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# Examination of forest products trade between Turkey and European Union countries with gravity model approach

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**The success of getting in the foreign trade forms one of the basic stones of economic development for countries. The current and potential trading volume among countries and determining the main factors affecting trade are quite important. The trade currents of the European Union (EU) countries and Turkey in the forest products industry field were analyzed by the gravity model in this study. For this reason, the panel data method was used for 2000 - 2006 periods. The results show the existence of a high degree of trade integration between Turkey and EU. The estimated gravity models explained 63% of the variation regarding the volume of bilateral trade flows in the EU and Turkey. Furthermore, it was determined that GDP had a positive effect on the amount of foreign trade while distance had a negative effect; and Turkey has lower trading volume with the EU countries than its potential regarding the forest products industry field.**

**Key words:** Forest product trade, European Union, Turkey, trade flows, gravity equation.

## INTRODUCTION

Countries recently generate policies to protect themselves from global competition that requires strengthening their economic structure because of the rapidly increasing population of the world and globalization tendency. Strengthening economic structure and getting the development level to the desired level for a country are closely related to the trade volume of a country. Therefore, each country has to increase their trade volume and effectively use their resources in the economic aspect. Recently, a lot of countries and the union, known as the big power in the economic and trade area, evaluated the current trade structure and accordingly took precautions in the direction of developments to use their resources

more economically and make new trade developments. Numerous different studies have been carried out in the literature on the determinant factors of trade flows in countries and organization; what kind of effects occur on the export and import of a country, using being or not being a member of the union as the determining factor; whether these effects cause increase or decrease of trade; how they affect the growth and productivity of the countries and the consequences of these effects on the world trade. Investigation of the trade volume among countries, determining determinant factors and the model generated from Newton's law of gravitation, named gravity model in literature, have been typically used in these studies.

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**Abbreviations:** EEC, European economic community; TEU, treaty on European Union; EU, European Union; P, export potential; A, actual value.

## Turkey-European Union relations and forest products industry

Standing in the face of changing economic conditions, and directing the world and local economy, constitutes

the underlying subjects of economic policy makers. Consequently, a lot of different economic confederations and communities were constituted; they were to remain in the foreground in economic direction and resource sharing all over the world. Among these corporations, European Union made progress against the other corporations in many respects, including political arena as well as in economic subjects.

According to the Paris Treaty of 1951, the European Coal and Steel Community was founded on the belief that an organized and vital Europe would make contribution to civilization and was dispensable to the maintenance of peaceful relations and the new institutions would give direction to a destiny hence forward shared. The new agenda for the European Economic Community (EEC) laid the foundations of an ever closer union, partly to preserve and strengthen peace and liberty, in 1957. The EEC became the European Community in 1992, with the primary tasks of establishing a common market, economic and monetary union, growth, respect for the environment, economic convergence, high employment, social protection, economic cohesion, solidarity and for raising standard of living. In the treaty on European Union (TEU) of 1992, the union was to respect the European Convention for the Protection of Human Rights (Salmon, 2006).

The European Union (EU) is the world's second largest economy; only slightly smaller than the US in purchasing power parity terms but slightly larger at the official exchange rates. Furthermore, the EU is the world's largest merchandise exporter, accounting for nearly one-fifth of the world trade, as well as the largest services exporter that accounts for over a quarter of the world trade. It is the world's largest importer of commercial services while the second only to the US regarding the import of goods. The EU is also a major home as well as being the source of foreign direct investment. The EU's economic importance has increased substantially since the early 1980s. Its number of members has increased from nine to twenty-five member states (Young and Peterson, 2006). As it is known, the biggest enlargement in the EU history, also known as the fifth enlargement, was made in 2004 in regards to the number of countries and population. As a result of that last enlargement, ten more countries, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Malta, and Southern Cyprus, joined the EU; and its overall population increased to 445 million with the addition of 75 million people. 28 million labor forces partook in the EU market by this way.

Turkey, wanting to be economically and politically strong in the region where it is situated, has been endeavoring to enter the EU for a long time. Turkey applied to the European Union in 1959, a year after the establishment of European Economic Community, to be one of the associate members of the community following Greece. Although the community signed the partnership

agreement with Greece two years later, the partnership with Turkey was four years later. It has been 46 years since the signing of the Ankara Agreement (Partnership Agreement), which is the fundamental text of European Union and Turkey association. It is certain that the association between both parties has not always been free from serious disagreements and problems (Aykaç and Parlak, 2002). The 46-year-old membership scheme of Turkey has become clear together with the start of the negotiations. Consequently, the position of Turkey, in comparison with the other members of European countries, has been a highly controversial subject because of its productive force in every field. Turkey's resource and production power would be a basic support of eligibility and competitive advantage in the economic and commercial area. Turkey's economy made progress and provided certain stability in the economy following the crises in 1994, 1998, and 2001. Since political and also economical criteria are important in EU process, Turkey's economy needs to obtain a stable structure. When Turkey's foreign trade was examined, it was realized that European Union countries took the first places, while USA, Russia, and the Far East countries follow these countries. The EU is Turkey's most important trading partner by far, accounting for slightly more than half of its exports and slightly less than half of its imports (Antonucci and Manzocchi, 2006).

There are two different aspects about the current situation of the relation between Turkey and the EU countries. Although opinions related to Turkey's concessionary membership for the EU are expressed, it was stated by some experts that Turkey's trade potential contributes to the full membership to Turkey. It is believed that obstacles formed in management field could be experienced in market conditions as well as the formation of technical problems because the standards and regulations in trade can be eliminated with mutual opinion and confidence. After all, more suitable environments can be developed for trade and investment by eliminating the uncertainty of political and macro-economic risks. The current situation could be evaluated with econometric models like the Gravity model; and regulations enforced accordingly would increase the trade volume. Another opinion is based on the ground that a high volume trade relation was formed between Turkey and the EU by Customs Union. Turkey opened its market to the EU member countries with the Customs Union pact. Thus, trade tariffs, encountered on many industrial products, were progressively cancelled. The forest products industrial sector, being one of the important sectors in the manufacturing industry, possesses an effective production and trade power in Turkey and the European Union members. Forest products firms represent approximately 22.3% of the total manufacturing industry while employee portion is approximately 11.5% of all the employees in Turkey. It includes 59,690 firms

(Anonymous, 2005), and 98.5% among them are classified as micro and small scale firms. Forest product firms are scattered all over the region; therefore, these firms have a significant role in the employment level and social welfare in Turkey (Yildirim and Özşahin, 2004; Akyüz, 2006).

The aim of this study is to examine the trade volume and determinant factors in the sub-sector level between the European Union, which is one of the most important organizations in the world regarding trade and economical structure, and Turkey that has been trying to join this union for over 40 years. For this purpose, trade potential in the union member countries of forest products industry, which is effective in Turkey's industry structure, and determining the effective factors, trade flows and gross national product (GNP), populations, and distance between the countries and Turkey, were tested. Manufacturing industry in Turkey is the main stay of the Turkish economy. The sectoral groups in the manufacturing industry have different advantages in different fields. The questions, of how those sectors that have critical importance for the Turkish economy are going to be restructured and how they are going to supplement the Turkish economy by their foreign trade potential, constitute the matters needed to be analyzed in this study.

## MATERIALS AND METHODS

### The gravity equation

The gravity model is a rather successful econometric approach that has been adopted to analyze spatial interactions among different kinds of variables (Antonucci and Manzocchi, 2006). The gravity model, which is one of the methods frequently used to analyze the foreign trade flow, has been applied in bilateral trade since the 1960s. The gravity model makes it possible to include place elements in the analysis of bilateral trade and capital flows. Robust theoretical basics of gravity model, which Tinbergen (1962) and Pöyhönen (1963) used to study the econometric application and Linnemann (1966) used for the analysis of international trade flows by adding other explanatory variables, in 1960s, were practiced after a long time by Anderson (1979) and Baltagi (2001).

The "physic entities" are the exporting and importing countries and their "masses" are the sizes of their economies within the context of the gravity approach to the international trade. The bigger the economies of the involved countries, the bigger are the trade exchanges among them. On the other hand, distance exerts a resistance effect on trade flows mainly because of transport costs and time of delivery. Additional trade hampering factors are the import tariffs, border controls, and quantitative restrictions that represent the indirect or artificial trade costs (Antonucci and Manzocchi, 2006). Numerous researchers discussed the gravity equation considering their different aspects, and formed an application area. Tinbergen (1962) and Pöyhönen's (1963) approaches among them are the typical ones.

The approaches of these authors are just a form of Newton's law of universal gravitation adapted to the bilateral trade relation.

According to Newton's law of gravitation, objects pull each other directly proportional with the mass but inversely proportional with the distance. It could be considered accordingly that the trade

quantity among two countries is directly proportional with the size of the countries but inversely proportional with the distance among them. A simple gravity model is expressed as follows:

$$T_{ij} = A \cdot \frac{(G_i \times G_j)^\alpha}{U_{ij}^\beta} \quad (1)$$

Where,  $T_{ij}$  is the trade flow among two countries;  $A$  is proportional constant;  $G_i$  and  $G_j$  are the (economic) size of  $i$  and  $j$  country (GDP, GDP per capita or population);  $U_{ij}$  shows the distance among capital cities or trade centers of countries.  $A$ ,  $\alpha$ ,  $\beta$  are the parameters of the model; and, as a prior,  $\alpha$  is positive whereas  $\beta$  is negative (Karagöz, 2007). Regression equation is logarithmic-linear. In other words, equation becomes linear when all variables are expressed as a logarithmic or dummy variable. GNP, population, and distance are presented as logarithmic. Coefficient of a logarithmic variable could be interpreted as the elasticity. In other words, it is the proportion of the change in percentage of dependent variable to 1% change of the independent variable. For example, if the predicted coefficient of log GNP is 0.9, then a 10% raise in the GNP, increasing the independent variable (trade) would be in proportion of 9% (URL1, 2009).

There are numerous applications of the gravity equation in the institutional and politic areas throughout the EU. Trade relations made by the EU member countries with the non-member countries were examined. They were implemented throughout EU, by considering bilateral trade flows; and the effect of Euro being common currency and European Monetary Union on trade was discussed. Turkey's membership to the EU was also discussed in assistance with the gravity equation model in different studies (Lejour et al., 2004; Flam, 2003). The gravity approach has also been used to assess the trade potential of EU enlargement; both for the ten new member states of 2004 and for the current applications. Furthermore, how Turkey's membership to the EU would affect the trade was examined with the help of the gravity equation model by Lejour et al. (2004) and Flam (2003). Lejour et al. (2004) carried out a wide range of study consisting of all the countries and sectors, and determined important trade relations among all of the countries in a sector. A potential in the sectors, which could raise the mutual trade between Turkey and the EU, was determined. According to this study, a 34% rise in the mutual trade volume in the sector level would occur in case of Turkey's membership to the EU while this rise was determined as 46% in the study carried by Flam (2003). Turkey's membership to the EU would cause an increase in the mutual trade volume in both the EU countries and in Turkey, as mentioned by various writers and researchers (Ülgen and Zahariadis, 2004).

In the light of this information, the trade flows of the European Union member countries and Turkey in the forest products industry field was analyzed in assistance with the gravity model by using the data of 2000-2006. The model, obtained from the result of the study carried out between Turkey and 25 EU member countries, was formed as follows:

$$\begin{aligned} \ln(T_{ij}) = & C + \beta_1 * \ln(GDP_i) + \beta_2 * \ln(GDP_j) + \beta_3 * \ln(POP_i) + \beta_4 * \ln(POP_j) \\ & + \beta_5 * \ln(DIST_{ij}) + \beta_6 * (BORD_{ij}) + \beta_7 * (LANG_{ij}) + \beta_8 * (EU15) + \epsilon_{ij} \end{aligned} \quad (2)$$

Where,  $T_{ij}$  shows the trade flow between  $i$  (exporter country) and  $j$  (importer country), and was formulated as the export value of the forest products industry of each country to the other country. Data were obtained from the FAOSTAT data base, in a 7 year process consisting of 2000 - 2006 years, and represented as dollars (US\$ 1000);  $GDP_i$  shows GDP of  $i$  country.  $GDP_j$ : It shows GDP of  $j$

**Table 1.** The gravity model results of EU and Turkey between the years 200 - 2006.

Variables	Coefficient	t-value	p-value
C (Constant)	- 13.38	- 20.23	0.000
Ln (GDP <sub>i</sub> )	0.96	30.67	0.000
Ln (GDP <sub>j</sub> )	0.93	14.99	0.000
Ln (POP <sub>i</sub> )	- 0.05	- 1.37	0.171
Ln (POP <sub>j</sub> )	0.04	0.75	0.451
Ln (DIST <sub>ij</sub> )	- 1.86	- 35.47	0.000
<b>Dummy Variables</b>			
BORD <sub>i</sub>	0.35	3.06	0.002
LANG <sub>ij</sub>	- 0.19	- 1.31	0.191
EU15	- 0.32	- 2.71	0.007
Adjusted R <sup>2</sup>	0.63		
Number of observation	5292		

country. Data are nominal on the yearly basis; they are obtained from the WDI-2008 (World Development Indicators) data base of the World Bank; and were represented as dollars (US\$ 1000). Since GDP shows countries' potential of export and import, the variable coefficients of both GDP<sub>i</sub> and GDP<sub>j</sub> are expected to affect the trade flows positively;

POP<sub>i</sub> shows population of i country. POP<sub>j</sub>: It shows population of j country. The population data were obtained from the WDI-2008 data base of the World Bank. Population was considered as an index of the size of the countries. The coefficient of the population variable can be positive or negative; DIST<sub>ij</sub> shows the distance between i and j countries and was obtained from an internet site with an address of <http://www.cepii.fr/anglaisgraph/bdd/distances.htm>. There is an inverse relation between the distance between countries and their trade flows. Thus, this coefficient is expected to be negative; BORD<sub>ij</sub> expresses the dummy variable that shows whether i and j countries do or do not have borders with each other. It is expected that coefficient of this variable would have a value of 1 if countries have border whereas the value would be 0 if countries do not have a border; and it will be positive because decreasing the distance would widely lessen transportation expenditures. Moreover, the countries having a border with each other would share a common culture which would make a positive effect on the trade among two countries; LANG<sub>ij</sub> expresses the dummy variable which shows whether i and j countries use common language or not. The value is 1 if they use common language but if not, the value becomes zero; EU15 is the dummy variable expressing the 15 member countries of the European Union before the big enlargement in 2004. The first 15 countries were encoded as 1 and the other countries were encoded as zero.

$\epsilon_{ij}$  represents the error term.

## Data

The data used in this study were obtained from different sources. The trade flow data were obtained from the FAOSTAT data base, in 7 year process consisting of 2000-2006 years, as dollars (US\$ 1000). GDP data, which are nominal on yearly basis, were obtained from the WDI-2008 (World Development Indicators) data base of the World Bank and were used as dollars (US\$ 1000). Population data were also obtained from the WDI-2008 data base of the World Bank. The data related to the distance were obtained from the <http://www.cepii.fr/anglaisgraph/bdd/distances.htm>.

address named "<http://www.cepii.fr/anglaisgraph/bdd/distances.htm>".

## RESULTS AND DISCUSSION

### Gravity model and estimated results

A seven year process, consisting of the time period between 2000 and 2006, was discussed in the study to minimize the effects of seasonal and temporary shocks. The least squares method was used to analyze the model. The advantage of this method is that it can estimate the effect of each variable by fixing the effects of the other variables. The results obtained by solving regression equation were presented in Table 1 as follows:

$$\begin{aligned} \ln(T_{ij}) = & C + \beta_1 * \ln(GDP_i) + \beta_2 * \ln(GDP_j) + \beta_3 * \ln(POP_i) + \beta_4 * \ln(POP_j) \\ & + \beta_5 * \ln(DIST_{ij}) + \beta_6 * (BORD_{ij}) + \beta_7 * (LANG_{ij}) + \beta_8 * (EU15) + \epsilon_{ij} \end{aligned} \quad (3)$$

The results in Table 1 display that the independent variables in this model explain 63% of the dependent variable. The coefficient of GDP variable, showing the size of countries' economies, is positive on both the exporter and importer countries and is statistically significant at the level of 1% according to the investigated years. The positive effect of GDP on the exporter and importer countries is at levels that are quite close to each other. 1% increase at the GDP of exporter countries raises the trade flow by 0.96%; and this proportion provides an increase at 0.93% level for the importer countries.

The population variable, being an index for the size of the countries, is taken as negative for the exporter countries while it is positive for the importer countries in the model. While 1% increase in the population of exporter countries decreases the trade flow at 0.05%, this situation provides a 0.04% increase for the importer countries. Nonetheless, both coefficients of two populations are not statistically significant at 1% level. The coefficient of DIST variable, being an index of the distances between the capital cities of Turkey and the EU countries, is significant at 1% level; and it was negative as expected. The distance negatively affects trade flow because increasing the distance among countries raise the transportation and operation costs. A 1% increase between the countries lessens the trade flow at 1.86% level. When dummy variables using gravity model are checked, only LANG variable is not found as statistically significant at 1% level but BORD and EU15 variables were. When the countries are neighbors with each other, this condition positively affects the trade flow. Neighboring countries raise the trade flow to 35% much more than the countries who are not neighbors. The coefficients of LANG and EU15, representing the first 15 member countries in the EU, came out as negative, affecting the trade flow.

**Table 2.** Export potential of forest products industry to P/A (Average data of 2000 - 2006 was used).

Countries	P/A	A	P
Austria	1.43	6.36	9.08
Belgium	1.17	7.18	8.43
Bulgaria	0.91	9.34	8.52
Cyprus	0.93	9.26	8.65
Czech Republic	1.34	6.16	8.24
Denmark	1.36	6.06	8.23
Estonia	2.23	2.54	5.67
Finland	1.65	4.83	7.96
France	1.28	7.85	10.07
Germany	1.24	8.69	10.82
Greece	1.12	9.41	10.53
Hungary	1.62	5.33	8.62
Ireland	1.10	6.59	7.24
Italy	1.14	9.34	10.66
Latvia	1.68	3.62	6.09
Lithuania	1.35	5.03	6.77
Luxembourg	1.47	4.25	6.24
Malta	1.11	5.03	5.58
Netherland	1.49	6.00	8.93
Poland	1.39	6.74	9.37
Portugal	1.13	6.27	7.09
Romania	1.13	8.48	9.55
Slovakia	1.51	5.01	7.56
Slovenia	1.45	5.02	7.29
Spain	1.20	7.54	9.05
Sweden	1.45	5.84	8.50
United Kingdom	1.13	8.83	9.96

**Table 3.** Actual and potential export values of Turkey to EU countries (1000 \$) (average data of 2000 - 2006 was used).

Countries	P/A	A	P
Bulgaria	0.44	11389.571	5034.150
Cyprus	0.54	10479.857	5698.740
Malta	1.72	153.000	263.750
Ireland	1.90	730.714	1391.310
Portugal	2.27	526.857	1196.310
Romania	2.92	4822.000	14100.990
Greece	3.05	12221.000	37272.090
United Kingdom	3.10	6813.857	21141.640
Belgium	3.49	1307.286	4559.640
Italy	3.74	11379.857	42574.040
Spain	4.54	1882.000	8535.590
Lithuania	5.74	152.429	874.800
Luxembourg	7.29	70.286	512.350
Czech Republic	8.03	471.143	3781.970
Germany	8.39	5958.429	50011.090
Denmark	8.80	427.000	3759.340
France	9.16	2576.286	23599.950
Slovenia	9.61	151.857	1459.720
Latvia	11.80	37.286	440.100
Slovakia	12.81	149.714	1917.930
Poland	13.81	845.000	11672.610
Sweden	14.17	345.429	4895.150
Austria	15.07	580.286	8742.920
Netherland	18.65	405.000	7555.270
Estonia	22.77	12.714	289.460
Finland	22.90	125.714	2878.430
Hungary	26.74	207.000	5535.850
Total	3.63	74221.572	269695.190

PS: ranges from small to big according to proportion of P/A.

### The actual and potential export values of Turkey to EU countries

The export potential of the forest products industry of Turkey to EU countries could be determined by using estimations of the gravity model. It is determined for which countries is the trade flow under the potential, over the potential, and same as the potential by comparing the export potential (P), estimated with the gravity model, and actual value (A). Concordantly, if the proportion of P/A is higher than 1, export value for the country is under the potential whereas it is over the potential when it is lower than 1. When proportion of P/A equals to 1, it means that the export value is the same as the potential (Table 2).

Proportions of P/A, as can be seen in Table 2, are the values obtained from utilizing the gravity model (some data were transformed as ln). As the last step, the potential export values, actual export values, and proportion of both of them are shown in Table 3 by making ln transformations. According to proportions in Table 3, the first 9 countries that are under export potential are Hungary,

Finland, Estonia, Netherland, Austria, Sweden, Poland, Slovakia and Latvia, respectively. There are only two countries over the export potential, and these are Bulgaria and Cyprus, respectively. Average total export value to the EU countries is about \$74.2 million for the years of 2000-2006. According to the result of the model, potential of export is \$269.7 million for the same period. Average total export value of the forest products of Turkey, for the same period, is about \$203.3 million. It can be seen that the proportion of export to the 27 EU countries is about 36% in total.

According to the current export values, 10 countries with export values exceeding \$1 million are Greece, Bulgaria, Italy, Cyprus, United Kingdom, Germany, Romania, France, Spain and Belgium, respectively.

According to the potential export values, however, there are 22 countries to which the country can export over \$1 million; and there are 7 countries to which the country can export over \$10 million. These countries are

Germany, Italy, Greece, France, United Kingdom, Romania and Poland, respectively.

## Conclusion

The aim of the study is to investigate the effect of variables studied to determine how well Turkey is ready to be a member of the EU in the context of forest products industry, and to determine the potential of export as part of the bilateral relations. The findings show that actual export of Turkey to EU countries in forest products industry was quite under the potential export value. Trade relations between the EU member countries and Turkey in regards to the forest products industry field would be able to get at a higher level after Turkey affiliates to the EU. This increase would be beneficial to both the EU and Turkey. The gravity equation expresses the trade flow between Turkey and EU at a level of 63%. This result shows that trade volume between the union countries and Turkey, regarding the forest products industry field, is at a level under the average. Products with high value products manufacturing in the EU countries are not used enough, especially, due to the problems in the economic development of Turkey. This situation negatively affects the trade potential. In this sense, economic development, beginning as a result of the union membership, advances the trade volume.

According to the result of the gravity model, GDPs of the exporter and importer countries have uniform positive effects on the trade flows. This result agrees with the expectations in the theory. The more the incomes of countries rise, the more rise in the demands of goods and service and in the export potential would be experienced. The populations of countries have a negative effect for the exporter countries but have a positive effect for the importer countries. The negativity of the coefficient of the population of exporter countries reveals that the population increases domestic demand and therefore, negatively affects the foreign trade. On the other hand, using the population variable on the trade flows is not statistically significant for this study. The distances between the capital cities of Turkey and EU countries, however, have a negative effect on the trade flows, as it is expected, and it is the most statistically effective variable following the GDP variables. Since augmentation of distance among countries will extend the transportation time, the transportation costs will increase. Furthermore, the dummy variables, regarding whether two countries have a border or not and they are the first 15 member countries of the EU, were statistically significant. Being neighbors positively affects trade flow but the EU15 dummy variables negatively affect the flow. Dummy variable for the countries using common language, on the other hand, is not found as statistically significant in this study.

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