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ABSTRACT

The paper explores regional trade integration of the countries involved in the EU eastward enlargement (EU-25) processes distinguishing the possible regional trade clusters within EU-25 that may support integration of the EU-15 and the new member states. We examine whether the gravity equation based on the new trade theory describes trade integration of the EU-25 countries, and whether the results of a gravity model based analysis may be different in the case of the Baltic Sea region (BSR). The gravity models are estimated based on panel data for the years 1993 to 2002. The results of our analysis indicate that the BSR is forming an exception within EU-25. The BSR trade cannot be explained as much with New Trade Theories as in the case of the whole EU. The BSR countries have different factor endowments and the intensive trade relations between the BSR countries are mainly based on comparative advantages.

Keywords: gravity models, international trade, regional integration, Baltic Sea region.
JEL classification: F15, R1, C5

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1 INTRODUCTION

The European eastward enlargement processes will have a long-lasting impact on future economic development of both, old and new member countries of the EU. Therefore, a profound analysis of outcomes and lessons of several aspects of European integration processes is continuously a topical issue of many empirical studies. An expedient economic factor in pushing economies into integration is international trade. International trade relations provide good preconditions and challenges for continuing integration creating also spatial spillover effects. In addition to several other factors, the intensity of international trade flows is significantly influenced by transportation costs and consequently by distance.

During the recent decade, gravity approaches of international trade have widely been applied for analysing the impact of a variety of policy issues and institutional determinants, including regional trading groups, currency unions, political blocs, border region activities etc on bilateral trade flows of the countries (Eichengreen and Irwin 1998; Soloaga and Winters 2001; Martinez-Zarzoso and Nowak-Lehmann 2003; de Groot et al. 2004; Cheng and Wall 2002 and 2005). The regional integration effects are ordinarily handled as deviations from the volume of trade predicted by a baseline gravity model adding dummies that characterise several effects of integration.

Theoretical foundations of gravity models for exploring international trade flows mainly rely on classical and new trade theories (Helpman and Krugman 1985; Krugman 1991 and 1995; Helpman 1999). Initially, gravity models have been estimated on the basis of cross-section data. Since the middle of the 1990s, a lot of attention has been given to the proper specification and estimation of gravity equations in the panel data framework (Egger 2002 a, b; Egger and Pfaffermayr 2003; Baltagi et al. 2003; Cheng and Wall 2005).

This paper explores regional trade integration of countries involved in the EU eastward enlargement (EU-25) processes distinguishing possible regional trade clusters within EU-25 that may support integration among the EU-15 and the new member states (NMS). One task of the study is also to examine whether the gravity equation based on new trade theory describes trade integration of the EU-25 countries, and whether the results of a gravity model based analysis may be different in the case of the Baltic Sea region (BSR). Gravity models for exploring BSR trade integration have also been applied in previous studies developed by Cornett and Iversen (1998), Hacker and Johansson (2001), Hacker and Einarsson (2003), Laaser and Schrader (2003). These studies mainly focus on explaining trade flows in the BSR and predicting future trade of the region.

The BSR consists of four old members (Germany, Finland, Denmark and Sweden) and four new ones (Estonia, Latvia, Lithuania and Poland) of EU-25. These countries have had strong historical traditions of cooperation, but due to historical reasons they vary significantly in the levels of economic development.[1] The economic integration of the Baltic Sea region countries is mainly based on geographical, historical and cultural factors and also on some feeling of Baltic identity. These factors create a solid basis for bottom-up activities, establishing networks and institutions that support economic development and co-operation having started after the collapse of the "iron curtain".[2] It is also reasonable to agree to the expectations of several economists that due to EU eastward enlargement processes, Europe's economic map is going to change and one potential growth area could be the former Hanseatic League in the Northern part of Europe with its stronghold in the Baltic Sea area (see Delamaide, 1994; Bröcker and Herrmann 2001; Hospers 2003). Thus, this region provides an interesting case in analysing the EU eastward enlargement processes.

The gravity models estimated in this paper are based on panel data for the years 1993 to 2002. The year 1993 marks the beginning of the transition process in the majority of the EU candidate countries. The year 2002, when the enlargement by the 10 accession countries (AC-10) was decided, marks the pre-accession period, which created the EU-

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1 The BSR countries show significant differences in their level of economic development. When examining the economic situation of the region, the BSR countries are traditionally divided into two groups: 1) high-income countries Finland, Sweden, Denmark and Germany, the so-called old market economy countries or developed economies of the region. The non-weighted average of per capita gross national income of these countries was 28,096 USD (PPP - purchasing power parity) in 2003 with the highest level in Denmark (31 210 USD) and the lowest in Sweden (26,620 USD); 2) the middle- or low-income countries Estonia, Latvia, Lithuania, and Poland, where the average per capita gross national income was 11,286 USD in 2003 with the highest level in Estonia (12,480 USD) and the lowest one in Latvia (10,130 USD) (World Bank, 2005).

2 The division of the BSR countries according to the level of economic development into two groups results from their different political conditions for economic and social development. This region has been most significantly affected by the split of post-Second-World-War Europe into two blocs. The BSR countries were divided between two diametrically different economic and political systems - the market-led Western Europe and the command-based socialist Eastern Europe. The socialist countries (republics) of the region were integrated into the Council of Mutual Economic Assistance (CMEA), while the market-oriented countries developed globally oriented integration processes based on the European Community (EC) and the European Free Trade Association (EFTA).

25 consisting of the old (EU-15) and the new members.[3] This year may also be considered as the end of the Central and Eastern European countries' (CEEC) transition phase. The transition from a command to a market economy was a period of economic development, during which the economic structures and institutions of the accession countries have simultaneously been adapted to the requirements of EU full membership.

Our empirical study of bilateral trade flows in EU-25 countries during the period 1993 to 2002 mainly focuses on the following questions: 1) Are there effects of historical trade relations among the EU-25 taking into account the bilateral trade flows between the EU-15 (West-West bias), the AC-10 (East-East bias), and EU-15 and AC-10 countries (West-East bias)? 2) Do there exist regional trade clusters (e g groups of countries with intensive bilateral trade flows) among EU-25 that may support East-West trade integration? 3) Could trade flows between EU-25 countries be explained by the new trade theory? 4) Is there any exceptionality in explaining international trade flows in the case of BSR?

The paper is organised as follows: In section 2 we outline some issues of the proper specification of gravity equations. Section 3 presents specifications of the gravity models estimated in the paper and describes proxies of variables. The empirical results are considered in section 4. Section 5 concludes. The empirical part of the paper draws mainly on the IMF's trade statistics and the data of the World Bank, Eurostat and national statistical offices.

2 SPECIFICATION OF GRAVITY EQUATIONS EXPLORING INTERNATIONAL TRADE

The antecedents for using the gravity models to analyse international trade date back to Tinbergen (1962), Pöyhönen (1963) and Linnemann (1966). These studies were without any serious attempt to justify the gravity equations from the point of economic theory.

3 AC-10: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic, Slovenia. Since May 2004, these ten countries are the EU new member states (NMS-10) and NMC-10 together with Bulgaria and Romania form the group of the EU candidate countries CC-12. EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, United Kingdom. EU-25 consists of EU-15 and AC-10 (NMS-10). Eight of these countries (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic and Slovenia) are post-socialist countries (CEEC).

Following Tinbergen-Pöyhönen-Linnemann's work, the theoretical foundations of gravity equations explaining international trade flows have been widely discussed and developed within the last three decades. These foundations mainly base on theories of international trade. Classical trade models explaining the existence and structure of international trade rely on comparative advantage and relative factor endowment differences. In these models no attention was paid to the presence of increasing returns to scale, monopolistic competition and transportation costs. The consideration of these issues characterises the new trade theories (e g Krugman 1980; Helpman and Krugman 1985; Helpman 1999). The new trade theories support Linder's (1961) hypothesis that trade flows between countries with similar relative factor endowments are larger than trade flows between countries that differ considerably in this respect. This hypothesis is supported by the evidence that intra-industry trade accounts for a big share of total trade nowadays, especially if the developed countries are considered. This is controversial to the view of Heckscher, Ohlin and Samuelson, according to which the inter-industry trade should be dominating.

The considerations about theoretical foundations of the gravity model for analysing international trade flows do not generate a proper and unique specification of the gravity equation used in empirical work. In the basic form of the gravity model, it is assumed that the amount of trade between two countries increases with their size - measured by their national incomes (or GDP) - and decreases with the cost of transport between them - measured by the distance between their economic centres (Tinbergen 1962). Linnemann (1966) included population as an additional variable for the size of the country and its economy in the gravity model. This model is sometimes called "the augmented gravity model". Including the size of economy in the gravity equation corresponds to new trade theory models in their basic form in which trade is positively related to the market size.

It is also common to specify the augmented gravity model using per capita income (or per capita GDP) as an explanatory variable. Per capita income expresses the level of economic development. Presumably, if the level of income is higher, also domestic expenditure per capita will be higher and consequently both domestic production and imports are expected to rise. Adding per capita income as an indicator for the level of economic development to the gravity equation also makes it possible to distinguish the effects of size and economic development level of a country (see also de Groot et al.

2004, p 110). Trade theories themselves do not provide a clear explanation for the positive effect of per capita income in bilateral trade flows.

The main push factors of international trade flows are related to transportation costs. Distance as an explanatory variable of bilateral trade flows serves as a proxy for transportation costs. Additionally, there are some so-called man-made conditions that have an impact on bilateral trade relations of the countries. Man-made conditions may consist of tariffs, quotas, subsidies, export taxes, exchange controls, marketing restrictions, etc.

Thus, the baseline gravity model which describes bilateral trade flows (Y_{ijt}) between the countries i and j over time t consists of traditional gravitational forces as the basic explanatory variables of the equation: 1) The pull factors that are often presented by the proxies: size of the economy and level of its economic development. The size of the economy is ordinarily measured by population or/and national income (or total GDP). The level of economic development can be measured by GDP per capita. 2) The push factor: transportation costs between trading countries - measured by some proxy variables - ordinarily by distance.

For exploring the deviations from the baseline gravity equation, some dummies are included in the equations as explanatory variables. A typical gravity equation of international trade consists of three types of variables, which may vary i) in all three dimensions: over country pairs i and j ($i \neq j$) and over time t (e g Y_{ijt}); ii) in two dimensions: over country i or j and over time t (for instance the explanatory variables X_{it} and X_{jt} - population or GDP of the country i and j, respectively, at time t); iii) in two dimensions i and j but not over time t (e g distance or dummies indicating regional trade blocs, common languages, etc).

Initially, gravity models were estimated on the basis of cross-sectional data. But already in the 1970s there appeared calls for using panel data for a more proper estimation of gravity equations (e g Ghosh 1976). Since the first half of the 1990s the econometric issues of the gravity models have been discussed more precisely (see also Sanso et al. 1993; Oguledo and MacPhee 1994). The authors of several papers started to argue that standard cross-sectional estimators of gravity equations may yield biased results (Polak 1996; Mátyás 1997 and 1998; Harris and Mátyás 1998; Chen and Wall 2002).

The estimation of a pooled cross-section time series gravity equation does not only increase the degrees of freedom, but also makes a more proper specification of exporting and importing (source and target country) countries, country pairs and time effects possible. The drawback of the panel data model with country-pair fixed effects is that the effect of time invariant variables cannot be estimated (e g distance - a variable that has an important role in traditional gravity models, proxying the transportation costs). Instead of this, Baltagi et al. (2003) recommend to use the difference between imports given at c.i.f. prices and exports reported at f.o.b. prices as a proxy for transportation costs. The proper econometric specification of a gravity equation should comprise both time and countries' effects, and we agree with Egger and Pfaffermayr (2003) that these effects depend on the interests of the analysis, the country sample, the data properties, and the theoretical model.

3 GRAVITY MODELS AND PROXIES FOR VARIABLES

In order to get answers to the research questions presented in the introductory part of the paper, two gravity models - Model 1 and Model 2 - are specified and estimated.

Model 1

$$\begin{aligned}\ln Y_{ijt} &= \beta_0 + \beta_1 \ln(POP)_{it} + \beta_2 \ln(POP)_{jt} + \beta_3 \ln(GDPpc)_{it} \\ &+ \beta_4 (GDPpc)_{jt} + \beta_5 \ln(DIST)_{ij} + \boldsymbol{\gamma}\mathbf{D}_{ij} + u_{ijt}\end{aligned}, \tag{1}$$

where

Y_{ij}	export from country i to country j (or import from country i to country j),
$(POP)_i$ and $(POP)_j$	populations of the exporting (i) and importing (j) countries, respectively (home (i) and host (j) countries),
$(GDPpc)_i$ and $(GDPpc)_j$	gross domestic product per capita of the exporting (i) and importing (j) countries, respectively,
$(DIST)_{ij}$	distance in kilometres between the countries i and j (flight distance between the capitals of the countries),
$\beta_0, \beta_1, ..., \beta_5$	parameters of the model corresponding to the traditional gravity forces,
$\boldsymbol{\gamma}$	row vector of parameters corresponding to the dummy variables,
$\boldsymbol{D}_{ij}$	vector of dummy variables,
u_{ijt}	error term,

$i = 1, 2, \ldots, N$; $j = 1, 2, \ldots, N$; $N = 25$, $i \neq j$,
$t = 1, 2, \ldots, T$; $T = 10$.

Model 1 is estimated in order to get answers to questions 1 and 2 (see Introduction): i) Are there effects of historical trade relations among the EU-25 taking into account the bilateral trade flows between the EU-15 (West-West bias), the AC-10 (East-East bias), and EU-15 and AC-10 countries (West-East bias)? ii) Do regional trade clusters exist, e g groups of countries within EU-25 with intensive bilateral trade flows that may support East-West trade integration?

We assume that the Western European countries (EU-15) have historically strong trade linkages (West-West), while the countries that belonged to the former Soviet bloc developed trade relations mainly within the socialist countries before the collapse of the Soviet system (East-East). The European integration processes focus on the development of trade between EU-15 and new member states (West-East). In order to check the validity of these assumptions in the case of EU-25 countries, the following sets of dummies are used:

- Dummies that control for the historical trade linkages. *D_West-West* = 1 if both trading partners are EU-15 countries, = 0 otherwise;

- *D_East-East* = 1 if both trading partners belong to the post-socialist accession countries (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, Slovenia), = 0 otherwise;

- *D_West-East* = 1 if one of the trading partners is an EU-15 country and the other partner is a post-socialist accession country, = 0 otherwise.

For testing the existence of regional trading clusters within the EU-25 countries, we introduce the dummies for three regions: 1) Baltic Sea region - includes Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden; 2) Central Europe - Austria, the Czech Republic, Germany, Hungary, Poland, the Slovak Republic, and Slovenia; 3) Mediterranean area - Cyprus, France, Greece, Italy, Malta, and Spain.

- *D_BSR = 1,* if the country belongs to the Baltic Sea region - includes Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden, = 0 otherwise;

- *D_CE = 1*, if the country belongs to Central Europe - Austria, the Czech Republic, Germany, Hungary, Poland, the Slovak Republic and Slovenia, = 0 otherwise;

- *D_MEDIT = 1,* if the country belongs to the Mediterranean area - Cyprus, France, Greece, Italy, Malta, and Spain, = 0 otherwise.

In determining the countries belonging to a specific area, we rely on the geographical proximity of the countries and the inclusion of both old and new members of the EU. Additionally, a land border dummy (*D_BORDER*) is included in equation (1) in order to capture the neighbouring effects. Indicators used as proxies for the variables of Model 1 and references for the data sources are presented in Appendix 1.

In order to get information about the strength of the so-called traditional gravity forces, the importance of historical linkages and the existence of regional trade clusters, first the between effects (BE) models, are estimated. Afterwards we use the pooled data in order to analyse possible dynamic effects. In that case it is assumed that each of the parameters depends linearly on time:

(2) $$\beta_{ht} = \alpha_h + \delta_h t; \quad \gamma_{lt} = \alpha_l + \delta_l t ,$$

where

t time index, $t = T$,
$h = 1, 2,..., H$ (H is the number of parameters corresponding to the traditional gravity forces),
$l = 1, 2,..., L$ (L is the number of dummy variables in the gravity equation).

Changes in the parameters are assumed as the period under observation covers continuous integration of Eastern European economies into the Western European region. Thus, it can be expected that importance and effects of factors influencing trade flows have changed in time.

The estimation results of Model 1 are analysed in section 4, subsections 4.1 and 4.2.

<u>*Model 2*</u>

In order to test whether the gravity equation based on the new trade theory describes the trade integration of EU-25 countries (question 3; see Introduction) and whether the results may be different in the case of the BSR (question 4; see Introduction), we estimate the following model (see also Baltagi et al. 2003):

(3) $\ln Y_{ijt} = \mathbf{x}'_{ijt}\delta + \alpha_i + \beta_j + \gamma_t + (\alpha\beta)_{ij} + (\alpha\gamma)_{it} + (\beta\gamma)_{jt} + u_{ijt}$,

where

$\ln(Y_{ijt})$	export from country *i* to country *j* in year *t*,
$\mathbf{x}_{ijt}$	the k × 1 row vector of independent variables,
α_i, β_j, and γ_t	the fixed exporter, importer and time effects, respectively,
$(\alpha\beta)_{ij}$, $(\alpha\gamma)_{it}$, $(\beta\gamma)_{jt}$	the interaction effects; $(\alpha\beta)_{ij}$ is the interaction effect between the unobserved exporter and importer characteristics; $(\alpha\gamma)_{it}$ and $(\beta\gamma)_{jt}$ capture exporter and importer specific time-variant effects, respectively (e g the relevant country's business cycle, cultural, political or institutional characteristics and unobserved factor endowment variables),
u_{ijt}	error term.

Vector $\mathbf{x}_{ijt}$ contains the following variables:

LGDTijt	natural logarithm of the total GDP of the trading partners *i* and *j* in year t[4],
LSIMijt	similarity index of the trading partners' GDPs[5], *LSIMijt* = 0 if one country produces nothing and *LSIMijt* = 0.5 if the GDPs of the two countries are equal,
LRFACijt	absolute difference in relative factor endowments[6],
LDISTij	natural logarithm of distance between the capitals of the countries *i* and *j* (dropped due to perfect collinearity when estimating the model with country-pair fixed effects),
DBORDij	dummy variable to control for the bordering effects (dropped due to perfect collinearity when estimating the model with country-pair fixed effects).

The indicators used for calculating the above described variables and the corresponding data sources are presented in Appendix 2. The estimation results of Model 2 are analysed in section 4, subsection 4.3.

4 $LGDT_{ijt} = \log(GDP_{it} + GDP_{jt})$.

5
$$LSIM_{ijt} = \log\left[1 - \left(\frac{GDP_{it}}{GDP_{it} + GDP_{jt}}\right)^2 - \left(\frac{GDP_{jt}}{GDP_{it} + GDP_{jt}}\right)^2\right].$$

GDP is the gross domestic product of the relevant country.

6
$$LRFAC_{ijt} = \left|\log\left(\frac{GDP_{it}}{POP_{it}}\right) - \log\left(\frac{GDP_{jt}}{POP_{jt}}\right)\right|.$$

GDP and *POP* denote the gross domestic product and the size of population of the relevant country, respectively.

4 EMPIRICAL RESULTS

4.1 Historical trade linkages

Table 1 contains the estimates of Model 1. Version 1 of this model includes additionally to baseline variables and border dummies West-West and East-East dummies; Version 2 includes West-West and West-East dummies.

Table 1: Estimation results for testing the importance of historical trade linkages (Model 1)

Variable	Version 1	Version 2	Time variant version 1		Time variant version 2	
			α	*δ*	*α*	*δ*
ln(*GDP_pc_hm*)	1.212** (0.104)	1.212** (0.104)	1.565** (0.086)	-0.034** (0.013)	1.565** (0.086)	-0.034** (0.013)
ln(*GDP_pc_hs*)	0.773** (0.106)	0.773** (0.106)	1.509** (0.086)	-0.093** (0.013)	1.509** (0.086)	-0.093** (0.013)
ln(*POP_hm*)	0.962** (0.027)	0.962** (0.027)	0.769** (0.022)	0.024** (0.003)	0.769** (0.022)	0.024** (0.003)
ln(*POP_hs*)	0.902** (0.027)	0.902** (0.027)	0.717** (0.024)	0.021** (0.004)	0.717** (0.024)	0.021** (0.004)
ln(*Distance*)	-1.220** (0.070)	-1.220** (0.070)	-1.245** (0.062)	0.006 (0.009)	-1.245** (0.062)	0.006 (0.009)
D(*Border*)	0.266' (0.140)	0.266' (0.140)	0.370** (0.094)	-0.014 (0.015)	0.370** (0.094)	-0.014 (0.015)
D(*West-West*)	0.894** (0.227)	0.851** (0.120)	0.861** (0.169)	-0.030 (0.026)	1.177** (0.080)	-0.068** (0.012)
D(*West-East*)	0.043 (0.160)		-0.316* (0.131)	0.038' (0.020)		
D(*East-East*)		-0.043 (0.160)			0.316* (0.131)	-0.038' (0.020)
D(*CypMlt*)	0.592** (0.192)	0.550** (0.122)	0.211 (0.178)	0.009 (0.027)	0.527** (0.118)	-0.029 (0.018)
Intercept	-21.6** (2.16)	-21.5** (2.26)	-25.5** (1.66)	0.424 (0.267)	-25.8** (1.72)	0.462' (0.277)
N	5392	5392	5392		5392	
F(9, 588)	604.8	604.8				
F(19, 5372)			2359		2359	
R^2	0.880	0.880	0.877		0.887	

Sample: EU-25 countries, 1993-2002. See Appendix 1 for the definitions of the variables. *hm* indicates the exporting country and *hs* the importing country; BE – between-effects model; see formula (2) for the definition of *α* and *δ*; White heteroskedasticity consistent standard errors in parenthesis.

** significant at 0.01 significance level, * – 0.05, ' – 0.1.
Source: Own calculations.

On the basis of the estimation results, it is possible to conclude that the traditional gravitational forces are important in explaining the trade relations of EU-25 countries. All corresponding parameter estimates show the expected sign and they are statistically significant. Also the neighbouring effect is statistically significant at the level of 0.1. Furthermore, the historical linkages seem to matter. The West-East trade relationships are weaker than those within the historical trading blocs (the EU-15 and the eight Eastern European accession countries).

Analysing the changes in the impact of traditional gravitational forces, it can be noticed that the effect of the economic development level has decreased during the period under observation and the effect of the size of countries has increased. The effect of distance has not changed. This finding is in accordance with the view that the role of distance is still important in bilateral trade relations of the countries despite globalisation processes.

As for the dummies of historical trade relationships in the time variant models (Table 1), it can be concluded that the integration of western and eastern European economies has resulted in more intensive trade between countries from different historical groups. Statistically, the West-West trade has significantly decreased (ceteris paribus) compared to that of West-East trade flows (Version 1). The West-East bias is negative, presumably indicating that the potential for improving trade integration between the EU-15 and AC-10 has not been fully utilised. The East-East bias is positive and statistically significant in the time variant model, but it has a weak evidence of the diminishing importance (Version 2). Trade integration of neighbouring countries has been significant over the whole observation period.

4.2 Regional trade clusters

The estimation results focused on the exploring regional trade clusters within EU-25 and based on the pooled data set of the period 1993 to 2002 are presented in Table 2. Comparing these results with our previous estimations based on cross-section equations (year by year) (see Paas and Tafenau 2005), we can notice the evidence of possible biased cross-section estimators of the regional dummies' parameters. In contrast to cross-section estimates, the panel data estimators indicate - at the significance level 0.1 - all three trade clusters (BSR, Mediterranean area, Central Europe) can be distinguished. According to the cross-section estimations we indicated this clear evidence only in the case of BSR parameters (ibid).

Table 2: Estimation results for testing the existence of regional trade clusters (Model 1)

Variable	Parameters	Time variant	
		α	***δ***
ln(*GDP_pc_hm*)	1.750** (0.074)	2.148** (0.066)	-0.053** (0.010)
ln(*GDP_pc_hs*)	1.317** (0.075)	2.073** (0.064)	-0.109** (0.010)
ln(*POP_hm*)	0.983** (0.023)	0.799** (0.021)	0.023** (0.003)
ln(*POP_hs*)	0.919** (0.023)	0.746** (0.020)	0.020** (0.003)
ln(*Distance*)	-0.840** (0.073)	-0.870** (0.063)	-0.005 (0.010)
D(*Border*)	0.511** (0.140)	0.646** (0.110)	-0.026 (0.017)
D(*BSR*)	0.991** (0.137)	0.988** (0.103)	-0.009 (0.017)
D(*MEDIT*)	0.370* (0.156)	0.237' (0.123)	0.009 (0.020)
D(*CE*)	0.283' (0.163)	0.251* (0.113)	-0.003 (0.018)
Intercept	-35.1** (1.38)	-39.9** (1.18)	0.856** (0.185)
N	5392	5392	
F(9,588)	600.3		
F(19,5372)		2046	
R^2	0.878	0.887	

Sample: EU-25 countries, 1993-2002. See Appendix 1 for the definitions of the variables. *hm* indicates the exporting country and *hs* the importing country; BE – between-effects model; See formula (2) for the definition of *α* and *δ*; White heteroskedasticity consistent standard errors in parenthesis.
** significant at 1 % - * significant at 5 %, ' significant at 10 %.
Source: Own calculations.

The BSR trade bias is the biggest. According to the BE estimators, the bias is 2.7 (exp(0.991)) at the significance level 0.01. Thus, the Baltic Sea region countries' bilateral trade flows among the countries involved in the EU eastward enlargement are around three times larger than trade flows outside the region after controlling for size of economy, level of economic development, distance and other dummies. In the case of the Mediterranean area, this bias is 1.4 (exp(0.370)) at the significance level 0.05 and in the case of Central Europe 1.3 (exp(0.283)), but only at the significance level 0.1. The trade biases of the regions do not show a significant linear change during the period of 1993 to 2002. Nevertheless, trade intensity between all countries in the sample has increased considerably during this period as indicated by the significance of the independent time trend term.

Of course, we have to admit that the choice of regions is somewhat arbitrary and significance of the estimates can be random. Nevertheless, the result is quite robust, at least as for the Baltic Sea Region. Moreover, it confirms our earlier findings (Paas and Tafenau 2004) that this region has been exceptionally successful in integrating post-socialist and Western European economies during the EU eastward enlargement preparation processes. This region is evidently playing an important role in supporting the integration processes of the developed and post-socialist economies under common EU umbrella and probably also in giving some lessons to other regions.

4.3 Gravity model based estimation results and new trade theory

Table 3 contains the estimates of Model 2. In order to avoid perfect collinearity, we use two approaches. First, we estimate the model without the exporter-importer interaction effects (Version 1 of Model 2). Second, we drop the individual country effects, assuming that country-pair effects also contain individual country effects as $(\alpha\beta)_{ij} \neq (\alpha\beta)_{ji}$ (Version 2 of Model 2). Both versions of Model 2 are also estimated with a dummy variable for the Baltic Sea Region and its interaction terms with the continuous variables that are included in equation (3).

The estimators are significant and positive in all the estimated versions of Model 2. But it can be noticed that depending on the type of fixed effects included to the model the estimates differ considerably. For the variable $LRFAC_{ijt}$ which enables to test for the Linder hypothesis the evidence is mixed: The corresponding parameter estimate is significant and negative in the model with individual country effects and insignificant in the model with country-pair effects. The negativity of the parameter estimate indicates the validity of the Linder hypothesis, while its positivity would support Heckscher-Ohlin-Samuelson's view.

Taking into account the non-homogeneity of the country sample consisting of EU-25 countries, we give preference to the model with individual country effects. In that case, our estimation results support Linder's hypothesis that EU-25 countries with similar factor endowments (i e the trading partners with low value of $LRFAC_{ijt}$) trade more with each other than dissimilar countries.

Table 3: Estimation results of the international trade flows in the European Union (Model 2)

Variable	Version 1	Version 2	Version 1 + BSR	Version 2 + BSR
$LGDT_{ijt}$	1.048** (0.111)	0.309* (0.156)	1.172** (0.106)	0.342* (0.162)
$LSIM_{ijt}$	0.538** (0.055)	0.417** (0.122)	0.558** (0.053)	0.439** (0.129)
$LRFAC_{ijt}$	-0.144** (0.019)	0.036 (0.040)	-0.138** (0.021)	0.055 (0.056)
$LDIST_{ij}$	-1.249** (0.024)		-1.056** (0.029)	
D_BORD_{ij}	0.458** (0.044)		0.528** (0.043)	
D_BSR_{ij}			14.6** (0.772)	
$D\_BSR*LGDT_{ijt}$			-0.601** (0.030)	-0.184 (0.134)
$D\_BSR*LSIM_{ijt}$			-0.018 (0.033)	-0.141 (0.156)
$D\_BSR*LRFAC_{ijt}$			0.135** (0.040)	-0.025 (0.076)
$D\_BSR*LDIST_{ij}$			0.229** (0.069)	
Intercept	0.556 (2.827)	11.2** (3.91)	-3.88 (2.70)	10.8** (4.02)
N	5327	5327	5327	5327
R^2	0.926	0.542	0.933	0.542
Adj. R^2	0.918		0.927	
P	0.000	0.000	0.000	0.000

Dependent variable: $\ln(EXPORT)_{ijt}$. See Footnotes 5-7 for variable definitions and Appendix 2 for data sources. Standard errors of estimates in the parenthesis; The model specification is given by equation (3). Model 1 does not contain country-pair effects. Model 2 does not contain individual country effects; ** significant at 1 % - * significant at 5 %, ' significant at 10 %.
Source: Own calculations.

The results for the BSR confirm our previous findings that BSR trade bias is large and statistically significant, being in accordance with the expectations and also the empirical results we presented in sub-section 4.2. At the same time, the continuous variables included in the model have a remarkably smaller influence in the BSR than in the EU on average. The total effect of the variable $LRFAC_{ijt}$ is insignificant for the BSR (-0.138 + 0.135), indicating that relatively more trade takes place between dissimilar countries in the region than in EU on average. Thus, in the case of the BSR, trade cannot be explained as much as in the case of the whole EU by new trade theories. The BSR countries have different factor endowments and this has resulted in specialised trade of those products using the relatively more abundant production factors more intensively.

5 CONCLUSIONS

We conclude that traditional gravitational forces characterised by proxies for size, level of economic development of trading partners and distance between them have had statistically significant impact on the bilateral trade flows of the countries that were involved in the EU eastward enlargement processes during the period from 1993 to 2002. The main push factor - the distance between trade partners - expresses not only geographical distances but may also describe the influence of various other factors like diversities in business cultures, languages, possibilities of using information and telecommunication technologies etc. The estimated results of this period show that the role of distance in explaining bilateral trade flows of EU-25 countries is not declining. Distance still matters and this result is in compliance with some previous studies (see Ghemawat 2001, Laaser and Schrader 2002, Jungmittag and Welfens 2001). The effect of the economic development level of trading partners' countries has somewhat decreased and the effect of the size of economies has increased.

Estimation results also indicate that additionally to the traditional gravitational forces, whose impact is expressed by the baseline gravity equation, bilateral trade flows between EU-25 countries are influenced by various other factors, like historical trade linkages and regional cooperations. The testing results show that trade relations between EU-15 countries are still intensive but the West-West trade bias is declining. The West-East bias is negative and insignificant; thus, presumably the potential for improving trade integration between the EU-15 and AC-10 is still underdeveloped.

In order to test whether there are regional trade clusters, which may support integration between the old and new EU members, the dummies of three areas - the Baltic Sea region, Central Europe and the Mediterranean area - are included in the gravity equations. These regions consist of both some EU-15 countries and some accession countries taking into account also the geographical proximity of the countries. At the significance level 0.1, we can conclude that all three areas (BSR, Mediterranean area, Central Europe), which may support the West-East trade integration, can be distinguished. The BSR bias is the largest one. The clear distinction of BSR as a trade cluster supports the view that there have been special relationships between countries of the region in existence favouring quick integration of economies with different factor endowments. Presumably, successful lessons of the recent decade's integration processes will have an ongoing positive impact on the development of the region also under the EU membership umbrella. This region has played an important role in supporting the integration processes between developed and post-socialist economies during the EU eastward enlargement preparation period and evidently this region is also giving lessons to some other regions.

The results of the analysis also indicate that BSR trade cannot be explained by new trade theories to such an extent as in the case of the whole EU. Intensive trade relations among BSR countries are mainly based on comparative advantages, thus on specialisation in labour-intensive goods in the post-socialist countries and in capital-intensive goods in the developed countries of the region. Under the conditions of increasing mobility of labour and capital, there will be a significant pressure on these specialisation patterns in both new and old member states. The BSR countries now face new challenges to develop intra-industry trade and horizontal integration in order to improve national and regional competitiveness in the European and global context.

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DATA SOURCES

How Far is It?	www.indo.com/distance
IMF	Direction of Trade Statistics Quarterly. Several issues.
IMF	Direction of Trade Statistics Yearbook. Several issues.
Statistical Office of Estonia	Statistical Database (http://www.stat.ee/)
World Bank	http://www.worldbank.org/data/databytopic/GDP.html
World Bank (2005)	GNI per capita 2003, Atlas method and PPP. Retrieved 23 February 2005 from http://www.worldbank.org/data/databytopic/GNIPC.pdf
WRI (World Resource Institute)	Economics, Business, and the Environment Searchable Database http://earthtrends.wri.org

APPENDICES

Appendix 1: The variables and sources of data used in the estimation of the gravity equations (Model 1)

Variable	Description (sources)
Y_{ij}	Export from country *i* to country *j* (export and import data of IMF)
POP_i	population of the exporting country (World Bank, WRI)
POP_j	population of the importing country (World Bank, WRI)
GDP_pc_i	gross domestic product per capita of the exporting country in the terms of purchasing power parity (World Bank, WRI)
GDP_pc_j	gross domestic product per capita of the importing country in the terms of purchasing power parity (World Bank, WRI)
$DIST_{ij}$	flight distance between the capitals of the trading partners (How Far is It? www.indo.com/distance)
D_West-West	= 1 if both trading partners are EU-15 countries, = 0 otherwise
D_East-East	= 1 if both trading partners are post-socialist accession countries (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, Slovenia), = 0 otherwise
D_West-East	= 1 if one of the trading partners is an EU-15 country and the other partner is a post-socialist accession country, = 0 otherwise
D_CypMlt	= 1 if at least one of the trading partners is Cyprus or Malta
D_Border_{ij}	= 1, if the trading partners share a dry land border, = 0 otherwise
D_BSR_{ij}	= 1, if both of the trading partners are from the Baltic Sea region (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden), = 0 otherwise
D_CE_{ij}	= 1, if both of the trading partners are Central European countries (Austria, the Czech Republic, Germany, Hungary, Poland, the Slovak Republic, and Slovenia), = 0 otherwise
D_MEDIT_{ij}	= 1, if both of the trading partners are Mediterranean countries (Cyprus, France, Greece, Italy, Malta, and Spain), = 0 otherwise

Appendix 2: The variables and sources of data used in the estimation of the gravity equations (Model 2)

Variable	Description (sources)
$EXPORT_{ijt}$	Export from country *i* to country *j* at year *t* (import data of IMF)
GDP_{it}	Gross domestic product of the exporting country in year *t* (World Bank, WRI)
GDP_{jt}	Gross domestic product of the importing country in year *t* (World Bank, WRI)
POP_{it}	Population of the exporting country (World Bank, WRI)
POP_{jt}	Population of the importing country (World Bank, WRI)
DIST	Flight distance between the capitals of the trading partners (How Far is It? www.indo.com/distance)
D_BORDER	= 1, if the trading partners share a dry land border, = 0 otherwise
D_BSR	= 1, if both of the trading partners are from the Baltic Sea region (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden), = 0 otherwise