DETERMINING FACTORS OF TRADE FLOWS IN BLACKSEA ECONOMIC COOPERATION (BSEC) REGION: A PANEL GRAVITY MODEL

Karadeniz Ekonomik İşbirliği (KEİ) Bölgesinde Ticaret Akımlarını Belirleyen Faktörler: Panel Çekim Modeli

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ABSTRACT

After the receding of the atmosphere of the cold war, suspicion and mistrust, the countries of Black Sea area have been able to undertake bold steps to be tightened the relationships among themselves. They come together and decided to how, in the age of globalisation of economies, valuable assets in their possession, such as geographical proximity, common history, cultural bonds and interdependence of their national economies could be efficiently employed for mutual benefit and prosperity. Foundation of the Black Sea Economic Cooperation (BSEC) bases on this intention. In this paper impacts of the gravitational factors on bilateral trade are investigated in case of BSEC region. The estimations of the panel gravity models reveal that economic size and population of the importer countries have a positive impact on trade volume, whereas the distance between them works on the opposite way.

Keywords: Bilateral trade, Black Sea Economic Cooperation (BSEC), Panel gravity model.

ÖZET

Soğuk Savaş, kuşku ve güvensizlik ortamının sona ermesinin ardından Karadeniz'e komşu ülkeler aralarındaki ilişkileri sıkılaştırmak için cesur adımlar atma fırsatı bulmuşlardır. Ülkeler bir araya gelerek, ekonomilerin küreselleştiği çağda, coğrafi yakınlık, ortak tarih, kültürel bağlar ve millî ekonomiler arasındaki bağımlılık gibi sahip oldukları değerli varlıkların karşılıklı kazanç ve refah için etkin bir şekilde kullanılmasına karar vermişlerdir. Karadeniz Ekonomik İşbirliği (KEİ) nin kuruluşu bu niyete dayanmaktadır. Bu çalışmada, KEİ örneğinde çekimsel faktörlerin ikili ticaret üzerindeki etkileri ele alınmaktadır. Panel çekim modeli tahminleri, ithalatçı ülkenin ekonomik ve nüfus büyüklüğünün ticaret hacmini olumlu, aradaki uzaklığın ise olumsuz etkilediğini göstermektedir.

Anahtar kelimeler: İkili ticaret, Karadeniz Ekonomik İşbirliği (KEİ), Panel çekim modeli.

1. INTRODUCTION

Despite a fervent debate about the welfare effects of it, a new regionalism movement is growing up all around the world. Since the late 1980's economic as well as politic and security oriented regionalization tendencies occurred, and along the 1990's and 2000's an intense accessions have been to these tendencies. In this context, soon after the dissolution of Soviet Union, together with the liberalisation waves, the countries around the Black Sea region have developed bilateral trade among themselves and this trend caused to tightening the economic relations. This knitting up is resulted in the establishment of Black-Sea Economic Cooperation (BSEC) organization. Currently with its twelve member countries and a population of over 320 million, BSEC has been in place for sixteen years and holds out much more potential for expansion for trade among its members.

In this regard, this paper aims to shed light on the gravitational factors those effect the bilateral trade between the member countries of Black-Sea Economic Cooperation. To this end, panel gravity model approach is used. The gravity model of trade is based on the idea that gross trade volumes between two countries depend on the size of the two countries and the distance between them. This simple model has been used extensively in analysing trade and has been successful to a high degree in explaining trade flows.

The paper organised as follows: in the next section an overview of BSEC organisation is given. Section three presents the theoretical foundations and mechanism of the basic gravity model. In the fourth section it is briefly reviewed the existing literature on the application of gravity model to international trade follows. In section five an outline of our approach, main econometric issues and data sample for estimation of the gravity model are put forth. Results are analyzed in section six. Section seven concludes the paper.

2. EVOLUTION OF THE BLACK SEA ECONOMIC COOPERATION

Until the collapse of the Soviet Bloc and Soviet Union itself in the late 1980's, most of the economies in Eastern Europe were members of CMEA (Council of Mutual Economic Assistance) that was formed to divert trade away from the market economies in the West. The development under Soviet planning of strong input-output linkages between industries in different countries/republics led to a significant degree of complementarity between member economies. This complementarity facilitated the maintenance of high degrees of in-bloc self-sufficiency. Following the dissolution of Soviet Bloc and hence CMEA, both the ex-Soviet republics gaining independence, and the formerly socialist nations of Eastern Europe became exposed to competition among the market economies for global markets. A considerable portion of trade in these markets was controlled by regional trade blocs (Sayan, 1998: ii). So, there were already close relationships between the countries in the region, when Turkey took the initiative for the formation of a regional economic cooperation zone among the countries around the Black Sea in 1990.

Table 1. Selected macroeconomic indicators of BSEC members (2006)

Country	GDP	Exports	Imports	Population	PCGDP	Inflation	Growth
Albania	9,097.9	25	9	3.2	6,000	2	5
Armenia	6,386.7	22	36	3.0	4,950	5	13
Azerbaijan	19,851.3	70	41	8.5	5,430	5	35
Bulgaria	31,483.0	64	83	7.7	10,270	8	6
Georgia	7,743.8	33	57	4.4	3,880	8	9
Greece	308,449.4	19	27	11.1	30,870	3	4
Moldova	3,356.2	46	93	3.8	2,660	13	4
Romania	121,609.1	34	44	21.6	10,150	10	8
Russian F.	986,939.6	34	21	142.5	12,740	16	7
Turkey	402,709.9	28	36	73.0	8,410	11	6
Ukraine	106,468.7	47	50	46.8	6,110	14	7

Source: World Bank, World Development Indicators, www.worldbank.org

At the beginning, the purpose of the negotiations was to gradually establish a free trade zone, but later meetings and summits led to an economic cooperation organization. The founders of the organization were Turkey, Romania and Bulgaria who have shores to the Black Sea. The Russian Federation, Ukraine, Azerbaijan, Moldova, Georgia, and Armenia joined after the dissolution of the Soviet Union. Greece and Albania participated as well later, even though they have no coasts to the Black Sea. The first meeting was held in Ankara on December 1990, as a result of Turkey's efforts (Dikkaya and Orhan, 2003: 64). In this summit parties worked on the blue print suggested by Turkey and declared the foundation of BSEC. Meetings which are held in 1991, concluded the purposes and principals of the organization. In the mid-1992, the BSEC Treaty was signed by Turkey, Russian Federation, Romania, Bulgaria, Ukraine, Azerbaijan, Moldova, Georgia, and Armenia as well as Greece and Albania in Istanbul Summit. Serbia has participated to the organisation later on. A number of countries are at the observer status.

The BSEC has gradually become more recognized after its foundation. In the preparation process the main purpose was to advance commercial, economic, scientific, and technical cooperation between member countries by making use proximity and their complementary economic resources. The ultimate goal is to promote the Black Sea region as an area of peace, cooperation and wealth. To this end, the member countries are supposed to prepare a ground for cooperation and trade of goods and services. In the long run, commodities, services and factors of production would be transferred freely among the BSEC countries. To develop

cooperation in terms of business environments, the Black Sea Economic Council was established as an extension of the early released declaration. The Council is currently active to improve industrial and commercial cooperation (Dikkaya and Orhan, 2003: 65). In summary, BSEC that currently has eleven member countries and a population of over 320 million has been in place for sixteen years.

The financial agency of the organisation is the Black Sea Trade and Development Bank (BSTDB), which was established in Thessalonica, Greece. The bank finances common regional projects and provides financial resources to the countries engaged in such projects. The members of the bank are the representatives of the BSEC countries and some international banks.

Some of the inter-relations are sensitive due to historical factors among the BSEC countries. For instance, Azerbaijan and Armenia have cut their diplomatic relations after the clashes in the Karabakh region. Since the Russian Federation supports Armenia in this debate, there is tension between Azerbaijan and the Russian Federation as well. Also Turkey has tense relations with Armenia historically. Similar tension is present between Georgia and Moldova with the Russian Federation due to the Abkhazia and the Dinyester problems respectively. Another fundamental debate is between Turkey and Greece that can be traced back to the collapse of the Ottoman Empire. On the other hand, the Russian Federation has trouble with Ukraine ever and anon, too.

3. GRAVITY MODEL OF INTERNATIONAL TRADE

3.1. The Gravity Model

The gravity model belongs to the class of empirical models concerned with the determinants of interactions. In its most general formulation, it explains a flow (of goods, capitals, peoples etc.) from an area to another area as a function of characteristics of the origin, characteristics of the destination and some separation measurement. Customarily the model is estimated in log-linear form (Porojan, 2000:2).

The gravity model has its origin in Newton's law of gravitation in seventeenth century. Newton's law of gravity in mechanics states that two bodies are subjected to a force of attraction force that depends positively on the product of their masses and negatively on their distance. Social scholars, in nineteenth century, applied this law to social phenomena of quite different nature the common character of which was transfers or flows between two or more entities or sources. Thus migration or traffic laws (vehicles, information etc.) were examined using the gravity law (Simwaka, 2006; 6).

Following a specification reminiscent of Newton's gravitation theory, gravity models relate bilateral trade to the mass of these two countries (commonly measured as the size of the countries involved) and the distance that separates them. This standard formulation of the model, which is consistent with standard models of international trade, is commonly extended to include other factors generally perceived to affect bilateral trade relationships. Indeed, the notion of

distance does not only relate to the geographical distance (i.e. transportation costs), but also to other factors affecting transaction costs. Besides or instead of distance variable some other variables also can be used, such as a dummy variable for each of the variables of having common language, common border, being in same territory and same free trade arrangement (Bussiére and Schnatz, 2006; 14).

There are several reasons, though, for the inclusion of distance as an explanatory variable. Batra (2004;3) counts some of these explanations as follows:

- Distance is a proxy for costs
- Distance is an indicator of the time elapsed during shipment. For perishable goods the probability of surviving intact is a decreasing function of time in transit.
- Synchronization costs: when factories combine multiple inputs, the timing of these needs to be synchronised so as to prevent emergence of bottlenecks. Synchronization costs increase with distance.
- Transaction costs: distance may be correlated with the costs of searching for trading opportunities and the establishment of trust between potential trading partners.
- Cultural distance: it is possible that greater geographical distance is correlated with larger cultural differences. Cultural differences can impede trade in many ways such as inhibiting communication, clashes in negotiating styles etc.

In international trade, the gravity model was first introduced by Tinbergen (1962) and Pöyhönen (1963) mainly to account for the patterns of bilateral trade flows among the European countries. Since then, the gravity model has been used and increasingly improved in empirical studies of international trade flows. Linneman (1966) extended the model of Tinbergen to include other trade explanators such as population, and more importantly, complimentarity (Kien and Hashimoto, 2005:3; Armstrong, 2007:4). Most familiar uses of the model relate to: the examination of bilateral trade patterns in search of evidence on natural (non-institutional) regional trading blocs; the estimation of trade creation and trade diversion effects from regional integration, and the estimation of trade potential (Porojan, 2000:3).

Although, the empirical results obtained with the model have always been judged as very good, yet there are a few objections to the model. One is the absence of a cogent derivation of the model, based on economic theory. Several authors have tried to provide the model with such a theoretical basis, notably Anderson (1979), Bergstrand (1985) and more recently Deardorff (1995). However, none of these derivations generates the gravity model as its most general form. It could only be approximated under a number of restrictive and unrealistic assumptions. Another imperfection of the gravity model is the absence of substitution between flows and ignoring the third country's effect on the bilateral trade. In the analysis of international trade, for which purpose the gravity model is frequently used, trade creation and trade diversion are important phenomena (Bikker, 1987). However, there is a huge number of empirical applications in the literature on international trade which have contributed to the improvement of the

performance of the gravity equation. Matyas (1997), Breuss and Egger (1999), and Egger (2000) improved the econometric specification of the gravity equation.

3.2. Framework of Gravity Model

The simplest form of the gravity model can be stated as below,

$$T_{ij} = A \cdot \frac{(Y_i \times Y_j)^{\alpha}}{D_{ij}^{\gamma}} \tag{1}$$

where, T_{ij} is the trade volume between country i and j; A is proportionality constant; Y_i ve Y_j are economic sizes of country i and j (with respect to GDP, GNP or per capita GDP); D_{ij} is the distance between countries. Equation (1) is the core gravity model equation where bilateral trade is predicted to be a positive function of income and negative function of distance. When applied to predict trade flows, population size of both exporter and importer country are often included as variables in the equation, assuming larger populations support and promote larger trade volumes:

$$T_{ij} = A \cdot \frac{(Y_i \times Y_j)^{\alpha} (P_i \times P_j)^{\beta}}{D_{ij}^{\gamma}} \tag{2}$$

After a simple arrangement equation (2) can be written as follow:

$$T_{ij} = A \cdot \frac{(P_i \times Y_i)^{\alpha} (P_j \times Y_j)^{\beta}}{D_{ij}^{\gamma}} \tag{3}$$

If for the both side logarithms are took, the equation becomes linear:

$$log\ T_{ij} = A^{*} + \alpha\ log\ (P_i \times Y_i) + \beta\ log(P_j \times Y_j) - \gamma\ log\ D_{ij} + \varepsilon_{ij} \tag{4}$$

where, A^{*} is $log\ A$, and α, β, and γ are parameters to be estimated. e_{ij} is a white noise error term with constant variance and zero mean, and stands for to represent the random factors those effect bilateral trade.

Now trade flows are defined as a function of per capita GDP in two countries and the distance between these countries. Since there is no deviation in $(P_i \times Y_i)$ with respect to the various importer countries, thus it cannot be a source of explanation for trade deviations to those importer countries, and hence can be dropped from the equation (Bos and van de Laar, 2004; 5). The estimable model can be written as;

$$log\ T_{ij} = A^{*} + \alpha\ log\ P_j + \beta\ log\ Y_j - \gamma\ log\ D_{ij} + \varepsilon_{ij} \tag{5}$$

Trade theories based upon imperfect competition and the Hecksher-Ohlin model justify the inclusion of the core variables – income and distance. Most studies have however, included additional variables to control for differences in

geographic factors, historical ties and at times economic factors like the overall trade policy and exchange rate risk (Batra, 2004; 4).

4. REVIEW OF LITERATURE

Among the many studies using the gravity framework, a high percentage shares the research task of predicting trade potentials. On the other hand, several studies have analyzed the trade enhancing impact of preferential trading agreements. These studies predict the additional bilateral trade that would be a consequence of the economic integration of set of economies. Both the cross section and panel data approach has been used by these studies. The cross-section as also the panel data approach is mainly static and refers to a long run relationship.

Hellvin and Nilsson (2000) have examined to what extent there may be a bias in the trade flows between the major trading blocs: the EU, the NAFTA countries, and ASEM members. They compared actual trade between the blocs with projected trade based on a gravity model estimation. The results they obtained suggest that both the EU's and NAFTA's level of trade integration with Asia above the average level of trade integration among the OECD countries, which make out their point of reference. However, the opposite holds for the level of trade integration between the EU and NAFTA. On the other side, trade between NAFTA and Asia are more integrated compared to the EU's trade with Asia, thereby supporting one of the reasons for the creation of the ASEM. This implies that the EU has lagged behind North America on the Asian market. Hellvin and Nilsson (2000) conclude that the weak link in trade bloc triangle therefore seems to be between the EU and NAFTA rather than between the EU and Asia.

Martinez-Zarzoso (2003) has evaluated the determinants of bilateral trade flows among 47 countries and particularly, the effects of preferential agreements between several economic blocs and areas. To this end she has estimated a gravity model that allows the comparison of the weight of the influence of preferential agreements and also, infers the relevance of the other determinants of bilateral trade flows such as geographic proximity, income levels, population and cultural similarities. Impacts of different variables on trade considered. Using the estimation results as a base, trade potentials resulting from new free trade agreements are calculated. The results indicate that the traditional gravity model variables present the expected signs and highlight the role played by intra-bloc effects.

Jayasinghe and Sarker (2004) have used an extended gravity model to investigate the trade creation and diversion effect of the North American Free Trade Area (NAFTA) on trade of six selected agrifood products from 1985 to 2000. The result shows that the share of intraregional trade is growing within NAFTA and that NAFTA has served to boost trade significantly among its members rather than with the rest of the world.

Baier and Bergstrand (2005) have investigated the average treatment effect of free trade agreements (FTAs) on trade, and they found convincing empirical

evidence using panel data gravity model. They estimated that an FTA will on average increase two member countries' trade about 86 percent after 15 years.

In his paper, Rojid (2006) has aimed to find out whether COMESA is a building or stumbling bloc, and to estimate trade potentials, if any, within COMESA region for COMESA members. An extended gravity model was used in the analysis. The results show that COMESA has certainly created more trade within the region than it has diverted for the rest of the world. However, more importantly, it was found that COMESA members are over-trading within the bloc and as such, potentials for more trade exist only for Angola and Uganda.

Widgren (2006) has analyzed trade potential, intra-industry trade and comparative advantage in the Baltic Sea Region (BSR). The analysis is carried out at HS 4-digit level. Trade potential is assessed using the gravity model of international trade. Trade flows analysis suggests that the BSR has reached its potential importance in intra-EU25+ (EU25 plus Norway and Russia) trade. The overall conclusion in trade potential analysis is that the centre of gravity within BSR is likely to move gradually to the east. It is also demonstrated in the paper there are big changes in some BSR's countries specialization patterns.

Martinez-Zarzosso and Nowak-Lehmann (2006) had explored the determinants of bilateral trade flows between EU and MERCOSUR countries. To the end of to investigate the relationship between the volume and direction of international trade and the formation of regional trade blocs where members are in different stages of development. The standard gravity model had been augmented with a number of variables, namely infrastructures endowments, squared differences in per capita incomes and real exchange rates, to test whether they are relevant in explaining trade flows. Finally, they have analyzed to what extent potentials for trade between these two economic areas are important. Estimation results have shown that exporter and importer incomes have a positive influence on bilateral trade. Exporter population has a large and negative effect in exports, whereas importer population has a large and positive effect on exports, indicating that bigger countries import more than small countries. The roles of augmentative variables are also investigated. The results reveal that income differences and exchange rates play as explaining bilateral trade flows in a panel data framework, while infrastructure variable is not statistically significant.

5. EMPIRICAL ANALYSIS: GRAVITATIONAL FACTORS OF TRADE IN BSEC REGION

5.1. Estimations of Panel Gravity Models

In order to investigate the gravitational determining factors of the trade among the BSEC countries panel data analysis is used. Actually, it is a necessity to employ the panel data analysis due to lack of the large data set. There are only 12 BSEC members. Hence, this situation does not allow to any cross sectional analysis. On the other hand, BSEC has only 16 years of past. Therefore the annual data set is not enough large to conduct a time series analysis. Due to these restrictions, inevitably we have employed panel data analysis.

Standard gravity models generally use cross-section data to estimate trade effects for a particular time period, such as one year, or over averaged data. However, panel data models might provide additional insights, capturing the relevant relationships over time and avoiding the risk of choosing an unrepresentative year. Moreover, panels allow monitoring unobservable individual effects between trading partners. Therefore, in order to investigate the impact of gravitational factors on the trade between Turkey and Asia-Pacific countries, we used panel gravity model framework. Panel data models have three basic approaches: They are pooled and estimated by OLS, or they are assumed to be motivated by fixed effects model (FEM). The third approach is the random effects model (REM). Each approach has its own advantages and disadvantages. As Antonucci and Manzocchi (2005) pointed out REM would be more appropriate when estimating trade flows between a randomly drawn sample of trading partners from larger population. On the other hand, FEM would be a better choice than the REM when one is interested in estimating trade flows between a predetermined selection of countries (Egger, 2000, 2005).

The variables had been included in the model are the core variables of gravity model, namely the economic size and population of the partner country and the distance between country pairs. For trade volume we took only the amount of exports instead of the total foreign trade. Economic size of the partner country has been represented by its GDP level. Expected effect of the economic size on trade is positive.

Trade data (exports per countries - in current million US$) were obtained from each country's statistics organization, incomes (GDPs) and populations are from the IMF statistical database, and distance in kilometers between capitals are from http://www.mapcrow.com.

The estimated gravity equation is specified as:

$$log\ EXPO_{ijt} = A^{*} + \alpha\ log\ GDP_{jt} + \beta\ log\ POP_{jt} + \gamma\ log\ WDIST_{ij} + \varepsilon_{ijt} \qquad (6)$$

where,

$EXPO_{ijt}$, is the exports volume from country i to country j in period t.
GDP_{jt} , indicates the GDP of the trade partner in period t.
POP_{jt} , indicates the population of the trade partner in period t.
$WDIST_{ij}$, is the weighted distance between countries i and j.
Expected signs of the parameters are as follow: $\alpha > 0$, $\beta <$ or > 0, $\gamma < 0$

It should be said something about the distance variable. The most controversial part of gravity model is, probably, the determination of distance. Some claim that this distance would preferably be the one between commercially important cities of the countries or the distance between capital cities. But, at global scale this choice does not make so much difference. Definition of the distance is also problematic, due to its time invariant nature. Although it is not a problem in cross sectional analysis, when time dimension entered in the analysis

(i.e. panel-data) the variable causes to trouble. In order to overcome this difficulty and to make the distance a *varying variable* over time, various approaches have been suggested in the literature. These approaches suggest weighted definitions of distance. The distance we adopt in this paper is defined as;

$$WDIST_j = \frac{DIST_{ij} \times GDP_{jt}}{\sum_{t=1}^{T} GDP_{ct}}$$

That is, weighted distance of country j is equal to, geographic distance of country j by GDP of her divided by GDPs of all countries in the sample for a certain year.

Table-2 presents the estimated coefficients for the six BSEC members in a panel data analysis context. Due to lack of data for some members we have conducted the analysis for only six countries. According to estimations, GDP (income) level of the importer countries play a positive role on bilateral trade. Each of the parameter estimations shows a strong significance. Except Greece and Turkey, the population coefficients of the partner countries are positive signed and significant. The positive sign indicates that country size is directly related to trade volume. Larger countries have a grater capacity to absorb imports than do their smaller counterparts. The coefficients of the distance variable have the expected negative sign and are highly significant for every country.

Table 2. Results of the fixed effects panel gravity model estimations

	Armenia	**Georgia**	**Greece**	**Moldova**	**Russia**	**Turkey**
GDP	2.351*	3.073*	3.150*	1.155*	1.792*	1.472*
	(0.512)	(0.344)	(0.179)	(0.321)	(0.300)	(0.291)
POP	0.857**	0.999*	-0.126	1.079*	0.820*	0.180
	(0.419)	(0.278)	(0.161)	(0.222)	(0.121)	(0.130)
WDIST	- 2.004*	2.618*	-2.439*	-0.967*	-1.514*	-1.063*
	(0.403)	(0.265)	(0.152)	(0.277)	(0.261)	(0.294)
R^2	0.438	0.727	0.890	0.738	0.861	0.752
F-value	12.992	55.173	137.915	58.261	116.086	56.578
Hausman	18.637	5.520	17.328	41.117	20.143	16.751
N	54	66	55	66	60	60

Note: * (**) denotes the significance at 1% (5%) level. Standard errors are given in parenthesis.

Hausman test statistics are also reported in the table. The values of Hausman test statistics indicate that fixed effects panel data models are more relevant in comparison with random effects models.

6.CONCLUSION

The aim of this paper was to estimate a gravity equation for bilateral trade flows among BSEC countries. The results indicate that the variables traditionally included in the gravity model present the expected signs. The variable GDP which denotes the economic size of the importer country has a positive effect on trade in each case. The estimated coefficient corresponding to the importer population is also positively signed for four countries included in the sample. Other two countries' coefficients are turned to be insignificant. The positive sign of the population variable points to market size effects in international trade models. Concerning geographic distance, its coefficients present negative sign as expected.

The analysis of trade potentials of BSEC members and impacts of adjacency, having common language and historical ties will be the subject of further research.

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