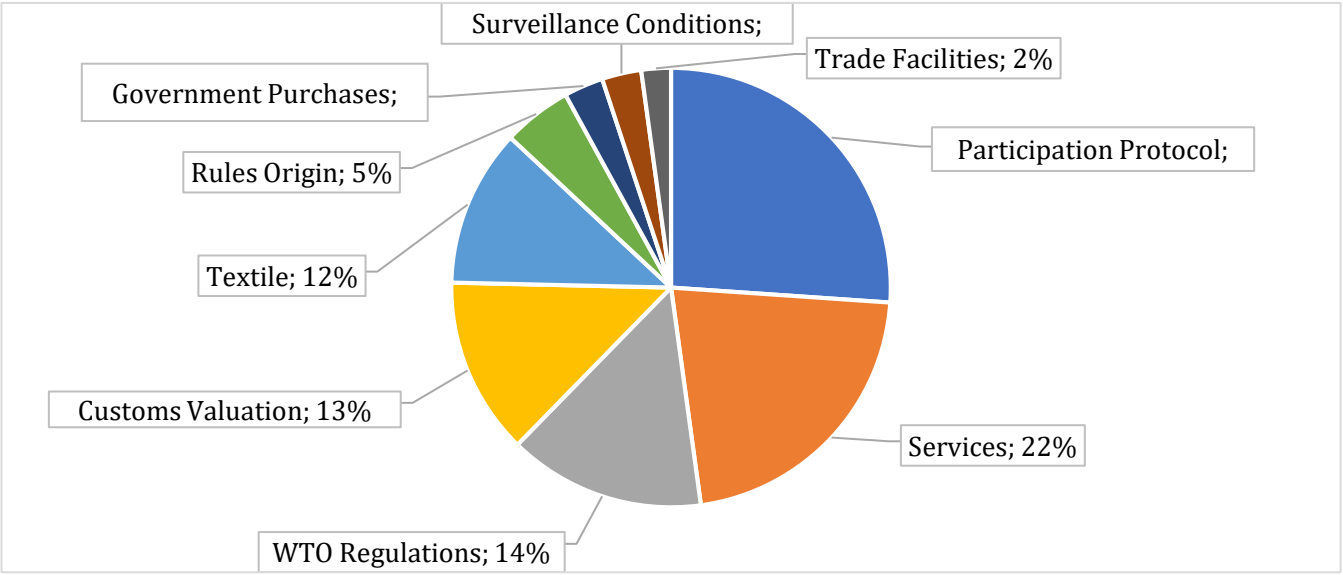
APPENDIX

Ap 1 Other dispute settlement areas



Source: Created by the author using WTO (2020) data.

Ap 2 Country List

1	Untd Arab Emirates	Morocco	China	Portugal	UK	Turkmenistan	Jordan
2	Azerbaijan	Malaysia	Cuba	Russia	Hong Kong	Turkey	Kuwait
3	Bosnia & Herzegova	New Zealand	Algeria	Slovakia	Indonesia	Yemen	Lithuania
4	Chile	Poland	France	Tajikistan	Italy	Australia	Mongolia
5	Czech Republic	Romania	Guatemala	Ukraine	S. Korea	Bulgaria	Norway
6	Dominican Republic	Slovenia	Hungary	Vietnamese	Lesotho	Switzerland	Philippines
7	Finland	Thailand	Israel	Austria	Malta	Costa Rica	Train
8	Greece	USA	Kazakhstan	Bangladesh	Netherlands	Denmark	Singapore
9	Croatia	Venezuelan	Libya	Canada	Panama	Spain	Sweden
10	Ireland	Argentina	Mexican	Colombia	Paraguay	Georgia	Tunisia
11	Japan	Belgium	Nigeria	Germany	Saudi Arabia	Honduras	Uzbekistan
12	Lebanon	Brazil	Pakistan	Egypt	El Salvador	India	S. Africa

Source: Created by the author using the data derived from IMF (2020) DOT.