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THE GRAVITY MODEL AND THE CLASSIFICATION OF COUNTRIES

We discuss the gravity equation based on Helpman's theorem (1987) using the approach of Debaere (2005). Unlike Debaere, we do not constrain our analysis to the split into OECD and non-OECD, but we propose an alternative division. We argue that the division of countries into OECD and non-OECD is not an appropriate representation of – respectively – developed and less developed countries. Instead, we propose the division of non-OECD countries into two groups: the first one consisting of non-OECD countries fulfilling membership criteria and the second one, not fulfilling these criteria. In our setting, the less developed countries are collected only in the last group, whereas OECD and non-OECD countries fulfilling membership criteria are the developed ones.

We analyze trade between pairs of countries and aggregate the results to illustrate trade between the three above mentioned groups of countries in the period of 28 years (1977-2005). We show that the Helpman's theorem designed to explain trade among developed countries still does not find support among less developed ones unless the last group is properly extracted.

Keywords: International trade, gravity model

JEL classification: F15

1. INTRODUCTION

In the simplest form of the gravity equation originating in Helpman (1987), it is expected that bilateral trade between two countries is directly proportional to the product of the countries' GDPs. The further expectation is that bigger and more similar countries tend to trade more intensively with each other than smaller and differentiated ones. The gravity model with its more sophisticated versions[1] has been for years "the workhorse for empirical studies" in international economics (Eichengreen, Irwin 1997).

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[1] The simplest form of the gravity model can be seen as a general equilibrium trade model explaining the typical (normal) level of trade between countries. It can be supplemented with dummy variables introduced into the gravity equation to account for deviations from the normal situation (and therefore from the typical level of trade) that are difficult to be measured quantitatively (e.g. the impact of common language or border, participation in a preferential trade agreement).

Below we examine whether Helpman's theorem (1987) is still valid only for developed countries, as it was originally meant, or it can be applied (at least to some extent) to less developed ones[2]. We argue, that some surprising results indicating growing intensity of trade between less developed countries (for non-OECD countries see e.g. Hummels and Levinsohn 1995) are (at least partly) the consequence of improper extracting of developed and less developed countries. Particularly, the most favored division of countries into OECD and non-OECD is not a proper approximation of a division into developed and less developed ones. We propose an alternative. We divide the non-OECD countries into two groups: the first consists of non-OECD countries fulfilling membership criteria and the second includes the countries not fulfilling these criteria. We argue that the less developed countries are collected only in the last group, whereas the first one consists of the developed ones.

In our analysis we cover all countries in the world. We analyze trade between pairs of countries and aggregate the results to illustrate trade among three groups: OECD-members, non-OECD countries fulfilling membership criteria and other non-OECD countries.

In the remainder of the paper we proceed as follows: in section 2 we present rationale for our countries' classification, in section 3 we shortly describe the theoretical background of our analysis, in section 4 we discuss the results of our empirical findings, and section 5 consists of conclusions.

2. OECD IN TERRITORIAL DIVISION OF THE WORLD

Territorial division of the world is subject to evolutionary changes. Geographical extension and composition of territorial units is affected by many factors, including social, cultural and economic ones. Of fundamental importance are those, which constitute a state security through participation in setting up the international security community. Political boundaries are artificial, as they do not constitute an integral part of the physical world map. A territory may be perceived as a unit, or as a multiplicity of interdependent territories indistinctly divided by natural elements.

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[2] We divide countries into developed and less developed ones not in line with the established split into developed and developing countries originating from the World Bank. Even ignoring the precise definition from the World Bank we find our intuitive split best fitting with analytical purpose of this paper.

From the point of view of economics, the world coherency is still visible, though geophysical criteria of a territory differentiation are not as important as they used to be. Historically, the criteria of marking the second level in a ternary division into: I. states, II. continents and III. the globe, have been determined by geographical closeness, creating interdependency on one side, and natural obstacles preventing contacts, on the other. Geographical discoveries and resulting from them transcontinental empires tightened intra-imperial ties, even those trans-continental, making them stronger than ties among one continent countries. In the 18th century Spain of Charles II, economic, social and cultural distance from Spain to its American possessions was shorter than from the remoteness of Catholic Spain from Protestant England.

Simultaneously, starting with the 17th century, alongside establishing a modern international community, states regard international law norms as one of the tools of implementing their national interests corresponding to the adopted values. Making international law norms, states agree to restrict their liberties considering the norms to be a protective umbrella and an instrument to engage other states in cooperation towards non-antagonistic targets. What has been a novelty of currently entered agreements is the increasing complexity of regulated matters. Agreements not only specify the trade terms but also provide space for common political, social and economic interests and generally, constitute international organisations institutionalising cooperation at the very moment of being established. Participation in international organizations and agreements creates a new form of closeness of states.

Numerous criteria allow to isolate as level II territories in the above mentioned ternary division such communities as: EU/EC, OECD, NAFTA and NATO. Undoubtedly, not only political, social, cultural and economic distances from Warsaw to Minsk are bigger than those to Lisbon or Washington. Distance in kilometres from Seoul to Phenian is misleading to anyone who knows the world not only from looking at the globe.

Within the *Organization for Economic Co-operation and Development* (OECD), as in other above mentioned groups of states, cooperation is a function of communication and mutual opening of autonomous sub-systems within a pluralistic one (Deutsch 1964, p. 58). Below it is shown that fundamental OECD principles allow to divide the world states into those meeting the criteria of the organization membership and those who do not fulfil them, considering this division as an approximated split into more and less developed states. This division takes into account not only economic but also non-economic criteria.

OECD[3] is a transcontinental space, in the geophysical sense, being at the same time economically, legally and politically homogeneous. From its very beginning it made a cornerstone of peaceful order construction and economic and social prosperity of Western European countries, being the European component of the western hemisphere. Not only an open market economy, the relatively high level of development and OECD legal instruments implementation but also pluralistic democracy and human rights respect are *sine qua non* conditions of its membership.

OECD analysed by its aspiration and ability to broaden its membership, is characterized by weighty time caesurae. The first stage of the Organization construction was the period 1961-69, although it was formally established in 1961. Its members were: Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. This stage extension till 1969 was caused by politically conditioned Italian (1962), Japanese (1964) and Finnish (1969) accessions.

The second stage – 1971-73 – was marked by small enlargement with Australia (in 1971) and New Zealand (1973) who became joiners confirming their uninterrupted presence in transatlantic area and choosing to directly participate in the Organization' further developments.

The third stage falls on mid 90s of the 20th century. Under the US political pressure, a long prevented OECD opening towards new members took place. Through the OECD threshold open passed Mexico (in 1994) and South Korea (in 1996). Their long lasting will and readiness had previously encountered a barrier of OECD institutional and functional inability to adopt new members.

The Organization also expanded and repelled the Soviet zone of influence space. Former member states of the COMECON joined the Organization: the Czech Republic (in 1995), Hungary and Poland (1996) and Slovakia (in 2000). The accession was intentionally designed by its American originator as a reiteration of the way of both victorious and defeated states of western hemisphere towards "security community" full membership. OECD

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[3] OECD was transformed from OEEC (*Organization for European Economic Co-operation*) established in Paris on April 16, 1948. OEEC was a frame for the *European Recovery Program* (ERP) transferring resources to facilitate recovery and reconstruction of European economies and their co-operation with the USA. OECD was founded by the agreement from 14 December 1960 (it started its activity on September 30, 1961).

accession has to be, and in fact has been, the beginning of the "Royal Road" of the new members towards European (EU) and transatlantic (NATO) institutions. Still, public opinion and politicians in transforming states interest in participation in western hemisphere institutions has focused on NATO and EU/EC accession, while other organizations and institutions membership was considered merely as an instrument towards the final aim of target institution membership and thus underestimated. That was the case of OECD as well as Council of Europe membership. Participation in both organizations has been indicated as a precondition of aspiring to NATO and EU/EC membership. This perception of OECD role and place resulted in the organization failing to play an autonomous role in constructing the strategy of Central European foreign policy. The Organization has been underestimated, not to say debased, which was inadequate not only to its historic achievements, its current place in international relations, but also to the membership balance of the "Wysehrad Group" and the benefits derived from it.

The OECD delimits with outer boundaries the coherent space, determined by important institutional, legal and economic factors, significantly different from the external space. Currently, OECD members are thirty states joined by common acceptance of democratic rules and open market economy. Still, many countries formally meeting the membership criteria stay outside the Organization. Even EU members (meeting institutional, legal and political terms underlying the OECD) such as Bulgaria, Cyprus, Estonia, Lithuania, Latvia, Malta, Romania and Slovenia have not acceded to the OECD. Additionally, the Organization maintains close relations with over 70 countries from all continents. All those states are member candidates and for institutional and political reasons stay outside the Organization[4].

Those non–OECD countries meeting the formal accession criteria and not able to join because of the Organization inability to expand, should be in parallel to the OECD member states, treated as a separate group. As this group is more like the OECD countries than the ones not sharing OECD fundamental principles and not meeting the economic criteria underlying the accession, it is a mistake to group them among the ones not sharing OECD principles, instead of the group consisting also of OECD members.

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[4] In May 2007, OECD decided to open for potential accession of Chile, Estonia, Israel, Slovenia and Russia, as well as to intensify cooperation oriented towards the future accession of Brazil, China, India, Indonesia and South Africa.

3. THEORETICAL BACKGROUND

In the simplest form of the gravity equation, it is expected that bilateral trade between two countries is directly proportional to the product of the countries' GDPs. The further expectation is that bigger and more similar countries tend to trade more intensively with each other than smaller and differentiated ones.

We test Helpman's theorem using multicountry framework in which: i, $j = 1,....,C$ denote trading countries, $k = 1,..., N$ denotes products, y_k^i denotes country i's value of production of good k.

In our framework, the GDP of country i is a sum of values of production of all goods k ($k = 1,..., N$) manufactured in the analyzed country i ($i = 1, ..., C$):

$$Y^i = \sum_{k=1}^{N} y_k^i \tag{1}$$

Consequently, the global GDP (Y^w) is the sum of GDPs of all trading countries:

$$Y^W = \sum_{i=1}^{C} Y^i \tag{2}$$

Further, we denote a share of country's i GDP in a global GDP as s^i:

$$s^i = Y^i \big/ Y^w \tag{3}$$

If trade is balanced in every country, then s^i denoting the share of country's i GDP in the global GDP influences the intensity of bilateral trade between i and j. As we measure each country's import as a fraction of its GDP, then with balanced trade it is equal to its partner's export[5]. Therefore, export of product k from country i to country j equals to:

$$X_k^{ij} = s^j y_k^i \tag{4}$$

X_k^{ij} in equation (4) depends on s^j because export from i to j is equal to j's import from i, and the latter one depends on GDP of country j.

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[5] We analyze export of all countries, avoiding therefore disturbances resulting from the non-zero costs of international trade (e.g. tariffs and transport or insurance costs).

Summing up the values of export of all products k manufactured in country i we get i's total export to j. By assumption of balanced trade it is equal to i's import from j and therefore to j's export to i. We write this equation using equations (1) – (4) as:

$$X^{ij} = \sum_{k=1}^{N} X_k^{ij} = s^j \sum_{k=1}^{N} y_k^i = s^j Y^i = \frac{Y^j Y^i}{Y^w} = s^j s^i Y^w = X^{ji}. \qquad (5)$$

Summing up the first and the last elements of the equation (5) we get the total trade of the analyzed pair of countries, defined as a sum of their exports (equal to the partner's import):

$$X^{ij} + X^{ji} = \left(\frac{2}{Y^w}\right) Y^i Y^j \qquad (6)$$

Formula (6) is the simplest derivation of the gravity equation. It shows that the intensity of bilateral trade depends on the product of GDPs of both trading countries.

The re-formulation of equation (6) with the use of the formula (5) confirms that the size of the country and the difference between the trading partners matter:

$$X^{ij} + X^{ji} = 2 s^i s^j Y^w \qquad (7)$$

A variable representing the size of a country is a share of its GDP in the world's GDP. Different values of these shares by trading partners express the differences in their sizes. According to the gravity approach, two countries of unequal sizes will not trade as intensively as two countries of similar sizes would do[6].

The extension of the gravity model we use, goes into evaluation of a role of the member countries in an economic region (a group of countries) and evaluation of economic position of a region in the global economy. In the simplest setting we have two countries (i, j) constituting a region A. GDP of A is therefore equal to:

$$Y^A = Y^i + Y^j \qquad (8)$$

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[6] E.g. if sizes of both countries are $s_i = 0.1$ and $s_j = 0.3$, then their sizes influence bilateral trade with coefficient 0.064. If they were equal in size and would have exactly the same joint share in the world's GDP as in the previous example $s_i = s_j = 0.2$, then the respective coefficient would be bigger than before (0,08).

We define the relative shares of GDPs of every country in the regional GDP and the GDP of A relative to the global GDP as, respectively:

$$s^{iA} = \frac{Y^i}{Y^A} \qquad s^A = \frac{Y^A}{Y^w}$$

Volume of A's trade relative to A's GDP depends on the position of every member country in the region and on the relative importance of the region's GDP in the world's one:

$$(X^{ij} + X^{ji})/Y^A = 2s^{iA}s^{jA}s^A \qquad (9)$$

where:

$$s^{iA} + s^{jA} = 1$$

because region A consists of just two countries.

Reformulating the right hand side of the equation (9) we get:

$$2s^{iA}s^{jA} = 1 - (s^{iA})^2 - (s^{jA})^2 \qquad (10)$$

Equation (10) presents a simple version of Helpman's theorem formulated under the assumptions about full specialization of both trading countries in their outputs, identical and homothetic tastes of consumers in both countries and worldwide free trade. The volume of trade relative to GDP is proportional to the dispersion index defined for the region A as:

$$disp = 1 - \sum_{i \in A} (s^{iA})^2 \qquad (11)$$

The relation presented in equation (11) is visualized in formula (12), which is a further reformulation of equations (9) and (10). In equation (12) volume of export from region A relative to A's GDP depends on the share of A's GDP in global GDP (s^A) and on the size dispersion index of A's members:

$$\frac{X^A}{Y^A} = s^A (1 - \sum_{i \in A} (s^{iA})^2) \qquad (12)$$

where N – number of countries in the region A (in our setting $N = 2$).

The size dispersion index in brackets in equation (12) is maximized for countries of the same relative size (for a region consisting of two identical

countries this index is equal to 0.5; in case of big dispersion the index is near to 0).

Equation (12) shows that the volume of trade in the region is also related to the relative size of countries constituting the analyzed region. It is expected that with increasing similarity of trading partners, their bilateral trade will intensify. Helpman (1987) confirmed his theorem for OECD countries. Hummels and Levinsohn (1995) first selected for their test not only OECD, but also non-OECD countries meant as representation of less developed countries for which one can expect low trade. They confirmed Helpman's findings for trade among OECD countries as well as for trade among non-OECD countries. Their result was revisited by Debaere (2005) who transformed Helpman's equation (6) using the linear form of the equation (12):

$$A = \{i, j\}$$

$$\ln\left(\frac{X^{ij} + X^{ji}}{Y^i + Y^j}\right) = \ln(s^i + s^j) + \ln\left[1 - \left(\frac{Y^i}{Y^i + Y^j}\right)^2 - \left(\frac{Y^j}{Y^i + Y^j}\right)^2\right] \quad (13)$$

By use of different econometric techniques and different measures of GDP, Debaere found that for OECD countries the value of similarity index is significant and positive. As in the work of Helpman (1987) and Hummel and Levinsohn (1995) this coefficient was statistically different from its theoretical value of 1. In Debaere (2005) it varied from 0.25 to 1.57 depending on the econometric technique. In contradiction to Hummel and Levinsohn, Debaere proved that the index of similarity does not play a significant role in trade of non-OECD countries.

We extend the work of Debaere testing his equation for differently constructed groups of countries. Building on our reflections about OECD and non-OECD countries in the previous section, we divide non-OECD countries into two groups. The first one consists of countries fulfilling OECD membership criteria. In the second one, non-OECD countries not fulfilling these criteria are gathered.

For the extraction of the last group, we consider three main criteria of OECD membership:

1. democracy and respecting human rights,
2. open market economy,
3. GDP *per capita* measured in PPP at least as high as in the poorest OECD member.

We treat membership in transatlantic institutions as a sufficient condition of fulfilling criterion 1. However, because we want to cover with our analysis a relatively long period, we supplemented it with the data published by the *Freedom House*. We have chosen this source of data because of the credibility of this institution and the availability of the required data for a relatively long period.

The *Freedom House* presents a division of the world into free, partly free and not-free countries. As we were confused about the real meaning of "free" and "partly free" countries, we describe "democracy" in two ways and made two separate tests for the countries fulfilling OECD – membership criteria. First, we take as democratic only the countries treated by the *Freedom House* as free, then we add to this group also partly free countries.

The second criterion is open market economy in an analyzed country. We treat membership in WTO (and GATT, its predecessor) as a sufficient condition for fulfilling this criterion[7].

The third criterion is the high level of development approximated by GDP *per capita* not lower than respective GDP of the poorest OECD member in the year of reference. In this context we consider GDP *per capita* in PPP as best fitting with an idea of measurement of real development.

4. EMPIRICAL RESEARCH

We test Helpman's prediction for pairs of countries extending Debaere's analysis on the third group of countries (non-OECD countries fulfilling membership criteria). In our estimations we base on equation:

$$\ln\left(\frac{X_t^{ij} + X_t^{ji}}{Y_t^i + Y_t^j}\right) = \alpha_{ij} + \gamma \ln(s_t^i + s_t^j) + \beta \ln\left[1 - dispersion_t^{ij}\right] \qquad (14)$$

which is a reformulated version of Debaere's equation (13).

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[7] We are aware of the fact that GATT membership was not fully comparable with open market economies. Especially, developing countries were (at least in some periods) allowed to access without need to fulfill strong conditions. Giving up market economy as *sine qua non* condition of GATT participation by central planning economies has always been criticized (see Curzon 1969, p. 225). Political arguments, however, prevailed. Political choice: support of economic development has also been shaping GATT policy towards developing countries (see Zamora 1997, p. 240-243) and Mingst, Karns, 2000, p. 119-141).

In formula (14) α_{ij} represents fixed effects and can account for bilateral transportation costs, language barriers, cultural barriers, tariffs or distances. Similarity index $\left[1 - dispersion_t^{ij}\right]$ represents the impact of changes in dispersion of countries on bilateral trade (related to their GDPs). The size index $(s_t^i + s_t^j)$ represents the impact of changes in countries' shares in the world GDP on the intensity of trade. This index varies over time. As we estimate the impact of changing GDP shares on trade in the period of 28 years these changes can be significant. For this reason we take them into consideration in our analysis.

The literature does not deliver any standard measure of GDP used to test the gravity model. We use only current GDP in USD. We argue that because exports are reported in current prices, this is the most appropriate measure for the share of trade in GDP. We use this measure also for the sake of simplicity.

We conducted the research using the data from *Comtrade* database for trade and *WDI* dataset for GDP. We used the panel data techniques of estimation using STATA. In all cases a fixed effects model specification is preferred to a random effects model based on the Hausman test.

We analyzed trade between pairs of countries and aggregated the results to illustrate trade among two groups of countries: OECD members plus non-OECD countries fulfilling membership criteria and non-OECD countries not fulfilling those criteria.

We took into account three OECD membership criteria discussed above: democracy, WTO/GATT membership, GDP *per capita* measured in PPP at least as high as in the poorest OECD member. We run the regression first for the OECD and countries fulfilling its membership criteria with democratic classified as free countries (in classification of the *Freedom House*). Both groups of countries are the developed ones in our interpretation. Than we add to the group of the developed countries also the "partly free" countries. In the second test we got a larger group of the developed countries and – respectively – a smaller group of the less developed ones. In our setting, "less developed" are only countries not fulfilling the OECD membership criteria.

In table 1 we present the results for bilateral trade of these groups of countries. The results are organized as follows. In column (1) we present aggregated results for bilateral trade among developed countries defined in the first way (democratic are not only the OECD members, but all countries classified by the *Freedom House* as free). In column (2) we present the aggregated results for bilateral trade among the developed countries defined in the second way (democratic are not only countries named in column (1) but also countries classified by the *Freedom House* as partly free).

Consequently, the group of the developed countries is bigger in column (2) than in (1) which results in a bigger number of observations in the empirical test shown in column (2). In column (3) we present trade among the developed (first definition; democratic are "free" countries) and the less developed countries. Column (4) is similar to (3), though as "developed" we take the OECD and the non-OECD countries fulfilling membership criteria defined in the second way (democratic are free and partly free countries). In column (5) we show trade among the countries not fulfilling OECD membership criteria with democracy defined in the first way ("partly free" countries do not fulfil the membership criteria). Finally, column (6) contains the results of trade among the countries not fulfilling OECD membership criteria with democracy defined in the second way (democratic countries are "free" as well as "partly free" countries). In columns (5) and (6) we analyse trade among the less developed countries.

Table 1

Estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
lns	0.238	0.336	0.431	0.356	-0.054	-0.173
	(7.51)**	(11.83)**	(19.07)**	(15.73)**	(1.77)	(4.81)**
lnsim	0.967	1.010	0.916	0.872	0.229	0.081
	(41.55)**	(46.56)**	(63.52)**	(57.72)**	(8.28)**	(2.43)*
Constant	8.987	9.317	9.000	8.507	4.924	3.890
	(57.43)**	(65.67)**	(74.38)**	(68.02)**	(24.32)**	(15.74)**
Observations	16619	22929	54239	55470	31077	23536
Number of group (k1 k2)	1445	1843	5363	5684	4148	3478
R-squared	0.36	0.35	0.36	0.32	0.11	0.02

Absolute value of *t* statistics in parentheses

* significant at 5%; ** significant at 1%

We got surprisingly high β coefficients in columns (3) and (4) containing results of bilateral trade between developed and less developed partners, though significantly lower than we got in trade of the developed ones. Also here, adding the partly free countries to the developed ones, confirms that this is the best match (β coefficient in column (4) is significantly lower than in column (3) which better fits the theoretical considerations about trade among partners with different level of development). Relatively high values of β coefficients in trade of differently developed countries can be explained by intensification of production fragmentation and consequently growing trade in intermediate goods. International trade liberalization (especially under

WTO/GATT auspices) results also in intensification of North–South type of international trade. Results in columns (5) and (6) also support Helpman's theorem as we got very low values of β for trade among the less developed countries. Repeatedly, the second way of defining democracy proves to fit better with the idea of less developed countries as opposite to the developed ones.

As far as the size of a country is concerned, we got results compatible both with the theoretical predictions and common sense. For the developed countries and countries with a different level of development, the trading country size is positively correlated with the intensity of bilateral trade (see *lns* in columns (1)–(4)). The opposite we note in the case of the less developed countries. Their size is negatively correlated with the volume of bilateral trade (negative *lns* in columns (5) and (6); however in column (5) we got statistically insignificant result). This means that in the case of two poor and underdeveloped countries, changes in their size (measured by current GDP) negatively affect potential trade (even if these countries grow, it does not mean they trade more intensively; even more than that: the opposite is true).

We obtained relatively big constant effects (α_{ij}). We suppose that it can be the evidence of the influence of decrease in prices (especially manufacturing) on intensity of trade. It can also be effect of trade liberalization (especially international). An additional factor is the decrease in transaction costs of trade (technological progress makes transport and communication costs lower).

We additionally proved our thesis about division of the world into OECD and non-OECD countries as unsuitable proxy for extracting the developed and the less developed countries testing the equation (14) for OECD and non-OECD countries. Results are reported in the table 2.

Table 2

Results of estimation for OECD and non-OECD countries

	(1)	(2)	(3)
lns	0.154	0.485	-0.013
	(4.33)**	(21.31)**	-0.48
lnsim	0.955	0.963	0.383
	(28.57)**	(77.14)**	(15.51)**
Constant	9.368	9.501	5.29
	(61.91)**	(85.51)**	(29.38)**
Observations	8268	51215	42452
Number of group(k1 k2)	434	3825	4915
R-squared	0.25	0.45	0.12

Absolute value of *t* statistics in parentheses
* significant at 5%, ** significant at 1%

In column (1) of the table 2 we present aggregate results for pairs of OECD – countries, whereas column (2) contains results for one OECD and one non-OECD partners. In column (3) we have bilateral trade of two non-OECD countries. In all cases we got results less fitting the theory. Especially, β coefficient for developed countries (*lnsim* in column (1)) is lower than for developed and less developed partners (*lnsim* in the column (2)). In this case we got confirmation of Helpman's theorem not only for trade between developed countries but even more for unevenly developed countries. At the same time both coefficients are lower than respective coefficients in table 1. The lowest β coefficient we got as expected for trade between less developed countries (it is significantly higher than in table 1). These results confirm our opinion that OECD is not an appropriate proxy for developed countries because it leaves aside many countries fulfilling membership criteria and not accepted by the OECD because of political and institutional reasons. The traditional division of countries makes both groups of countries more similar than the developed and less developed countries are in reality.

As testing gravity proposition economists concentrate usually on economic criteria, we were also interested in the importance of all three OECD membership criteria and we took them into account as a base for our research. However, we additionally checked equation (14) only for the one economic criterion (criterion 3: GDP per capita not less than in the poorest OECD member). This should confirm whether the economists are right taking into account only the level of economic development. It could also show how far the non-economic criteria are important. The results are presented in table 3 (columns as (2), (4) and (6) in table 1).

Table 3

Estimation results for economic criterion 3

	(1)	(2)	(3)
lns	0.608	0.254	-0.344
	(26.66)**	(10.50)**	(6.64)**
lnsim	1.010	0.780	-0.183
	(57.77)**	(47.70)**	(3.44)**
Constant	10.458	7.669	2.073
	(88.70)**	(54.75)**	(5.62)**
Observations	37699	51340	12896
Number of group(k1 k2)	3010	5507	2131
R-squared	0.44	0.05	0.00

Absolute value of *t* statistics in parentheses

* significant at 5 %; ** significant at 1 %

Having compared results in tables 1–3, we can see that constraining analysis to the economic criterion even better fits the empirical findings with the theory than in table 1. Though β is exactly the same for the developed countries in both tables (column (1) in table 1 and column (2) in table 3), it differs significantly for the less developed countries. Especially, in table 1 it is a small positive number proving expectation for possibility of some intensification of trade between them, whereas in table 3 it is a negative number which fits better with the theory (similarity of two poor and underdeveloped countries negatively affects their trade potential).

In this analysis, constraining the research to criterion 3 would not worsen the obtained result. However, we are aware that this result cannot be generalized. Human rights and democracy criteria softness should not induce to give them up in economic analysis. Undoubtedly, a system of social values represented by states-societies influences economic results. Thus, „God bless the righteous" (see Hampden-Turner, Trompenaars 1993). But on the other hand, even the best proven market economy instruments become their own parodies in states-societies with systems of values not derived from human rights and democracy foundations. To conclude, undoubtedly, the correlation between politics and economy is not accidental (Stiglitz 2006, p. 254) and crucial for economy (ethics and law interdependence idea verification Russia case study see Stiglitz 2004, p. 127–163).

5. CONCLUSIONS

We got full confirmation of Helpman's theorem for developed countries. However, in almost all analyzed cases we can confirm the increasing similarity of trading partners (positive *lnsim*). Therefore we can expect trade expansion. This result is surprising for trade between developed countries and less developed ones. Of course, our research proves that the developed countries become much more similar than other groups of partners and therefore they are expected to trade more intensively than any other pairs of countries do.

In our opinion, the increasing similarity even of very different countries can be the result, among others, of intensified cooperation in production between countries. It may change the characteristics and reasons for trade with growing intensity of trade in semi products. Our division of countries into two groups: OECD together with non-OECD countries fulfilling membership criteria and non-OECD countries not fulfilling membership criteria turned out to be better than the simple division into OECD and non-

OECD countries. From our research we can conclude that the criterion of democracy with the free and partly free countries best fits with the theory of international trade.

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