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Investigation of Foreign Trade between Turkey and Member Countries of Asia-Pacific Economic Cooperation (APEC) with Gravity Model[1,2]

Türkiye ile Asya ve Pasifik Ekonomik İşbirliği (APEC) Ülkeleri Arasındaki Dış Ticaretin Çekim Modeli ile İncelenmesi

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Abstract: Member countries of Asia-Pacific Economic Cooperation (APEC) constitute an important part of World foreign trade flows. Because of the share's size that APEC takes from foreign trade and its potential of increasing the share it has in the upcoming years, it seems that Turkey's trade with member countries of APEC will gain more importance in the future. The aim of this study is to analyze the factors that influence Turkey's trade with 21 member countries of APEC between the years of 1997-2016 using panel data analysis method and basing upon gravity model and to explain and interpret the changes occur in the foreign trade of these countries within this period. Thus the factors influencing the international trade between APEC countries and Turkey have been determined and evaluated. In this study, total foreign trade volume of Turkey and member countries of APEC is used as dependent variable; the ratio of foreign trade volume to GDP, export, import, gross domestic product (GDP) difference, GDP per capita difference, population, Linder effect, relative factor endowment, distance and acreage are used as independent variable; G20 membership, G8 membership, OECD (Organization for Economic Co-operation and Development) membership, free trade agreements, crisis and visa variables are used as dummy variable. In the consequence of analyses made with 7 model set up in this study, it has been concluded that variables of foreign trade volume / GDP, export, import, Linder effect, relative factor endowment and G20 membership influence the foreign trade volume between Turkey – APEC countries positively and variables of GDP difference, OECD membership and visa variables influence foreign trade volume negatively. It has been determined that there is no significant relationship between variables of GDP per capita difference, distance, population, acreage, G8membership, crisis, free trade agreements and variable of foreign trade volume between Turkey-APEC countries.

Key Words: APEC, Turkey, International Trade, Import, Export, Gravity Model, Panel Data Analysis

Öz: Asya ve Pasifik Ekonomik İşbirliği'ne (APEC) üye olan ülkeler dünya dış ticaret akımlarının önemli bir bölümünü oluşturmaktadır. APEC'in günümüzde dış ticaretten aldığı payın büyüklüğü ve ilerleyen yıllarda da uluslararası ticarette sahip olduğu payı arttırma potansiyelinin olması nedeniyle, Türkiye'nin bu ekonomik gruba üye olan ülkeler ile yaptığı ticaretin, gelecekte daha da önem kazanacağı görülmektedir. Bu çalışmanın amacı; Türkiye'nin APEC üyesi 21 ülke ile 1997-2016 yılları arasındaki dış ticaretini hangi faktörlerin etkilediğini, panel veri analizi yöntemi kullanarak ve çekim modelini temel alarak incelemek ve bu süreçte ülkelerin dış ticaretinde meydana gelen değişiklikleri açıklamak ve yorumlamaktır. Bu sayede; Türkiye ve APEC ülkeleri arasındaki uluslararası ticareti etkileyen faktörler belirlenmiş ve değerlendirilmiştir. Çalışmada, Türkiye ve APEC üyesi ülkelerin toplam dış ticaret hacmi bağımlı değişken olarak; dış ticaret hacminin GSYİH'ye oranı, ihracat, ithalat, gayri safi yurtiçi hasıla (GSYİH) farkı, kişi başına düşen gayrı safi yurtiçi hasıla (KBGSYİH) farkı, nüfus, Linder etkisi, göreceli faktör donanımı, uzaklık ve yüz ölçümü bağımsız değişken olarak; G-20 üyeliği, G-8 üyeliği, OECD (İktisadi İşbirliği ve Kalkınma Örgütü) üyeliği, serbest ticaret anlaşmaları ve vize değişkenleri kukla değişken olarak kullanılmıştır. Kurulan 7 model ile yapılan analizler sonucunda; dış ticaret hacmi / GSYİH, ihracat, ithalat, Linder etkisi, göreceli faktör donanımı ve G-20 üyeliği değişkenlerinin Türkiye – APEC ülkeleri arasındaki dış ticaret hacmini olumlu yönde etkilediği; GSYİH farkı ve OECD üyeliği ve vize değişkenlerinin ise dış ticaret hacmini olumsuz yönde etkilediği sonucuna ulaşılmıştır. Ayrıca; KBGSYİH farkı, uzaklık, nüfus, yüz ölçümü, G-8 üyeliği, kriz, serbest ticaret anlaşmaları değişkenleri ile Türkiye ve APEC ülkeleri arasındaki dış ticaret hacmi değişkeni arasında anlamlı bir ilişkinin bulunmadığı belirlenmiştir.

Anahtar Kelimeler: APEC, Türkiye, Uluslararası Ticaret, İthalat, İhracat, Çekim Modeli, Panel Veri Analizi

1. Introduction

Foreign trade, in general terms, can be defined as the import and export operations of countries. It is important for countries to increase their foreign trade volumes in order to compete with other countries in the globalizing world. Foreign trade volume can be increased by close trade relations with the countries in which foreign trade is made; external payment deficits can be eliminated and income can be provided to the treasury.

Asia-Pacific Economic Cooperation (APEC) is one of the groups with the highest foreign trade volume among economic groups in the world today. The Asia-Pacific region accounts for approximately 45% of world trade. The share is expected to increase in the future with the effect of the share of this group in the world economy in recent years and of

[1]This study was generated from a postgraduate thesis entitled "Investigation of Foreign Trade between Turkey and Member Countries of Asia-Pacific Economic Cooperation (APEC) with Gravity Model" in Erciyes University International Trade and Logistics Department. The postgraduate thesis was supported by Erciyes University Scientific Research Projects Unit with the project with code of **SYL-2018-7734**.

[2]This study has been prepared by expanding of the report presented verbally and summarized in the 2. International Congress on Sociology and Economics.

the countries in this group such as USA, China and Japan. Also The Asia-Pacific region is a region with a rapid growth tendency. Therefore, it is predicted that investments will increase in this region in the following years and the region will be the leader of international trade. This situation reveals the importance of Turkey's trade relations established with the APEC countries for the national economy. Therefore, trade between 21 member countries of APEC and Turkey was examined in this study; this study was aimed to contribute to the literature and to be a premise study about the trade of Turkey with APEC countries. Panel data were constituted by obtaining economic and demographic data of Turkey and 21 member countries of APEC between the years of 1997-2016 from Turkish Statistical Institute (TSI), World Bank and official statistical websites of countries. With these data, foreign trade volume between Turkey and APEC countries was analyzed over 7 models by using panel data analysis method, and findings and assessments were included.

2. Turkey's Foreign Trade with APEC Countries

APEC is one of the most important economic groups constitute trade flows in the world. Since Turkey has enhanced the trade with Taiwan, Hong Kong, Singapore, South Korea, which have industrialized rapidly and increased growth rates in recent years and are known as "Asia Tigers" or "Asia's Four Little Dragons", and other member countries, the foreign trade with this group is very important for Turkey's economy.

In this section, Turkey's foreign trade with APEC countries between the years 1997-2016 has been demonstrated with a general table. The data were examined and interpreted under the table. When the foreign trade data in Table 1 are examined, it is seen that Turkey has performed the highest export with APEC countries in 2013 with 21.2 billion dollars while the lowest export was in 1999 with 3.9 billion dollars. When the import figures are examined, it is seen that the lowest import was realized in 1999 with 10.2 billion dollars and the highest import was realized in 2014 with 85.8 billion dollars.

Table 1.Foreign Trade between Turkey and APEC countries ($)

Years	*Export*	*Import*	*Balance of Foreign Trade*	*Foreign Trade Volume*
1997	*5,544,138,880*	*12,750,268,945*	*-7,206,130,065*	*18,294,407,825*
1998	*4,476,565,969*	*12,358,207,886*	*-7,881,641,917*	*16,834,773,855*
1999	*3,949,390,595*	*10,246,653,645*	*-6,297,263,050*	*14,196,044,240*
2000	*4,940,090,661*	*14,315,794,668*	*-9,375,704,007*	*19,255,885,329*
2001	*5,234,372,101*	*11,346,961,644*	*-6,112,589,543*	*16,581,333,745*
2002	*6,193,581,155*	*13,109,892,674*	*-6,916,311,519*	*19,303,473,829*
2003	*7,040,099,239*	*17,814,391,420*	*-10,774,292,181*	*24,854,490,659*
2004	*8,856,010,306*	*27,999,570,452*	*-19,143,560,146*	*36,855,580,758*
2005	*9,539,617,407*	*37,398,015,683*	*-27,858,398,276*	*46,937,633,090*
2006	*11,183,218,788*	*47,615,028,613*	*-36,431,809,825*	*58,798,247,401*
2007	*12,406,036,312*	*62,160,941,132*	*-49,754,904,820*	*74,566,977,444*
2008	*15,997,687,993*	*77,289,506,061*	*-61,291,818,068*	*93,287,194,054*
2009	*10,894,010,910*	*53,928,975,438*	*-43,034,964,528*	*64,822,986,348*
2010	*14,357,266,902*	*68,367,271,879*	*-54,010,004,977*	*82,724,538,781*
2011	*18,038,491,890*	*84,293,932,588*	*-66,255,440,698*	*102,332,424,478*
2012	*19,879,033,085*	*82,710,623,739*	*-62,831,590,654*	*102,589,656,824*
2013	*21,156,115,250*	*84,826,942,765*	*-63,670,827,515*	*105,983,058,015*
2014	*20,345,320,020*	*85,810,976,510*	*-65,465,656,490*	*106,156,296,530*
2015	*17,253,339,318*	*77,806,875,429*	*-60,553,536,111*	*95,060,214,747*
2016	*15,809,243,769*	*73,479,499,991*	*-57,670,256,222*	*89,288,743,760*

Source: Turkish Statistical Institute, 2018

According to data of Turkey's foreign trade with APEC countries in Table 1, it is seen that Turkey has a deficit in foreign trade every year. Especially with the rapid increase in foreign trade deficit since 2003, 2013 was the year with the highest deficit of 66.3 billion dollars. When considering groups of products that APEC countries exported to Turkey, high value added products such as natural gas, electrical and electronic devices, data process machinery and equipment, auto and auto parts, heavy industry machinery and equipment predominate whereas Turkey exports to these countries agriculture and livestock products, cans, rough or semi-processes mines, various construction materials, light industry productions such as vehicle tires, kitchen utensils and rubber products with low value added. Therefore every year foreign trade deficit gradually increased in the trade between Turkey and APEC countries. According to foreign trade volume figures, the highest volume was realized in 2014 with 106.2 billion dollars.

3. History and Literature Review of Gravity Model

In international trade, gravity model can be defined as a function of two countries' trade volume and these countries' economic size and distance variables. In this model that derives from Newton's Law of Universal Gravitation; trade flow between two countries is directly proportional to GDP of these countries but inversely proportional to distance between them. Gravity model is an econometric model used frequently in literature and in the explanation of international trade flows between countries.

H. Carey, who studied human behavior in the 1860s, is the first to mention the law of gravity on behavioral science. In his study of human behavior, he applied Newton physics for the first time, thus he enabled the use of the gravity model in the social sciences widely (Cheng and Wall 1999).

Ravenstein (1885) pioneered the use of the law of gravity in explaining the migration flows and explained how the migration flows were directed to the centers of trade and industry, and how they were reduced in proportion to the distance.

Tinbergen (1962) was the first to use the gravity model to explain trade flows between countries. Tinbergen stated that the gravity model is an important econometric model that can be used to explain the migration movements and international trade between countries. Although there are many pioneers of the gravity model, the first group made mathematical formulation and empirical application of the model is a group of Dutch economists headed by Tinbergen (Van Bergeijk and Brakman 2010, 4).

After Tinbergen (1962) and Pöyhönen (1963) who used Law of Gravity to explain trade flows between countries, interest to the gravity model increased and more researchers began to use this model in their studies in the empirical analysis of international trade. Tinbergen and Pöyhönen, stated the masses of objects expressed in the formula in Newton Law of Gravity with national income of the countries on the gravity model used in international trade, used the model to explain the trade flows between European countries.

Helpman and Krugman (1985) wanted to contribute and improve the gravity model. They used product trade theories that are differentiated and with increasing yield according to scale in order to verify the equation of gravity.

Deardorff (1998) constituted gravity model in his study basing on the model of Heckscher-Ohlin. Deardorff showed that the gravity model he constituted was compatible with Heckscher-Ohlin International Trade Theory, and then the gravity model was widely used as a tool to explain international trade for many researchers.

Beside there is no much publication for examination of foreign trade between Turkey and APEC countries as economic group by gravity model in literature, this study has been performed for various regions, economic groups and countries.

Martinez-Zarzoso and Nowak-Lehmann (2003) examined the trade relationship between the Southern Common Market (MERCOSUR) and the European Union with the help of an augmented gravity model. In the analysis, infrastructure, exchange rate, income, population, distance, per capita income variables and common language, common border, trade barriers as dummy variables were used. In this study, the Hausman test was used to determine which of the fixed effects and random effects models should be used, and the fixed effects model was found appropriate. Then, for the comparison of the standard gravity model and the extended gravity model, ordinary least squares (OLS) was used, in addition, regression was applied to cross-section means to obtain similar results with OLS. The regression for the two ways fixed effects model was used among models. Then, a Wald test was performed to check the significance of time effects. As a result of the analysis; they have concluded that the income of importer and exporter countries affects the foreign trade between countries positively; the high population density is positive for the importing country and has a negative effect on the exporting country; infrastructure, income differences and exchange rate variables are effective in explaining the trade between these countries and also the dummy variables affect the trade positively.

Rahman, Shadat and Das (2006) examined the trade in South Asian Free Trade Area (SAFTA) using the gravity model. Two-stage estimation technique was applied in this study. Estimation was made using the Tobit Model in the first stage, and OLS was used in the second stage. As a result of the analyzes, it was concluded that the fact that the GDP, import/GDP, common border or common language have a positive and statistically significant effect on the trade volume between the two countries.

Bhattacharya and Bhattacharyay (2007) analyzed the gains and losses of India and China in commercial cooperation with the gravity model. In the study, fixed effects model was tried but since the results were not appropriate, random effects model was applied. Then, Variance-Component Regression Model was used to measure the effect of countries' distance from each other over a period of time. As a result of the analysis, it has been concluded that the gross national product has a positive effect on the foreign trade flow between the two countries; their distances and customs tariffs have a negative effect on the foreign trade and real exchange rates' effect is uncertain.

Bilgili (2007) has examined Turkey's exports in the sectoral level by the gravity model. In the study, Lagrangian Multiplier (LM) Test was used to evaluate the pooling model and random effect and Hausman test was used to compare random effects and fixed effects model. According to the LM and Hausman test results, the random effects model was found appropriate. The production sector was categorized and evaluated by panel regression analysis. In the study, export has been used as dependent variable; GDP, GDP per capita difference, population, distance as an independent variable and EU membership as dummy variable. As a result of the analysis, it has been concluded that GDP, population and GDP per capita differences variables affect Turkey's export positively and the distance variable affects negatively.

Erkekoğlu (2007) has examined intra-industry trade of the EU and Turkey between 1996-2005 years by panel data analysis using the Grubel-Lloyd Index. Hausman Test and White Cross-Section Correction were performed in the study and random effects model was found appropriate. As a result of the analysis it has been concluded that the coefficient of

GDP difference between the EU and Turkey and the coefficient of GDP per capita difference are negative and statistically insignificant, coefficient of the distance variable is negative and statistically significant, coefficient of average GDP variable is positive and statistically significant.

Kien (2009) has examined the export flow of 39 countries in the ASEAN Free Trade Area with the help of the gravity model using the data from 1988-2002. Two-way Error Component of Gravity Model was used in the study by considering the unexamined heterogeneous factors in the errors. Variable coefficients were compared for Pooled OLS, FEM (Fixed Effects Model), REM (Random Effects Model) and Hausman Taylor Estimator as estimation methods. He has concluded that national income, population, language and other factors have positive effects on the export flow of countries, while the distance between countries affects foreign trade negatively.

Tansey and Hanson (2011) have examined the trade of developing countries with the help of the gravity model. According to the gravity model they applied to the Asian, Latin American and African regions, it has been concluded that trade of countries in these regions with the developing neighboring countries has positive effects on the volume of foreign trade rather than establishing commercial relations with the developed countries in the remote regions.

Rasoulinezhad (2016) has examined the effect of oil prices and economic sanctions on Iran-Russia trade using the gravity model. In the study, ADF (Augmented Dickey-Fuller Test) and PP (Phillips-Perron Test) were applied from unit root tests to determine whether the series was stationary. Johanson Co-integration Test was applied to determine whether there is a cointegration relationship between the variables. Then, Vector Error Correlation Model (VECM) was applied to measure the effect of dummy variables added to the model. In the study, the trade volume between Iran and Russia has been used as dependent variable; GDP, GDP per capita and transport cost as independent variable and in addition, whether there are financial and non-financial sanctions against Iran and whether the oil prices have experienced hard changes have been used as dummy variables. It has been concluded that the financial and non-financial sanctions on Iran and the sudden changes in oil prices have a significant negative effect on the trade of the two countries.

Şahin (2017) has examined trade of Azerbaijan between 2010 and 2015 with Georgia and Belarus, Kazakhstan, Armenia, Russia, Kyrgyzstan, Turkmenistan, Ukraine, Uzbekistan and Moldova members of Commonwealth of Independent States (CIS) with the basing on the Theory of Similarity in Preferences by panel gravity model. In the study, random effects model was preferred because of the use of distance variable which does not change according to time in the Gravity Model. Wallace & Hussein Prediction Model was used in estimation of the random effects model. As a result of the analysis, it has been concluded that the export volume of Azerbaijan is influenced positively by GDP of the countries it makes trade, population of these countries and having common borders with them. Distance between countries affects trade of Azerbaijan negatively.

4. Data Set And Variables

In this study the determinants of trade flows between Turkey and the APEC countries have been analyzed using gravity model. In this study, which includes the annual data of 1997-2016 periods, 7 different models were used and the model was expanded and enriched with the addition of different independent variables and dummy variables beside the GDP and distance that belong to the standard gravity model variables. The variables used in these models are:

$FTVOLUME_{ijt}$: It is foreign trade volume of country i and country j at t period (total of export and import).

$DGDP_{ijt}$: It is the difference between GDP of country i and country j at t period. This difference is formulated as follows (Zhang and Li, 2006, p. 1140-1141):

$$DGDPijt = 1 + \frac{[w\ln(w) + (1-w)\ln(1-w)]}{\ln 2}$$

Here;

$DGDP_{ijt}$= It is GDP difference between country i and country j at t period.

w: It is the ratio of the GDP of a country to the total of its GDP with the trading partner country. Calculation of this ratio is as follows (Zhang and Li 2006, 1140-1141):

$$w = \frac{GDPi}{GDPi + GDPj}$$

$EXPORT_{ijt}$: It is export of country i to country j at t period.

$IMPORT_{ijt}$: It is import of country i from country j at t period.

$FTGDP_{ijt}$: It is ratio of total foreign trade volume of country i and country j at t period to GDP of country i. It shows country i's index of openness.

$POPULATION_{jt}$: It is population of country j at t period.

$DGDPPC_{ijt}$: It is the difference between GDP per capita of country i and country j at t period. GDP per capita difference variable is calculated taking logarithm of absolute value of Turkey and its trade partner's GDP per capita difference (Erkekoğlu, 2007, p. 81).

$LİNDER_{ijt}$: It shows the similarity between per capita income levels of country i and its trade partner country j in t period. This variable has been measured by taking the square of the difference of the per capita income level of country i and the income level of the trade partner country j. The variable is formulated as follows (Arnon and Weinblatt 1998, 608):

$LİNDER_{ijt} = \ln (GDPPCit - GDPPCjt)^2$

Here;

$GDPC_{it:}$ It is GDP per capita of country i at t period

$GDPC_{jt:}$ It is GDP per capita of country j at t period

RFE_{ijt}: It is the relative factor endowment of country j at t period. Relative factor endowment is an important source of intra-industry trade. According to Helpman and Krugman (1985), economies with larger factor endowments create more trade opportunities within the industry. In the Heckscher - Ohlin model, the difference in factor endowment between the two countries increases specialization and this increases the trade volume between industries (Yamarik and Ghosh 2005, 107-108). The variable is formulated as follows (Egger 2002, 300):

$$\text{Relative Factor Endowmentijt} = \left| \ln\left(\frac{GDPit}{POPit}\right) - \ln\left(\frac{\text{GDPjt}}{\text{POPjt}}\right) \right|$$

Here;

GDP_{it}: It is GDP of country i at t period.

GDP_{jt}: It is GDP of country j at t period.

POP_{it}: It is Population of country i at t period.

POP_{jt}: It is Population of country j at t period.

$DISTANCE_{ij}$: It expresses distance (km) between capitals of country i and j.

$ACREAGE_j$: It expresses acreage (km^2) of country j.

$G20_{ijt}$: It is the dummy variable that shows whether country i and j are members of G-20 community or not at t period. The countries in question have a value of 1 if they are members of G-20 and 0 if they are not.

$G8_{ijt}$: It is the dummy variable that shows whether country i and j are members of G-8 community or not at t period. The countries have a value of 1 if they are members of G-8 and 0 if they are not. Since Russia's G-8 membership was suspended in 2014, this country has 0 value between the years 2014-2016.

$CRISIS_{jt}$: In this dummy variable, the global economic crisis of 2008 was taken into consideration. In this period, foreign trade figures changed significantly. A variable was created by giving 1 to 2008 and 2009 years and 0 to other periods.

$OECD_{ijt}$: It is the dummy variable that shows whether country i and j are members of OECD community or not at t period. The countries have a value of 1 if they are members of OECD and 0 if they are not.

FTA_{ijt}: It is a dummy variable that shows the free trade agreements signed by the countries i and j at t period. The countries that Turkey signed a free trade agreement in the related period have the value 1 while other countries have the value 0.

$VISA_{ijt}$: It is a dummy variable that shows the visa liberalization applications of country i and j that can facilitate trade at t period. Trade partner countries and the period in which these treatments have the value1 and other periods have the value 0.

Export, import, population, GDP and GDP Per Capita data used in models were obtained from the World Bank (2018), the distance between Turkey and the capital of trade partner country from Time and Date (2017) and acreage data from Coğrafya Dünyası (2018).

5. Findings

In this section, Augmented Dickey Fuller (ADF) Test which is one of the unit root tests that are used to understand whether the series is stationary or not and if it is, what is the level of stationarity, Hausman Test that is used to determine which of fixed effects and random effects model will be used, Wooldridge autocorrelation test that is used to measure whether there is autocorrelation or not, Heteroskedasticity Test that is used to determine whether there is changing variance before estimation of models or not, results of panel regression analysis which is estimated by the method of OLS Method and Panel EGLS Method the interpretations of these results are discussed.

Firstly, ADF Test was performed to determine whether the series is stationary or not. The hypotheses used in the unit root test are as follows:

H_0: The series is not stationary; there is unit root in the series.

H_1: The series is stationary; there is no unit root in the series.

As a result of unit root test, if the probability value of the variables in the model is greater than 0.05, the hypothesis H_1, which expresses that there is no unit root, is rejected and H_0 hypothesis is accepted. If the probability value is less than 0.05, the hypothesis H_0, which accepts the existence of unit root, is rejected and H_1 hypothesis is accepted.

When the results of ADF unit root test in Table 2 are examined; it is seen that the first differences of the variables are taken for all dependent and independent variables and the variables are become stationary. As a result of the first differences it is concluded that the probability value at the first difference level is less than 0.05 for all variables. According to this, the H_0 hypothesis which expresses the first state of the series is not stationary and that the unit root is present in the series is rejected and the hypothesis H_1, which expresses that the series is stationary, is accepted.

After the unit root test was applied, the Hausman test was performed to determine which of the fixed effects and random effects model would be used. This test assumes that the specific effect belonging to the group is random. If there is no correlation between the specific effects of the groups and the explanatory variables, the null hypothesis (H_0: Random Effects estimator is correct) is accepted, and if there is a correlation between them, the alternative hypothesis (H_1: Fixed Effects estimator is correct) is accepted (Erkekoğlu 2007, 80).

In panel data analysis, autocorrelation is an important problem. One of the basic assumptions of regression analysis is that there is no correlation between the same errors for different observations (Korkmaz, Yıldız and Gökbulut 2010,

101). There are autocorrelation problems when the error terms are related to each other. In this study, autocorrelation was investigated by Wooldridge autocorrelation test.

The hypotheses used in the Wooldridge autocorrelation test are as follows:

H_0: There is no autocorrelation between the error terms.

H_1: There is autocorrelation between error terms.

A comment is made on whether there is autocorrelation or not according to the probability (p) values of the Wooldridge test. If the probability value is less than 0.05, the hypothesis H_0 is rejected according to the significance level of 5% and it is accepted that there is autocorrelation between error terms. If the probability value is greater than 0.05, the H_1 hypothesis is rejected and it is assumed that there is no autocorrelation between the error terms.

In a statistical model, variances of error terms may vary with increasing or decreasing or both increasing and decreasing distribution. When the variance of the error term is different, it is called as Heteroskedasticity and this is an undesirable situation like autocorrelation in regression analysis (Albayrak 2008, 113). The heteroskedasticity problem has a negative effect on the results of regression analysis. In a regression analysis, heteroskedasticity causes the statistical tests to lose their reliability (Yamak and Köseoğlu 2008, cited in Albayrak 2008, 114).

The hypotheses used in the heteroskedasticity test are as follows:

H_0: There is no heteroskedasticity.

H_1: There is heteroskedasticity.

Table 2.The Results of ADF Unit Root Test

AUGMENTED DICKEY-FULLER (ADF) TEST							
VARIABLE	*INDIVIDUAL INTERCEPT*		*INDIVIDUAL INTERCEPT AND TREND*		*NONE*		*DEFERMENT LEVEL*
	t Statistic Value	*Probability Value*	*t Statistic Value*	*Probability Value*	*t Statistic Value*	*Probability Value*	
LOGFTVOLUME	*162.459*	*0.0000*	*134.137*	*0.0000*	*203.189*	*0.0000*	*I (1)*
LOGFTGDP	*171.860*	*0.0000*	*141.441*	*0.0000*	*258.127*	*0.0000*	*I (1)*
LOGEXPORT	*160.658*	*0.0000*	*128.174*	*0.0000*	*211.714*	*0.0000*	*I (1)*
LOGIMPORT	*130.104*	*0.0000*	*98.5540*	*0.0000*	*195.791*	*0.0000*	*I (1)*
LOGDGDP	*118.065*	*0.0000*	*74.3166*	*0.0015*	*209.719*	*0.0000*	*I (1)*
LOGDGDPPC	*115.275*	*0.0000*	*82.1762*	*0.0002*	*200.255*	*0.0000*	*I (1)*
LOGPOPULATION	*91.6949*	*0.0000*	*126.725*	*0.0000*	*68.4357*	*0.0061*	*I (1)*
LOGRFE	*111.940*	*0.0000*	*71.6774*	*0.0029*	*204.275*	*0.0000*	*I (1)*
LOGLİNDER	*96.3922*	*0.0000*	*62.7860*	*0.0204*	*168.904*	*0.0000*	*I (1)*

As Berke (2009, 41) stated in his study; The Likelihood Ratio: LR test has been performed to determine whether there is heteroskedasticity or not before the estimation of the models. In the study, whether there is heteroskedasticity or not has been determined by looking at the P value of the Heteroskedasticity LR (Likelihood Ratio) test. If the P value is less than 0.05, the H_0 hypothesis is rejected and it is assumed that the heteroskedasticity exists. If P value is greater than 0.05, hypothesis H_1 is rejected and it is assumed that there is no heteroskedasticity in the model.

Table 3 shows the results of panel regression analysis estimated by the OLS method. Probability Hausman (Chi-Square) values seen in the models' results of panel regression analysis estimated by the OLS method are smaller than 0.05 so that the fixed effects model is appropriate. Since the P value of the Wooldridge test is smaller than 0.05 and the Durbin Watson values are outside the range of 1.85-2.10, all models have autocorrelation problems. In order to solve this problem, White's cross section coefficient covariance method has been used and it has been aimed to correct the standard errors. This method will also solve the problem of correlation between the cross sections as well as the different error variances in each of the cross sections. Also, since P value of the Heteroskedasticity Likelihood Ratio (LR) test is 0.0000<0.05, there is a heteroskedasticity problem in the models. For the heteroskedasticity problem, in addition to this correction, Cross-section weights GLS have been applied to models since they are fixed effect (Hacıimamoğlu 2016, 68; Çolak 2012, 142).

Table 4 shows the results of panel regression analysis estimated by the Panel EGLS Method. When considering adjusted R^2 and probability (F-statistic) values for all models; it can be said that the values are statistically significant since the R^2 values are significant at 0.97 rate and the probability (F-statistic) values are less than 0.05.

In this study, 7 different models were installed by using the mentioned variables. In all models, independent and dummy variables added to the model explain the dependent variable by 97% rate. This ratio shows that independent and dummy variables have high power to explain the dependent variable in 7 models. In all installed models, foreign trade volume/GDP, exports, imports, Linder effect and G-20 membership affect foreign trade volume between Turkey and

APEC countries positively and statistically at %1 significance level; The GDP difference and OECD membership affect negatively at 1% significance level. Relative factor endowment variable affects the foreign trade volume positively and statistically at 5% significance level in Model II and Model III and affects positively at 1% significance level in other five models. The visa dummy variable affects negatively and statistically at 10% significance level in Model I; at 1% significance level in Model VI, and at 5% significance level in other models. There is no significant relationship between GDP Per Capita difference, population, distance, acreage, G-8 membership, crisis, free trade agreements variables and foreign trade volume variable between Turkey and APEC countries.

Table 3.Results of Panel Regression Analysis Estimated by OLS Method

Variable code	*Variable Type*	*Models*						
		I	*II*	*III*	*IV*	*V*	*VI*	*VII*
CONSTANT		*-0.176612*	*-0.176131*	*-0.159058*	*-0.159152*	*-0.160609*	*-0.176276*	*-0.148853*
D(LOGFTGDP)	*Independent*	*0.854631* ***	*0.854350* ***	*0.854339* ***	*0.854525* ***	*0.855890* ***	*0.855238* ***	*0.855820* ***
D(LOGEXPORT)	*Independent*	*0.129731* ***	*0.129557* ***	*0.129537* ***	*0.129146* ***	*0.128000* ***	*0.128111* ***	*0.128135* ***
D(LOGIMPORT)	*Independent*	*0.037607* ***	*0.037359* ***	*0.037353* ***	*0.037306* ***	*0.037570* ***	*0.037485* ***	*0.037662* ***
D(LOGDGDP)	*Independent*	*-0.302756* ***	*-0.299764* ***	*-0.299541* ***	*-0.297769* ***	*-0.300293* ***	*-0.300009* ***	*-0.299077* ***
D(LOGDGDPPC)	*Independent*	*-0.025984*	*-0.028444*	*-0.028437*				
D(LOGPOPULATION)	*Independent*	*-0.001173*						
D(LOGLİNDER)	*Independent*	*7.054384* ***	*6.981942* ***	*6.977427* ***	*6.935630* ***	*6.997504* ***	*6.996162* ***	*6.971603* ***
D(LOGRFE)	*Independent*	*0.020444*	*0.021182*	*0.021178*	*0.014191* **	*0.014140* **	*0.013975* **	*0.014286* **
LOGDISTANCE	*Independent*	*0.025444*	*0.025478* *	*0.023493* *	*0.023498* *	*0.023518* *	*0.021890* *	*0.021785* *
LOGACREAGE	*Independent*	*-0.002356*	*-0.002350*	*-0.002261*	*-0.002257*	*-0.002254*		*-0.002014*
G20	*Dummy*	*0.051137* ***	*0.051367* ***	*0.051210* ***	*0.051144* ***	*0.050855* ***	*0.043877* ***	*0.048197* ***
G8	*Dummy*	*0.004022*	*0.003896*					
CRISIS	*Dummy*	*-0.012517*	*-0.010809*	*-0.010822*	*-0.010743*			
OECD	*Dummy*	*-0.058190* ***	*-0.058352* ***	*-0.056377* ***	*-0.056348* ***	*-0.056152* ***	*-0.054385* ***	*-0.052298* ***
FTA	*Dummy*	*0.026734*	*0.025907*	*0.024538*	*0.024873*	*0.026235*	*0.023354*	
VISA	*Dummy*	*-0.020355* *	*-0.020325* *	*-0.020428* *	*-0.020439* *	*-0.020626* *	*-0.014843*	*-0.018243* *
Hausman (Chi-Square)		*30.069999*	*30.848232*	*23.881630*	*22.819840*	*21.692085*	*22.866824*	*22.757409*
Probability Hausman (Chi-Square)		*0.0046*	*0.0021*	*0.0132*	*0.0114*	*0.0099*	*0.0065*	*0.0037*
Model		*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*
Adjusted R2		*0.968744*	*0.968842*	*0.968920*	*0.968994*	*0.969027*	*0.969014*	*0.969017*
Durbin Watson Value		*1.683711*	*1.669258*	*1.668514*	*1.670824*	*1.683903*	*1.684715*	*1.679347*
Wooldridge P Value		*0.0004*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
Panel Cross Section Heteroskedasticity LR Test P Value		*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*

**** significant at %1 level **, significant at %5 level , * significant at %10 level*

Table 4.Results of Panel Regression Analysis Estimated by the Panel EGLS Method

Variable Code	*Variable Type*	*Models*						
		I	*II*	*III*	*IV*	*V*	*VI*	*VII*
CONSTANT		*-0.059502*	*-0.080600*	*-0.083408*	*-0.086606*	*-0.082580*	*-0.075596*	*-0.078574*
D(LOGFTGDP)	*Independent*	*0.867610* ***	*0.867734* ***	*0.867565* ***	*0.867111* ***	*0.867535* ***	*0.867684* ***	*0.867857* ***
D(LOGEXPORT)	*Independent*	*0.110038* ***	*0.110026* ***	*0.110072* ***	*0.109751* ***	*0.109489* ***	*0.109409* ***	*0.109301* ***
D(LOGIMPORT)	*Independent*	*0.050734* ***	*0.050889* ***	*0.050903* ***	*0.050484* ***	*0.050580* ***	*0.050724* ***	*0.050560* ***
D(LOGDGDP)	*Independent*	*-0.313288* ***	*-0.313715* ***	*-0.313736* ***	*-0.306884* ***	*-0.308257* ***	*-0.308368* ***	*-0.307905* ***
D(LOGDGDPPC)	*Independent*	*-0.088516*	*-0.091886*	*-0.091945*				
D(LOGPOPULATION)	*Independent*	*0.314548*						
D(LOGLİNDER)	*Independent*	*7.313212* ***	*7.321492* ***	*7.320787* ***	*7.162554* ***	*7.194041* ***	*7.178872* ***	*7.184512* ***
D(LOGRFE)	*Independent*	*0.043410* ***	*0.044274* **	*0.044358* **	*0.025106* ***	*0.024894* ***	*0.025070* ***	*0.024643* ***
LOGDISTANCE	*Independent*	*0.008570*	*0.011384*	*0.011693*	*0.012105*	*0.011641*	*0.011028*	*0.010961*
LOGACREAGE	*Independent*	*0.000113*	*0.000105*	*0.000106*	*6.80E-05*	*7.64E-05*		*0.000229*
G20	*Dummy*	*0.030733* ***	*0.029822* ***	*0.029768* ***	*0.030205* ***	*0.029543* ***	*0.028424* ***	*0.028012* ***
G8	*Dummy*	*0.000226*	*-0.000548*					
CRISIS	*Dummy*	*-0.001966*	*-0.001757*	*-0.001789*	*-0.001620*			
OECD	*Dummy*	*-0.041457* ***	*-0.041726* ***	*-0.042220* ***	*-0.042631* ***	*-0.042139* ***	*-0.041033* ***	*-0.040716* ***
FTA	*Dummy*	*0.021927*	*0.021286*	*0.021593*	*0.022320*	*0.022267*	*0.021817*	
VISA	*Dummy*	*-0.016275* *	*-0.017347* **	*-0.017281* **	*-0.017347* **	*-0.017500* **	*-0.018147* ***	*-0.016342* **
Hausman (Chi-Square)		*30.988775*	*30.848232*	*23.881630*	*22.819840*	*21.692085*	*22.866824*	*22.757409*
Probability Hausman (Chi-Square)		*0.0034*	*0.0021*	*0.0132*	*0.0114*	*0.0099*	*0.0065*	*0.0037*
Model		*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*
Adjusted R2		*0.973289*	*0.973337*	*0.973453*	*0.973617*	*0.973969*	*0.974610*	*0.974247*
F-Statistic Value		*886.9070*	*947.6948*	*1019.865*	*1105.260*	*1213.909*	*1358.475*	*1338.839*
Probability (F-statistic)		*0.000000*	*0.000000*	*0.000000*	*0.000000*	*0.000000*	*0.000000*	*0.000000*

**** significant at %1 level **, significant at %5 level , * significant at %10 level*

6. Conclusion and Evaluation

According to the results of the study, the positive effect of the independent variables that are import and export on the foreign trade volume variable, which is the dependent variable, supports the expectations in the literature. In other words; it has been concluded that these variables are statistically significant and affect positively the foreign trade volume between Turkey and APEC countries.

The foreign trade volume / GDP variable shows how much of the value of all goods and services produced in a certain period of time within the borders of a country, in terms of the currency and the import and export figures of that country. According to the results of the analysis this variable affects positively the trade of Turkey-APEC countries.

The Linder effect variable shows the similarity of the per capita income levels of two countries that are trade partners in a given period. In the analysis, it has been determined that this variable has a positive effect on the volume of foreign trade. According to this situation, having similar income levels also increases trade between countries.

As stated in the literature, factor endowments difference between countries increases trade flows between countries. Analysis results also support this situation. It has been concluded that the relative factor endowment variable affects the foreign trade volume between Turkey-APEC countries positively.

It has been determined that G-20 membership dummy variable expresses the situation of being a member or not of a community with the largest 20 economies in the world and according to the results being a member of this community affects the foreign trade volume between Turkey-APEC countries positively.

According to the result that GDP difference variable affects foreign trade volume between Turkey - APEC countries negatively, the increase in the GDP difference between countries decreases the trade between them. In other words, the import and export that the countries do with countries of which GDP is close to their own GDP are more intense. As the GDP difference between two countries increases, the foreign trade volume between them decreases.

GDP Per Capita difference can be expressed as a variable indicating the difference between the living standards of countries. It is expected that the foreign trade flows will be affected negatively as countries' GDP Per Capita difference increases. Looking at the analysis results; it has been observed that GDP Per Capita difference variable has no statistically significant effect on the foreign trade volume between Turkey and APEC Countries.

Turkey and some of the APEC countries' membership to OECD, was expected to affect the volume of foreign trade between these countries positively. But contrary to expectations; it has been concluded that OECD membership variable affects trade of Turkey with APEC member countries statistically negative.

It is expected that visa liberalization between trade partner countries will affect the foreign trade volume of these countries positively. But contrary to the expectations; it has been concluded that OECD membership variable affects foreign trade volume of Turkey with APEC member countries statistically negative.

The population variable is one of the variables expressing the size of countries in the gravity model. In the results of analysis in established models, it has been concluded that population variable has no statistically significant effect on Turkey- APEC countries' foreign trade flows.

The distance variable is one of the basic variables in the gravity model. When the studies in the literature about the gravity model in international trade are examined; it is seen that the distance between the countries has an effect on transportation and communication costs and thus decreases the volume of foreign trade. In contrast to the results seen in the literature; it has been concluded that the distance variable in this study has no statistically significant effect on Turkey-APEC countries' foreign trade volume. Developing of communication network in the world by globalization and elimination of physical boundaries can be shown among reasons of these. The rapid development of information and communication technologies has also accelerated the communication between countries and allowed countries to interact with each other with lower costs. Therefore, in recent years, the notion of distance in economic activities has slipped into background relatively.

Acreage variable is a variable that shows the physical magnitudes of countries. Big acreage of a country paves the way for the country to have different climates, cultures and expectations. These differences also cause regional differences in the goods and services demanded by consumers and diversification of these goods and services. The ability to respond to different expectations of consumers can be achieved by increasing the foreign trade relations of the country with other countries. Therefore, the acreage variable is expected to increase the volume of foreign trade between two countries. However, this study shows that acreage variable has no statistically significant effect on the volume of foreign trade of Turkey - APEC countries.

It has been expected that being member of G-8 that is the community constituted by world's eight largest economies affects own foreign trade flows of some of the member countries of APEC Community and Turkey positively. However, according to the results of analysis; it has been determined that G-8 membership variable has no significant effect on trade between Turkey and APEC countries. In addition, since G-8 membership of Russia was suspended in 2014, G-8 community has been G-7 community since 2014. Evaluations in the models have been carried out by taking into consideration of this alteration.

During the period of the 2008 global economic crisis, there was a significant decrease in the import and export figures of the countries. Therefore, it has been expected that the crisis variable will have a negative effect on foreign trade volume. According to the results it has been determined that the crisis variable has no significant effect on trade between Turkey and APEC countries.

Free trade agreements that lead countries to economic and commercial cooperation are expected to have a positive effect on the volume of foreign trade. But in this study; it has been determined that the free trade agreement variable has no significant effect on the foreign trade volume between Turkey and APEC countries.

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