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Tiiu Paas*

Abstract

The advantages of using gravity approach for modeling transition processes in foreign trade are the ability of gravity models to explain international trade pattern under the conditions of comparatively little amount of data and validity of theoretical background of the model to the economies in transition. The both advantages are important when modeling transition processes. The results of the use gravity approach to explore international trade pattern of Estonia as a country with a small, open and comparatively successful transitional economy allow us to conclude that economies in transition should look for a regional niche to penetrate into the world market. Estonia has an excellent potential to develop trade relations within the Baltic Sea region countries. Estonia's situation is certainly not unique, and conclusions presented in this paper could be applied to analysis of international trade pattern in other economies in transition.

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TABLE OF CONTENTS

Introduction

The beginning of the transition process towards national independence and market economy has significantly changed international trade patterns of all countries in transition. The fall of communism was associated almost simultaneously with a collapse of the CMEA (Council for Mutual Economic Assistance) trade block and the disintegration of the Soviet customs union. Intrablock trade suddenly became international trade, subject to the barriers that countries have always been found of. These significant changes in international trade pattern have called economists to pay more attention to thorough analysis of transition processes in foreign trade and trade policy, and to develop several qualitative and quantitative approaches for estimating of trade potential of economies in transition (Rodrik, 1993; Ferreira, 1994; Christin, 1996; Mundell, 1997; Brenton and Gros, 1995; Cooper and Gacs, 1997).

In recent years, gravity models have been used in empirical studies of changes in international trade pattern and reintegration of economies in transition in the international division of labor (Wang and Winters, 1991 and 1994; 1992; Baldwin, 1993, 1994 and 1997; Gros and Gonciarz, 1996; Iversen, 1998; Cornett and Iversen, 1998, Fidrmuc, 1998 and 1999). The advantage of using gravity models to examine the foreign trade pattern of transitional countries is that the data needed for the model is easily accessible and reliable. This advantage is especially favorable when modeling transition processes. The lack of reliable and internationally comparable statistical data is the most significant obstacle to modeling economies in transition and their integration into the world economy. Another advantage in using gravity models is that theoretical considerations for using these models to explore international trade flows are discussed and developed (Tinbergen 1962; Linnemann, 1966;

Bergstrand, 1985, 1989 and 1990; Deadorff, 1995 and 1998; Evenett and Keller, 1998; Mathur, 1999). These theoretical considerations based on trade theories are also valid when exploring the changes in international trade patterns during transition processes.

This paper analyses the possibilities to use a gravity approach for modeling international trade paying a special attention to modeling and analyzing international trade pattern of Estonia as a country with a small, open and comparatively successful economy in transition and as one of the leading candidates for admittance into the European Union (EU). Exports and imports of goods and services have formed more than 150% of the GDP in Estonia in recent years. Foreign trade has been liberalized and there are almost no restrictions or protectionism worth noting. According to the World Bank's evaluation, the liberalization rate of economies in transition has been highest in Estonia in the mid of 90s (World Development Report 1996).

The paper is organized in four main parts. In the first and second parts, the possibilities of using a gravity model approach for modeling international trade flows are described and analyzed giving emphasis on theoretical foundation of a gravity model approach in economics. In the third part of the paper a short overview of using a gravity approach for modeling international trade pattern of economies in transition is given. The fourth part of the paper presents the main empirical results of estimation of the gravity models for analyzing the international trade flows between Estonia and its main trading partners paying a special attention to trade scenarios within the Baltic Sea region (Baltic Rim).

1. Gravity Theory and Social Phenomena

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; Harvey, 1969). 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. Therefore, this law can be formalised as:

$$a_{ij} = g m_i m_j d_{ij}^{-2} \quad (1),$$

Where

g – is a constant proportionality factor.

As early as 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). In the gravity models used in social sciences, a region is ordinarily conceived as a mass. The mass is structured according to certain principles. These principles govern in an over-all fashion the range of behaviour of the individual particles, both constraining and initiating their action. Interregional relations may be thought of as interactions among masses. Again general principles may be said to govern the frequency and intensity of such interactions influencing the behaviour of individual units within each mass.

W. J. Reilly (1929) proposed a law of retail gravitation, which states that a city attracts retail trade from a customer in its hinterland in proportion to its size (population) and in inverse proportion to the square of the distance separating the customer from the centre of the city. The boundary separating the market areas of two cities i and j competing for customers in hinterland is thus defined as the locus of points for which

$$P_i/d_{xi}^2 = P_j/d_{xj}^2 \quad (2),$$

Where

d_{xi} and d_{xj} – distances of cities i and j respectively from any point x on the boundary,

P_i – population of the city "i",

P_j – population of the city "j".

J. Q. Steawart (1948) reasoned that similar forces might underlie the interaction of social units, such as people, which could be revealed only by investigating large aggregates of such units. Following the formula for gravitational force, Steawart defines demographic force as constant times the product of two masses divided by the square the distance (d_{ij}) separating the masses. Where the population of cities i and j, designated by P_i and P_j respectively (analogous to approach of W. Reilly), demographic force F is

$$F = G(P_i P_j) d_{ij}^{-2} \qquad (3),$$

Where

G – a constant corresponding to the gravitational constant.

In empirical studies mass has been measured in a number of ways. Thus, W. Isard and G. Freutel (1954) used income as a measure of a mass and developed the concept of income potential to parallel Steawart's concept of population potential. Concept of income potential has first of all been used in population and migration studies (Carrothers, 1959; Warntz, 1959). If migration is to be studied, it seems that employment or income tends to be a more significant index of mass than population. Likewise, when the marketing problem for manufactured products is being assessed, the total volume of retail and wholesale sales tends to be a more significant measure. Clearly, the measure of mass depends on the problem to be studied, available data, and related considerations. According to W. Isard (1960), the array of possible measures range from total investment in facilities, number of car registrations, hospital beds, investment in tractors and farm equipment, commodity output, value added in manufacture, etc (Hammer and Ikle, 1957; Harris, 1954; Ikle, 1955). Masses are weighted differently. Just as the weights of different molecules are unequal, so should the various social phenomena be weighted differently.

Similarly, distance has been and can be measured in a number of ways related to various aspects of the problem. Many of related forms of measurement of distance are related to the state

of transport technology. If a metropolitan traffic study is being conducted, distance in terms of travel time is at least as important. Among the other possible measures of distance are, mileage along a specific transport route (waterway, highway, airline, railway), fuel (energy) in transportation, number of gear shifts stops, etc. (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)

$$t_{ij} = Ko_i^{b1} d_j^{b2} f(s_{ij}) \qquad (4),$$

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,
$b1, b2$ – weighted geometric averages of o_i and d_j respectively,
$f(s_{ij})$ – distance friction, a decreasing 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 (ibid) 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.

2. Gravity Approach for Modeling Bilateral Trade Flows

The gravity model to examine international trade flow is also analogous to Newton's law, relating the gravity between two objects to their masses and the distance between them. According to the gravity approach, bilateral trade between two regions (countries) is directly related to their incomes (GDP, GNP) and inversely related to the distance between them. 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 a resistance to trade and thus affect the degree of trade intensity.

These include ordinarily tariff barriers and transportation costs. The first and second factors are expected to be equal to one another if one disregards the international flow of capital, services or land transfers. The basic form of the gravity model for the examination of international trade flow follows (ibid.):

$$X_{ij} = b_0 Y_i^{b1} Y_j^{b2} N_i^{b3} N_j^{b4} D_{ij}^{-b5} P_{ij}^{-b6} \qquad (5),$$

Where,

X_{ij} – the trade flow between country i and j,
b_0 – a constant,
$b_1, b_2, b_3, b_4, b_5, b_6$ – coefficients, weighted geometric averages,

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,

P_{ij} – dummy variable to take into account preferential trade factors between i and j.

Trade is assumed to occur when domestic production is not equivalent to domestic demand. Essentially, certain fields of production have an advantage in certain regions or countries, which results in specialization of production and a division of labor. In trade theory this specialization of production explains why trade occurs in terms of comparative advantage in production. There are several formal theoretical foundations for the gravity equation in international trade (Anderson, 1979; Bergstrand, 1985, 1989 and 1990; Helpman and Krugman, 1985; Helpman, 1987; Deadorff, 1995). Thorough overview of trade theories explaining the success of the gravity equation for exploring trade flows international trade pattern is given by Mathur (1999) and Evenett and Keller (1998).

Based on various approaches to theoretical foundations of gravity equations, Evenett and Keller (1998, p. 1) summarise three types of trade models, which differ in the way product specialisation is obtained in equilibrium:

1) technology differences across countries in the Ricardian model,
2) variations in terms of countries' differing factor endowments in the Heckscher-Ohlin (H-O) model,
3) increasing returns at the firm level in the increasing returns to scale (IRS) models.

Each of these perfect specialization models is a limiting case a model of imperfect specialization, but imperfect product specialization is empirically important. 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 can not explain the extent of trade, whereas the gravity model allows more factors can be taken into account to explain the extent of trade as an aspect of international trade flows.

The theory of comparative advantage formulated in the beginning of 19th century and associated with the name of Ricardo is one of the oldest theories used for explaining international gains from trade. In the Ricardian framework trade takes place because of differences across countries in technologies. Hechler-Ohlin theory says trade results from the fact that different countries have different factor endowments. According to Posner (1961) and Vernon (1966), trade takes place not only because of differences in technologies across countries but due to continuous renewal of existing technologies and their transfer to other countries. Based on approach used by Dreze (1961), it is possible to summarize, that country size and scale economies are important determinants of trade (Mathur, 1999).

Small industrial countries will enjoy a comparative advantage in those sectors where demand is standardized. At the same time small countries will be at disadvantage in highly differentiated goods because of the domestic market is not sufficiently large to enable scale economies to be fully exploited. All these approaches, which try to explain roots of international trade flows do not provide a complete explanation since they leave unexplained facts of international trade in terms of their pattern, direction and rate of growth. Among the new trade theories those by Krugman (1979), Helpman (1981, 1984, 1987, 1989), Helpman and Krugman (1985, 1989) and Deardorff (1984, 1995 and 1997) a special attention is paid on explanation international trade both empirically and theoretically. New theories of

international trade base on the assumption of monopolistic competition and economies of scale and they provide better explanation of the empirical facts of international trade. Assumptions of similar technologies and factor endowments across countries are implicit in these models.

The presence of economies in scale causes the production to be located in one country. Economies of scale also induce the producers to differentiate their product. The larger the country is for instance in terms of its GDP the larger the varieties of goods offered. The more similar the countries are in their GDP, the larger is the volume of this bilateral trade. In thr presence of differentiated products produced with economies of scale, the volume of trade depends in an important way on country size in terms of its GDP (GNP, national income, wealth of nations, etc). In particular, when monopolistic competition, increasing returns to scale and "love of variety" by consumers ensure that each good is produced in only one nation, if there is balanced and free trade, and each countries consumers have identical homothetic preferences, then among a group of countries (A) the total intra-group trade volume (V_A) is given by (Mathur, 1999):

$$V_A = S_A Y_A DIS_A \qquad (6)$$

Where

Y_A – the sum of the GDP-s of the countries in group *A*,
S_A – he share of Y_A in world GDP,
DIS_A – a measure of the similarity of the GDPs of the countries that comprise the group.

From (6) follows that the volume of trade within a group of countries A will grow faster than income if the relative size of these countries in terms of GDP gets equalized over time. This explanation provides explanation of the fact that the volume of trade of industrialized countries grew faster than their GDP.

Additionally to the new trade theories, also economic geography and its models support the explanation of trade flows and trade pattern. Role of distance in determining the pattern and direction of trade is essentially a topic of economic geography

models, which subsumes of the assumptions of the new trade theories. These models are concerned with issues of localization of firms and industrial concentration. References in this context may be made to Krugman (1991 and 1998). According to this theory, there are two fundamental forces guiding the location of the firm: 1) economies of scale at the factory level, and 2) trade costs.

Actually all theories acknowledge the restraining effect on transportation costs on trade. Production of the same good in two or more countries in the presence of transport costs is inconsistent with factor price equalization, moreover, as emphasized by recent economic geography literature (Davis and Weinstein, 1996), different trade models might behave differently in presence of transport cost and differences in demand across countries.

To summarize the results of discussions and explanations of theoretical foundations of gravity models in exploring international trade flows, it is reasonable to agree with three major findings of Evenett and Keller (1998):

1. little productions perfectly spezialized due to factor endowment differences, making the perfect specialization version of the Heckscher-Ohlin model an unlikely candidate to explain the empirical success of the gravity equations,
2. increasing returns are important causes for perfect specialization and the gravity equation, especially among industrialized countries,
3. to the extent that production is not perfectly specialized across countries, it is possible to find support for both Heckscher-Ohlin and Increasing Returns models. Both models explain different components of the international variation of production patterns and trade volumes, with important implications for productivity growth and labour.

The findings of Evenett and Keller are in accordance with statement of Eichengreen and Irwin (1998), who aptly summarized the state of theoretical foundations for the gravity model (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 Heckscher-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." Hence, despite of many discussions about theoretical foundations of gravity models, they are widely used for exploring international trade flows. Gravity equations ordinarily have strong empirical explanatory power with R^2 ranging from 70 to 95 percent.

The various considerations regarding the application of a gravity approach to social phenomena and modeling international trade flows, which are presented in the first and second parts of the paper, are generalised in the main stages of the development of a theoretical background of the gravity approach in social science and economics, and they are presented in the table 1.

Table 1

Theoretical foundations and main concepts of the use of gravity laws in social science and economics

Theoretical background	The main concepts	Authors
Regional science, economic geography	Measurement of intraregional relationships and their influence on the behaviour of individual units. Regions are conceived as a mass. The location of the firm is guided by two fundamental forces: 1) economies of scale at	Carey (1858), Reilly (1929), Steawart (1948), Isard and Freutel (1954), Hammer and Ikle (1957), Carrothers (1959), Isard (1960), Harvey (1969), Nijkamp and Reggiani (1992,

Theoretical background	The main concepts	Authors
	the factory level, and 2) trade costs.	Krugman (1991, 1998), Davis and Weinstein (1996), Fujita, et al (1999)
Microeconomics, utility maximization, general equilibrium	An optimal allocation of the given budget can be obtained by postulating a utility function for the decision-maker that reflects relative preferences. Assuming the budget constraint is linear, the volume of transactions between two points can be stated as a utility maximizing problem. A model using gravity theory could be derived from a utility maximizing function.	Linnemann (1966), Niedercorn and Bechdolt (1969), Golob and Beckman (1971), Nijkamp (1975), Bergstrand (1985), Nijkamp and Reggiani (1992),
Trade theories, which differ in the way product specialisation is obtained in equilibrium: 1) technology differences across countries in the Ricardian model, 2) variations in terms of countries' differing factor endowments	A gravity model for trade, considers three main factors: 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 a resistance to trade and thus affect the degree of trade intensity.	Tinbergen (1962), Poyhonen (1963), Linnemann (1966), Anderson (1979), Bergstrand (1985), Helpman and Krugman (1985), Deadorff (1995), Evenett and Keller (1998), Eichengreen and Irwin (1998)

Theoretical background	The main concepts	Authors
in the Heck-scher-Ohlin (H-O) model, 3) increasing returns at the firm level in the increasing returns to scale (IRS) models.		

3. Gravity Approach for Modeling International Trade Pattern of Economies in Transition

Since the beginning of 1990s, gravity models have been widely used for estimating the potential trade flows between Eastern and Western Europe. Special attention has been given to the modeling trade relations between the EFTA (European Free Trade association), EU (European Union), CEE (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, 1996 and 1998, Fidrmuc, 1998 and 1999).

The main directions of application of a gravity approach for modeling international trade pattern of economies in transition could be summarized:

1. Estimating a trade potential of Central and Eastern Europe and development of a East-West trade;

2. Regional integration and trade flows in the framework of international organizations (OECD, EU; EFTA, Baltic Sea Region, etc.);
3. Bilateral trade flows between a country in transition and its main trade partners.

In the beginning of the 1990s, Wang and Winters used data from 76 non-CEE countries in the period 1984-1986 and constructed the gravity models to analyze foreign trade relations between the EFTA and CEE countries. According to the results obtained, the potential trade turnover between CEE countries and EFTA is much larger than actual turnover. The gap ranges were from about 30% for Hungary to almost 650% for Bulgaria. The model of Wang and Winters (1991) was updated by R.E.Baldwin (1993 and 1994). This model asserts that the bilateral trade flow from country "x" to country "i" depends upon the GDP of the two countries, their populations, the distance between two countries as well a variety of dummies. Trade potentials were estimated for Albania, Croatia, the Czech Republic, Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Russia, Ukraine, Belarus and Moldavia (Baldwin, 1994). The estimates were based on two distinctive scenarios. According to a medium-run scenario, the CEE and Baltic countries will be integrated into world trade in the same way as the other countries, included in the sample of 76 countries used by Wang and Winters. A long-run scenario assumes those per capita incomes in CEE and Baltic countries will catch up to the level of the poorer West European countries. According to the estimates based on the above-mentioned scenarios, CEE and Baltic countries will be important trading partners with of most of the EFTA nations in the near future: exports to these EFTA countries have the potential to continue to expand at double digit rates for decades to come. It is estimated that eventually CEE markets could account for a 17% share of EFTA countries exports to all of Europe (Baldwin, 1994, p.88-96). Similar results got also other researchers estimating trade potential of former socialist counties. It is possible to summarize that the most of gravity approach based studies

from the beginning of 1990s support the statement that in the next decades between East and West European countries could at least double from its present level.

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." Despite its simplicity, the gravity model explains the actual pattern of trade flows remarkably well, especially compared to the comprehensive empirical performance of other trade models. The advantage of the gravity model is that it needs comparatively little data, moreover internationally comparable data for the construction of a gravity model are usually available. These advantages are especially of interest when modeling potential trade flows and examining changes in the international trading patterns of transitional countries.

According to various estimations, trade potential of Central and Eastern European countries is higher that recent development has been so far. It is possible to conclude that real development of international trade between East and West needs some adjustment time to overcome historical and cultural hindrances and equalize the requirements and habits of international customers. Based on the results of previous research, it is reasonable to predict that trade flows between economies in transition and industrialized countries have a tendency to increase also in future. This statement is supported by recent trends in development of FDI flows. The FDI flows in the transitional countries have significantly increased over the last five-ten years and remarkable part of FDI flows in oriented on producing of export in the countries of FDI destination.

4. Modeling Foreign Trade Flows Between Estonia and the Main Trading Partners

4.1. Foreign Trade Relations of Estonia

Estonia started its trade policy reform in 1990 and moved rapidly towards very liberal trade system, one with virtually no tariffs or quantitative restrictions at all. During the period 1990-1999, Estonian geographical trade pattern changed remarkably. In 1990 the share of intraregional (trade within the USSR and East and Central European socialist countries) was 95.5% in export and 88.9% in import (Michalopolous, Tarr, 1994, p.6), in1999 the share of the European Union countries was 61.5% in Estonian export and 57.8% in import (Estonian Statistics Monthly, 2000, No 1, Statistical Office of Estonia, p. 63). In 1999, Estonia engaged in trade with about 170 countries, however, the bulk of trade was done with 15 countries, which accounted for more than 80% of the foreign trade volume (Table 2). Three major partners - Finland, Sweden and Russia - accounted for 46.3 percent of Estonian total foreign trade in 1999. The share of Russia in Estonian trade relations has declined rapidly during the recent year. In 1993 export from Russia formed 22.6 percent in 1993, 17.7 percent in 1995 and only 9.3 percent in 1999; the share of Russia's import declined accordingly from 17.2 percent in 1993 and 16.1 percent in 1995 to 13.5 percent in 1999 (Statistical Yearbook of Estonia, 2000, pp. 228-233). The remarkable part of Estonian foreign trade flows belongs to the countries around the Baltic Sea (The Baltic Sea Region: Estonia, Latvia, Lithuania, Poland, Germany, Sweden, Finland, Denmark, Norway and Russia (the northwest part of Russia)). According to the data of the Statistical Office of Estonia, the share of the Baltic Sea region countries was 74.4 percent in Estonian export and 64.2 percent in import in 1999.

Table 2

The main export and import partners of Estonia in 1999

Country	Share in export (%)	Share in import (%)	Balance (+/– Mil. EEK)
Finland	19,4	22,8	– 5 372,6
Sweden	18,8	9,3	2 490,0
Germany	7,5	9,3	– 2 377,3
Russia	9,2	13,5	– 4 185,1
Denmark	3,9	2,5	– 406,2
Norway	2,4	1,1	393,9
Latvia	8,7	2,2	2 454,3
Lithuania	3,9	1,6	680,9
United States	2,5	4,4	– 1 623,2
United Kingdom	4,5	2,4	492,6
Netherlands	3,3	2,5	– 43,4
France	1,2	2,1	– 754,6
Belgium	1,3	1,5	– 383,8
Italy	1,1	3,2	– 1 445,6
Ukraine	2,9	1,0	646,0
TOTAL volume of Estonian foreign trade (Mil. EEK)	43 128,3	60 392,0	– 17 263,7

Source: Estonian Statistics Monthly, 2000, No 1, Statistical Office of Estonia, Tallinn, 2000, p.63-64

Estonia has been intent on the rapid liberalization of trade among the three Baltic countries and advocated of the establishment of the Baltic Free Trade Agreement. In 1994, the agreement was signed and during 1996, this co-operation reached the next level: a Baltic Customs Union, which covered not only industrial but also

agricultural products. Both of these agreements, Baltic Free Trade Agreement and Baltic Customs Union, have improved the competitiveness of Baltic countries in the long run. In 1996, the Free Trade agreement between Estonia and Ukraine came into force. In 1997 a major task of Estonian trade policy was to develop trade relations with Russia. The Ministry of Economic Affairs of Estonia considered co-operation with a number of regions of Russia through the participation of various professional associations and enterprises. Special priority was given to the regions of St. Peterburg, Moscow, Yekaterinburg and Pskov. Thought was also given to the establishment of regional trade representations in Russia by Estonian professional associations and enterprises. It was planned to conclude an Investment Protection Agreement as well as an Agreement on the Avoidance of Double Taxation. Before the crisis in Russia in autumn 1998, most of these agreements were only on a level of preparation and negotiation stage. After the Russia's' economic crisis in 1998, development of tight bilateral trade relations sounds to be too risky for Estonia.

Estonia also has Free Trade Agreements with the most of CEE countries (Czech and Slovak Republics in April and May 1996, with Slovenia in November 1996, with Poland and Hungary in November 1998, etc). Estonia has agreements on Investment Promotion and Mutual Protection with Germany (signed in November 1992, implemented in January 1997) and Unites States (signed in April 1994 and implemented in February 1997). A Free Trade Agreement with the EU, Estonia signed in July 1994 and it took into force on January 1, 1995. The Association Agreement was signed in June 1995 and was ratified in 1997. The Free Trade Agreement set up a free trade area with the EU within the transition period. Hence, to sum up, at the beginning of 2000, Estonia had Free Trade Agreements with the EU, EFTA, Latvia, Lithuania, Ukraine, Poland, The Czech Republic, Slovenia, Hungary, Slovakia, Turkey and Faeroe Islands.

Estonia is one of the leading candidates for membership of the European Union and a member of the WTO since 1999. The process of negotiation to join the EU and to follow the requirements of the WTO is long and complex and revising of Estonian

very liberal trade policy system is necessary. The liberal trade and customs policy reform facilitated Estonia's comparative success in moving towards a market economy during the first stages of transition processes and the necessary rapid restructuring of economy will now have to be revised according to the requirements of the WTO and EU.

4.2. Gravity Equation and Data

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 (under the conditions of *ceteris paribus*). Distance influences foreign trade. It is generally more convenient and cheaper to have trade relations with nearby countries. The greater the distance (cost of transportation) between trade partners the less the expected trade flows. One category of trade flow restrictions is made up of 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 means by which governments or their agencies can create trade barriers. There are also economic and political unions like the European Union (EU), Commonwealth of Independent States (CIS), Organization of Economic Cooperation and Development (OECD), etc. that create trade preferences to selected countries. To analyze the effects of regionalism, investigators typically add dummy variables for participation in regional arrangements. According to empirical analysis of Whalley (1998), the benefits from this form of market of assurance may in fact be quite large, particularly in case of small country. Regional trade arrangements include the traditional welfare gains from preferential tariff reductions, the market-power benefits of forming a larger unit for tariff setting and bargaining, and strategic benefits from integrating markets and committing to preferential arrangements.

Based on these considerations and on various agreements between Estonia and its trade partners, the following specification of the gravity model is used in the present paper:

$$Y_j = A\, X_{i1}^{B1}\, X_{i2}^{B2}\, D_{i1}^{B3}\, D_{i2}^{B4}\, D_{i3}^{B5}\, D_{i4}^{B6} + u_i \qquad (7),$$

Where

Y_j – trade flows (exports or imports) between Estonia and country "*i*",
$X_{i1} = \mathrm{GDP_i}$ – total GDP of country "*i*";
$X_{i2} = \mathrm{DISTANCE}$ – distance between Estonia and country "*i*";
u_i – error term

Dummy variable (D_{ij}) indicate to which group or trading area a given country belongs:

$D_{i1} = 1$ – transitional countries, new candidates for EU membership (Poland, Hungary, Czech Republic, Slovakia, Slovenia, Latvia, Lithuania, Bulgaria, Romania, Estonia);
$D_{i1} = 0$ – other;
$D_{i2} = 1$ – member of EU;
$D_{i2} = 0$ – other;
$D_{i3} = 1$ – member of CIS;
$D_{i3} = 0$ – other;
$D_{i4} = 1$ – belongs to the Baltic Sea Region (Baltic Rim);
$D_{i4} = 0$ – other.

Based on the specification of the gravity model (7), the following exports and imports equations are estimated:

$$\begin{aligned} ln(\mathrm{EXPORTS})_I = {} & B_0 + B_1 ln(\mathrm{GDP})_i + \\ & + B_2\, ln(\mathrm{DISTANCE})_i + \\ & + B_{3-6}(\mathrm{DUMMIES}) + u_i \end{aligned} \qquad (8)$$

and

$$\begin{aligned} ln(\mathrm{IMPORTS})_i = {} & B_0 + B_1 ln(\mathrm{GDP})_i + \\ & + B_2 ln(\mathrm{DISTANCE})_i + \\ & + B_{3-6}(\mathrm{DUMMIES}) + u_i \end{aligned} \qquad (9)$$

It could be presumed that Estonia has different conditions for exporting goods to various countries or group of countries as well as for importing goods from these countries (transitional countries, non-transitional countries, EU, CIS, Baltic Rim). In the conditions of Estonian very liberal trade policy, Estonian trade partners do not have any restrictions or customs duties for exporting their goods to Estonia. It could be assumed that, CIS and Baltic countries have more developed their trading relations with Estonia as a result of historical traditions. Estonia also has more experience in exporting goods to these countries. Hence, Estonia has a regional niche to penetrate into international market. This statement will be tested in the next part of the paper.

Estimation of the exports and imports equations (8) and (9) bases on:

- The exports and imports data of the Statistical Office of Estonia in 1997 (Foreign Trade 1997, Statistical Office of Estonia, 1998),
- GDP data of 1997 (International Financial Statistics 1998, IMF),
- A matrix of distance between the countries.

All estimations base on the data of 46 Estonian main trading partners. The trade flows between Estonia and these trading partners (countries) form more than 95% of Estonian total foreign trade volume. The measure of the geographical distance between countries is defined as the distance between capital cities. For neighboring countries this distance is defined as the distance between their capital city and geographical center of Estonia. The foreign trade statistics of Estonia have been compiled according to the recommendations of the United Nations Statistical Commission. The principles for compiling statistics of exports and imports are based on the Customs Law (passed in Estonian Parliament on September 15, 1993). Both exports and imports are valued at the Estonian border: exports at FOB-values and imports at CIF-values. Foreign trade is classified according to the "Estonian Goods Nomenclature" issued in 1993, which is consistent with the "Harmonized System" (HS) used in international trade. The countries are classified on basis

of the "Standard of Country Area Codes" (ISO 3166): in exports the trading partner is the receiving country, in imports - the country of origin. To compare the elaborated trade scenarios with actual development of Estonian foreign trade flows the data of the Statistical Office of Estonia in 1999 are used.

4.3. Empirical Results

According to the basic assumptions of the gravity model, the following hypotheses could be tested in the current research study (*ceteris paribus*):

1) Estonia has developed more active foreign trade relations with countries where total GDP is higher;
2) Distance negatively influences trade flows. Estonia has developed more active foreign trade relations with nearby countries;
3) Belonging to the EU, CIS, Baltic Sea region and transitional countries (the new candidates for the EU) influences Estonian exports and imports flows.

WLS method in used for estimation of export and import equations (Equations 10 and 11)

The results of the regression analysis show that the independent variables explain more than 70% of the variation in the dependent variables in all gravity equations. The GDP coefficients are positive and the distance coefficients, as expected, negative. The coefficient signs of dummies 3 and 4 also correspond to expectations. The hypothesis that being a member or a candidate to EU (dummies 1 and 2) influences trade flow has not been statistically accepted in the current research. It is possible to conclude that in the conditions of very liberal trade policy only some historical traditions and comparatively closed economic relations within the Baltic Rim countries have influenced Estonian exports and imports flows and international foreign trade pattern in 1997. Similar results were obtained from running the econometric analysis based on 1995 and 1996 as well as data of Wealth of nations instead of GDP (Paas 1996 and 1998).

Export equation: (10)

$$ln(\text{EXPORTS})_i = 8.781 + 0.883ln(\text{GDP})_i - 1.931ln(\text{DISTANCE})_i - 0.846D_{i1} - 0.332D_{i2} + 2.289D_{i3} + 1.0854D_{i4}$$

se	(2.892)	(0.146)	(0.321)	(0.771)	(0.558)	(0.768)	(0.662)
t	(3.037)	(6.065)	(–6.022)	(–1.097)	(–0.594)	(2.979)	(1.636)
p	(0.004)	(0.000)	(0.000)	(0.279)	(0.556)	(0.005)	(0.110)

$R^2 = 0.793$, adj. $R^2 = 0.761$, $F = 24.855$, $p = 0.000$

Import equation: (11)

$$ln(\text{IMPORTS})_i = 1.685 + 0.854ln(\text{GDP})_i - 0.851ln(\text{DISTANCE})_i + 0.418D_{i1} + 0.009D_{i2} + 1.278D_{i3} + 1.349D_{i4}$$

se	(2.580)	(0.130)	(0.286)	(0.688)	(0.592)	(0.768)	(0.662)
t	(0.653)	(6.573)	(–2.973)	(0.607)	(0.181)	(1.864)	(2.280)
p	(0.517)	(0.000)	(0.005)	(0.547)	(0.853)	(0.070)	(0.028)

$R^2 = 0.764$, adj. $R^2 = 0.727$, $F = 21.008$, $p = 0.000$

The results of analysis allow us to conclude that parameters for different gravity equations constructed for exploring trade flows between Estonia and the main trading partners are comparatively stable, and consequently, the results of analysis of trade scenarios do not remarkably depend on the year of data used for estimating gravity equations.

For analysing stability of parameters of the gravity equations (5) and (6), pooled data of the period 1995-1997 are used. We consider the following equations:

$$\begin{aligned} ln(\text{EXPORTS})_i = {} & B_0 + B_1 ln(\text{GDP})_i + \\ & + B_2 ln(\text{DISTANCE})_i + B_3 D_{i3} + \\ & + B_4 D_{i4} + B_5 D_{i5} + B_6 D_{i6} + u_i \end{aligned} \qquad (12)$$

and

$$\begin{aligned} ln(\text{IMPORTS})_i = {} & B_0 + B_1 ln(\text{GDP})_i + \\ & + B_2 ln(\text{DISTANCE})_i + B_3 D_{i3} + \\ & + B_4 D_{i4} + B_5 D_{i5} + B_6 D_{i6} + u_i \end{aligned} \qquad (13),$$

Where

$D_{i3} = 1$ – member of CIS,
$D_{i3} = 0$ – other.
$D_{i4} = 1$ – belongs to the Baltic Sea Region (Baltic Rim),
$D_{i4} = 0$ – other.
$D_{i5} = 1$ – for year 1995,
$D_{i5} = 0$ – other.
$D_{i6} = 1$ – for year 1996,
$D_{i6} = 0$ – other.

WLS estimations for the pooled data 1995-1997 (n=138) are as follows:

(14)

$$ln(\text{EXPORTS})_i = \underset{\text{t}}{\underset{(5.857)}{6.883}} + \underset{(13.698)}{0.850}ln(\text{GDP})_i - \underset{(-10.480)}{1.670}ln(\text{DISTANCE})_i + \underset{(8.339)}{2.371}D_{i3} + \underset{(3.137)}{1.137}D_{i4} - \underset{(-1.973)}{0.468}D_{i5} - \underset{(-0.838)}{0.199}D_{i6}$$

(15)

$$ln(\text{IMPORTS})_i = \underset{\text{t}}{\underset{(3.189)}{3.575}} + \underset{(13.953)}{0.829}ln(\text{GDP})_i - \underset{(-6.767)}{1.032}ln(\text{DISTANCE})_i + \underset{(3.134)}{0.851}D_{i3} + \underset{(3.414)}{1.181}D_{i4} - \underset{(-3.668)}{0.833}D_{i5} - \underset{(-2.084)}{0.471}D_{i6}$$

We see that the parameters of the export-import equations are approximately the same as for the equations based on the data of the year 1997. To test the stability of the exports-imports equations we estimated also the exports-imports equations separately for the years 1995-1997 and tested linear restrictions for the parameters using F-test. The linear restrictions are taken from the gravity equations estimated on the base of pooled data. For the export equations of the years 1995, 1996 and 1997, the hypothesis H_0:

$$B_1 = 0.850, B_2 = -1.670, B_3 = 2.371, B_4 = 1.137;$$

and for import equations H_0:

$$B_1 = 0.829, B_2 = -1.032, B_3 = 0.851, B_4 = 1.181.$$

The maximum value of the F statistic for exports equations is 0.39 (1995) and for imports equations 0.31 (1996). Consequently, the observed F values are not significant even at the 80% level.

The results of analysis allow us to conclude that parameters for different gravity equations constructed for exploring trade flows between Estonia and the main trading partners are comparatively stable. Consequently, the results of analysis of trade scenarios do not remarkably depend on the year of data used for estimating gravity equations.

To sum up, the following hypotheses were accepted in estimating the export and import equations of the gravity model based on data of Estonian Statistical Office (export and import data) and IMF (GDP data) in 1997:

1) Estonia tends to have trade relations with countries where total GDP is higher;
2) Distance influences foreign trade flows. The larger the distance between Estonia and the trading partners, the smaller the trade flow;
3) Belonging a trade partner to the CIS or Baltic Sea region countries had positive impact on trade flows between Estonia and a trade partner.

The results from the gravity model seem to support the notion that the existing trade relations between Estonia and Baltic Sea region countries are most favorable for developing Estonian foreign trade. Russia as the major representative of CIS trade partners belongs also to Baltic Sea region (the northwest part of Russia).

4.4. Trade Scenarios

On the basis of the gravity model (7) and WLS estimators of the export and import equations (10) and (11) two scenarios for Estonian export and import pattern are elaborated: an optimistic and a pessimistic scenario. Following the optimistic scenario (Scenario 1), we expect that transitional economies will have average GDP growth rate 5% in year, industrialized countries 3% and Russia 1%. According to pessimistic scenario (Scenario 2), the average GDP growth rate is suggested 2% in all partner countries, except CIS countries, where a negative growth rate is predicted (–2%). According to the both scenarios, the share of Baltic Rim countries will increase in Estonian export and import, and the share of CIS countries decline (Tables 3 and 4). If we compare the figures of the trade scenarios with Estonian actual trade pattern in 1999, it is possible to conclude that the actual share of the Baltic Sea region countries in Estonian export and import is still smaller than potential. The same conclusion we could make regarding the share of the CIS countries in the Estonian export. At the same time, the actual share of the CIS countries in the Estonian import in 1999 was higher than predicted.

Table 3

Actual and potential share of Baltic Rim trade in Estonian export and import (%)

Country	Export 1999	Export Scenario 1	Export Scenario 2	Import 1999	Import Scenario 1	Import Scenario 2
Norway	2,4	0,89	0,93	1,1	1,40	1,44
Sweden	18,8	9,42	9,79	9,3	9,63	9,87
Germany	7,5	12,73	13,23	9,3	20,75	21,27
Finland	19,4	36,52	37,95	22,8	20,25	20,76
Denmark	3,9	2,48	2,58	2,5	3,65	3,74
Lithuania	3,9	0,75	0,68	1,6	0,82	0,74
Latvia	8,7	1,93	1,76	2,2	1,34	1,31
Poland	0,6	2,28	2,08	1,9	3,35	3,03
Russia	9,2	18,47	16,72	13,5	9,85	8,83
Total	74,4	85,47	85,72	64,2	71,04	70,89

Source: Estonian Statistics Monthly, 2000, No 1, Statistical Office of Estonia, Tallinn, 2000, p.63-64, Authors calculations

Table 4

Actual and potential share of CIS trade in Estonian export and import (%)

Country	Export 1999	Export Scenario 1	Export Scenario 2	Import 1999	Import Scenario 1	Import Scenario 2
Armenia	0,0	0,04	0,03	0,0	0,04	0,04
Aserbaid.	0,0	0,04	0,04	0,0	0,05	0,04
Georgia	0,1	0,03	0,03	0,0	0,03	0,03
Kazahstan	0,2	0,09	0,09	0,9	0,12	0,11
Kyrgystan	0,0	0,02	0,02	0,0	0,03	0,02
Moldova	0,1	0,13	0,12	0,1	0,10	0,09
Tajiki	0,1	0,02	0,01	0,1	0,02	0,02
Turkmenis.	0,0	0,04	0,04	0,1	0,05	0,05
Ukraine	2,9	3,06	2,77	1,0	1,92	1,72
Uzbekistan	0,3	0,12	0,11	0,6	0,15	0,14
Belarus	0,6	1,94	1,75	0,7	0,96	0,86
Russia	9,2	18,47	16,72	13,5	9,85	8,83
Total	13,5	23,98	21,70	17,0	13,32	11,93

Source: Estonian Statistics Monthly, 2000, No 1, Statistical Office of Estonia, Tallinn, 2000, p.63-64, Authors calculations ions

The Baltic Sea region has an excellent potential for economic growth starting from early 1990s. Factor proportions of countries located around the Baltic Sea are clearly different and it suggests that Hecksler-Ohlin type trade have a good reason to happen. The Baltic States and Poland are rapidly growing economies with relatively cheap and skilled labor force, Scandinavian countries and Germany can provide capital for various technologies through investment to neighbor countries around the Baltic Sea. This creates an excellent base for mutually beneficial economic co-operation.

Regardless of future economic growth of the region, it feasible to expect that changes in trade relations and foreign trade pattern within the Baltic Sea region countries will take place. The differences between trade patterns in the two scenarios are not significant. The membership of the EU does not significantly change Estonian trade relations with the EU members as the already existing European Agreement with the EU has provided Estonian firms free access to EU market by all manufactured goods. The only field, which will be opened after joining EU, is agricultural products. Development of mutually beneficial economic co-operation with capital abundant Scandinavian countries and Germany mainly influences changes in Estonian trade patterns. According to both scenarios, main trade partners for Estonia in the long run will be Finland. Many Finnish companies have invested in Estonia and this investment will produce goods, which will be resold or used in Finland (Table 5). Germanys share in Estonian export and import will increase. Estonia has also good potential to develop trade relations with Poland.

Foreign direct investments (FDI) predominantly support the expansion of markets for products and services, therefore international trade and FDI are highly correlated. More than 80 percent of FDI came in Estonia from the countries around the Baltic Sea in 1999 (Table 5). Based on the surveys of firms operating in Estonia, the statement that FDI plays an important role in promoting export growth through the opening of new markets and improving competitiveness of Estonian enterprises got

verification in the previous research studies (see Varblane and Ziacik, 1999). Hence, it is possible to conclude that good business environment created by the FDI from the Baltic Sea region countries will promote Estonian export flows in the neighbour countries around the Baltic Sea.

Table 5

Foreign direct investment in Estonia by Baltic Sea Region countries in 1994-1999 (share, %)

Country	FDI flow in 1994	FDI flow in 1999	FDI stock in 1999
Germany	1,3	1,3	2,4
Denmark	1,2	6,8	4,0
Finland	22,6	38,6	32,2
Lithuania	0,0	2,4	– 0,1
Latvia	0,0	0,9	0,3
Norway	0,1	4,3	3,2
Poland	0,0	0,0	0,0
Russia	15,0	1,7	1,3
Sweden	18,9	32,3	41,0
Total of the Baltic Sea region countries	59,0	88,3	84,3

Source: Authors calculations based on the data of the Bank of Estonia (www.ee/epbe/fdi, June, 2000)

According to the both scenarios, Russia's share in Estonian export and import will decline, but Russia's role in developing bilateral trade relations will still be remarkable also in future. Russia is a large market in the neighborhood of Estonia and Russia's share in Estonian export could be estimated at about 18 percent and import 9 percent (see table 4). Russia is also dominating CIS trading partner for Estonia. Unfortunately, due to

political reasons Russia has applied double tariffs to Estonia, which policy blocks the export of Estonia to this country. The total share of CIS in Estonian foreign trade flows was less than 12 percent in 1999 (9.2% in export and 13.5% in import). Recent economic crisis in Russia have had a negative effect on bilateral trade relations between Estonia and Russia as well as other CIS countries. The other members of the CIS besides Russia could be comparatively perspective markets for Estonian export, especially food products. Ukraine and Belarus have sometimes been considered to be counterweights to foreign trade problems with Russia, in particular due to favorite foreign trade regimes in these countries. On other hand, recent market reforms and several problems that Estonian companies emerged during trade relations with these countries have made bilateral trade between Estonia and Ukraine as well as Belarus more complicated. Other members of the CIS are very strongly influenced by economic and political events in Russia, and this makes their possibilities to compensate Russian market questionable.

CONCLUSIONS

International trade is one of the most expedient economic factors in pushing economies to transition and integration. The general trend in the development of international trade has been the rapid growth of the East-West trade relations in recent years. The most remarkable changes have been in the foreign trade patterns of Estonia – a country with a small open economy in transition. In 1990, less than 10% of Estonian foreign trade flows were outside the former socialist countries. In 1999, more than half of Estonian international trade was with the EU countries and in particular with industrialized countries around the Baltic Sea. These remarkable changes in international trade pattern were accompanied by reform of foreign trade and customs policies. Estonia's trade policy reform has been the most liberal among the economies in transition.

Significant changes in Estonian economy and foreign trade pattern could be looked in a broader context of development of Baltic Sea region. Trade growth in this region has often been above the average growth ratio in the EU. Estonia has cultural and historical traditions to develop trade relations with Baltic Sea Region countries and this region can be used as a starting point to gain experience and to penetrate into international markets. Co-operation within the Baltic Sea region improves competitiveness of the country and makes this country more attractive for foreign direct investment by multinational companies. Foreign direct investment supports the expansion of markets for products and services, therefore international trade and FDI are highly correlated. Development of trade relations in the Baltic Sea region is also important for admittance into the European Union and to establish an institutional framework for the integration.

The results of the use of gravity approach to explore Estonian international trade patterns also support the statement that the Baltic Sea region plays a significant role in the development of Estonian foreign trade relations, especially for developing Estonian export. Development of export relations and opening of new export markets are the main priorities in Estonian foreign trade in order to halt the increasing gap between export and import and avoid the possible consequences of negative trade balance. According to both scenarios elaborated on the basis of the gravity models, the potential share of Baltic Rim in Estonian total export volume is expected to be about 85 percent and in import volume 71 percent. The respective actual shares were 74 percent and 64 percent in 1999. Hence, according to the estimations, Estonia has a good potential to develop trade relations with the countries around the Baltic Sea Region countries also in future, especially with Finland, Germany and Sweden. Russia's share in Estonian trade relations is declining but according to both scenarios of the research study, Russia's share in Estonian export will be significant also in long run perspective. Estonia has also good potential to develop trade relations with Poland – the biggest economy in transition among the Central and East European (CEE) countries. Hence, the results of the study allow us to conclude that small economies in transition should look for a regional niche to penetrate into the international market.

According to results of this study, parameters of the gravity equations estimated on the base of data from various years are comparatively stable. Consequently, the results of analysis do not remarkable depend on the year of database but it depends on specification of equations and content of data. Further development of the gravity approach to explore Estonian international trade flows and to predict changes in trade patterns has to be focused on the preparing more relevant data to estimate parameters of models. It is advisable to pay more attention on the regional GDP data as well as the distance between countries and to distinguish two separate groups in foreign trade relations according to the mode of transport: sea and air. The gravity

models can then be elaborated and estimated in relation to different distances. These models can also be estimated using regional GDP data of a country, particularly in case of large countries (Germany, Russia). Last not least, Estonia's situation is certainly not unique, and conclusions presented in this paper could be applied to analysis of international trade pattern of other economies in transition.

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KOKKUVÕTE

Gravitatsioonimudelite kasutamine Eesti ja partnerriikide vaheliste kaubavoogude modelleerimisel

Gravitatsioonimudeleid on viimastel aastatel küllaltki ulatuslikult kasutatud siirderiikide ja arenenud turumajandusega riikide kaubavahetuse võimaluste kvantitatiivsel hindamisel ning ida ja lääne vahelise kaubavahetuse arengupotentsiaali väljatoomisel. Lähenemisviisi eelisteks on suhteliselt väike andmevajadus ning asjaolu, et gravitatsioonimudelite kasutamiseks vajalikule majandusteoreetilisele tagapõhjale ja selle arendamisele on erialakirjanduses pööratud suurt tähelepanu. Gravitatsioonimudeleid iseloomustab küllaltki hea selgitusvõime. Tegemist on statistilises mõttes "heade" mudelitega.

Käesolevas töös on antud üldistav kokkuvõte gravitatsioonimudelite majandusteoreetilisest taustast, käsitledes mikroökonoomikast tulenevat tagapõhja kontekstis regionaalsete ja kaubandusteooriatega ning nende uuemate arengusuundadega. Gravitatsioonimudelite majandusteoreetiline tagapõhi on sobiv ka siirdeprotsesside modelleerimiseks. Gravitatsioonimudelite kasutamisel siirderiikide kaubavoogude modelleerimisel võib üldistavalt välja tuua kolm põhisuunda: 1) siirderiikide kaubavahetuse geograafilise laienemise võimalused ja ida-lääne kaubanduse arengupotentsiaali hindamine, 2) integratsiooniprotsessid ja nende mõju kaubavoogude liikumisele rahvusvaheliste ühenduste raamides, 3) riigi väliskaubanduse geograafilise struktuuri modelleerimine ja arengustsenaariumide väljatöötamine.

Tuginedes andmetele Eesti ja peamiste partnerriikide vaheliste kaubavoogude, SKP ning riikide vaheliste kauguste kohta on modelleeritud Eesti ekspordi ja impordi geograafilise struktuuri kujunemist ning välja pakutud arengustsenaariumid. Saadud

mudelid on hea selgitusvõimega ning annavad statistilise kinnituse hüpoteesidele riikide vahelist kaubavahetust mõjutavate võimalike tõuke- ja tõmbejõudude kohta. Statistilist kinnitust sai ka seisukoht, et Eesti kaubavahetuses kuulub oluline koht Läänemere regiooni riikidele. Kontrollitud on mudelite stabiilsust ajaliste muutuste suhtes ning saab väita, et Eesti väliskaubanduse geograafilist struktuuri kirjeldavad gravitatsioonimudelid on ajas stabiilsed.

Gravitatsioonimudelitele tuginevalt on antud lühiajalised hinnangud Eesti väliskaubakäibe geograafilisele struktuurile. Mõlema stsenaariumi kohaselt on Eestil hea potentsiaal kaubandussuhete arendamiseks Läänemere regiooni riikidega, eriti Soome, Rootsi ja Saksamaaga. Võrreldes mudelite alusel saadud hinnanguid 1999. aasta tegelike andmetega, nähtub, et tegelik kaubakäibe maht Läänemere regiooni riikidega oli hinnangulisest mõnevõrra väiksem. Kaubandussuhete head arengupotentsiaali Läänemere regiooni riikidega kinnitab ka info Eesti otseste välisinvesteeringute geograafilise struktuuri kohta. Rohkem kui 80% otsestest välisinvesteeringutest on Eestisse tulnud Läänemere regiooni riikidest. Ka varasemad uuringud on kinnitanud otseste välisinvesteeringu toetavat mõju riigi ekspordi arengule. Välisinvesteeringute mõju kaubandussuhete arengule avaldub tavaliselt viitajaga ning seega võib arvata, et pikaajalises perspektiivis kasvab Läänemere regiooni roll Eesti väliskaubandussuhetes veelgi.