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The Impact of Economic Integration Agreements on Turkey's High Technology Product Exports: ASEAN Case

Ekonomik Entegrasyon Anlaşmalarının Türkiye'nin Yüksek Teknolojili Ürün İhracatına Etkisi: ASEAN Örneği

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Abstract

It is seen that there have been great changes in the economic system and understanding in the phase from the settlement of humanity to the present day. The adventure of finding the technique of survival has been the key for states to dominate each other and become developed countries centuries later. Especially after World War II, there has been an increase in efforts to establish economic integration and to apply technology to industry in various parts of the world, especially in Europe. When this situation is evaluated in terms of Turkey, the fact that its exports of high-tech products, which is one of the indicators of development, is stuck between 2% and 4% and that it has a foreign trade deficit among the economic integrations of which it is a member, reveals that the understanding of establishing economic integration needs to change. Therefore, in this study, the impact of economic integration agreements between Turkey and ASEAN, the world's fifth largest economy, on Turkey's exports of high-tech products is analyzed with a panel gravity model covering the years 2007-2020 in line with the purpose of the study. As a result of the study, it is found that economic integration agreements with ASEAN positively affect Turkey's exports of high-tech products.

Jel Codes: *F14, F15, O33, O38*
Keywords: *Economic İntegration, High Technology Export, Türkiye, ASEAN, Economic Integration Agreements*

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Öz

İnsanlığın yerleşik düzene geçmesinden günümüze kadar geçen evrede ekonomik sistem ve anlayışta büyük değişimler yaşandığı görülmektedir. Hayatta kalmanın tekniğini bulma serüveni, yüzyıllar sonra devletlerin birbirlerine hükmetmelerinin ve gelişmiş ülkeler haline gelmelerinin anahtarı olmuştur. Özellikle 2. Dünya Savaşı'ndan sonra başta Avrupa olmak üzere dünyanın çeşitli bölgelerinde ekonomik entegrasyon kurma ve teknolojiyi sanayiye uygulama çabalarında artış olmuştur. Bu durum Türkiye açısından değerlendirildiğinde, gelişmişliğin göstergelerinden biri olan yüksek teknolojili ürün ihracatının %2-%4 arasına sıkışmış olması ve üyesi olduğu ekonomik entegrasyonlar arasında dış ticaret açığı vermesi, ekonomik entegrasyon kurma anlayışının değişmesi gerektiğini ortaya koymaktadır. Bu nedenle bu çalışmada, Türkiye ile dünyanın beşinci büyük ekonomisi olan ASEAN arasındaki ekonomik entegrasyon anlaşmalarının Türkiye'nin yüksek teknolojili ürün ihracatına olan etkisi, çalışmanın amacına uygun olarak 2007-2020 yıllarını kapsayan bir panel çekim modeli ile analiz edilmiştir. Çalışma sonucunda, ASEAN ile yapılan ekonomik entegrasyon anlaşmalarının Türkiye'nin yüksek teknolojili ürün ihracatını olumlu yönde etkilediği tespit edilmiştir.

Jel Kodları: *F14, F15, O33, O38*
Anahtar Kelimeler: *Ekonomik Entegrasyon, Yüksek Teknoloji İhracatı, Türkiye, ASEAN, Ekonomik Entegrasyon Anlaşmaları*

1. Introduction

The continuous development of human beings and their development by understanding their environment has shown itself in every field. We see this in trade as well. It is seen that the societies that initially realized their needs and trade with barter in a simple way, started to trade in order to have more money with the use of money. However, it is seen that agreements are made in trade between countries, whether the trade is realized by barter method or by the use of money or precious metals.

Although money was invented by the Lydians in the 7th century BC by the method of minting, the agreement that took place without money and which also had the feature of being the first regional trade agreement, was in BC. King of Alasia and Pharaoh of Egypt in XIV. It is an agreement signed between Pharaoh Amenophis and the content of which exempts the Cypriot merchants from customs duties in exchange for wood and copper within the determined rates (Lammy, 2011). As it is seen, the desire of human beings to guarantee their trade and to realize their profits within certain rules has reached today as a legacy from the depths of history.

In addition, it is seen that the understanding of the parties in international trade agreements evolves to both obtaining commercial privileges and creating political and economic integration as time progresses. For example, BC. While the purpose of the trade agreement that took place in the 14th century was to gain some privileges for the Cypriot merchants, the purpose of the capitulations given by Suleiman the Magnificent to France was to prevent the Christian Union and advance in Europe. While the establishment of the Hanseatic Union by the trade guilds in the Baltic Sea and Northern Europe was to protect their economy from the damages caused by pirate activities in maritime trade and to guarantee their economy, the purpose of the Zolleverein agreement, which was established in 1834 under the leadership of Prussia, was to spread the free trade and unify Germany by creating a German customs union. was its purpose (vedantu, 2023).

The difference between today's trade agreements and past agreements is that the desire to gain technological superiority is added as well as to create political or economic integration. II. World War II is a turning point in this respect. The reason for this is that the technologies used during the war began to be used in industries after the war, and they became the determinant of economic development.

In fact, the desire to have technology has reached such an advanced level that the OPEC (Organization of Petroleum Exporting Countries), which was formed by countries that have oil, which is the traditional raw material source, in the common attitude they determined in 1980, that the counterpart of oil is technology and that the technologically advanced countries They stated that if they do not make the necessary transfers, oil exports will be restricted. In short, they have made it clear that the real price of oil is technology (Perrin, 1992: 7)

The aim of the study is to examine the relationship between agreements and technology that constitute political and economic integrations, since they are determinant in the level of development of their countries. Measuring the effect of Türkiye's trade agreements with ASEAN, which is considered today's successful economic integration, on Türkiye's high technology exports, is the subject of the study. In addition, another aim of the study is to

examine the effect of technological factors on the competitiveness of Türkiye and ASEAN by using the variables of human capital, patents, foreign direct investments and the gross domestic product of the countries. The reason for this is that the technological proficiency levels of the countries to which you will export are equivalent or superior or their concentration in certain sectors stands out as the determinants of export rates. For this reason, it is thought that the analysis that will be carried out on the variables that are the determinants of the technological infrastructure of the countries you will compete will be a guide for the future of the export of high-tech products.

The feature that distinguishes this study from other studies in the literature is that the analysis of the effect of economic integration agreements between Türkiye and ASEAN on high technology exports, which is one of the development indicators, has not been done before and it develops a new perspective in the formation of economic integration agreements.

2. Economic Integration

Regional economic integration agreements are intergovernmental agreements in which signatory countries agree on conditions that are more advantageous than those applied to other non-signatory partners in the conduct of their mutual trade and investment relations (Cuervo-Cazurra & Un, 2007). Looking at the data of the World Trade Organization, the number of regional trade agreements in force as of 2023 is seen as 621 (WTO, 2023). In addition, according to the 2023 data of the World Trade Organization, the only country that is not a party to any regional trade agreement is Mauritania. However, it is seen that Mauritania is in the early announcement and application stage to become a member of the EU-West Africa EPA (WTO, 2023).

Since economics is a discipline within the social sciences, most of the definitions are diverse because they reflect the thoughts of scientists working on the subject. We see this diversity in the definition of economic integrations. Integration, which is a definition of Latin origin, means "integration" renewal (Ertürk, 1997: 8).

Tinbergen (1965) defined it as the integration of the economies of countries by organizing the economic relations between countries in a planned way. Balassa (1961) on the other hand, considered economic integration as a temporal program and its outcome.

Staley & Machlup (1977) on the other hand, defined economic integration as taking advantage of all opportunities for the realization of the division of labor.

Myrdal (1959) on the other hand, defined economic integration as ensuring that there are no obstacles to the movement of trade and production factors between the economies of the countries that are in integration, and ensuring equality of opportunity in all aspects within the union. As it is seen, although there are differences between the definitions, Çakmaklı (2023) mentioned that the definitions have common points. These can be summarized as follows.

Elimination of inequality between countries, free movement of production factors and removal of borders,

- Definitions that consider economic integration as regionalism,

- Definitions of economic integration as the removal of tariffs,
- Definitions of economic integration as connecting countries to each other,
- Definitions of economic integration as organization and cooperation and establishment of new institutions and organizations.

In short, we can define economic integration as the sum of the areas of freedom that countries give up in order to strengthen their economies. Because at the stage of establishing economic integration, the dependency ratios increase as a result of the agreements made by the countries with each other, and even in the further integration agreements, they have to comply with the policies of the supra-state institutions that are formed economically and politically.

3. Economic Integration Agreements (Phases)

Economic integration agreements differ according to the benefits that the countries that will realize the agreement will derive from the agreement. The narrowest economic integration agreement is the 'Preferential Trade Agreements'. The countries that have signed the agreement are either among themselves or unilaterally by reducing the customs tariffs on certain products (Seyidoğlu, 2015: 240).

The next agreement after the Preferential Trade Agreement is the Free Trade Agreement. This agreement is based on the elimination of customs duties between the countries that are party to the agreement. As the factors in creating the Free Trade Agreement; It can be shown that the expectation of countries to provide export opportunities to local companies by eliminating quotas or tariffs that prevent trade, and also that the countries that are party to the agreement will gain the advantage of growing their economies with expanding markets.

The next stage after the Free Trade Agreement is the Customs Union. In the Customs Union, countries again remove tariffs and quotas that prevent trade among themselves, but unlike the Free Trade Agreement, they apply a common customs tariff against third countries (Kara, 1996: 63).

The next step after the Customs Union agreement is the Common Market Agreement. Common Market understanding is a concept that started to be used more in the second half of the 20th century (Oğuz, 1969: 1). We can characterize the idea of the Common Market as giving up the rights of national sovereignty by introducing a set of supranational provisions and principles (Zadil, 1965: 148). In addition to having the content of all other agreements, the Common Market Agreement; Among the countries that are party to this agreement, there is freedom of labor, capital and entrepreneurs. In short, it means removing the obstacles in front of an entrepreneur to invest in any country that is a party to the agreement, as if he is investing in another city in his country with the capital he holds.

The agreement that will be formed after the Common Market is the Economic and Political Union, which is Full Integration. At this stage, it is desired to reach the "United State" status by establishing supra-state institutions with the participants of the countries that are party to the agreement. Every institution, from the legal system to the monetary system, from political

organizations to policy-making institutions, creates the rules that the member countries of the union must comply with. Among the integrations created so far, the European Union is the closest.

When we look at the content of the agreements, the differences in the opportunities provided by each agreement to the countries that are parties vary. For this reason, it is of great importance for countries that want to establish economic integration to make agreements according to their own economic, industrial and socio-cultural structures.

Because being in a Common Market agreement without having sufficient capital and human capital can cause domestic companies to experience negative effects in their competition with companies belonging to member countries. Customs Union agreements can be cited as another example. The trade agreements that any of the countries that are party to the Customs Union will make with third countries should not be particularly flexible or abolishing the tariffs applied by the member countries against the third country. In addition, if the party does not take part in the joint decision mechanism that will establish the Customs Union, the party may be deprived of determining the conditions for opening its internal market.

In short, the fact that countries carry out the necessary feasibility studies without making economic integration agreements will lead the countries to be in a developmental position in a controlled way in the right way.

4. Technology and Economic Integration Relationship

In international trade, the technological capacities of the countries are as important as the economic integrations. With technology, countries can have a competitive advantage by achieving maximum efficiency in a short time with less resources. Thanks to the innovation achieved with technology, consumers are provided with access to quality and various goods. The effect of technology on human life in this way has led to increasing individual and social welfare until today. However, the use of technology in the industrial field is a situation realized by developed countries. Technological innovation does not occur in developing countries due to reasons such as lack of sufficient human capital, lack of institutional, sociological and technological infrastructure, lack of necessary financial support and lack of qualified workforce (Karataş & Bekmez, 2005: 113).

We can say that the relationship between economic integrations and technology emerges at this point. With the economic integration agreements, the disappearance of the barriers to trade between countries causes investors to turn to new markets and take technology with them with investments. With this pressure created by domestic companies to carry out activities for R&D activities and qualified workforce in order to survive in the competition, an increase in technology capacities is realized within the country. Obtaining the technological capacity as a result of technology transfer and R&D activities carried out by the companies may cause the host country to benefit in international trade and export high-tech products.

It contributes to the growth of the economies of the countries by creating foreign demand, spreading technology, increasing factor productivity and contributing to trade by creating foreign demand with the developing export thanks to the high-tech product (Şanlı &

Konukman, 2021). This means more prosperity than an international trade where there are no trade-inhibiting quotas and tariffs without economic integration agreements.

5. Literature Review

Economic integrations and high technology exports are among the activities that countries should do in line with the interests of countries in international competition. The agreements necessary for economic integrations are based on the extent to which countries benefit from each other. In fact, the parties that make these agreements are in a relationship not only economically but also politically (Türkcan & Pişkin, 2016: 22). After 1990, the regionalization movements accelerated by globalization have increased the interest of those who shape the politics of the countries and the academic circles in measuring the effects of the agreements that make up the regionalization movements on the economies.

It is seen that the economic integration agreements that Türkiye has signed are mostly examined in the axis of the European Union and studies are carried out on the effects of trade volumes. It is thought that especially the integration agreements will be evaluated in terms of high technology exports, which will form the basis of today's and future leader country's industry, and it will be an important point for the agreements to be made within this benefit.

Kruger (1995) compared Free Trade Agreements and Customs Union in his study. In the study, which is the first study in which the trade agreements are evaluated with each other, it is stated that the Customs Union is more effective than the Free Trade Agreements in terms of achieving freedom in trade, and thanks to this, the increase in welfare will be more in the agreements with the Customs Union.

As a researcher who took an attitude towards the World Trade Organization (WTO), Rose made the first study to evaluate trade agreements within the framework of the WTO. In his work covering the period 1948-1999 and covering 178 countries, he used the gravity model and determined that the role of WTO member countries in world trade was ineffective. Thus, he stated that he lacks empirical evidence that the GATT/WTO systematically plays a strong role in promoting trade.

In their study, Subramanian & Wei Rose (2004) concluded that the explanations they found were inadequate and that the WTO did a great job in promoting international trade. They also found that GATT/WTO greatly improved world imports, but that this made the role of GATT/WTO unequal in promoting imports. They also emphasized that the developing countries cannot benefit from the WTO membership and that a result cannot be drawn, and that an analysis should be made by distinguishing the developing countries as exporters and importers in order for this to happen.

Kalaycı (2017) in his study covering the years 2012-2016 on the product group in which Türkiye has a comparative advantage with the countries with which it has a Free Trade Agreement, Türkiye's "live animals and foodstuffs; spirits and tobacco; non-renewable raw materials excluding fuel oil, for which it has a comparative advantage in various manufactured goods" groups; animal, vegetable fats and oils, waxes; It has been determined that it has a

comparative disadvantage in the "chemical industry and related industrial products" goods groups not specified elsewhere.

In their studies, Koçtürk & Kocaefe (2014) stated that after 2000, the number of countries with which Türkiye signed Free Trade Agreements increased and thus the foreign trade volume increased. They mentioned that the increase in the number of countries with which Free Trade Agreements are made for Türkiye, which is trying to integrate into the world, has positive results in terms of foreign trade, as well as that Türkiye can become one of the leading countries in world trade.

Cihan & Sandalcılar (2021) found that the Free Trade Agreements and the income levels of the countries have a significant and positive effect on the total trade, using the panel gravity model between the years 1985-2019 and the six countries with the largest share in trade among the countries with which Türkiye has signed a Free Trade Agreement. They found that the distance between countries has a negative effect. When they created an extended model with the effects of the countries, they found that the income and price variables were more significant than the population variable.

Bolat & Kaplan (2021) examined the sectoral exports of Türkiye to the countries with which it signed a Free Trade Agreement and analyzed the data of 20 countries covering the 2010-2019 period using the gravity model and found a significant and positive relationship between the GDPs of the countries they export to and Türkiye's sectoral exports. They found that there is a negative relationship between distance and sectoral exports. In addition, they found that there is no relationship between Türkiye's GDP and sectoral exports, and that the dummy variable alphabet used in the model has a negative effect on sectoral exports.

Türkcan & Pişkin (2016) the impact of the Customs Union (CU) and Free Trade Agreements (STA) on extensive and intensive trade; They analyzed Türkiye's export shares of 172 countries and six products, covering the period 1996-2011, using the gravity model by separating the export shares developed by Hummels and Klenow into common and intensive methods. As a result of the study, they determined that CU and FTA had significant and negative effects on extensive trade, while they had significant and positive effects on intensive trade. In addition, another result is that CU has more effect on extensive and intensive trade than FTA.

6. Data and Methodology

6.1. Model

In the study, the panel gravity model was used to estimate the impact of economic integration agreements on Türkiye's high technology exports. Studies in the literature (Leamer & Levinsohn, 1995; Yotov et al.,2016; Demiroğlu, 2019) have expressed the superiority of gravity models in estimating international trade flows.

In this study, it is aimed to measure the effects of free foreign trade agreements, Customs Union and preferential trade agreements and economic integration agreements and to reveal the heterogeneous effects of the agreements by using the high technology export data of 10

ASEAN countries for the 14-year period covering the years 2007-2020. In this context, the gravity model will be used.

The gravity model is a mathematical method used to reveal the trade flows between two geographical locations and the factors affecting these flows. Newton's law of universal gravitation forms the theoretical basis of this model. This model determines the trade volume between the two countries by taking into account the cost of trade. Thanks to this model, the potential and actual trade volumes between the two countries can be compared, and the effects of the trade policy variables added to the model on the actual trade volume can be evaluated.

According to Newton's law of universal gravitation, gravitational force (F); The universal gravitational constant (G) is a function of the masses of the objects (Mi, Mj) and the distance between them (Dij), and this can be expressed as follows:

$$F_{ij} = G\frac{M_i M_j}{D_{ij}^2} \quad (1)$$

The first application of the gravity model to explain foreign trade was carried out in 1962 by the Dutch economist group under the leadership of Jan Tinbergen. The economists in question adapted Newton's physics law, which is included in equation (1), to foreign trade as follows (Golovko, 2009)

$$\xi_{ij} = \beta_0 \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{D_{ij}^{\beta_3}} \quad (2)$$

ξ_{ij}: export or import from country i to country j

Y_i: GDP of country i

Y_j: GDP of country j

D_{ij}: Distance between country i and country j

Additional explanatory variables can be added to the gravity model specified in equation (2) in accordance with the purpose of the study. The gravity model, in which other explanatory variables are added besides income and distance, is called the "extended gravity model". In the study, an extended gravity model developed by Anderson & Van Wincoop (2003) and adapted to panel data analysis by Bajer & Bergstrand (2007) will be created.

The structural gravity model proposed by Anderson & Van Wincoop (2003) took into account trade costs between countries. According to the structural gravity model, an increase in trade costs between two countries causes a decrease in trade between countries. However, this assumption is valid in a world where only two countries exist. In a multi-country economic system, a free foreign trade agreement between country i and country j reduces trade costs and creates an increasing effect on trade between countries.

Anderson & Van Wincoop (2003) demonstrated the importance of a gravity model in which relative trade costs are controlled, and they also stated that the relative trade costs of other countries, rather than trade costs between countries, are the determinants of trade flows between two countries. The main element in this study is how the economic integration and

free foreign trade agreements signed between Türkiye and ASEAN countries affect high technology exports.

In this context, the structural gravity model was adapted to the panel data covering the high technology exports of 10 ASEAN countries with Türkiye in a 14-year period, based on the model proposed by Baier & Bergstrand (2007).

Bajer & Bergstrand (2007) adapted the structural gravity model proposed by Anderson & van Wincoop (2003) to the panel data model. In recent years, many econometric methods have been developed to consistently determine the determinants of foreign trade. Among these methods, the Poisson Pseudo Maximum Likelihood method is applied to overcome the problems of varying variance and zero value in trade data. The Poisson Pseudo Maximum Likelihood method minimizes the deviation in models with varying variance and measurement errors in the dependent variable and allows analysis in foreign trade data in their raw form without the need for logarithmic transformation.

In this way, foreign trade data with a value of zero can be included in the analysis without removing it from the data set (Silva & Tenreyro, 2006: 649). For this reason, in the study, the structural gravity model was estimated with the Poisson Pseudo Maximum Likelihood (PPML) method, which takes into account the varying variance, does not exclude the variables that are constant with respect to time from the model, and does not cause loss of observation since it is included in the analysis without taking the logarithm of the foreign trade data.

In the use of the PPML method, time-varying exporter and importer fixed effects (Anderson & van Wincoop, 2003; Feenstra, 2004; Baldwin & Taglioni, 2007) to account for changes in "trade resistance" constraints, eliminating unobservable barriers to trade and endogenous trade policy variables resulting from unobserved binary heterogeneity that does not change over time. In order to take this into account, time-invariant trading pair fixed effects (Baier & Bergstrand, 2007) need to be included in the structural gravity model. The PPML method is based on the exponential form. In this context, the structural gravity model is written in exponential form, and the time index and error term are added to the model. The model in question can be written as:

$$\xi_{ijt} = \exp\left(\ln Y + \ln Y_{it}\, \Pi_{it}^{\sigma-1} + \ln Y_{jt}\, P_{jt}^{\sigma-1} + \ln \tau_{ijt}^{1-\sigma}\right) + \varepsilon_{ijt} \qquad (3)$$

ξ_{ijt} in equation (3) is the trade between countries i and j, t index is time, Y is the GDP of the world, $Y_{it}$and $Y_{jt}$is the GDP of countries i and j, $\tau_{ij}$is country j's import cost from country i, σ is elasticity of substitution, Π and P stands for exporter and importer's trade resistance, with ε_{ijt}error term. The trade cost τ_{ij}can be expressed as:

$$\tau_{ij} = d_{ij}\delta_1 \exp\left(\delta_2 con_{ij} + \delta_3 lang_{ij} + \delta_4 ccol_{ij} + \delta_5 col_{ij} + \delta_6 landlock_{ij} + \delta_7 RTA_{ij}\right) \quad (4)$$

When the factors that make up the commercial cost are taken into consideration, it is seen that the said factors are generally the factors that do not change according to time, such as distance between countries, border neighborhood, language. However, the existence of trade agreements, which is one of the factors that make up the trade cost, changes over time. In other words, while commercial agreements do not exist in some of the period covered by the dataset, some do.

Time-varying fixed effects are added to the model to show the trade resistances of destination and source countries, which are the key features of the structural gravity model. In other words, dummy variables for the importing countries are added to the fixed effects model in order to show the fixed effects over time.

It expresses the sum of free foreign trade agreements (FTA), Customs Union (CU), preferential trade agreements (PSA) and economic integration agreements (EIA) and all integration agreements in the gravity model to be created in order to reveal the effect of economic integration and free trade agreements on advanced technology exports. Regional trade agreements (RTAs), which are the dummy variables, are taken into account as independent variables. The distance between countries i and j (DISTANCE), population of importing countries, GDP (GDP) of importing countries, foreign direct investments (FDI), human capital (HC), number of patents (PT) are other independent variables in the model.

In order to measure the impact of economic integration and free trade agreements on Türkiye's high technology exports, the structural gravity model is the dummy variables that take the value of 1 for the countries with which the agreement was made, and 0 for the countries that did not, taking into account the years of the agreement. The mentioned variables were added to the model separately because of the high level of correlation between the dummy variables in question, in other words, causing the multicollinearity problem. Thus, the effects of economic integration and free trade agreements on high technology exports were evaluated separately.

Free foreign trade agreements (FTA), Customs Union (CU), preferential trade agreements (PSA) and economic integration agreements (EIA) that Türkiye has signed with ASEAN countries and regional trade agreements (RTA), which represent the sum of all integration agreements, and the importing country's Structural gravity models can be expressed as follows, in which GDP, the population of the importing country and foreign direct investments are the independent variables, and the dependent variable is Türkiye's high-tech exports to these countries:

Model 1:

$$EX_{ijt} = \exp\left(\delta_0 + \delta_1 \ln GDP_{jt} + \delta_2 \ln DISTANCE_{jt} + \delta_3 \ln POP_{jt} + \delta_4 \ln FDI_{jt} + \delta_5 \ln HC_{jt} + \delta_6 \ln PT_{jt} + \delta_7 RTA_{ijt}\right) + \varepsilon_{JT} \quad (5)$$

Model 2:

$$EX_{ijt} = \exp\left(\delta_0 + \delta_1 \ln GDP_{jt} + \delta_2 \ln DISTANCE_{jt} + \delta_3 \ln POP_{jt} + \delta_4 \ln FDI_{jt} + \delta_5 \ln HC_{jt} + \delta_6 \ln PT_{jt} + \delta_7 FTA_{ijt}\right) + \varepsilon_{JT} \quad (6)$$

Model 3:

$$EX_{ijt} = \exp\left(\delta_0 + \delta_1 \ln GDP_{jt} + \delta_2 \ln DISTANCE_{jt} + \delta_3 \ln POP_{jt} + \delta_4 \ln FDI_{jt} + \delta_5 \ln HC_{jt} + \delta_6 \ln PT_{jt} + \delta_7 CU_{ijt}\right) + \varepsilon_{JT} \quad (7)$$

Model 4:

$$EX_{ijt} = \exp\left(\delta_0 + \delta_1 \ln GDP_{jt} + \delta_2 \ln DISTANCE_{jt} + \delta_3 \ln POP_{jt} + \delta_4 \ln FDI_{jt} + \delta_5 \ln HC_{jt} + \delta_6 \ln PT_{jt} + \delta_7 PSA_{ijt}\right) + \varepsilon_{JT} \quad (8)$$

6.2. Data

In the study, explanations regarding the variables used in the structural gravity models that will be created to measure the factors affecting Türkiye's high technology exports with ASEAN countries and the effect of free trade agreements are given in Table 1:

Table 1: Explanations on Variables

Variables	Descriptions	Source
EX	Türkiye's High-Tech Export	World Bank
GDP	GDP levels of exporting countries	World Bank
DISTANCE	Distance in km between Türkiye and Exporting Countries	Timeanddate.com
POP	Population of exporting countries	UNCTAD
FDI	Ratio of foreign direct investment in Türkiye by exporting countries to GDP	TCMB
PT	Number of patents	World Bank
RTA	Regional trade agreements that represent the sum of all integration agreements	World Trade Organisation
FTA	Free foreign trade agreements	World Trade Organisation
CU	Customs Union agreements	World Trade Organisation
PSA	preferential trade agreements	World Trade Organisation

High technology exports remain an extremely important factor in today's economies in terms of being indicators of the level of development of countries and providing positive value in the cost-benefit analysis by using resources more effectively. for this reason, the policies to be determined by countries for high technology exports and the infrastructure works to be carried out are important. The use of the GDP ratios of ASEAN countries in our model aims to measure the effect of the national product of the integration members on Turkey's exports of high-tech products. Another variable used in our model, foreign direct investment, is included in the model since it contributes to the technological infrastructure of countries through technology transfer.

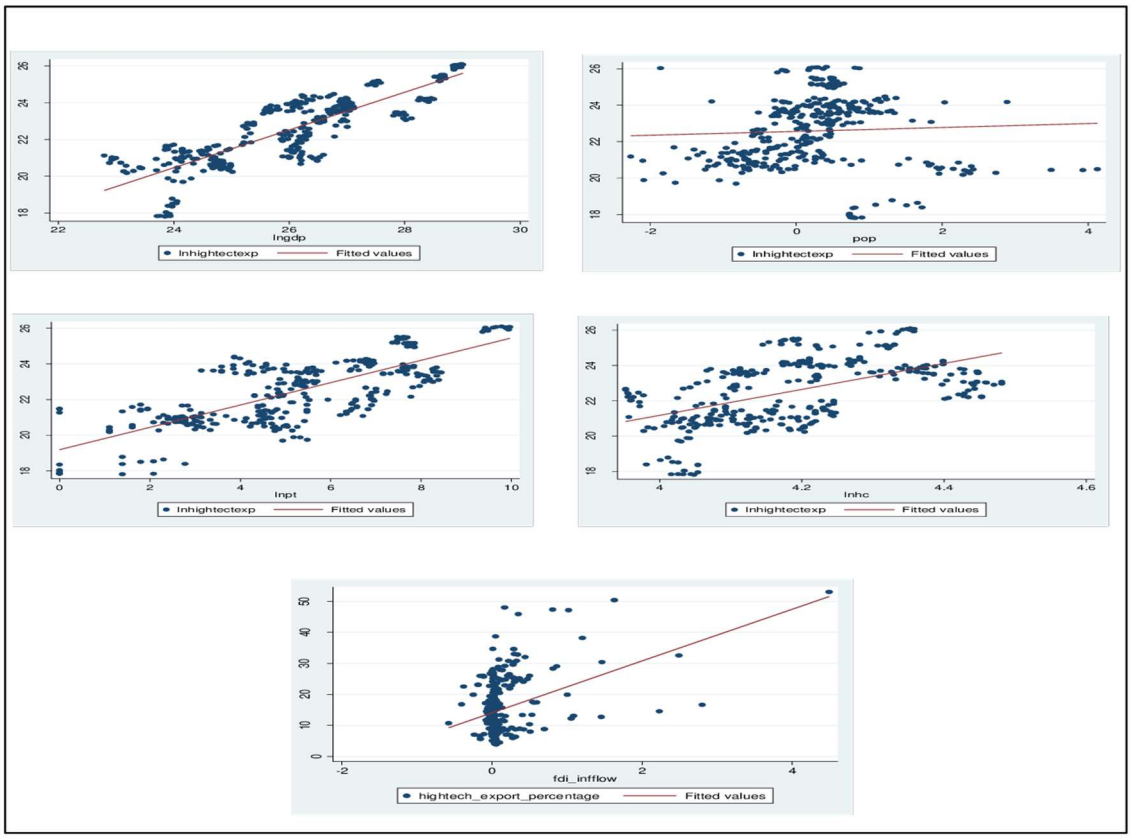
Foreign direct investments, which act as a catalyst for high technology exports or infrastructure investments required for technology exports, contribute to the technological composition of the country with the technological knowledge they bring with them. The number of patents used in our model is included in our model as it is an indicator of actual technological activities. As a result of the trade with ASEAN countries, the most precise information on Turkey's high-tech product exports will be controlled by the number of patents of the products produced. The geographical distance and population variables used in our model are variables determined in the main composition of the gravity model. The inclusion of economic integration agreements in our model is to determine which economic integration agreement has a greater impact on Turkey's high-tech exports and to test the idea that economic integration agreements should be realized with a focus on technology.

After the explanations regarding the variables were made, descriptive statistics of the said variables were calculated. Table 2 contains descriptive statistics for dependent and independent variables used in the structural gravity model to be created for ASEAN countries.

Table 2: Descriptive Statistics on Variables (ASEAN Countries)

Variables		Average	Standard Deviation	Minimum	Maximum
EX	All	21.43	3.87	10.97	25.80
	Between Groups		3.78	15.73	25.62
	In-Group		1.42	15.59	25.17
DISTANCE	All	8.96	0.11	8.75	9.11
	Between Groups		0.12	8.75	9.11
	In-Group		0	8.96	8.96
GDP	All	25.54	1.68	22.16	29.69
	Between Groups		1.59	23.11	27.43
	In-Group		0.72	23.84	28.72
PT	All	7.03	2.24	2.39	9.42
	Between Groups		2.31	3.80	9.15
	In-Group		0.46	5.06	8.05
FDI	All	0.06	0.06	-0.01	0.32
	Between Groups		0.06	0.017	0.21
	In-Group		0.02	-0.08	0.16
POP	All	16.97	1.79	12.83	19.42
	Between Groups		1.88	12.91	19.34
	In-Group		0.05	16.82	17.07

Figure 1: Distribution Charts of High-Tech Exports by Determinants (ASEANCountries)



When Figure 1 is examined, it is seen that there is a positive relationship between Türkiye's high technology exports and the GDP of importing countries for ASEAN countries. Similarly, it can be stated that there is a positive relationship between the number of patents, human capital and foreign direct investment inflows and high technology exports. However, it is seen that there is no significant relationship between the population ratio of importing countries and high technology exports.

6.3. Empirical Results

Unlike other economic integrations Türkiye has established, only regional trade agreements and preferential trade agreements are included in the models created to measure the impact of free foreign trade and economic integration agreements on Türkiye's high-tech exports to ASEAN countries. This is because the Customs Union agreement, free foreign trade agreements and economic integration agreements have not been signed between Türkiye and ASEAN.

Model 1:

$$EX_{ijt} = \exp\begin{pmatrix}\delta_0 + \delta_1 \ln GDP_{jt} + \delta_2 \ln DISTANCE_{jt} + \delta_3 \ln POP_{jt} \\ +\delta_4 \ln FDI_{jt} + \delta_5 \ln PT_{jt} + \delta_6 RTA_{ijt}\end{pmatrix} + \varepsilon_{JT}$$

Model 2:

$$EX_{ijt} = \exp\begin{pmatrix}\delta_0 + \delta_1 \ln GDP_{jt} + \delta_2 \ln DISTANCE_{jt} + \delta_3 \ln POP_{jt} \\ +\delta_4 \ln FDI_{jt} + \delta_5 \ln PT_{jt} + \delta_6 PSA_{ijt}\end{pmatrix} + \varepsilon_{JT}$$

Before examining the stationarity of the variables, firstly, the cross-section dependencies of the variables were examined. Table 3 shows the results of the cross-section dependence test results for the variables in the structural gravity model to be created for ASEAN countries. Considering the results in Table 3, the null hypothesis stating that there is no cross-sectional dependence for the cross-sectional dependency test statistics of the dependent and all independent variables in the models was rejected at the 5% significance level; Therefore, it can be stated that there is a cross-section dependency in all variables in the models. Since there is cross-section dependency in the variables, tests and estimators that take into account the cross-section dependence should be applied in order to obtain effective and consistent results. For ASEAN countries, the stationarities of the variables were examined with the 2nd generation unit root test, which takes into account the cross-section dependence.

Table 3: Cross Section Dependency Test Results (ASEAN Countries)

	Breusch-Pagan LM	Pesaran CD LM_1	Pesaran CD LM_2	Pesaran CD
EX	340.53*** (0.0000)	31.15*** (0.0000)	30.76*** (0.0000)	17.34*** (0.0000)
GDP	458.26*** (0.0000)	43.56*** (0.0000)	43.27*** (0.0000)	21.19*** (0.0000)
PT	465.36*** (0.0000)	44.31*** (0.0000)	43.89*** (0.0000)	21.51*** (0.0930)
FDI	74.71*** (0.0035)	3.13*** (0.0017)	2.74*** (0.0060)	1.49** (0.0354)
POP	424.17*** (0.0000)	39.96*** (0.0000)	39.58*** (0.0000)	20.32*** (0.0000)

Note: Values in parentheses represent probabilities. ***, **, * denote significance at 1%, 5% and 10% significance levels, respectively.

Before moving on to the model estimation phase, the stationarities of the variables are examined. In this way, the spurious regression problem is eliminated. The second generation unit root test developed by Pesaran (2007) was used to test the stationarity of the variables to be used in the structural gravity models of Türkiye's high-tech exports with ASEAN countries, since they contain cross-section dependence.

Table 4 shows the results of the Pesaran unit root test for the variables in the structural gravity model to be created for ASEAN countries:

Table 4: Pesaran Unit Root Test Results (ASEAN Countries)

	CIPS İstatistikleri	CIPS İstatistikleri
	Sabit Terimli	**Sabit Terim ve Trendli**
EX	-2.55 (1)**	-2.98 (1)**
GDP	-2.12 (1)	-0.92 (1)
Δ GDP	-2.37 (0)**	-2.80 (0)*
PT	-2.51 (0)**	-2.85 (0)*
FDI	-2.07 (0)	-2.37 (0)
ΔFDI	-3.30 (0)***	-3.19(0)**
POP	-3.37***(1)	-4.67 (1)***
DISTANCE	-2.61 (0)***	-1.70 (0)***

Note: For constant term unit root testing, the critical values at 1%, 5%, and 10% significance levels are -2,660, -2,370, and -2,220, respectively. The critical values at 1%, 5% and 10% significance levels for the unit root test with constant term and trend are -3,210, -2,920, and -2,760, respectively. Values in parentheses indicate suitable lag lengths determined according to the Akaike information criterion. ***, **, * denote significance at 1%, 5% and 10% significance levels, respectively.

When the CIPS statistics regarding the Pesaran unit root test results with both constant terms and trends of the variables in Table 4 are examined, the null hypothesis stating that the series does not have a stationary structure at the 5% significance level cannot be rejected for GDP and FDI variables; It appears to be rejected for the EX, POP, PT, and DISTANCE variables.

This result indicates that GDP and FDI variables are not stationary in their level values, while EX, POP, PT and DISTANCE variables are stationary in their level values. The non-stationary GDP and FDI variables were made stationary by taking their first difference.

After determining the stationarities of the variables of ASEAN countries, the existence of unobservable effects in the models created to examine the effects of free foreign trade and economic integration agreements on high technology exports were tested. Ignoring unobservable effects leads to biased and inconsistent estimators.

Table 5 shows the LR test results applied to test the existence of unobservable time and unit effects related to the models created for high technology exports.

Table 5: LR Test Results for Unit and Time Effects (ASEAN Countries)

	Model 1	**Model 2**
Unit Effects Test	2.16** (0.03)	2.15** (0.03)
Time Effects Test	12.68*** (0.00)	14.06*** (0.00)
Time and Unit Effects Testing	8.37*** (0.00)	8.75*** (0.00)

Note: Values in parentheses represent probabilities. ***, **, * denote significance at 1%, 5% and 10% significance levels, respectively

When the LR test results, which are performed individually and in combination to test the existence of unit and time effects, are examined, it is seen that unit (importing country) and time (year) effects are significant at the 5% significance level in high-tech export models. Therefore, there are both unit and time effects in the models.

Elimination of the variance problem in the model is important in terms of obtaining effective estimators. The modified Wald test developed by Greene (2000) was applied to examine the variable variance problem in structural gravity models where the importing countries are ASEAN countries. Table 6 shows the modified Wald test results applied for models where the importing countries are ASEAN countries.

Table 6: Modified Wald Test Results (ASEAN Countries)

	χ^2
Model 1	16307.15*** (0.0000)
Model 2	5849.02 *** (0.0000)

Note: Values in parentheses represent probabilities. ***, **, * denote significance at 1%, 5% and 10% significance levels, respectively.

Structural gravity models created to reveal how Türkiye's high-tech exports with ASEAN countries are affected by free foreign trade agreements and economic integration agreements are estimated with the PPML estimator, which has unit and time effects, overcoming the problems of changing variance and zero value in trade data.

Table 7 presents the PPML estimation results for the structural gravity models Model 1 and Model 2, which were created to reveal the effects of regional trade agreements and preferential trade agreements on Türkiye's high technology exports.

The model estimation results in Table 7 can be summarized as follows: The distance between Türkiye and ASEAN countries negatively affects high technology exports. The increase in the GDP of the partner countries, ASEAN countries, positively affects Türkiye's advanced technology exports.

A 1% increase in the GDP of ASEAN countries increases Türkiye's high technology exports by an average of 55%. Similarly, it can be stated that foreign direct investments made by ASEAN countries increase high technology exports. Accordingly, a 1% increase in foreign direct investments causes Türkiye's high technology exports to increase by an average of 1.1%. The 1% increase in the number of patents in the partner country increases the advanced technology exports by 0.55% on average. The population of the partner country has not been found to have a significant effect on Türkiye's high-tech exports.

Considering the effects of regional trade agreements with partner countries on Türkiye's high technology exports, it is seen that these agreements have a positive effect on high technology exports. Accordingly, Türkiye's high technology exports have increased by 44.86% with the ASEAN countries that have signed regional trade agreements, compared to the countries that have no agreements since the signing of the agreement. Similarly, it is seen that Türkiye's advanced technology exports are 71.96% higher with the ASEAN countries that have signed preferential trade agreements, compared to the countries that did not have an agreement after the signing of the agreement.

Table 7: PPML Forecast Results (ASEAN Countries)

	Model 1	Model 2
DISTANCE	-0.26*** (0.071)	-0.27*** (0.07)
GDP	0.53*** (0.17)	0.61*** (0.16)
FDI	1.16** (0.58)	1.00* (0.53)
PT	0.58*** (0.12)	0.51*** (0.11)
POP	0.03 (0.06)	0.01 (0.06)
RTA	0.44*** (0.14)	-
PSA	-	0.71*** (0.21)
Constant Term	6.116342 (6.134768)	9.92 (6.03)
Brunei	1.27*** (0.51)	1.24 (0.56)
Cambodia	1.97*** (0.81)	1.86 (0.90)
Indonesia	1.07*** (0.40)	1.05 (0.45)
Laos	1.43*** (0.53)	1.36 (0.60)
Malaysia	1.86*** (0.70)	1.77 (0.78)
Phillippines	0.85*** (0.29)	0.78 (0.34)
Singapore	1.67*** (0.64)	1.58 (0.72)
Thiland	1.91*** (0.69)	1.79 (0.78)
Vietnam	4.43*** (1.38)	1.24 (0.56)

Note: Values in parentheses represent standard errors. ***, **, * denote significance at 1%, 5% and 10% significance levels, respectively.

Table 8: Country Based Results from the Fixed Effects Model

	GDP				FDI			
	Coefficient	**Standard Error**	**T Statistic**	**Possibility**	**Coefficient**	**Standard Error**	**T Statistic**	**Possibility**
Brunei	1.60	4.65	3.50	0.00	-16.23	5.97	-2.70	0.00
Cambodia	5.05	1.22	4.10	0.00	-8.13	4.22	-1.90	0.00
Indonesia	0.02	4.52	6.30	0.00	6.33	4.27	1.50	0.00
Laos	3.85	9.97	3.90	0.00	19.25	7.69	2.50	0.00
Malaysia	1.17	4.37	2.70	0.00	-4.24	7.71	-5.50	0.00
Phillippines	0.00	4.95	1.40	0.00	-0.33	4.68	-7.10	0.00
Singapore	0.47	1.99	2.40	0.00	-0.05	1.66	-3.60	0.00
Thiland	0.25	1.45	1.80	0.00	1.414	3.16	4.50	0.00
Vietnam	1.95	4.15	4.70	0.00	-5.74	1.67	-3.40	0.00

Table 9: Country Based Results from the Fixed Effects Model

	PT				POP			
	Coefficient	**Standard error**	**t statistic**	**Possibility**	**Coefficient**	**Standard error**	**t statistic**	**Possibility**
Brunei	0.06	1.25	5.00	0.00	8.59	8.46	1.00	0.00
Cambodia	-0.17	5.74	-3.10	0.00	2.76	4.47	6.20	0.00
Indonesia	-0.39	6.61	-6.00	0.00	-0.22	3.74	-6.10	0.00
Laos	-0.55	9.63	-5.70	0.00	9.19	6.69	1.40	0.00
Malaysia	-0.22	5.63	-3.90	0.00	0.17	2.91	5.90	0.00
Phillippines	0.05	7.75	6.70	0.00	-0.02	5.19	-4.20	0.00
Singapore	0.19	6.82	2.90	0.00	0.00	2.98	2.70	0.00
Thiland	-0.01	7.28	-2.00	0.00	-0.70	3.40	-2.10	0.00
Vietnam	1.58	5.03	3.20	0.00	4.29	7.30	5.90	0.00

7.Conclusion

Although the effects of the Second World War are seen intensely in the European States, it can be said that it opened the beginning of a period that had great effects both in terms of economic understanding and in terms of the independence of the countries. The skillful use of free trade by European states with the Industrial Revolution continued until the First World War and until the end of the Second World War, countries had to return to protectionist policies. During this period, it is seen that this protectionism increased in the 1929 economic crisis as well as the wars.

Before the end of the Second World War, it completed its industrialization outside of Europe and an agreement was reached in terms of removing the barriers to trade with the Bretton Woods meeting, which was convened with the help of the states looking for a market. Although multilateral trade was interrupted by the establishment of bilateral agreements and economic integration by the countries in the process that continued with the GATT, it is seen that the process continued until today with the acceleration of trade agreements and regionalization's at the end of the 1990s. Although there are various opinions about the benefits or harms of trade agreements in the literature, the common point is that trade agreements increase the trade volume.

As well as the importance of economic integration agreements, one of the ways for countries to gain more benefits from development and trade is the ability of countries to export high-tech products as a result of their technological capacity. For these reasons, in our study, the effect of Türkiye's trade agreements with the world's fifth largest economy, ASEAN, which we have chosen as our commercial partner on high technology exports, as well as the effects of patents, foreign direct investments and human capitals belonging to ASEAN countries have been analyzed.

As a result of our analysis, it has been determined that there is a positive and significant relationship between GDP, foreign direct investments and patent variables, which we evaluated for ASEAN countries, and Türkiye's high technology exports.

However, no negative relationship was found between the distance between Türkiye and ASEAN countries and Türkiye's high technology exports, and there was no relationship between the population of ASEAN countries and Türkiye's high technology exports. When this situation is evaluated in terms of human capital and foreign direct investments required for technology, which is shown as Türkiye's development indicators, and in terms of patents, which are indicators of technology capacity, there is a positive relationship between them and the technology products and sectors of the technology products and sectors of the high-tech exports that Türkiye has realized with the ASEAN countries. shows that it has a different structure. Therefore, in terms of export diversification, both economic integration and the continuation of the production of tradable products are considered important in terms of providing Türkiye with foreign exchange and benefiting from international competition.

In terms of trade agreements, it has been determined that regional trade agreements with ASEAN countries have a positive relationship with Türkiye's high technology exports.

Türkiye's high technology exports have increased by approximately 45% compared to the ASEAN member countries that are party to this agreement and the ASEAN members who have not signed the agreement since the signing of the agreement. In addition, in preferential trade agreements, which are among the economic integration agreements, Türkiye's high technology exports have increased by 72% compared to the members of the ASEAN member countries who are party to this agreement and the members who are not party to the agreement since the signing of the agreement. In this case, an interesting situation has emerged for Türkiye. It has been revealed that Türkiye's agreements with ASEAN countries on a national basis and on certain goods are more beneficial in terms of economic integration than the trade agreement with ASEAN. This result reveals the importance of Türkiye's making an agreement in high-tech exports by considering the activities on a certain product group. It is seen that the market rate of Turkish goods reached 90% in the Malaysian defense industry market, and the agreements made with the Philippines and Indonesia over the defense industry towards the end of 2022 are policies that coincide with the results of our analysis. For this reason, it will be beneficial in terms of international competition for Türkiye to concentrate on high technology exports in the defense industry, where it has a comparative advantage with ASEAN countries.

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