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The Determining Role of EU in Turkey's Trade Flows: A Gravity Model Approach

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Working Papers in Economics

The Determining Role of EU in Turkey's Trade Flows: A Gravity Model Approach

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Abstract

This paper aims to determine the role of EU in Turkey's trade flows by using the gravity model. It also aims to test whether the Customs Union (of EU) that Turkey entered in 1996 made a deviation in Turkey's trade flows. Regional trade agreements on the one hand create new trade opportunities (trade creation effect). On the other hand, these agreements may also lead to diversion from free trade (trade diversion effect). Turkey's Customs Union agreement without becoming a member of EU provides a laboratory to researchers to test whether the agreement was significant enough to cause any deviation in Turkey's trade flow. In the first part of the study, we shortly provide some descriptive statistics related to Turkey's trade flows with EU to see whether EU has gained any weight in the flows. In the second part, we first develop a gravity model that econometrically designates the determinants of Turkey's trade flows via panel data approach. Next, we use this equation to test the importance of EU countries in Turkey's trade flow and whether the flow has been subject to a deviation after the Customs Union agreement. Our findings indicate that EU countries have always been important in Turkey's trade flow and that Customs Union has increased EU's importance marginally in determining Turkey's trade flow.

Keywords: Gravity model, Turkey, EU, Panel Data, Customs Union
JEL Classification: F02, F11, F13, F14, F21.

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1. Introduction

One popular trend is to open national economies to free trade. This trend is generally called globalization. However, national economies have also shown a contradicting trend to globalization: they increasingly join (regional) trade agreements, that is, they regionalize. NAFTA, EFTA, MERCOSUR and ASEAN are examples to this regionalization trend. The best (and extreme) example is European Union (EU). The European regionalization trend, which started in 1957, has reached 25 members and become comparable to USA in population, GDP and land size.

In some cases, economic integration supports free trade, and in others it causes diversion from free trade. Irrespective of whether the integration causes trade creation or trade diversion, it suggests that a country's trade flow may subject to a deviation after an economic integration. In this study, after identifying the determinants of Turkey's foreign trade flow via a gravity model, we aim to test by panel data analysis whether Turkey's trade flow has changed significantly after the Customs Union membership of EU.

Our interest to Turkey has several reasons. Firstly, Turkey is one of the first countries that started to open her economy to free trade in the globalization era. In 1980, Turkey has moved from import substitution to export promotion as its growth strategy and since then, its trade pattern gradually changed from exporting primary and agricultural products and importing manufactured goods to exporting manufacturing and intermediate goods[1]. Hence, Turkey has become a laboratory of testing the impact of free trade.

Secondly, Turkey has become member of Customs Union (CU) of EU in 31 December 1995 without full membership to EU. This decision practically meant the acceptance of regionalization by Turkey as Turkey was giving up her trade rules against third countries and adopting EU's trade rules. Intuition suggests that Turkey's trade pattern must experience deviation in favor of EU after the CU membership, minor or major.

This study aims to determine the trade flow determinants of Turkey by using a gravity model and whether the CU has caused any deviation, minor or major, in Turkey's trade flow. To this end, we first undertake descriptive country concentration analysis in the next section. Our analyses show that both exports and imports have changed in favor of EU immediately after CU but lasted only for few years; the trend have not sustained. In the third section, we use panel data analysis to determine a trade equation of Turkey to identify whether CU had caused a statistically significant deviation in Turkey's trade flow. Our analyses indicate that EU was always significant in Turkey's trade and this importance has become more prominent after CU. Our analyses however do not indicate any substantial break in the trade flow of Turkey. The last section gives some concluding remarks.

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[1] Interested readers may refer to for example a report of Central Bank of Turkey (2002) for a detailed discussion of history of globalization of Turkish economy.

2. Descriptive Analysis: Country Concentration Ratios

Country concentration analysis is derived from market concentration analysis of industrial organization literature.[2] In time, market concentration indices are started to be used in measuring trade performance of countries. For example, Beckerman (1956) analyzed country concentration in exports and imports for OEEC (Organization for European Economic Co-operation) countries and found that there is an inverse relationship between country concentration and distance. Massell (1964) analyzed the relationship between export concentration and export revenues and showed that a decrease in country concentration stabilizes export revenues. Lall (1998) analyzed the export performance of developing countries and showed that exports of these countries have increasing manufacturing share. Low, Olarreage and Suarez (1998) investigated whether globalization has caused a change in the country concentration of trade and investment (FDI) and found that country concentration has declined in the last 20 years. Monteiro ve Fernandes (2005) made a research on the impact of 1999 devaluation on Brazil's export concentration and found that country concentration has declined after 1999 devaluation.

Country concentration of trade flows of Turkey has also been studied. Ergün (1991) analyzed country concentration of Turkish exports for the period 1975-1989 and found that it declined for the period. Country concentration of imports in Turkey has been studied by Togan (1994). This study has shown that Turkey's import concentration has declined. Erlat and Akyüz (1998) analyzed country concentration of imports and exports at industry level. They found that Turkey's export concentration has significantly declined and that import concentration has not changed significantly.

In this section, we use 5 different indices to analyze country concentration of Turkey. We shortly summarize each index below. All these indices use one common measure: trade share. We suppose that a country has trade relations with N countries. Let us denote export or import of a country from ith country at time t by q_{it}. In that case, the share of ith country in export or import would be s_{it}, which is defined as:

$$s_{it} = \frac{q_{it}}{q_t} \qquad i = 1,...,N \text{ and } t = 1,...,T .$$

All indices below use this measure to compute country concentration.

Concentration Ratio (CR-index)

[2] Cury and George (1983) discuss the theoretical background of concentration indices. They argue that scale, market structure, and the degree of market entry easiness determine concentration rates. Bailey and Boyle (1971) analyze which concentration measure yield better results. They argue that none of the measure is better than the other and that these measures are not dependent on number of and size of firms operating in the market.

The Concentration Ratio is a widely used empirical measure of industrial structure in the field of Industrial Organization and defined as the market share of the top n firms. Analogously, in the context of international trade, it is defined as the share of the top n countries in imports or exports of a country. Formally, it is defined as

$$CR(\mathrm{n}) = \sum_{\mathrm{i}=1}^{\mathrm{n}} \mathrm{s}_{\mathrm{it}}$$

By CR, what is actually being measured is the degree of inter-element dispersion within a vector. An increase in the value of the index signals a growing trade specialization. The comparison of CRs in time would allow us to make whether the level of trade specialization increased or decreased for the top n countries.

Herfindahl-Hirschman Index (HH-Index)

The Concentration Ratio suffers from two major drawbacks. The first is the subjectivity of choice of n. The results one gets from the top 4 countries may differ significantly from the results gotten from the top 5 firms; or top 10 firms. In general relative rankings of concentration may differ with different choices of n. The second (and related) weakness of the $CR(n)$ is that it does not take into account the full information available in the underlying concentration curve (distribution) representing all possible n values. An alternative to $CR(n)$ that reflects more fully all the information in the concentration curve is the Herfindahl-Hirschman index (HH). For a country having import or export transaction with N countries, it is defined as follows:

$$HH = \sum_{\mathrm{i}=1}^{\mathrm{n}} \mathrm{s}_{\mathrm{it}}^{2}$$

where s_{it} is the export or import share of the i^{th} country. In other words the HH is the sum of the squares of the market shares of all of the firms in the industry.

In principle the HH index can reach a minimum of 0 – when there is a very large number of very small firms, each with a trivial market share, or a maximum of 10,000 – where there is only one firm controlling 100 percent of the market. The point to understand is that higher values of HH index reflect the combined influence of both unequal export or import sizes and the concentration of activity in a few countries. It is this ability to reflect both average trade (export or import) size and inequality of trade size between countries that leads economists to prefer the HH index to simple concentration ratios.

Rosenbluth-Hall-Tideman Index (RHT-Index)

The next summary measure, the Rosenbluth-Hall-Tideman (RHT) index, requires the s_{it} to be put in descending order because the s_{it} are weighted by

their ranks, i. Small sized countries which do not have a significant effect in the HH index, could now have a larger effect on concentration this way. RHT is calculated as

$$RHT_t = \left[\left(2\sum_{i=1}^{N} i \cdot s_{it} \right) - 1 \right]^{-1}$$

where $\frac{1}{2N-1} \leq RHT \leq 1.$

Entropy Index (E-Index / H-Index)
The final summary measure of concentration is the Entropy Index (E). The s_{it}'s are weighted by the natural logs of the inverses of the s_{it}'s:

$$E_t = \sum_{i=1}^{N} s_{it} \cdot \ln\left(\frac{1}{s_{it}} \right)$$

Hence, small values of the entropy index reflect high concentration, as opposed to the previous three measures. In order to make it comparable with the other measures, the inverse of the antilog of E_t is used and called H_t:

$$H_t = \frac{1}{anti\log(E_t)} = \prod_{i=1}^{N} s_{it}^{s_{it}}$$

Comprehensive Measure of Concentration Index (CCI-Index)
The final measure combines the characteristics of both discrete and summary measures. Our last measure of concentration, the Comprehensive Measure of Concentration (CCI), belongs to this group. As with RHT, it requires the s_{it} to be put in descending order but its main focus is on the largest s_{it}, namely s_{1t} according to this ordering. The remaining s_{it}'s are used to adjust s_{1t}:

$$CCI_t = s_{it} + \sum_{i=2}^{N} s_{it}^2 (1 + (1 - s_{it}))$$

After this short introduction, we may now undertake our descriptive analysis.

2.1. Data and Analysis

We use export and import data provided by Turkish Statistics Institute. The data covers 1992-2006 period. First, we determine the export destinations and import sources of Turkey from the list accounting 90% of exports or imports.

Next, we found export and import shares of this list. In the third step, we calculated the abovementioned concentration indices for EU-15 countries that are counted in the short list. Below, we present the EU concentration results of exports and imports of Turkey. In general, the indices yield similar results. Figure 2.a below shows the concentration indices of EU-15 in Turkey's imports.

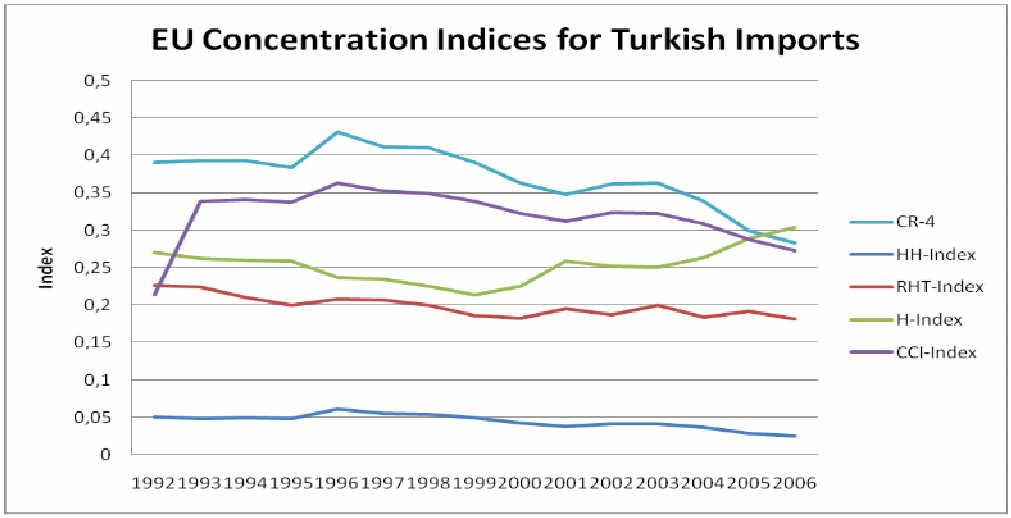

Figure 2a *EU Concentration Indices in Turkish Imports*

The indices indicate that the share of EU in Turkey's imports has increased slightly after CU. After then however, EU concentration has tended to fall in time. We know from our other calculations (not shown) that a similar result is valid for all countries as well. In conclusion, we may argue that CU has caused a bias in Turkish imports temporarily but then the impact disappeared.

Figure 2.b below shows the concentration indices of EU-15 in Turkey's exports.

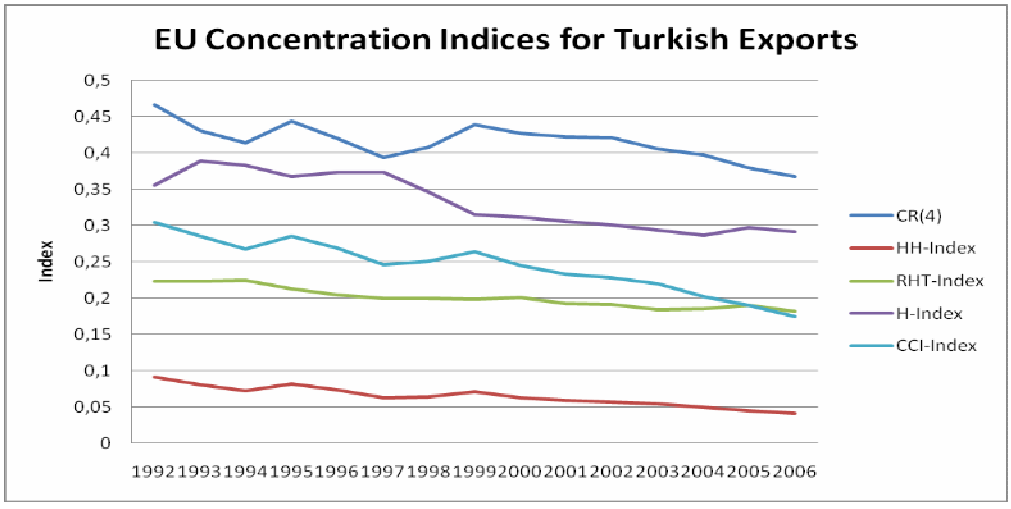

Figure 2b *EU Concentration Indices in Turkish Exports*

As figure 2.b shows, the EU concentration in exports of Turkey has been declining since 1992. That simply involves that CU had no significant effect on Turkish exports in the sense that it did not lead to higher exports to EU countries. This observation for EU is also valid for all countries that Turkey makes exports (not shown). The four EU countries that had more than 45 percent share in Turkey's total exports in 1992 had only about 35 percent share in 2006. It seems that Turkish imports and exports are asymmetrically affected from CU in the sense that there was at least a transitional period in imports that EU countries had increased share.

In short, our descriptive analysis has shown that CU has played a marginal change in the trade pattern of Turkey and that this marginal change has disappeared in time. In the next section, we verify whether trade flow of Turkey has been affected from CU via a panel data approach.

3. Econometric analysis: Panel Data Approach

We will use Gravity Model to clarify the determining role of EU in Turkey's total trade flow. Gravity model is based on Newton's Gravity Law. Main argument of this model is that foreign trade is determined by demographic and economic factors. Gravity model is firstly used by Tinbergen (1962) and Pöyhönen (1963) to explain trade flows between countries. Many researchers used different gravity models and they obtained consistently similar results; so it has become one of the widely used models to explain trade flows in the literature.

The short summary of gravity model in the literature is as follows[3]: After the first studies of Tinbergen (1962) and Pöyhönen (1963), Linneman added the population variable into the model. Theoretical foundations of the empirical model are firstly formed by Anderson (1979). Some other works which contributed to gravity models are Bergstrand (1985; 1989; 1990), Deardorff (1998), Helpman and Krugman (1985), and Helpman (1987).)

There are many applications of gravity model concerning economic integrations. For instance, Frankel (1997) used the model to explain determinants of inter and intra integration trade of EC, EU, EFTA, CUFTA, MERCOSUR and ASEAN. Soloaga and Winters (1999) conducted a similar study for EU, EFTA, NAFTA, MERCOSUR and ASEAN. Likewise, Kruger (1999) used the gravity model for NAFTA.

Gravity model is also used to clarify determinants of Turkey's trade flows and reasons of changes in these flows[4]. Antonucci and Manzocchi (2006) used gravity model in a panel data set to explain Turkey's trade flows during 1967-2001 period. They followed Cheng and Wall's two step fixed effect model procedure because of time invariant variables in their model. They first

[3] A longer summary of gravity literature is given in Appendix 1. See also Haveman and Hummels (2004) for a more detailed literature review.

[4] A longer summary of studies on Turkish foreign trade using the gravity model is summarized in Appendix 2.

demonstrated that their gravity model explains Turkey's trade pattern. Next, they used the model to explain whether EU has a special role concerning the commodity trade between Turkey and EU. According to their analysis, CU has no significant role in Turkey's trade with EU. Our critique on Antonucci and Manzocchi (2006) is that the time coverage of the study is too broad to determine determinants of trade flow of Turkey and too narrow to measure the impact of CU (just five years).[5] Lejour and Mooij (2005) simulated economic effects of Turkey's full membership to EU. Lejour and Mooij (2005) first determined potential trade between Turkey and EU for 15 sectors by the gravity model. Next, they determined custom equivalence of trade barriers by comparing numbers of potential trade and actualized trade. Then they calibrated 2001 world data in order to simulate computable general equilibrium model and analyzed economic effects of Turkey's full membership to EU after removal of foreign trade barriers. Lejour and Mooij (2005) showed that Turkey's foreign trade would be positively affected by Turkey's affiliation to EU. Likewise, they proposed that foreign trade of EU-15 and EU-25 countries would be affected positively by this affiliation although at marginal level. Our critique on Lejour and Mooij (2005) is that the time coverage of the study is again too narrow to cover the impact of CU on Turkey's trade flow. In that respect, our study should be considered as an extension of previous studies with a newer data and a longer time interval to capture the impact of CU on Turkey's trade flows.

The general form of the gravity equation used in the literature is as follows:

$$F_{ij} = G\frac{Y_i^{\beta_1} Y_j^{\beta_2} P_i^{\beta_3} P_j^{\beta_4}}{D_{ij}^{\theta}} \qquad (1)$$

In Equation (1) F_{ij} denotes a trade flow such as export, import or total trade from i (origin) to j (destination); Y_i and Y_j are economic size of two countries (GDP); P_i ve P_j are population of home country and trading partner, respectively. G denotes all the other variables that can be included in this equation and D_{ij} denotes physical distance between two countries. Through linearizing equation (1) by natural logarithm, we obtain equation (2):

$$F_{ijt} = \alpha_j + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(P_i) + \beta_4 \ln(P_j) + \beta_5 \ln(\Delta Y_{ij}) + \beta_6 \ln(D_{ij}) + \beta_7 DUM\_EU + \beta_8 DUM\_BSEC + \beta_9 DUM\_BOARD + \varepsilon_{it} \qquad (2)$$

In equation (2):

[5] As we mentioned at the very beginning, Turkey has experienced a change in its trade regime after 24 January 1980 in years; therefore, (i) pre-1980 period is completely irrelevant, (ii) 1980-1990 period is rather the transition period.

F_{ijt}: Total trade (export plus import) between Turkey (i) and her trading partner (j) in time t,
Y_j: Economic size of Turkey's trading partner,
Y_i: Economic size of Turkey,
P_j: Population of Turkey's trading partner,
P_i: Population of Turkey,
ΔY_{ij}: Development difference between Turkey and her trading partner,
D_{ij}: Physical distance between Turkey and her trading partner,
DUM_EU: Dummy variable for EU membership,
DUM_BSEC: Dummy variable for Black Sea Economic Cooperation (BSEC)[6] membership, and
DUM_BOARD: Dummy variable for common border between Turkey and her trading partner.

GDP and demographic data are obtained from World Economic Outlook Database of IMF. Data concerning physical distances between countries are obtained from indo.com as the crow flies in terms of km. DUM_EU variable takes 1 for EU countries and 0 for other countries among the 42 countries in question. DUM_BSEC variable takes 1 for countries which are member of BSEC and 0 for others among the 42 countries in question. DUM_BOARD variable takes 1 for countries having common border with Turkey and 0 for others. Finally, absolute difference of GDP per capita between countries is used as a proxy variable to signify development level differences between Turkey and her trading partner[7].

Theory suggests that (i) import depends on GDP and, (ii) a country's export capacity is dependent on its potential production. Therefore, we assume that the sum of export and import should depend on the country's GDP positively. Likewise, a positive relationship should be expected between GDP of partner and the sum of export and import (the dependent variable), by analogy.

Theory does not suggest a clear-cut relationship between population and trade flow. Let us first start with export. The relationship between export and population is not clear. According to Bergstrand (1989), the positive (negative) sign of β_4 indicates that export of the trading partner is labor (capital) intensive and the negative (positive) sign of β_3 indicates that export is mostly composed of luxury (necessities) goods. Theory suggests that an increase in the domestic country's population leads to an increase in import and an increase in the population of the trading partner may affect domestic country's export positively in absolute terms. In conclusion, with some ambiguity, it is more likely that populations of domestic country and her trading partner will affect trade flows positively.

A positive sign for difference in country's development level implies that conventional trade theories work (according to Heckscher-Ohlin Theorem, an increase in factor endowment differences increases total trade). Otherwise,

[6] We used dummy variable for BSEC membership as an alternative to EU.
[7] More details about the variables are given in Appendix 3.

new trade theories work (According to new trade theories - for example intra-industry trade – increasing trade is expected between similar countries in terms of development level) (Helpman, 1981).

Physical distance variable is used as a proxy for transportation costs. Theory suggests a negative sign between distance and trade flow. We expect that affiliation to an economic union and having a common border with a trading partner have positive effects on trade flows.

In this study, we used panel data approach in order to estimate gravity equation as it allows monitoring unobserved individual effects of countries (countries are the cross-section units here) on trade flows. To ignore these individual effects is an econometric specification problem if these effects have correlations with independent variables. Ordinary least squares (OLS) estimators become biased by such a problem. For this reason, we run a panel regression. There are two estimating methods in panel data approach: Fixed Effects Model (FEM) and Random Effects Model (REM). FEM assumes that each cross-section has a different effect on the model, but these effects do not change during the time period in question; whereas REM assumes that each cross-section has different and changeable effect on model. From theoretical perspective, if the sample represents whole population, then FEM is used; whereas Random Effect Model (REM) is used if the sample does not exactly represent population (Baltagi, 2001:12). In this work, we used FEM because the countries that we have chosen have a high share in Turkey's total trade. Hausman test has also been used to support this choice.

The main problem with the FEM is that we cannot estimate directly the time invariant variables such as dummies and physical distance. Cheng and Wall (2003) have suggested a two step procedure. Accordingly, a regression for time variant variables is run by standard FEM. Then, individual cross-section effects obtained from this model are used as a dependent variable and time invariant variables are used as explanatory variables in a cross-section analysis. Via the latter regression, we can estimate coefficients of time invariant variables.

$$IE_i = \sigma_0 + \sigma_1 \ln(D_{ij}) + \sigma_2 DUM\_EU + \sigma_3 DUM\_BSEC + \sigma_4 DUM\_BOARD + \vartheta_{it} \quad (3)$$

where, IE_i denotes individual cross-section effects obtained from Standard FEM.

Estimation Results

As there exists a time invariant variable in the model, i.e., distance, we have to first use OLS in order to determine the effects of all variables on total trade. We run equation (2) in OLS for that purpose. As the first column of Table 1 below indicates, GDP of countries, EU membership and BSEC membership have a positive effect on total trade flow. On the other hand, results indicate that an increase in populations, physical distance, difference in countries

development level (differences in real GDP per capita) and having a common border have negative effect on Turkey's trade flow.

The second column of Table 1 presents an estimation of gravity equation with fixed effects through the Estimated Generalized Least Squares (EGLS) procedure excluding time invariant variables. In this analysis, we excluded POP_TR variable because of high correlation between POP_TR and GDP_TR. We found that the signs of coefficients are consistent with OLS results. However, the variable level of development difference, DGDPPC, becomes statistically insignificant.

Table 1 *Gravity Model for Turkey's Total Trade*

	Panel OLS		**Panel EGLS - FEM**	
variable	**coefficient**	**t-stat**	**coefficient**	**t-stat**
Constant Term	2.566	1.300	-4.191	-1.965
LOG(GDP_PARTNER)	1.024***	20.339	0.636***	2.451
LOG(GDP_TR)	2.043***	9.186	1.924***	8.644
LOG(POP_PARTNER)	-0.373***	-8.618	-1.311***	-2.221
LOG(POP_TR)	-1.640**	-2.131		
LOG(DGDPPC)	-0.140***	-5.168	-0.031	-0.298
LOG(DISTANCE)	-0.734***	-33.334	-	-
DUM_EU	0.216***	3.791	-	-
DUM_BSEC	0.091*	1.805	-	-
DUM_BOARD	-0.222***	-4.123	-	-
Number of Observation	630		630	
Number of Country	42		42	
R^2	0.69		0.72	
DW	1.129		1.836	

Note: * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level. All estimation use White's heteroskedasticity-consistent covariance matrix estimator.

After the standard FEM regression, we undertook the second stage of our panel data analysis which consists of running a cross-section regression with the country specific individual effect as the dependent variable and distance and dummies as explanatory variables. Our estimation results indicate that the distance variable and EU dummy are statistically significant at 95% confidence level and have theoretically expected signs. The proxies for common border and BSEC membership are statistically in significant.

Table 2 *Fixed Effect Model – Second Stage*

variable	coefficient	t-stat
C	-0.014	-0.974
DISTANCE	-0.429**	-2.229
DUM_EU	0.610**	4.080
DUM_BOARD	-0.314	-0.432
DUM_BSEC	0.273	0.607

Note: * denotes significance at the 10% level
** denotes significance at the 5% level
*** denotes significance at the 1% level.

Above, our data set covers 42 countries. In order to uncover whether (regional) economic integration had any effect on Turkey's trade flow, we repeated the same analyses for two different country groups: EU countries and non-EU countries. Results are shown in Table 3.

Table 3a *Gravity Model for Turkey's Total Trade: EU15 Countries and Non-EU Countries*

EU15 countries			Non-EU Countries		
variable	coefficient	t-stat	variable	coefficient	t-stat
C	-3.149	-1.051	C	-3.973*	-1.735
LOG(GDP_PARTNER)	-9.121*	-1.874	LOG(GDP_PARTNER)*	-0.743***	-1.875
LOG(GDP_TR)	4.543***	3.461	LOG(GDP_TR)	2.009***	8.097
LOG(POP_PARTNER)	13.970**	2.575	LOG(POP_PARTNER)	-1.679***	-2.675
LOG(DGDPPC)	7.630**	2.134	LOG(DGDPPC)	-0.031**	-2.134
Number of Observation	210		Number of Observation	420	
Number of Country	14		Number of Country	28	
R^2	0.83		R^2	0.88	
DW	1.983		DW	1,718	

Note: * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

The first column in Table 3a demonstrates the effects of explanatory variables on trade flows actualized between Turkey and EU-15 countries. According to our estimates, GDP of Turkey, population of trading partners and difference in countries' development level have positive effects on total trade; however, GDP of trading partners and population of Turkey have negative effects on trade flows of Turkey. The second column in Table 3a displays our estimation results for non-EU countries. Our estimates show that trade flows between Turkey and 28 non-EU member countries is positively affected by Turkey's GDP and negatively affected by other variables. The signs of population of trading partners and differences in countries' development level are different between the EU and non-EU groups. In order to explain this difference, one has to analyze commodity trade composition among trading partners.

Table 3b *Second Stage of Gravity Model*

EU members			Non-EU Countries		
variable	**coefficient**	**t-stat**	**variable**	**coefficient**	**t-stat**
C	-0.266	-0.122	C	-0.014	-0.974
DISTANCE	0.282	0.143	DISTANCE	-0.539**	-2.629
			DUM_BOARD	-0.314	-0.432
			DUM_BSEC	0.167*	2.033

Note: * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

The second stage of country group regressions is shown in Table 3b. In this stage, individual cross-section effects are dependent variables and we analyzed effects of time invariant variables. First column of Table 3b presents our findings for EU-15 countries. Accordingly, distance has no significant effect on total trade statistically. This implies that total trade actualized between Turkey and EU countries has other determinants such as historical and political factors. The second column of Table 3b shows the estimation results for the non-EU countries. We specifically find that dummy variable for BSEC membership is statistically significant at 95% confidence level.

Table 4 presents analyses which decompose effects of CU on trade flows actualized between Turkey and EU15 countries. We divided our data into two time periods: 1992-1997 (before CU) and 1998-2006 (after CU). We assumed that the impact of CU must be reflected in data by one year lag.

Table 4a *Gravity Model for Turkey's Total Trade: The Effects of CU*

	1992-1997		**1998-2006**	
variable	**coefficient**	**t-stat**	**coefficient**	**t-stat**
C	-19.957***	-3.435	-13.114***	-3.022
LOG(GDP_PARTNER)	-8.322	-1.530	-4.775	-1.382
LOG(GDP_TR)	5.084***	3.449	3.040***	3.700
LOG(POP_PARTNER)	9.171*	1.683	7.833*	1.696
LOG(DGDPPC)	7.033*	1.818	3.063	1.380
Number of Observation	210		210	
Number of Country	14		14	
R^2	0.89		0.86	
DW	2.091		1.952	

Note: * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 4a shows that all time variant variables but GDP_PARTNER are significant at different significance levels in the 1992-1997 period. This variable is insignificant in 1998-2006 period as well. The main effect of this variable on trade flows can be analyzed by decomposing data as imports and exports. Besides, level of difference in development is statistically significant

in determining trade flow for 1998-2006 period, though at different significance levels.

Table 4b *Second Stage of Gravity Model*

	1992-1997		1998-2006	
variable	**coefficient**	**t-stat**	**coefficient**	**t-stat**
C	-1.628	-1.415	0.508	1.952
DISTANCE	-0.216*	-1.734	-0.436	-1.069

Note: * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Following Table 4b, the distance variable -the main variable of gravity equation- is insignificant after CU while it was significant at 90% confidence level before CU. It can be interpreted that distance variable, as a proxy for transportation cost, lost its negative effect on trade flows after CU.

4. Conclusion

This study aims to determine the trade equation of Turkey and to pinpoint whether the recent CU has created a bias in Turkey's trade flow. While on the one hand the globalization trend has been welcomed by many economies, regional economic integration agreements seem to be also popular. Taking these two trends into account, this study analyzes the determinants the Turkish trade flow, which is under the influence of both globalization and regionalization. In particular, this study aimed to detect whether the CU has caused any significant deviation in trade flow of Turkey. In the first part of the study, we presented some descriptive evidence related to EU's country concentration in Turkish exports and imports. We showed that there is some evidence that EU's share has increased after CU but disappeared in time. This evidence suggests that Turkish economy was ready for CU and that it adopted itself quite quickly after the CU.

In the second part of the study, we did panel data analysis by using the 1992-2006 trade data of Turkey to determine whether CU was statistically significant in Turkey's trade flows; in other words, we investigated whether CU led to a structural change in Turkish trade. Our preliminary results indicate that EU was always important in Turkish trade and the CU has reinforced this importance. More econometric results of our panel data analysis show that (i) the gravity equation used for trade data with fixed effects yield that while the economic size of Turkey and its trading partners are positive and significant in determining Turkey's trade flows, population is negative and significant, and level of differences in per capita income is insignificant; (ii) the second stage of fixed effects shows that physical distance between countries is significant and has negative impact on trade flows as gravity model suggests and that dummy variable for EU is positive and significant; (iii) physical distance is

insignificant for EU countries; (iii) comparison of the model for before-CU and after-CU yields that distance lost importance after-CU. We believe that our results may be interpreted as reinforcing the importance of EU in Turkey's trade flow, but has not caused any significant change.

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Appendix 1: A Concise Literature Survey on Gravity Model Applied on Trade

Paper	Explanations
Timbergen(1962) and Pöyhönen(1963)	This study is the first study that applying gravity equation to analyze international trade flows. They improved an empirical model lacking robust theoretical foundations. According to results of studies, trade flows have a positive relationship with economic sizes of countries and a negative relationship with physical distance between countries.
Linnemann (1966)	A population variable was inserted to standard gravity equation improved by Timbergen and Pöyhönen. Population variable was employed as a proxy variable for consumer preferences in terms of importer and for capital–labor intensity in terms of exporter.
Anderson (1979)	He made theoretical contributions to gravity model. Similarity of preferences, cost structures and tax regulations between trading partners are factors that affect trade flows positively.
Frankel (1997)	He used the model to explain determinants of inter and intra integration trade of EC, EU, EFTA, CUFTA, MERCOSUR and ASEAN. The purpose of study was to analyze effects of factors such as common language, common culture and common border on trade flows.
Soloaga and Winters (1999)	They conducted gravity model for EU, EFTA, NAFTA, MERCOSUR and ASEAN during 1980-1996 period. Common language, common culture and common border variables proxy by dummy variables inserted to standard gravity model. The results are proper to theoretical expectations. But according to analyses, new regional integration process has no trade creation effect.
Krueger (1999)	He used gravity model for NAFTA. He determined that constitution of NAFTA in 1994 has a significant positive effect on Mexico's trade.
Cheng and Wall (2002)	They used OECD country pairs and analyzed econometrical foundations of gravity model. An augmented model with different dummy variables was estimated by heterogeneous panel data approach.
Martinez-Zarzosa and Nowak-Lehmann (2003)	This study was used panel data approach for MERCOSUR-EU countries during 1988-1996 period. They plugged real exchange rates, infra-structures of exporter-importer and differences in per capita income in standard model. The results are proper to theoretical expectations.
Rojid (2006)	He used model in order to analyze trade creation and diversification effects of COMESA for 147 countries during 1980-2001 period and got results consistent with theoretical expectations.

Appendix 2: A Literature on Gravity Model Studying Turkish Trade

Paper	Explanations
Lejour and Mooij (2005)	They determined potential trade between Turkey and EU for 15 sectors by the gravity model. Then, they determined custom equivalence of trade barriers by comparing numbers of potential trade and actualized trade. According to analyses, CU increased Turkey's bilateral trade with EU by 34%.
Antonucci and Manzocchi (2006)	This study used gravity model to explain Turkey's trade flows during 1967–2001 period. Firstly, they demonstrated that the model explains Turkey's trade pattern statistically. Then, they used the model to explain whether EU has a special role concerning the commodity trade between Turkey and EU. According to analyses, CU has no significant effect on Turkey's bilateral trade with EU.
Genç, Artan and Berber (2007)	They applied gravity model to explain determinants of trade flows in Black Sea Economic Cooperation (BSEC) region. For this purpose, panel data analysis is used for the 1997-2004 and 1997-2000, 2001-2004 sub-periods. The results are consistent with theoretical expectations.

Appendix 3: Detailed Explanation of Variables Used in the Model

Variable	Explanations	Definitions	Sources
Fijt	Turkey's total trade with her jth trading partner in time t	TOTAL_TRADE	TUİK
Y_i	Turkey's GDP as a proxy for economic size	GDP_TR	IMF
Y_j	GDP of Turkey's trading partner as a proxy for economic size	GDP_PARTNER	IMF
P_i	Turkey's population as a proxy for market size and labor force	POP_TR	IMF
P_j	Population of Turkey's trading partner as a proxy for market size and labor force	POP_PARTNER	IMF
ΔY_{ij}	Difference in per capita GDPs of countries as a proxy for development difference between Turkey and her trading partner	DGDPPC	
D_{ij}	Physical distance between Turkey and her trading partner as a proxy for transportation costs	DISTANCE	indo.com
DUM_EU	Dummy variable for EU membership; takes value 1 for members and takes value 0 for others	DUM_EU	
DUM_BSEC	Dummy variable for BSEC membership; takes value 1 for members and takes value 0 for others	DUM_BSEC	
DUM_BOARD	Dummy variable for common border; takes value 1 if there is a common border between Turkey and her trading partner; 0 otherwise.	DUM_BOARD	

Note: All variables except dummies are expressed in natural logarithms.