# EUROPEAN INTEGRATION AND EU EASTWARD ENLARGEMENT PROCESS IN INTERNATIONAL TRADE: USING A GRAVITY APPROACH FOR EXPLORING BILATERAL TRADE FLOWS

**Tiiu Paas**[1], **University of Tartu, Estonia**

**Email: tpaas@mtk.ut.ee**

**The 42nd Congress of the European Regional Science Association, August 27-31, 2002, Dortmund, Germany**

## Abstract

The paper analyzes bilateral trade flows between the EU and its candidate countries using a gravity approach. The advantages of using gravity models in examining international trade flows are twofold 1) Data needed for the model are easily accessible and reliable, 2) Theoretical considerations for using these models to explore international trade flows have been widely discussed and developed. Both advantages are important when analyzing the EU eastward enlargement and regional integration processes. Empirical results of using gravity approach for exploring changes in the international trade pattern allow us to summarize that the knowledge gained from the laws of nature is also applicable for exploring economic processes. The results of the gravity models based empirical analysis support the premise that essential attraction force or pull factor for developing bilateral trade flows is the size of economy, and push factor is the distance between the countries. In many cases distance also expresses cultural proximity and historical relationship between the countries. There are also some regional factors that influence development of trade relations, for instance cooperation of the countries around the Baltic Sea (the Baltic cluster).

*Keywords:* trade flows, regional integration, EU eastward enlargement, gravity models.

*JEL:* F10, C10

---

[1] The paper was prepared with the support of the Estonian Science Foundation research grant (4588). The author is grateful for this support.

## INTRODUCTION

International trade is one of the most expedient economic factors in pushing economies into integration. Significant changes in international trade pattern have attracted economists to pay more attention to the development of theoretical considerations and empirical approaches that enable us to explore international trade flows and the role of regional integration in developing bilateral trade relations between the countries.

In recent years, gravity models have been widely used in empirical studies of integration processes in foreign trade in order to explore main changes in the geographical trade pattern and reintegration of economies in transition in international division of labor (Wang and Winters, 1991 and 1994; Baldwin, 1993, 1994 and 1997; Gros and Gonciarz, 1996; Iversen, 1998; Cornett and Iversen, 1998, Fidrmuc, 1998 and 1999; Laaser and Schrader, 2002).

Using gravity equation for exploring international trade flows has more than forty years of history and this equation is still at the center of applied research on international trade. Gravity equation fits the data remarkably well. Theoretical considerations for using gravity models to explore international trade flows have been widely discussed and developed (Tinbergen 1962; Linnemann, 1966; Anderson, 1979; Bergstrand, 1985, 1989 and 1990; Deadorff, 1984, 1995 and 1998; Evenett and Keller, 1998; Anderson and Wincoop, 2001; Harrigan, 2001). Despite of continuing discussions and uncertainty about the foundations of the gravity model, it is possible to say, that these theoretical considerations, which are mostly based on microeconomic foundations and trade theories, are also valid when exploring the changes in international trade patterns during transition and EU eastward enlargement processes.

The paper consists of two main parts. In the first part, the possibilities of using the gravity approach for modeling international trade flows are described and analyzed laying emphasis on the theoretical foundations of this approach in examining foreign trade flows. The second part of the paper presents the main empirical results using gravity equation for analyzing bilateral trade flows between the EU and the candidate countries. The EU eastward enlargement candidate countries form two groups: 1) Luxembourg group of candidate countries (formed in 1997): Poland, Czech Republic, Hungary, Estonia, Slovenia, Cyprus, and

2) Helsinki group of candidate countries (formed in 1999): Latvia, Lithuania, Bulgaria, Romania, Slovakia and Malta.

The aim of the empirical part of the paper is using gravity models to test the hypothesis that the bilateral trade flows of the EU and candidate countries are explained by the size of economy, the level of economic development of trade partners´ countries, the distance between the countries and other factors, such as the existence of similar cultures and historical relationships, common borders, regional groups of countries, etc. It is important to take into account, that gravity models have strong power in explaining trade pattern and testing hypotheses, but the modeling results are not very reliable if we want to estimate the level of trade flows in absolute terms. This statement is also expressed by Gros and Conciarz (1996). Hence, it is not reasonable to use gravity equations to forecast bilateral trade flows but it is recommendable to evaluate the potential for developing bilateral trade flows paying attention first of all to the cases where bilateral trade has good potential for growth.

## I. THEORETICAL FOUNDATIONS OF USING GRAVITY APPROACH IN EXPLORING INTERNATIONAL TRADE FLOWS

From a methodological point of view, gravity theory can be considered as a relational theory, which describes the degree of spatial interaction between two or more points in a manner analogous to physical phenomena (Nijkamp and Reggiani, 1992). Classical gravity theory states that the attraction force $a_{ij}$ between two entities $i$ and $j$ is proportional to their respective masses $m_i$ and $m_j$ and inversely proportional to the squared distance $d_{ij}^2$ between these entities ($a_{ij} = \gamma m_i m_j d_{ij}^{-2}$; $\gamma$ is a constant proportionality factor).

As early as in the middle of the nineteenth century H.C. Carey (Principles of Social Science, 1858-1859) observed the presence of gravitational force in social phenomena, stating that the force was in direct ratio to mass and inverse to distance (Isard, 1960). Gravity theory has primarily been centered on in the fields where a distance plays a significant role. Gravity theory has proven to be useful in describing social phenomena in space such as population migration, flow of goods, money, and information, traffic

movement and tourist travel. One can specify gravity theory for such uses as follows (Nijkamp, 1975, p. 204)

$t_{ij} = K\, O_i^{b1} Dj^{b2} f(S_{ij})$ (1),

Where

$t_{ij}$ – the volume of flows between two points,

$K$ – a constant,

$O_i$ – volume of flows from the points of origin,

$D_j$ – volume of flows at the point of destination,

$b_1, b_2$ – weighted geometric averages of $O_i$ and $D_j$ respectively,

$f(S_{ij})$ – distance friction, a function of $S_{ij}$.

The utility specification of the gravity model has been analyzed by Niedercorn and Bechdolt (1969), Golob and Beckmann (1971), and Nijkamp (1975). The theory of consumer behavior assumes that, subject to budget constraint, the available income will be spent on several alternatives so as to maximize utility. An optimal allocation of the given budget can be obtained by postulating a utility function for the decision-maker that reflects relative preferences. Niedercorn and Bechdolt as well as Nijkamp have shown that, assuming the budget constraint is linear, the volume of transactions between two points can be stated as a utility maximizing problem. They proved that a model using gravity theory could be derived from a utility maximizing function, either in a specified form as in equation (1) or in logarithmic form.

The antecedents for using the gravity approach to model international trade flow date back to Tinbergen (1962), Poyhonen (1963) and Linnemann (1966). Linnemann added more variables and went further toward a theoretical justification in terms of Walrasian general equilibrium system. He pointed out that, when considering the theoretical aspects of a gravity model for trade, there are three main factors to be considered: 1) the total potential supply (or exports) of a country to the world market; 2) the total potential demand (or imports) of a country to the world market; 3) those factors that create resistance to trade and thus affect the degree of trade intensity. These include ordinarily tariff barriers and transportation costsThe basic form of the gravity model for the examination of international trade flow is as follows.

$$X_{ij} = b_0 Y_i^{b1} Y_j^{b2} N_i^{b3} N_j^{b4} D_{ij}^{b5} P_{ij}^{b6} u_{ij} \quad (2),$$

Where,

$X_{ij}$ – the trade flow between country *i* and *j*,

$b_0, b_1, b_2, b_3, b_4, b_5, b_6$ – coefficients,

$Y_i$ and $Y_j$ – domestic expenditures per capita in country *i* and *j*, respectively,

$N_i$ and $N_j$ – population in country *i* and *j*, respectively,

$D_{ij}$ – trade resistance due to geographic distance between countries i and j,

*Pij* – dummy variable to take into account possible preferential trade factors between countries *i* and *j,*

$u_{ij}$ – error term.

In fact there are several theoretical foundations of the gravity model (Anderson, 1979; Bergstrand, 1985, 1989 and 1990; Helpman and Krugman, 1985; Helpman, 1987; Deadorff, 1995 and 1998; McCallum, 1995, Evenett and Keller, 1998; Harrigan, 2001; Anderson and Wincoop, 2001). Additionally to the utility specification of the gravity model, Anderson (1979) presented a theoretical foundation o the gravity model based on constant elasticity of substitution (CES) preferences and goods that are differentiated by region of origin. Subsequent extensions (see Bergstrand, 1989 and 1990; Deadorff, 1998) have preserved the CES preference structure and added monopolistic competition and/or a Hecksher-Ohlin structure to explain specialization.

Analyzing various approaches to theoretical foundations of gravity equations, Evenett and Keller summarized three types of trade models, which differ in the way product specialization is obtained in equilibrium (1998, p. 1): technology differences across countries in the Ricardian model, 2) variations in terms of countries' differing factor endowments in the Hecksher-Ohlin (H-O) model, 3) increasing returns at the firm level in the increasing returns to scale (IRS) models.

In reality, though, technologies and factor endowments are not the same around the world; they change over time and can be transferred between countries. Trade theory, as a rule explains why countries may trade in different products but does not explain why some countries' trade links are stronger than others and why the level of trade between countries tends to increase over time. This emphasizes the limited applicability of trade theory in

explaining the size of trade flows. Therefore, while trade theory can explain why trade occurs, it cannot explain the extent of trade, whereas the gravity model allows to take into account more factors for explaining the extent of trade as an aspect of international trade flows.

Gravity equations ordinarily have strong empirical explanatory power with $R^2$ ranging from 70 to 95 percent. Eichengreen and Irwin aptly summarized the state of theoretical foundations for the gravity model (1998, pp.33-34): "Where there is no close correspondence between the leading theoretical models of trade and the variables appearing in the gravity equation, a number of authors have suggested that the gravity-model framework is compatible both with the Hecksher-Ohlin model and with theories of trade in the presence of imperfect competition. The attraction of the gravity model (no pun intended) is not simply lack of theoretical incompatibility, of course, but its ability to explain the variation in bilateral trade flows across a wide variety of countries and periods. Few aggregate economic relationships are as robust."

It is possible to summarize that despite of many discussions about theoretical foundations of gravity models, they are widely used for exploring international trade flows. The development of using gravity equations for modeling economic processes including also international trade flows bases on various theoretical considerations, which could be explained by: 1) Regional science and new economic geography, 2) Microeconomic foundations, 3) Trade theories. The theoretical foundations and main concepts of using gravity law in social science and economics are summarized in the table 1.

Since the beginning of 1990s, gravity models have also been widely used to estimate trade flows between East and West Europe. Special attention has been given to estimating potential trade flows between the EFTA, European Union, Central and East European and Baltic countries (Winters and Wang, 1991 and 1994; Baldwin, 1993, 1994 and 1997, Hamilton and Winters, 1992, Gros and Dautrebande, 1992 and 1996; Eltetö and Szemler, 1996; van Beers and Biessen, 1996; Iversen, 1998, Cornett and Iversen, 1998; Paas, 2000 and 2001; Fidrmuc, 1998 and 1999; Laaser and Schrader, 2002). In the mid and late 1990s a lot of attention was paid to the CEE and Baltic countries integration into the European Union laying emphasis on the regional integration's effect on the development of trade relations.

TABLE 1. The theoretical foundations and main concepts of using gravity law in social science and economics

| Theoretical background | Main concepts | Authors |
|---|---|---|
| Regional science, economic geography | The measurement of intra-regional relationships and their influence on the behavior of individual units. Regions are conceived as a mass. | Reilly (1929), Steawart (1948), Isard (1960), Krugman (1991a 1991b, 1998), Fujita, et al (1999) |
| Microecono-mics (utility maximi-zation, general equilibrium theory, constant elasticity of substitution preferences) | A model using gravity theory could be derived from a utility maximizing function. | Tinbergen (19962), Linnemann (1966), Niedercorn and Bechdolt (1969), Golob and Beckman (1971), Nijkamp (1975), Anderson (1979), Bergstrand (1985, 1989, 1990), Nijkamp and Reggiani (1992) |
| Trade theories | Trade theories differ in the way product specialization is obtained in equilibrium: 1) technology differences (Ricardian model); 2) factor endowments differences (Hecksher-Ohlin model); H-O model); 3) Inreasing returns to scale models (IRS) | Tinbergen (1962), Poyhonen (1963), Linnemann (1966), Anderson (1979), Bergstrand (1985), Helpman (1987 and 1989), Krugman, (1979), Helpman and Krugman (1985), McCallum (1995), Deadorff (1995), Evenett and Keller (1998), Eichengreen and Irwin (1998), Harrigan (2001); Anderson and Wincoop (2001) |

The main directions of developing the gravity approach for modeling international trade pattern of economies in transition and their integration into the world trade system could be summarized as follows: 1) Estimating the trade potential of Central and Eastern Europe and development of East-West trade, 2) Exploring regional integration and trade flows in the framework of international organizations and regions, 3) Estimating bilateral trade flows between a country in transition and its main trade partners.

Using gravity approach for exploring bilateral trade flows between the East and West countries, Baldwin also focused on problems of theoretical foundations for the gravity model (Baldwin, 1994, p.82) "The gravity model used to have a poor reputation among reputable economists. Starting with Wang and Winters (1991), it has come into fashion. One problem that lowered its respectability was its oft-asserted lack of theoretical foundations. In contrast of popular belief, it does have such foundations."

In summary, empirical results of the using gravity approach in exploring international trade pattern allow us to conclude that despite its simplicity, the gravity model explains the actual pattern of trade flows remarkably well. The advantage of the gravity model is that it needs comparatively little data, and internationally comparable data for the construction of a gravity model are usually available. These advantages are particularly of interest when modeling trade flows and developing trade scenarios of economies in transition and exploring integration processes of transitional and industrialized economies. Developments of empirical studies using gravity models also help us to understand and develop theoretical foundations of these models.

## II. EMPIRICAL RESULTS OF MODELING TRADE FLOWS

In the gravity model, as a rule, the basic assumption is that a particular country tends to have trade relations with a large and rich partner. Distance influences foreign trade. It is generally more convenient and cheaper to have trade relations with nearby countries. The greater is the distance between trade partners the less the expected trade flows there are. One category of trade flow restrictions is man-made impediments. These barriers or disincentives are created and maintained by governments or their agencies as well as by groups of private individuals or firms. Tariffs, quotas, subsidies, export taxes, exchange controls, and different marketing restrictions are the means by which governments or their agencies can create trade barriers. There are also economic and political unions like the EU, Commonwealth of Independent States (CIS), Organization of Economic Cooperation and Development (OECD), etc. that create trade preferences to selected countries. In order to analyze the effects of regionalism, investigators typically add dummy variables for participation in regional arrangements. According to the empirical analysis of Whalley

(1998), the benefits from this form of market assurance may in fact be quite large, particularly in the case of a small country.

Based on the main aim of the empirical part of the paper and according to the basic assumptions of the gravity model, the following hypothesis could be tested:

1) The EU and candidate countries have developed more active trade relations with countries where the number of population is bigger (expresses the size of economy) and GDP per capita (expresses the level of economic development) is higher;
2) Distance influences foreign trade flows negatively: the larger the distance between countries, the smaller the expected level of bilateral trade flows;
3) Belonging to certain groups of countries (border countries, Baltic Sea region countries, Nordic countries, Visegrad countries, etc) influences foreign trade flows.

In order to test the stated hypotheses and to explore trade flows between the countries the following gravity equation has been estimated:

$$lnY_{ij}=B_0+B_1ln(POP)_i+B_2ln(POP)_j+B_3ln(GDPPC)_i+B_4(GDPPC)j+B_5ln(DISTANCE)_{ij}+ +DUMMIES+u_{ij} \quad (3),$$

where

$Y_{ij}$ – export from country $i$ to country $j$ (or import from country $j$ to country $i$);

$(POP)_i$ and $(POP)_j$ – population of exporting ($i$) and importing ($j$) countries respectively (or home ($i$) and host ($j$) countries);

$(GDPPC)_i$ and $(GDPPC)_j$ – gross domestic product per capita of exporting ($i$) and importing ($j$) countries respectively; both GDP(PPP) (purchasing parity power adjusted) and GDP(MER) (market exchange rate) data are used in the estimated versions of the gravity equations;

$(DISTANCE)_{ij}$ – the distance in kilometers between the countries $i$ and $j$ (the flight distance between the capitals of the countries);

*DUMMY 1* – designating that the trade partners are the Baltic Sea region countries (Denmark, Finland, Germany, Sweden, Poland, Estonia, Latvia, Lithuania);

*DUMMY 2* – designating that the trade partners have a common border (land border);

*DUMMY 3* – designating that the trade partners are the Nordic countries (Denmark, Finland, Sweden);

*DUMMY 4* – designating that the trade partners are the Visegrad Nordic countries (Czech Republic, Slovakia, Hungary, Poland);

*DUMMY 5* – East-West trade relations (the trade flows are between the EU (west partner) and former socialist (east partner) countries);

$u_{ij}$ – error term.

The estimation of the gravity equation (3) bases on:

1) Exports and imports data of IMF on the EU (15 counties) and candidate countries (12 countries, incl. Malta and Cyprus) (IMF, Direction of Trade Statistics Yearbook 2001 and earlier issues);
2) GDP data, (IMF, International Financial Statistics Yearbook 2001 and earlier issues); World Bank (www.worldbank.org/data/databytopic/GDP.html);
3) A matrix of distances between the countries *(www.indo.com/distance)*.

The equation (3) is estimated based on the data of the years 1998, 1999 and 2000.

Several authors have discussed how to use the GDP data for estimating gravity equations; whether to use GDP(PPP) or GDP(MER)? (Gros and Consiarz, 1996; Baldwin 1994 and 1997; Cornett and Iversen 1998; Iversen, 1998). According to Gros and Consiarz, it is not recommendable to use PPP-converted GDP for estimating gravity equations. Estimates of trade potential should be made on the basis of the international value of goods and services a counry produces, not how well off inhabitants are (Gros and Consiarz, 1996, pp. 715). Iversen argues that the proper measure of the transition economies' incomes (GDP(MER) or (GDP)PPP) lies somewhere between the two approaches, and it is impossible to settle this matter on a purely theoretical basis (Iversen, 1998, p. 273). ). Modeling bilateral trade flows between the Baltic Sea region countries using the data of the year 1998 the result was that the statistical estimations are the best in the equations with GDP(PPP) (Paas, 2001).

Based on these considerations and the results of previous studies, both GDP indicators (MER and PPP) are used in this paper in order to estimate the gravity equation (3). The

statistical results of the estimated gravity equations using the EU and candidate countries' databases of the years 1998, 1999 and 2000 are rather stable. The explanatory powers of the regression models are not significantly different using GDP(PPP) or GDP(MER). The coefficients of determination are a bit higher in the case of using GDP (PPP) (table 2). Hence, the GDP (PPP) per capita as the independent variable that characterizes the level of economic development as a possible attraction force of developing bilateral trade relations between the countries is used in the following analysis.

The statistical characteristics of the estimated gravity equation (3) using GDP (MER) or GDP (PPP) are presented in table 2.

TABLE 2. Statistical characteristics of the estimated gravity equations

| Equations that include as an independent variable | Coefficient of determination ($R^2$) | Adjusted coefficient of determination ($R^2_{adjusted}$) | F-statistic | Significance ($p$) |
|---|---|---|---|---|
| 1998, GDP(MER) per capita | 0.618 | 0.611 | 94.575 | 0.000 |
| 1998, GDP(PPP) per capita | 0. 627 | 0.620 | 109.510 | 0.000 |
| 1999, GDP(MER) per capita | 0.620 | 0.614 | 100.963 | 0.000 |
| 1999, GDP(PPP) per capita | 0.696 | 0.691 | 129.708 | 0.000 |
| 2000, GDP(MER) per capita | 0.732 | 0.727 | 155.176 | 0.000 |
| 2000, GDP(PPP) per capita | 0.752 | 0.749 | 207.853 | 0.000 |

*Source:* White's heteroskedasticity-consistent covariance matrix estimators using statistical package Eviews

The estimators of the gravity equation (3) based on the data of the years 1998 (one year after establishing the Luxembourg group of the EU candidate countries), 1999 (the year of establishing the Helsinki group of the EU candidate countries), and 2000 are presented in the table 3.

TABLE 3. Estimations of the gravity model (3)

| Coefficients | 1998 | 1999 | 2000 |
|---|---|---|---|
| Constant | –16.328 (p=0.000) | –0.140 (p=0.918) | –1.760 (p=0.119) |
| Number of population, home country | 1.085 (p=0.000) | 1.036 (p=0.000) | 1.117 (p=0.000) |
| Number of population, host country | 0.969 (p=0.000) | 0.974 (p=0.000) | 1.019 (p=0.000) |
| GDP (PPP) per capita, host country | 0.134 (p=0.000) | –0.029 (p=0. 282) | –0.166 (p=0.000) |
| GDP (PPP) per capita, home country | 0.010 (p=000 | –0.114 (p=0.000) | –0.112 (p=0.000) |
| Distance | –0.293 (p=0.002) | –1.368 (p=0.000) | –0.987 (p=0.000) |
| Dummy 1, trade partners are Baltic Sea region countries | –0.613 (p=0.010) | –0.130 (p=0.459) | 0.402 (p=0.051) |
| Dummy 2, trade partners are border countries | 0.406 (p=0.056) | 0.209 (p=0.282) | 0.356 (p=0.084) |
| Dummy 3, trade partners are Nordic countries | 1.279 (p=0.063) | 0.727 (p=0.247) | 1.813 (p=0.001) |
| Dummy 4, trade partners are Visegrad countries | –0.214 (p=0.607) | –1.321 (p=0.001) | –0.563 (p=0.096) |
| Dummy 5, trade flows are between the East West countries | –0.214 (p=0.023) | –0.145 (p=0.201) | –0.738 (p=0.000) |

*Source:* White's heteroskedasticity-consistent covariance matrix estimators using statistical package Eviews

The size of economy (expressed by the numbers of population of home and host countries) has statistically significant positive and the distance between the countries negative impact on developing bilateral trade flows. The distance is expressing not only transportation costs but in many cases also cultural proximity and historical relationship between the countries.

In 1998, the impact of the level of economic development (expressed by GDP (PPP) per capita) was statistically significant in the case of both home and host countries, the corresponding regression coefficients have a positive sign. The estimations based on the data of the years 1999 and 2000 show that the sign of these coefficients has changed and it is negative. The negative sign of the corresponding coefficients could be explained by the expanding trade relations between the countries with different level of economic development and growing export and import volumes of the EU accession countries.

The bilateral trade relations between the EU countries and candidate countries that were former socialist countries are still less developed than trade relations between the EU member states. The east-west dummy (dummy 5) is statistically significant but negative. There is statistical evidence that the trade relations are stronger between the border

countries. Analyzing regional dummies, it is possible to summarize that the Nordic counties and also Baltic Sea region countries are forming a special cluster or block of countries with rather strong regional integration in the field of foreign trade. The same conclusion is not valid in the case of the Visegrad countries.

In summary, the following hypotheses were accepted in estimating the gravity equation for exploring bilateral trade flows based on the data of the EU and candidate countries in 2000:

1) The countries tend to have bilateral trade relations with countries where the number of population is higher. Hence, the size of economy of exporting and importing countries influences bilateral trade flows positively.
2) Distance influences international trade flows: the larger the distance between the trading countries, the smaller the trade flows. Distance is expressing not only transportation costs but in many cases also cultural proximity and historical relationship between the countries.
3) Belonging to regional groups of countries influences bilateral foreign trade flows. There are some regional clusters that support development of trade relations, for instance the Baltic Sea region cluster. Bilateral trade relations between the EU member and candidate countries are still less developed than the trade relations between the current EU member states.

The gravity models have strong power in explaining trade pattern and testing hypotheses, but the modeling results are not very reliable if we want to estimate the level of trade flows in absolute terms. It is not reasonable to use gravity equations to forecast bilateral trade flows. Based on the modeling results, it is first of all recommendable to pay attention to the cases where bilateral trade has good potential for development[2]. According to the preliminary estimations of the potential for developing bilateral trade flows it is possible to summarize that there is good potential for developing trade relations between the EU member states and the candidate countries and between the candidate countries as well. After collapse of CMEA the trade relations between the CEE countries have been underdeveloped and it is reasonable to restore and develop them within the EU. The results

[2] The differences between the estimated and actual trade flows are calculated as follows: {(Estimated trade flows – Actual trade flows) / actual trade flows)} *100%. Based on the differences it is possible to make estimations about trade potential and possible trends in development of bilateral trade flows.

of the study support the standpoint that the favorable location of the Baltic Sea region between East and West and the dynamic interdependence between transition and integration processes will have an important role in the future development of this region.

## CONCLUDING REMARKS

Empirical results of using gravity approach for exploring changes in the international trade pattern allow us to summarize that the knowledge resulting from law of nature is also applicable for exploring economic processes. The principles of gravitation could be used for estimating bilateral trade flows and analyzing regional integration in the field of foreign trade. Despite its simplicity, the gravity model explains the actual pattern of trade flows empirically remarkably well. The advantages of using gravity models to examine the international trade pattern are 1) data needed for the model are easily accessible and reliable, 2) theoretical considerations of using these models to explore international trade flows have been widely discussed and developed. The empirical studies certainly support better understanding and development of theoretical foundations of using gravity models for exploring economic integration, particularly in the conditions of interdependence between transition and integration processes of countries with different economic and political background. The latter is a typical feature of the EU eastward enlargement processes.

The results of the gravity models based analysis of integration processes between EU and accession countries support the premise that essential attraction force or pull factor for developing bilateral trade flows is the size of economy, and push factor is the distance between the countries. In many cases distance is expressing most significantly cultural proximity and historical relationship between the countries. There are also some regional factors that influence development of trade relations, for instance cooperation of the countries around the Baltic Sea (the Baltic cluster). The development of mutually beneficial economic integration between the capital-abundant industrialized countries and economies in transition of the region has created conditions that support economic restructuring and rise of competitiveness. It is possible to summarize that there is good potential for developing trade relations between the EU member states and the candidate countries and also between the EU candidate countries in the framework of EU. Economic integration in

the field of foreign trade is playing an important role in adjustment processes with the requirements of the EU eastward enlargement of both the current EU members and the accession countries. Due to developing bilateral trade relations between the current members and accession countries, the industrialized countries have got the experience of how to penetrate new markets and how to develop economic cooperation with Russia and other former socialist countries, the accession countries have got experience for establishing the institutional base for economic integration within the EU.

## REFERENCES


Anderson, James E. "A Theoretical Foundation for the Gravity Equation" *American Economic Review,* Vol. 69 (1), 1979, pp. 106-116

Anderson, James E., van Wincoop, Erik "Gravity with Gravitas: A Solution to the Border Puzzle", *NBER Working Paper,* No 8079, Cambridge Mass.: National Bureau of Economic Research, 2001

Baldwin, Richard E. "The Potential for Trade between Countries of EFTA and Central and Eastern Europe" *Occasional Paper,* No 44, 1993, European Free Trade Association, Geneva

Baldwin, Richard E. *"Towards an Integrated Europe" Centre for Economic Policy Research, 1994*

Baldwin, Richard E. "Comment on Gros and Gonciards", *European Journal of Political Economy*, Vol. 13,1997, pp.187-188

Beers Cees, Biessen Guido "Trade Possibilities and Structure of Foreign Trade: The Case of Hungary and Poland", *Comparative Economics Studies,* Vol. 38 (2/39), Summer/Fall, 1996, pp.1-19

Bergstrand, Jeffrey H. "The Gravity Equation in International Trade - Some Microeconomic Foundations and Empirical Evidence" *Review of Economics and Statistics,* Vol.67, 1985, pp.474-481

Bergstrand, Jeffrey H. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade" *Review of Economics and Statistics,* Vol.71, 1989, pp.143-153

Bergstrand, Jeffrey .H. "The Hecksher-Ohlin-Samuelson Model, the Linder Hypothesis, and the Determinants of Bilateral Intra-Industry Trade" *The Economic Journal,* Vol. 100, 1990, pp. 1216-1229

Christin, Domonique Ella "The Long Run Volume of East Europe's Foreign Trade: An Estimate", *Economics of Planning,* 29, 1996, pp.1-24

Cornett Andreas P., Iversen, Soren P. "The Baltic State in an European and Baltic Perspective: Trade and Transition in the Baltic Rim." *Materials of the Conference "Global-Local Interplay in the Baltic Sea Region"*, Pärnu, Estonia October 1-4, 1998 http://www.geo.ut.ee/nbc/paper/cornett_iversen.htm

Deadorff Alan V. "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?" *NBER Working Paper,* No 5377, Cambridge Mass.: National Bureau of Economic Research, 1995

Deadorff Alan V. "Testing Trade Theories and Predicting Trade Flows" *Handbook of International Economics,* Volume 1, Amsterdam: North-Holland, 1984

Deadorff Alan V. "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World" J.A. Frankel, ed. *The Regionalization of the World Economy*, The University of Chicago Press, Chicago, London, 1998, pp. 7-31

Direction of Trade Statistics Yearbook, International Monetary Fund 2001

Dreze, J. "Leo exportation intra-CEE en 1958 et la position Belge", *Recherches Economiques de Louvain*, 1961, No. 27 pp. 717-738

Eichengreen Barry, Irvin Douglas A. "The Role of History in Bilateral Trade Flows" J.A. Frankel ed. *The Regionalization of the World Economy,* The University of Chicago Press, Chicago, London, 1998, pp.33-64

Eltetö Andrea, Szemler Tamas "Analysis of Hungarian Trade Relations. A Gravity-Model Approach" *Working Paper,* No 66, Hungarian Academy of Sciences: Institute of World Economics, Budapest , 1996

Evenett Simon J., Keller Wolfgang "On Theories Explaining the Success of the Gravity Equation" *NBER Working Paper*, No W6529, Cambridge Mass.: National Bureau of Economic Research, 1998

Fidrmuc Jarko "Trade Diversion in the 'Left-Outs' in the Eastward Enlargement of the European Union. – The Case of Slovakia", *Transition Economics Series No 8*, Institute for Advanced Studies, Vienna, 1999

Fidrmuc Jarko "Application of Gravity Models to Commodity Groups and Trade Projections Between the European Union and the Central-Eastern European Countries." Kulicowski, R. , Nahorski, Z. and Owsinski, J.W. eds. *Transition to Advanced Market Institutions and Economies: Problems, Arguments, Propoals.* System Research Institute, Warsaw, 1998

Fujita M., Krugman P., Venables A. J. "The Spatial Economy. Cities, Regions and International Trade" Cambridge: MIT, 1999, 367 p.

Gros Daniel, Dautrebande Berenice "International Trade of Former Republics in the Long Run: An Analysis Based on the "Gravity" Approach", *Working Document,* No 71, Centre for European Policy Studies (CEPS), Brussel, 1992

Gros Daniel, Gonciarz Andrzej "A Note on the Trade Potential of Central and Eastern Europe", *European Journal of Political Economy*, Vol.12, 1996, pp. 709-721

Golob, T.F., Beckmann M.J. "A Utility Model for Travel" *Transportation Science,* Vol. 5, (1)1971, pp. 79-90

Harrigan, James "Specialization and the Volume of Trade: Do the Data Obey the Laws?" *NBER Working Paper*, No 8675, Cambridge Mass.: National Bureau of Economic Research, 2001

Helpman Elhanang, Krugman Paul R. "Market Structure and Foreign Trade" MIT Press, 1985

Helpman Elhanang "International Trade in the Presence of Product Differentiation, Economies of Scale and Monopolistic Competition: A Chamberlin Heckscher-Ohlin Approach" *Journal of International Economics,* 11, 1981, pp. 305-340

Helpman, Elhanang "Imperfect Competition and International Trade: Evidence From Fourteen Industrial Countries" *Journal of the Japanese and International Economies*, Vol 1 (1), 1987

Helpman Elhanang "Monopolistic Competition in Trade Theory" Frank Graham Memorial Lecture, Special Paper 16, International Finance Section, Princeton University, Princeton, N.J., 1989

International Monetary Fund, *International Financial StatisticsYearbook.* 1999

International Monetary Fund, *International Financial Statistics Yearbook*, 2000

International Monetary Fund, *International Financial Statistics Yearbook*, 2001

International Monetary Fund, *Direction of Trade Statistics Yearbook*, 1999

International Monetary Fund, *Direction of Trade Statistics Yearbook*, 2000

International Monetary Fund, *Direction of Trade Statistics Yearbook*, 2001

Iversen, Soren P "The Czech Republic's Reintegration in The European Division of Labour. A gravity Model Analysis." *Proceedings of the Conference "Business and Economic Development in Central and Eastern Europe: Implications for Economic Integration into Wider Europe,* Brno, 1998, pp.257-280

Krugman Paul "Increasing Returns, Monopolistic Competition, and International Trade", *Journal of International Economics*, 1979, Vol. 9, pp.469-479

Krugman Paul "Geography and Trade" Cambridge: MIT Press, 1991, 136 p.

Krugman Paul "Increasing Returns and Economic Geography" *Journal of Political Economy*, Vol.3, 1991, pp. 483-499

Krugman Paul "Space: The Final Frontier" *Journal of Economic Perspectives*, Vol.12, 1998, pp. 161-175

Linnemann, Hans *"*An Econometric Study of International Trade Flows" Amsterdam: North-Holland Publishing Company, 1966

Laaser Claus-Friedrich, Schrader, Klaus "European Integration and Changing Trade Patterns: The Case of the Baltic States" *Kiel Working Paper*, No 1088, Kiel Institute of World Economics, 2002

McCallum, J. "National Borders Matter: Canada_U.S.regional TradePatterns", *American Economic Review,* June 1995, 85(3), pp.615-623

Paas, Tiiu "The Gravity Approach for Modeling International Trade Patterns for Economies in Transition" *International Advances in Economic Research*, Vol. 6, No 4, November 2000, pp.633-648

Paas, Tiiu Modeling International Trade Flows of the Baltic Sea Region Countries. In:Global Business & Economics Review - Anthology 2001, Selected Papers of Business and Economics Society International, Worcester, USA, 2001, pp.607-618

Poyhonen, Pentty "A Tentative Model for Volume in Trade Between Countries *Weltwirtschaftliches Arhiv,* Vol. 90, 1963, pp.91-113

Reilly, William "Methods for the Study of Retail Relationships", *University of Texas Bulletin,* No 2944, November 1929

Steawart, John Q. "Demographic Gravitation: Evidence and Application"*, Sociometry*, 1948, Vol. 11

Tinbergen, Jan "Shaping the World Economy" New York: Twentieth Century Fund, 1962

Wang, Z.K., Winters, L.A. "The Trading Potential of Eastern Europe" *CEPR Discussion Paper No 610,* CEPR, London, 1991

Winters, L. Alan, Wang, Zhen Kun "Eastern Europe's International Trade," Manchester University Press, Manchester and New York, 1994, 189 p.

Whalley John "Do Countries Seek Regional Trade Agreements?" J.A. Frankel ed., *The Regionalization of the World Economy*, The University of Chicago Press, Chicago, London, 1998, pp. 63-89

World Development Indicators, CD-ROM, World Bank, 2000