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SOCIAL DEVELOPMENT AND INTERNATIONAL TRADE IN CENTRAL EUROPE**

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Abstract: *In this paper we study the impact of social development on international trade in Central and Eastern Europe using the generalized gravity model. Many previous empirical studies which explored the determinants of trade flows, concentrated only on traditional gravity variables, such as the size of trading partners, factor abundance, technology differences or distance. In our study, in addition to the standard set of gravity variables, we examine the role of aggregate social development indicators such as Human Development Index and its components. Our results show that both aggregate and disaggregate measures of social development affect the volume of international trade flows. In particular, the education indexes seem to be positively related to bilateral trade flows.*

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INTRODUCTION

In this paper we investigate the relationship between social development and international trade flows in Central and East European countries, including all former Soviet republics. The role of human capital has been stressed by both traditional and the new trade theory. The traditional Ricardian trade theory predicts that differences in technology at country level create the basis for international comparative advantage and affect trade flows. Similarly, the role of labour productivity is stressed by the latest strand of the new trade theory initiated by Melitz (2003) which focuses on firm heterogeneity and shows that export decisions are based on labour productivity at the firm level. However, both traditional and new trade theory treat labour productivity both at the country and at the firm level as an exogenous variable. However, in our view, labour productivity may depend on stock of human and social capital. Therefore, we can expect that higher level of social development may be positively associated with the efficiency of human capital and thus may positively affect firms' productivity and their decisions to export.

The main goal of this paper is to study the role of social development in increasing international trade among the Central and Eastern European countries using the theory consistent gravity model. In particular, we examine the role of aggregate social development indicators such as HDI as well as its components. In particular, we try to verify a number of research hypotheses:

- higher level of *Human Development Index* (HDI) is positively associated with larger trade;
- higher life expectancy (a proxy for the quality of the healthcare system and a reflection of the level of social development) should be associated with larger international trade;
- higher literacy rates, reflecting better access to education and skills, are positively associated with higher levels of international trade.

In order to verify those hypotheses, we estimate the generalized gravity model based on the panel covering all Central and Eastern European countries and years 1980–2009 using fixed and random effects estimation methods. Our empirical results show there is a positive relationship between our most general measure of social development (HDI) and the level of exports for the reporting and partner countries. The disaggregation of HDI into its constituent components yields, reveals that these results are mostly driven by the education indexes for both trading countries.

The structure of this paper is as follows: in Section 2 we present the analytical framework and discuss data explanatory variables. In Section 3 we

present estimation results. Section 4 summarizes and concludes with policy recommendations and directions for future studies.

ANALYTICAL FRAMEWORK

The role of human capital, interpreted usually as the educational attainments and skills of labor force, is taken into account in both the classical and the new trade theories. It is assumed that a higher level of human capital has a positive effect on the productivity of the labour force, and on the competitiveness of sectors and firms, and as a result on their exports.

These relationships are quite clear in the classical theory of international trade. In accordance with the Ricardo theory the comparative advantage of a given sector is determined by differences in the productivity of the homogeneous workforce in different sectors of the economy. In particular, those differences in productivity may result from the differences in human resources. In Ricardian theory, countries export products manufactured in those sectors of the economy in which the relative productivity, compared to other countries is higher, while they import products in the sectors with relatively lower level of labor productivity.

The importance of human capital as a an important factor determining the size of the trade flows was included in the developed neoclassical trade theory. According to Heckscher-Ohlin theory of the trade of the differences in the relative factor endowments determine the structure of comparative advantage and affect international trade flows. In other words, the country relatively abundant in the factor of production should specialize in the production and export of goods requiring relatively large inputs this factor.

Since then, many empirical studies have tried to verify the predictions of the neoclassical model, taking into account the role of human capital. These analyses have become increasingly sophisticated, inter alia with the new, enhanced version of the H-O model, proposed by Vanek (1968). In this model, many factors of production, many products and many countries were taken into account. In accordance with the Heckscher-Ohlin-Vanek model, countries should have a positive net factor content of production in their net exports, reflecting their factor abundance. In particular, Leamer (1984) suggests that skilled labour has a significant impact on the size and structure of the international trade in selected OECD countries.

In the Polish literature (Greszta, Śledziewska-Kołodziejska and Michałek (2001)) also an analysis of the impact of the level of education on foreign trade was conducted. In particular, the resource of human capital was updated by the average number of years of science in a given society collection, and therefore by the one used in the proposed examination of aspects of so-

cial development. The authors used data on trade in individual countries of Central and Eastern Europe with the "old" countries of the European Union in the years 1988–1998. They obtained a partial confirmation of the position that differences in the level of investment in human capital in various countries (and not only the level of GDP per capita) affect their relative advantage in trade in human capital intensive goods. According to the authors, also in the Polish case, reducing the gap should, in the long term, contribute to changes in the structure of foreign trade.

In the latest theory of foreign trade, represented mainly by Melitz (2003) model, heterogeneous firms diversified in terms of cost make their export decisions depending on their level of productivity. In turn, the level of productivity of the workforce may depend on the resource of human and social capital. It can therefore be expected that a higher level of social development is positively associated with higher productivity of human capital and thus can positively affect the productivity of companies and their export decisions. This would mean that greater resources of skilled labour and the differentiation of wages, reflecting differences in human capital stocks, may be factors which increase exports of heterogeneous firms.

Since the publication of the Melitz model (2003), there have already been numerous empirical studies, using firm-level data. They tested, inter alia, whether actually higher productivity of the labour force increases the likelihood of a decision to export. For example, the EFIGE (2010) report examined the functioning of companies in seven European countries, and in particular their propensity to export. Those studies have revealed that the productivity of the workforce is an important determinant of export decisions. Unfortunately, these studies do not include the countries of Central and Eastern Europe, with the exception of Hungary. Similar studies for Poland were recently published by Cieślik, Michałek and Michałek (2012). Their analysis shows that the productivity of the labour force is positively related to the probability of exporting.

In contrast to the aforementioned studies, we investigate the impact of social development on bilateral exports of Central and Eastern European countries using the generalized gravity model. Empirical gravity equations have been widely used to study the determinants of international trade flows during the last six decades. However, these equations were frequently criticized for the lack of theoretical foundations. Anderson and van Wincoop (2003, 2004) proposed a theoretical framework which is often used to derive so-called “theoretically consistent gravity equations”. However, this framework assumes complete specialization in production which may not be appropriate in the case of developing and transition countries.

Therefore, the analytical framework used in this study is based on the generalized gravity equation derived from the trade theory models which assume incomplete specialization in production. In the traditional gravity models, trade flows are explained by the economic size of the trading partners and the distance between them. In contrast to those models, in our specification, in addition to the standard gravity variables, we also use the measures of relative factor endowments (Bergstrand 1990; Cieślik 2009). Moreover, we will also control the changes in trade policy which occurred during the period covered by our sample which reflect multilateral as well as regional trade liberalization. To verify empirically our research hypotheses we examine in our study, the role of aggregate social development indicators such as Human Development Index and its components in addition to the standard set of gravity variables.

Our estimating equation used to study the determinants of bilateral trade flows, specified in the logarithmic form, is as follows:

$$\begin{aligned}\ln Exports_{ijt} &= \alpha_0 + \alpha_1 rep\_\ln GDP_{it} + \alpha_2 part\_\ln GDP_{jt} + \alpha_3 rep\_\ln Land_{it} \\ &+ \alpha_4 part\_\ln Land_{jt} + \alpha_5 \ln dist_{ij} + \alpha_6 contig_{ijt} + \alpha_7 rep\_land\_locked_i \\ &+ \alpha_8 part\_land\_locked_j + \alpha_9 EU_{ijt} + \alpha_{10} GATT - WTO_{ijt} + \alpha_{11} OECD_{ijt} \\ &+ \alpha_{12} EU\_Europe\_Agreement_{ijt} + \alpha_{13} Europe\_Agreement\_EU_{ijt} \\ &+ \alpha_{14} post\_soviet_i + \xi' Z_{ijt} + c_{ij} + \varepsilon_{ijt}\end{aligned}$$

where:

- $Exports_{ijt}$: bilateral exports between country *i* and *j* in period t depending on model specification;
- $rep\_\ln GDP_{it}$: GDP in reporting country *i* in period t;
- $rep\_\ln Land_{it}$: arable land per capita proxying for the factor proportions in reporting country *i* in period t;
- $part\_\ln GDP_{jt}$: GDP in partner country *j* in period t;
- $part\_\ln Land_{jt}$: arable land per capita proxying for the factor proportions in partner country *j* in period t;
- $dist_{ij}$: distance proxying for the trade cost between country *i* and *j*;
- $contig_{ijt}$: dummy variable that has an impact on trade cost and takes value 1 if there is a common border between countries *i* and *j* in period t and 0 otherwise;
- EU_{ijt}: dummy variable that takes value 1 if both countries are members of the European Union in period t and 0 otherwise;

- GATT-WTO: dummy variable indicating whether both countries are the GATT/WTO members or otherwise.
- OECD: dummy variable indicating whether both trading countries are the OECD members or otherwise;
- Europe_Agreement_ EU: dummy variable that takes value 1 if exporter signed the Europe Agreement and importer is the EU member and 0 otherwise;
- EU_Europe_Agreement: dummy variable that takes value 1 if exporter is the EU member and importer signed the Europe Agreement and 0 otherwise;
- land_locked: dummy variable that affects trade cost and takes value 1 for land-locked countries and 0 otherwise;
- post_soviet: dummy variable that takes value 1 for post-soviet countries and 0 otherwise;[1]
- Z_{ijt}: vector of social development variables that affect labor productivity and price indexes in country i and country j in period t. These variables include HDI and its components. The detailed description of these variables is provided in the next section.
- c_{ij}: individual country-pair specific effect that may be fixed or random depending on model specification;
- ε_{ijt} : error term which satisfies the standard properties (i.e. is not correlated with explanatory variables and individual effects c_{ij} and is homoscedastic and not autocorrelated).

Our empirical specification includes an unobserved country-pair specific effect c_i which can be often correlated with explanatory variables. In this case the joint error term can be defined as: $v_{ijt} = c_{ij} + \varepsilon_{ijt}$. The country-pair specific effect may be fixed or random. Therefore, two estimation methods are used: fixed and random effects. The Hausman test is used to determine the proper estimation format.

The complete description of the dataset and data sources used in our study is provided in the next section.

DATA SOURCES AND DATA DESCRIPTION

In our study, we used bilateral trade exports of all CEE countries with each other, i.e. in our analysis as reporters and partners we treated all CEE countries. Our dependent variable is bilateral exports from reporter to partner countries. Export data is expressed in current US dollars for exports (*gross*

[1] Among the post-soviet countries that were the soviet republics under the USRR trade ties might be stronger. Therefore, we expect a positive and statistically significant coefficient on this variable.

exports). Trade data comes from the WITS (*World Integrated Trade Solution*) database, complied jointly by the World Bank, WTO and UNCTAD.

The data on social and human development were obtained from the last edition of Human Development Indices (2010), prepared by United Nations Development Programme. Human development is a process in which people can develop their full potential and lead productive, creative lives in accord with their needs and interests. It is a broad concept with many dimensions. In our study, we use the hybrid Human Development Index (HDI) to measure the level of human development. The values of this index have been recently calculated for the period 1970–2009. This index is the original and best-known composite index of social development. Among the most important dimensions there are: healthy life, access to knowledge and a decent standard of living. The Human Development Report (HDR), introduced the HDI by combining indicators of income, education, and health into a single index. By ranking countries according to their HDI value, the HDR has helped to shift the debate away from GDP per capita as the only measure of development.

The HD index measures country's average achievement in attaining:

– A long and healthy life (as measured by life expectancy at birth).
– Access to knowledge (as measured by the education index composed of the adult literacy rate index and the combined gross enrolment ratio (GER) index in primary, secondary, and tertiary education).
– A decent standard of living (as measured by the GDP per capita expressed in purchasing power parity [PPP] US dollars).

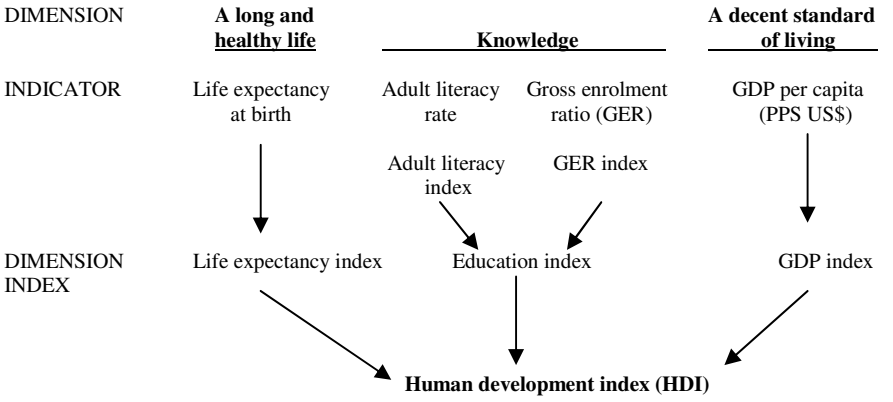
The construction of the HD index is shown in Graph 1.

These three dimensions are standardized to values between 0 and 1, and the arithmetic mean is taken to calculate HDI value in the range 0 to 1. The equal weights are not crucial for the level of indices. The application of other weights (e.g. 0.25; 0.25 and 0.5) does not change significantly the ranking of countries, according to HDI indices[2]. The HDI components used in our study include:

– GDP_pc – GDP per capita measured in current US dollars;
– Literacy – adult literacy rate, percentage of population aged 15 and above;
– Life expectancy – expected number of years at birth, expressed in terms of relevant indices ranging from 0 to 1.

[2] Human Development Indices (2010).

Graph 1. Construction of Human Development Index



Source: Human Development Report (2009, p. X).

Other explanatory variables are defined as follows:

– GDP - measure of the economic size of countries; measured in current US dollars (WDI);
– Distance - geographic distance between principle cities measured in kilometres, proxy for trade costs (CEPII);

Macroeconomic data were obtained from the World Development Indicators (WDI) 2011 database published online by the World Bank in Washington at www.worldbank.org. Data on distance comes from the CEPII (*Centre d'Etudes Prospectives et d'Informations Internationales*) database. Geographic distance was measured using the *great circle formula*[3].

ESTIMATION RESULTS

In Table 1, we present two sets of estimation results. First, in columns (1)-(2) we discuss the general results obtained using the HDI index for the period of 1970-2009. In columns (3)-(4) we present the estimation results for the particular components of HDI including the GDP per capita index, the life expectancy index and the education index. Then, in columns (5)-(6) we show estimation results with decomposition of the education index into the literacy index and the gross enrolment ratio (GER) index.

[3] The great circle formula which uses longitudes and latitudes of the most important cities. See Head and Mayer (2002) for more details.

Our specification of the estimating equation includes the extended set of gravity variables: GDP, distance, and land per capita approximating the factor proportions in the trading countries. Moreover, we include trade policy variables such as membership in the OECD, EU, GATT-WTO and the Europe Agreements between CEE countries that joined EU in 2004 and those that joined in 2007.

Table 1. Estimation results

(t and z-stats in parentheses)

Variable	1 FE	2 RE	3 FE	4 RE	5 FE	6 RE
lrep_GDP	0.194*	1.112***	0.250**	1.056***	0.168	1.079***
	(1.89)	(20.90)	(2.40)	(19.54)	(1.60)	(19.85)
lpart_GDP	0.560***	0.890***	0.515***	0.874***	0.597***	0.894***
	(6.15)	(17.80)	(5.62)	(17.59)	(6.33)	(17.88)
lrep_Land	0.189	0.482***	0.248*	0.334***	0.202	0.340***
	(1.49)	(5.99)	(1.91)	(3.92)	(1.56)	(3.98)
lpart_Land	-0.127	1.166**	-0.180	0.159*	-0.117	0.185**
	(0.97)	(2.09)	(1.36)	(1.90)	(0.89)	(2.20)
oecd	0.289**	0.201	0.273*	0.284**	0.162	0.237*
	(1.98)	(1.39)	(1.87)	(1.97)	(1.11)	(1.64)
eu	0.524***	0.618***	0.397***	0.524***	0.289***	0.468***
	(8.51)	(9.89)	(5.84)	(7.76)	(4.23)	(6.87)
gatt_wto	0.118***	0.145***	0.099**	0.162***	0.155***	0.209***
	(2.66)	(3.30)	(2.21)	(3.67)	(3.41)	(4.65)
post_soviet		1.861***		1.407***		1.487***
		(12.48)		(9.01)		(9.46)
ldist		-1.340***		-1.523***		-1.505***
		(13.09)		(14.96)		(14.71)
Europe_Agreement_EU	0.052	-0.014	0.029	-0.005	0.064	-0.006
	(0.43)	(0.11)	(0.24)	(0.04)	(0.53)	(0.05)
EU_Europe_Agreement	0.214*	0.177	0.201*	0.152	0.124	0.120
	(1.77)	(1.44)	(1.66)	(1.24)	(1.04)	(0.98)
contig		0.541**		0.330		0.342
		(2.45)		(1.54)		(1.59)
rep_land_locked		0.216*		0.273**		0.238*
		(1.74)		(2.26)		(1.95)
part_land_locked		0.130		0.154		0.172
		(1.02)		(1.25)		(1.39)
rep_hdi	3.303***	-0.820				
	(2.75)	(1.11)				
part_hdi	1.796*	-2.364***				
	(1.69)	(3.58)				
Rep_GDP_pc_index			0.296	-0.179	-0.158	-0.318
			(0.60)	(0.52)	(0.32)	(0.92)

Table 1 continued

Variable	1 FE	2 RE	3 FE	4 RE	5 FE	6 RE
Part_GDP_pc_index			-0.269	-0.997***	-0.761*	-1.207***
			(0.66)	(3.31)	(1.82)	(3.95)
Rep_life_exp_index			-0.170	-5.048***	0.940	-5.093***
			(0.11)	(5.01)	(0.62)	(5.05)
Part_life_exp_index			4.435***	-2.435***	4.523***	-1.822**
			(3.71)	(2.70)	(3.81)	(2.00)
Rep_edu_index			3.641***	4.564***		
			(5.00)	(6.94)		
Part_edu_index			1.275**	0.785		
			(1.96)	(1.35)		
Rep_literacy_index					-34.15***	-15.28***
					(8.82)	(4.55)
Rep_GER_index					1.089***	2.157***
					(2.94)	(6.55)
Part_literacy_index					-0.875	-1.586**
					(1.14)	(2.32)
Part_GER_index					0.994***	0.845***
					(2.88)	(2.62)
Hausman test (chi2)		125.73		200.52		173.45
(p-value)		(0.000)		(0.000)		(0.000)
r2_w	0.415	0.408	0.418	0.406	0.426	0.411
r2_b	0.319	0.759	0.335	0.781	0.186	0.776
r2_o	0.357	0.742	0.358	0.753	0.233	0.748
No. of observations	6681	6681	6681	6681	6681	6681

- *** denotes statistical significance at the 1% level,- ** denotes statistical significance at the 5% level, - * denotes statistical significance at the 10% level.

Source: own estimation.

The benchmark estimation results for bilateral exports obtained using fixed effects are presented in column (1) in Table 1. In our results, the estimated parameters for *reporters* should be interpreted as accompanying characteristics of exporting countries, while the parameters for *partners* as accompanying characteristics of importing countries. Our estimation results reveal that in both in the case of partner and reporter countries the estimated parameters on HDI variables statistically significant, although at different levels of statistical significance, and both display expected positive signs.

The remaining gravity variables in most cases display the expected signs and are statistically significant. For example, the positive and statistically significant values of the estimated parameters on the GDP variables of both exporting and importing countries show that trade flows are bigger between larger countries. The negative values of parameters on land per capita variable in the reporting country, proxying for factor proportions, can be inter-

preted as factors increasing differences in factor composition between countries and hence decreasing the level of bilateral exports. However, the land per capita variables are not statistically significant. The positive values of the parameters on trade policy variables suggest that the membership in the EU, OECD and GATT-WTO, promotes trade. Moreover, the positive estimate on the EU Europe Agreement variable suggests that accession to the EU in 2004 promoted exports to Bulgaria and Romania.

In column (2) we verify the robustness of our results using random effects. However, the results are very different from those obtained using the fixed effects. In particular the estimates on the HDI variables display negative signs but only the estimate for the partner country is statistically significant. The Hausman test favors fixed effects as the proper estimation format.

In column (3) and (4) we disaggregate the HDI into its components. Our estimation results in column (3) obtained with the use of fixed effects reveal that the estimated parameter on the education index is positive and statistically significant for both countries, although at different levels of statistical significance. Thus, the higher level of education in trading countries promotes both exports and imports. Moreover, the life expectancy index is positive and statistically significant only for the reporting country.

In column (4) we verify the robustness of our results with the use of random effects. However, the results are again different from those obtained using the fixed effects. In particular, the estimate on the life expectancy index displays negative signs and is statistically significant. The Hausman test favours fixed effects as the proper estimation format.

In columns (5) and (6) we disaggregate the education index into its components: the GER and literacy indexes. The results obtained via the fixed effects are shown in column (5). The estimated parameter on the Gross Enrolment Ratio variable is positive and statistically significant for both partner and reporter countries. However, the literacy index for the reporter displays an unexpected negative sign. This may be due to the fact that this index is simply a binary variable – literate or illiterate, with no gradations which may not capture properly education achievements. Similar to the previous specifications, the Hausman test favours fixed effects as the proper estimation format.

CONCLUSIONS

In this paper we have studied the role of social development in international trade using the generalized gravity model. Our empirical results show there is a positive relationship between our most general measure of social development (HDI) and the level of exports for the reporting and partner coun-

tries. The disaggregation of HDI into its constituent components yields, reveals that these results are mostly driven by the education indexes for both trading countries, which confirms our research hypothesis regarding the positive relationship between skills and exporting.

Further disaggregation of the education index demonstrates that this result is due to the positive correlation between the GER indexes and trade. However, the puzzling result is related to the negative correlation between the literacy rate index and the volume of exports. To explain this puzzling result further studies are needed. In particular, it can be argued that the literacy rate used in the education index is an insufficient measure for getting a complete picture of knowledge achievements due to the fact that it is simply a binary variable. Therefore, in the future studies it would be better to use other measures of schooling achievements such as average years of schooling and expected years of schooling.

LITERATURE

Anderson J. (1979), *A Theoretical Foundation for the Gravity Equation*, "The American Economic Review", Vol. 69, No. 1.

Anderson J.E., van Wincoop E. (2003), *Gravity with Gravitas: A Solution to the Border Puzzle*, "The American Economic Review", Vol. 93, No. 1.

Anderson J.E., van Wincoop E. (2004), *Trade Costs*, "Journal of Economic Literature", Vol. 42, No. 3.

Barro R.J., Lee J.W. (2000), *International Data on Educational Attainment: Updates and Implications,* CID Working Paper No. 42, Harvard University.

Bergstrand J.H. (1989), *The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade*, "The Review of Economics and Statistics", 71(1).

Bergstrand J.H. (1990), *The Heckscher-Ohlin-Samuelson Model, The Linder Hypothesis and the Determinants of Bilateral Intra-Industry Trade, "*The Economic Journal" 100 (403).

Granger C.W.J. (1969), *Investigating causal relations by econometric models and cross-spectral methods*, "Econometrica", 37 (3).

Grossfeld, I., Senik C. (2010), *The emerging aversion to inequality. Evidence from subjective data*, "Economics of Transition", 18(1).

Human Development Indices (2008), A statistical update 2008, UNDP.

Lutz W.A., Goujon S.K.C., Sanderson W. (2007), *Reconstruction of population by age, sex and level of educational attainment of 120 countries for 1970–2000*, Vienna Yearbook of Population Research.

Markusen J.R. (1986), *Explaining the Volume of Trade: An Eclectic Approach*, "American Economic Review", 76(5).

Melitz M.J. (2003), *The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity*, "Econometrica", 71(6).

Ranis G., Stewart F.(2005), *Dynamic Links between the Economy and Human Development*, DESA Working Paper No. 8 ST/ESA/2005/DWP/8.

Ranis G., Stewart f., Ramirez A. (2000), *Economic Growth and Human Development*, "World Development", 28(2).

Sen A.K. (1976), *Real National Income*, "Review of Economic Studies", Vol. 43, No. 1.