Tinatin Akhvlediani*

Katarzyna Śledziewska**

Bartosz Witkowski***

*, **University of Warsaw, Faculty of Economic Sciences & Digital Economy Lab
t.akhvlediani@delab.uw.edu.pl
k.sledziewska@uw.edu.pl
***Warsaw School of Economics, College of Economic Analyses
bwitko@sgh.waw.pl

Implications of the European Integration: Revisiting The Hypothesis of Hub-and-Spokes Model

WORKING PAPER DELAB UW, NR 02 (1/2016) | styczeń 2016 | SMART ECONOMY & INNOVATION

http://delab.uw.edu.pl/

Digital Economy Lab | University of Warsaw

ABSTRACT

Already in 1994, Baldwin predicted the formation of the hub-and-spokes model to describe the outcomes of economic integration across the European Union (EU) implying marginalization of the new EU member states (NMS). We examine the validity of this hypothesis by putting an emphasis on Visegrad group of countries (The Visegrad four, V-4: Poland, the Czech Republic, Slovakia, Hungary) and investigate the impact of the European integration scheme on their export performances. To conduct the analysis, we estimate the augmented gravity model for the panel data of the exports of the EU members with the rest of the world consisting of 234 countries. We set the structural break in 2004 and employ pseudo Poisson maximum likelihood (PPML) estimator for panel data. Furthermore, we provide robustness checks with the use of PPML for the pooled sample. Estimation results do not favor the creation of the hub-and-spokes model, but rather demonstrate that integration within the EU was quite beneficial for V-4 without giving the origin neither to their peripherisation nor to the loss of markets of the natural trade partners.

TABLE OF CONTENT

1. INTRODUCTION

The cooperation within the Visegrad four postulated in the Visegrad Declaration dates back to 1991, preceding the closure of the Council for Mutual Economic Assistance and the withdrawal of Soviet troops from the region. Aiming the creation of the regional stability, the declaration emphasized the importance of internal changes, democratization and liberalization of the economies involved. The same year Czechoslovakia, Poland and Hungary signed Association Agreements (AA or Europe Agreements) establishing an association between them and the European Communities (EC). By AA agreements, both sides committed themselves in "the gradual introduction of a free trade area in a transitional period of a maximum of ten years". Finally the declaration and AA agreements were followed by creation of the Central European Free Trade Agreement (CEFTA) that was ratified by individual countries in 1994, being considered as an important step towards the integration of V-4 in the EU.

The EU enlargement scheme based on the AA agreements, inspired Richard Baldwin to postulate the hypothesis predicting the formation of the "hub-and-spokes" (Baldwin, 1994). Namely he stated that such bilateral agreements provided separate links between the EU and Central and Eastern European Countries (CEEC) without supporting intra CEEC economic integration that finally should form the hub-and-spokes model, the EU being the hub and CEEC being spokes. It is remarkable, that Baldwin discussed explicitly the case of V-4 since among other CEEC, this group of countries are mostly connected geographically to the Western Europe and to themselves. He suggested that to translate this physical geography into the favorable economic geography there would be the necessity of the trade liberalization not only between the hub and spokes but also among spokes. He referred to the economies of scale and the market access to explain that only the whole trade liberalization would locate the EU FDI in the most efficient ways and would avoid the concentration of firms production in the central market i.e. the EU.

One may reasonably state, that after the EU accession all CEEC would benefit of the free trade among all the other EU members including themselves and therefore the hub-and-spokes model would not impede their economic development. However, Baldwin stated that if the core EU countries had got a head-start due to the 5 or 10 years of hub-and-spoke bilateralism preceding the EU enlargement, then it would have been far more difficult for the NMS to catch up. So he argued that improper policies even being only temporarily might have very long-lived harmful consequences by emphasizing that even EU membership in ten years might not be enough to offset the initial head-start of core EU countries on CEEC. Additionally, Baldwin predicted the loss in trading between CEEC and the former Soviet republics. His intuition was that as these republics would start to develop they would raise barriers against the CEEC's exports which finally would result in harming CEEC exports in the long run due to the lost markets in these natural trading partner countries.

We aim to examine this early hypothesis of Baldwin (1994) predicting the formation of the "hub-and-spokes" model. We construct the augmented gravity model for the panel data of the exports of the EU members with the rest of the world (234 countries) in 1999-2014. To identify the main trade partners of V-4, our model controls for both: the impacts of Common Commercial Policy (CCP) and natural trade partners of V-4. While the former involves the adoption of the common external tariffs together with regional trade agreements (RTAs) of the EU, the latter controls for the former Soviet member states among trade partners. We set the structural break in 2004 and derive estimations by employing PPML for the panel data. Furthermore we provide robustness checks with the use of PPML for the pooled sample. Estimation results do not favor the creation of the hub-and-spokes model but rather demonstrate that integration within the EU was quite beneficial for all NMS including V-4 without giving the origin neither to their peripherisation nor to the loss of natural trade partners predicted by Baldwin (1994).

The rest of the paper is organized as follows: section 2 presents the literature review, section 3 specifies model and describes the data followed by estimation results in section 4 and finally the last section concludes the findings of the analysis.

2. LITERATURE REVIEW

The most popular methodology to study the impacts of international trade on economies of countries involved in the process of regional integration is the theoretical framework of the Gravity model (Soloaga and Winters 2001, Ghosh and Yamarik 2004, Carrere 2006, Silva and Tenreyro 2006, Baier and Bergstand 2009, Magee, 2008, Acharya et al. 2011). The model was introduced by the crucial work of Jan Tinbergen (1962) based on a law called the "gravity equation" by analogy with the Newtonian theory of gravitation reflecting the relationship between the size of economies, the amount of their trade and the distance between the trade partners, in the following form:

$$X_{ij=} GS_i M_j \, \emptyset_{ij},$$

where X_{ij} is the monetary value of exports from country i to country j, M_j controls for all importer-specific factors that make up the total importer's demand and S_i comprises exporter-specific factors that represent the total amount that the exporters are willing to

supply. G is the set of regressors, whose values are not specific for each i and j pair, such as the level of world liberalization. Finally, $\emptyset_{ij}$ represents the trade costs between i and j countries. The latter is mainly represented as the country-pair-specific information such as contiguity and distance, common language, ethnic groups or borders, common memberships in regional trade agreements and tariff rates between trade partners.

It is considerable, that based on the theoretical framework of gravity model, the literature shows quite opposite findings to Baldwin's predictions. Namely, studies demonstrate that surprisingly the EU accession has increased the intra Visegrad trade flows relatively more than the trade flows among the Visegrad and the other EU member states. In an attempt to explain this remarkable upward intra V-4 trade tendencies, the literature outlines the impacts of improved economic performances reflected in higher GDP growth rates, increased FDI inflows from the EU-15 and other advanced countries and the elimination of non-tariff barriers to trade.

Namely, Hunya and Richter (2011) analyze FDI flows to figure out the reasons for the increased intra trade between the four countries since the EU accession. Their statistical analysis indicates that while the overall FDI inflows have been playing a decisive role in the economic growth, both inward and outward bilateral FDI in most cases are negligible. Thus authors conclude that it is not bilateral FDI, but the FDI in general from the EU-15 and other advanced countries that boosted the intra Visegrad trade. Additionally, the paper indicates that the division of the period 2000-2007 into a pre-accession and a post-accession segment does not reveal outstanding changes in the composition of intra-V-4 trade by factor inputs since the integration process was started long before the official accession date in 2004.

The impact of improved economic performances on the enlarged trade flows is also outlined in the paper of Foster (2011). Namely, the author studies the gravity determinants in intra-Visegrad trade after these countries' accession to the EU. The analyses shows that this is higher GDP growth rates of V-4 after their EU accession coupled with an increased GDP growth differential relative to the EU 15, which yields the significant positive impact on the bilateral trade. Therefore, the author concludes that the EU accession is associated with the improved economic performances reflected in the increased GDP which in its turn causes the upward trend in bilateral trade flows between V-4 countries.

Additionally, Hornok (2010) highlights that the elimination of non-tariff barriers as a consequence of the EU accession might increase the trade flows among V-4 countries. More precisely, the author outlines elimination of the following non-tariff barriers: customs procedures, border waiting times, technical barriers to trade (TBT) through completion of harmonization, lower legal and information costs for exporters and reduced political risk. Moreover, the role of the government export promotion for all the Visegrad countries is analyzed by Janda, Michalíková and Psenakova (2013) and Janda (2014), who find significant positive impacts of export credit agencies (ECAs) on export performances of V-4. Furthermore,

Akhvlediani and Sledziewska (2015, 2016) find the positive and statistically significant impacts of Common Commercial Policy (CCP) of the EU on the V-4 exports and moreover reveal that together with EU trade partners, trading with post-Soviet countries is considerable even after the EU accession of V-4.

To conclude, the reviewed empirical studies demonstrate that unlike to the hypothesis of Baldwin, the intra V-4 trade did not decrease but instead increased during their integration processes in the EU. To examine explicitly the impact of the EU enlargement on NMS trade performances, we aim to test empirically the theoretical predictions of Baldwin (1994) implying the marginalization of NMS economies and the loss of markets of natural trading partners. Thus, we postulate the following research hypotheses:

- o   The EU integration processes before the EU accession and CCP after the EU accession have decreased exports from V-4 to the EU15;
- o   The EU integration processes before the EU accession and CCP after the EU accession have decreased V-4 exports to other V-4 and NMS;
- o   The EU integration processes before the EU accession and CCP after the EU accession have decreased exports of V-4/NMS to the Post-Soviet countries.

3.   MODEL SPECIFICATION AND DATA DESCRIPTION

Although the gravity model is already a commonly accepted and a standard tool to study the trade flows, the specification of the equation for estimation purposes differs according to the approaches of different authors. The most remarkably, Silva and Tenreyro (2006) in their seminal paper have raised a problem that has been ignored so far by both the theoretical and applied studies. In particular they argued, that the logarithmic transformation of the original model is not relevant approach to estimate elasticities. Namely, the multiplicative trade models with multiplicative error do not satisfy the assumption of the homoscedasticity of the error term since there is dependency between the error term of transformed log-linear model and the regressors, which finally causes inconsistency of the ordinary least squares estimator or the random and fixed effects estimator unless very specific (and highly improbable) conditions are fulfilled.

Let us denote the gravity equation for the case of cross-section at certain period t as follows:

$$EX_{ij} = \beta_0 \cdot Y_i^{\beta_1} \cdot Y_j^{\beta_2} \cdot diffGDP_{ij}^{\beta_3} \cdot Z_{ij,1}^{\beta_{4,1}} \cdot ... \cdot Z_{ij,k}^{\beta_{4,k}} \cdot \exp(D'_{ij}\beta_5) \cdot \varepsilon_{ij} \qquad (1)$$

where EX_{ij} is the export flows from country i to country j, Y_i and Y_j represent the current GDPs of the trade partners, $diffGDP_{ij}$ is equal $|Y'_i - Y'_j|$ and stands for the absolute value of the difference between the real GDP per capita of the importer and exporter countries respectively, $Z_{ij,1}$ up to $Z_{ij,k}$ are the k non-binary variables that contain the information on the reporter-partner pair (such as distance between the trade partners), while D_{ij} are the l dummy variables that carry information on the pair and its economic surrounding such as contiguity which equals one when the trade partners share the common border and zero otherwise; time dummy for the financial crisis which equals 1 if the year is 2009; several dummies standing for the RTAs, which equals one if both trade partners are sides of a particular RTA and zero otherwise and dummies denoting the EU15, NMS, V-4 and the former states of the Soviet-Union among trade partners. The ε_{ij} represents the pair-level error term, while all the β are the structural parameters (or their vectors) of the models.

Silva and Tenreyro (2006) provide a profound explanation why the typically applied solution that consists of taking the logarithms of both hand sides of the equation (1) and then estimating the resulting equation with some form of a linear least squares estimator is statistically incorrect and leads to inconsistent estimates. Furthermore, it should be noticed that the procedure of logarithmization enforces either dropping all the pairs with zero trade or applying certain not-fully-true solution (such as incrementing the value of export in each pair by certain low value in order to achieve positive export values that could be logarithmized in each case). While the first solution is a form of non-random subsample selection (usually the distant and small countries are dropped from the estimation sample), the second changes the structure of the model which does not fit the theoretical assumptions anymore. Instead, Silva and Tenreyro (2006) propose a different procedure. Namely, assuming that

$$E\left(\varepsilon_{ij}\middle| Y_i^{\beta_1}, Y_j^{\beta_2}, diffGDP_{ij}^{\beta_3}, Z_{ij,1}^{\beta_{4,1}}, ..., Z_{ij,k}^{\beta_{4,k}}, D_{ij}^{\beta_5}\right) = 1, \qquad (2)$$

the first moment of ε_{ij}, is independent from the explanatory variables (as given in the equation 2), equation (1) can be written as follows:

$$E[EX_{ij}\middle| Y_i^{\beta_1}, Y_j^{\beta_2}, diffGDP_{ij}^{\beta_3}, Z_{ij,1}^{\beta_{4,1}}, ..., Z_{ij,k}^{\beta_{4,k}}, D_{ij}^{\beta_5}) =$$

$$= \beta_0 \cdot Y_i^{\beta_1} \cdot Y_j^{\beta_2} \cdot diffGDP_{ij}^{\beta_3} \cdot Z_{ij,1}^{\beta_{4,1}} \cdot ... \cdot Z_{ij,k}^{\beta_{4,k}} \cdot \exp(D'_{ij}\beta_5)] =$$

$$= \exp(\ln\beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln diffGDP_{ij} +$$

$$+\beta_{4,1} \ln Z_{ij,1} + \cdots + \beta_{4,k} \ln Z_{ij,k} + D'_{ij}\beta_5). \qquad (3)$$

Further we can denote $A(x_{ij})$ as:

$$A(x_{ij}) = ln\beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lndiffGDP_{ij} +$$

$$+\beta_{4,1} lnZ_{ij,1} + \cdots + \beta_{4,k} lnZ_{ij,k} + D'_{ij}\beta_5, \tag{4}$$

where x_{ij} is the (column) vector of the transformed variables in the right hand side of equation (4):

$$x_{ij} = [1 \ lnY_i \ lnY_j \ lndiffGDP_{ij} \ lnZ_{ij,1} \ \ldots \ lnZ_{ij,k} \ D'_{ij}]' \tag{5}$$

Silva and Tenreyro (2006) propose to find the estimates of equation (1) by solving the set of first order condition equations:

$$\sum_{ij}(EX_{ij} - \exp A(x_{ij})) \, x_{ij} = 0. \tag{6}$$

Besides tackling with the zero export flows in the data, the authors demonstrate that the estimator based on the above-mentioned equation shall generally be more efficient than the competitive nonlinear least squares one, while the efficiency depends on the assumption that the conditional variance of EX_{ij} is proportional to its expected value. It is remarkable, that even if the latter does not hold, the estimator remains consistent, but it could be made more efficient if the proper ratio of the conditional variance to conditional mean is considered. Additionally, the set of first order conditions in this case is exactly the same as in the case of the Poisson regression model and solving equation (6) would be equivalent to finding the maximum likelihood estimator of the Poisson regression though without assuming the Poisson conditional distribution (or even integrity) of the exports. Thus the above-stated estimator is called the Poisson pseudo-maximum likelihood.

The data considered in this paper are a panel of paired (*i,j*) country-level observations in subsequent years 1999-2014 and the annual *i-j* export flows are observed in each pair. Therefore equation (1) converts into

$$EX_{ijt} = \beta_0 \cdot Y_{it}^{\beta_1} \cdot Y_{jt}^{\beta_2} \cdot diffGDP_{ijt}^{\beta_3} \cdot Z_{ijt,1}^{\beta_{4,1}} \cdot \ldots \cdot Z_{ijt,k}^{\beta_{4,k}} \cdot \exp(D'_{ijt}\beta_5) \cdot \varepsilon_{ijt}, \tag{7}$$

where *t* denotes a particular year. Obviously, some of the variables might remain time invariant (such as the dummy variable for common border). We further extend (7) in two ways.

Firstly, we allow for structural changes in 2004 due to the EU enlargement, which reflects the belief that the influence of particular independent variables on the level of exports might be altered since 2004. Technically this can be done in two ways: either by estimating equation (7) separately for the periods 1999-2003 and 2004-2014 or by introducing a set of interaction

terms of the independent variables with a dummy variable which distinguishes between the two considered time spans (1999-2003 and 2004-2014). The latter is better: we can get a single model with a higher number of degrees of freedom and additionally, by employing the Wald statistics we can easily test whether the parameter on each independent variable exhibited a statistically significant change in 2004.

Secondly, as in most panel data model we introduce the individual effect α_{ij} for each pair of trade partners ij. These reflect individual, non-quantified time constant (at least in the considered mid-length horizon) characteristic of each pair, that might have impact on their trade intensity (such as cultural or political proximity). The latter finally converts (7) as:

$$EX_{ijt} = \beta_0 \cdot Y_{it}^{\beta_1} \cdot Y_{jt}^{\beta_2} \cdot diffGDP_{ijt}^{\beta_3} \cdot Z_{ijt,1}^{\beta_{4,1}} \cdot ... \cdot Z_{ijt,k}^{\beta_{4,k}} \cdot \exp(D'_{ijt}\beta_5) \cdot \alpha_{ij} \cdot \varepsilon_{ijt}, \quad (8)$$

As mentioned before though, we allow for a structural break in 2004, due to EU accession by a large group of countries at that time. So as to reflect it, model (7) converts into

$$EX_{ijt} = \beta_0 \cdot Y_{it}^{\beta_1} \cdot Y_{jt}^{\beta_2} \cdot diffGDP_{ijt}^{\beta_3} \cdot Z_{ijt,1}^{\beta_{4,1}} \cdot ... \cdot Z_{ijt,k}^{\beta_{4,k}} \cdot \exp(D'_{ijt}\beta_5) \cdot$$

$$\cdot (I_{2004}Y)_{it}^{\gamma_1} \cdot (I_{2004}Y)_{jt}^{\gamma_2} \cdot (I_{2004}diffGDP)_{ijt}^{\gamma_3} \cdot (I_{2004}Z)_{ijt,1}^{\gamma_{4,1}} \cdot ... \cdot (I_{2004}Z)_{ijt,k}^{\gamma_{4,k}} \cdot$$

$$\cdot \exp((I_{2004}D)'_{ijt}\gamma_5) \cdot I_{2004,t}\gamma_6 \cdot \varepsilon_{ijt} \quad (9)$$

and model (8) yields

$$EX_{ijt} = \beta_0 \cdot Y_{it}^{\beta_1} \cdot Y_{jt}^{\beta_2} \cdot diffGDP_{ijt}^{\beta_3} \cdot Z_{ijt,1}^{\beta_{4,1}} \cdot ... \cdot Z_{ijt,k}^{\beta_{4,k}} \cdot \exp(D'_{ijt}\beta_5) \cdot$$

$$\cdot (I_{2004}Y)_{it}^{\gamma_1} \cdot (I_{2004}Y)_{jt}^{\gamma_2} \cdot (I_{2004}diffGDP)_{ijt}^{\gamma_3} \cdot (I_{2004}Z)_{ijt,1}^{\gamma_{4,1}} \cdot ... \cdot (I_{2004}Z)_{ijt,k}^{\gamma_{4,k}} \cdot$$

$$\cdot \exp((I_{2004}D)'_{ijt}\gamma_5) \cdot I_{2004,t}\gamma_6 \cdot \alpha_{ij}.\varepsilon_{ijt}, \quad (10)$$

where I_{2004} is a dummy indicator variable, which equals 0 before 2004 and 1 from 2004 on. As a result the γ_1 up to γ_5 represent the estimated differences in the influence of particular variables before 2004 and from the 2004 on. The β's can be interpreted as their influence in the earlier years, while the $(\beta + \gamma)$'s represent the influence after 2003.

As far as the random effects treatment is considered, we adopt the random effects approach as the fixed effects approach seems inappropriate: first of all the number of periods are too low yielding the incidental parameters problem if the full Maximum Likelihood (ML) estimator were to be used. On the other hand, conditional ML could be applied, however this would not only result in dropping all the time invariant regressors (such as the distance which is supposed to reflect the transaction costs to a great extent) but also all the pairs of never-trading

countries from the sample. While the former is only a matter of fewer interpretation possibilities, the latter is clearly a form of sample selection and one might doubt whether the conclusions drawn from the model based on the resulting skewed sample would still be representative for the whole intended population. The random effects approach requires the distribution of the individual effects to be independent of the regressors, which we implicitly assume. We also adopt the typical assumption that individual effects have the gamma distribution with an expected value of one. The distributional assumptions that regard the individual effects are difficult to validate directly and if not fulfilled may cause loss of estimator consistency.

It should be noticed, that given the independence of the distribution of the individual effects both the full panel specification (10) panel PPML estimator and the pooled panel specification (9) PPML estimator should be consistent (assuming no general specification error). Thus as a form of robustness check we provide the estimates of both and expect that the difference between the two sets of estimates not to be statistically significant if the independence assumption holds. Additionally we also provide the pooled PPML with no interaction with post-2004 dummy (7) results so as to enlighten the influence of proper structural break treatment on the results.

The data on the export flows in millions of Euros come from the Eurostat. The data of the current GDP levels in millions and real per capita GDPs are included from the World Development Indicators database complied by the World Bank. The data for the other variables such as distance and contiguity are taken from the CEPII database and the data for the regional agreement memberships come from the World Trade Organization (WTO). According to the data availability, the sample covers the period from 1999 to 2014. The considered group of countries consists of Visegrad countries as reporters, and the rest of the world consisting of 234 countries as partners in our sample. The complete set of variables included in the model is given in Table 1.

Table 1. Variables employed in the model

Variable Name	Description	Source	Expected sign
exports	Exports in millions of Euros (dependent variable)	Eurostat	
lGDP_rep	Natural logarith of GDP in current US dollars of a reporter country	WDI	+
lGDP_par	Natural logarithm of GDP in current US dollars of a partner country	WDI	+
lGdpR_pc	Natural logarith of the absolute value of difference of GDP per capita in purchasing power parity (PPP) of reporter and partner countries	WDI	-
ldistance	Natural logarithm of geographical distance between the capital of the trading partners	CEPII	-
contig	Dummy variable standing for the neighboring countries	CEPII	+
EU_15	Dummy variable denoting the EU15 countries among partners		+
NMS	Dummy variable denoting new member states of the EU among partners, excluding Visegrad countries		+
VS	Dummy variable denoting V-4 among partners		+
RTAs	Dummy variable standing for the all three types of signed RTAs with trade partners excluding the EU members	WTO	+
Post Soviet	Dummy variable denoting the former Soviet states	CEPII	+/-

Source: own compilations.

4. ESTIMATION RESULTS

As discussed in the previous section, we estimate the augmented gravity model for the export flows of V-4 in the period 1998-2014. To control for the effects of the EU accession we include the time interaction of the individual independent variables with the dummy that splits the time period into two parts:1998-2003 and 2004-2014 periods. In columns 1-2 the results of estimation of panel PPML estimates of model (10) are provided. While column 1 provides the estimates for the period 1999-2014, the results in column 2 are the estimates of parameters on the post-2004 interacted variables and should be understood as the estimated difference in the influence of the given variable compared to the pre-2004 period. Notably, the significance statistics in column 2 reflect the significance of the difference between the two considered periods. In columns 3-4 the results of panel PPML (model 9) are provided to report the precise estimates of the coefficients before and after the EU accession. Finally, column 5 provides the estimates of the pooled PPML model with no structural break (equation (7)). In

each of the specifications, all the variables, except the dependent variable and dummies, are taken in logarithms, the latter two are taken in levels. Table 2 reports estimation results.

Table 2. Estimation Results

Variables	PPML for panel data with structural break		PPML for panel data		Pooled PPML
	(1) **1999-2014**	**(2)** **(change)**	**(3)** **1999-2004**	**(4)** **2004-2014**	**(5)** **1999-2014**
lGDP_rep	0.542***	0.11**	0.57***	0.644***	0.645***
	(8.40)	(2.32)	(8.73)	(10.52)	(37.63)
lGDP_par	0.80***	0.06*	0.805***	0.85***	0.879***
	(21.06)	(1.76)	(20.40)	(24.07)	(64.77)
lGdpR_pc	0.14**	-0.13**	0.18**	0.00	-0.063**
	(2.16)	(2.44)	(2.28)	(0.01)	(-2.58)
ldistance	-0.98***	0.05	-0.96***	-0.94***	-0.877***
	(6.90)	(0.72)	(7.27)	(9.77)	(-25.23)
contig	0.59**	-0.07	0.60**	0.51*	0.267***
	(2.00)	(0.69)	(2.03)	(1.73)	(5.37)
EU_15	0.50**	0.17	0.52***	0.66*	0.804***
	(2.45)	(0.92)	(2.60)	(1.92)	(15.24)
RTAs	-0.00	0.36**	0.01	0.34	0.236***
	(0.01)	(2.20)	(0.05)	(1.24)	(5.65)
NMS	0.89***	0.14	1.00***	1.01***	1.143***
	(4.81)	(0.84)	(6.63)	(3.58)	(12.75)
VS	1.40***	0.18	1.55***	1.54	1.660***
	(5.28)	(1.03)	(6.69)	(4.74)***	(20.43)
Post Soviet	0.91***	-0.18	0.99***	0.72***	0.760***
	(3.18)	(1.60)	(3.90)	(2.66)	(12.46)
Constant	-11.88***	-2.15	-12.94***	-2.15	-13.20***
	(9.91)	(0.57)	(13.41)	(0.57)	(-29.57)
Observations	11123	11123	11123	11123	11123

t statistics in parentheses
Significance at the 10%*, 5%** and 1%*** levels
Source: own calculations, Stata (2013).

First of all, we should notice that estimates exhibit the expected signs and suggest statistical significance of most variables at the 1% significance level. GDP of reporter countries as well as GDP of partner countries yield positive and statistically significant coefficients at 1% level. The magnitude of partner countries' GDP exceeds the magnitude of the reporter countries GDP. However, the estimated post-accession change parameters indicate that since the EU

accession the impact of the reporter countries' GDP increases more than the one of partner countries. This finding is in line with the literature and implies that the economic prosperity of V-4 following the EU accession has strong positive impacts on export performances of V-4. The estimated influence of the absolute difference of GDP per capita is positive, however over the time it faces a negative, statistically significant change. This finding highlights that V-4 used to export to the countries owning different factor endowments (either lower or higher), however over the past years they are more likely to export to the countries with the similar factor endowments.

The influence of the geographical factors is also in line with the literature. Namely, distance yields the negative coefficient and contiguity - the positive one. Both are statistically significant and in both cases the change in the magnitudes due to the EU accession is not significant. This implies that these two variables keep the standard effects on export flows.

As far as the regionalism is concerned, we examine explicitly the impacts of trading with the EU 15, NMS (excluding V-4), V-4, post-Soviet countries and the countries for which the EU has any RTAs. Our benchmark estimations indicate that the EU 15 countries increase V-4 exports significantly while the magnitude of their relevance as the key group is higher for the period after 2004 than the period before 2004, yet the post-accession change over time is not found statistically significant. This finding suggests that whole process of the EU integration was more important for V-4, rather than the year of the EU accession itself. In other words, we can state that unlike to the Baldwin's hypothesis Europe Agreements were quite efficient tools for easing the trade. Going further, the impact of RTAs of the EU is found statistically insignificant before 2004, however the results reveal that the change since the EU accession is highly positive and significant. The latter implies that together with the effectiveness of the Europe Agreement V-4 also benefits from the CCP since the EU accession. Therefore we can reject our first hypothesis stating that the EU integration processes before the EU accession and CCP after the EU accession have decreased exports from V-4 to the EU15.

NMS yield positive and statistically significant coefficient with the higher magnitudes than the coefficient of the EU 15, before as well as after 2004. This finding implies that through the whole period of time V-4 traded with the other NMS efficiently without being marginalized in any sense. Moreover, V-4 is found to be the most important partners for one another. Namely, coefficient standing for V-4 countries yields the highest magnitude among all of the country groups before as well as after the EU accession. Therefore our estimations indicate that the intra-V-4 trade remained intensive without any hurdles due to the integration processes and therefore we can reject the second research hypothesis implying that the EU integration processes have decreased V-4 exports to other V-4 and NMS. Finally, the dummy for post-Soviet countries also yields positive and statistically significant coefficient, and its post-accession change, though decreasing, is not statistically significant. So V-4 exports to the post-Soviet countries is neither distorted due to the EU accession. Thus our estimation results allow us to reject the last two hypothesis stating that the EU integration processes before the

EU accession and CCP after the EU accession have decreased exports of V-4 to the Post-Soviet countries.

Sensitivity checks by applying PPML estimator highlight robustness of our estimations when both the full period (with no structural break) is considered as well as when the pooled- PPML is used instead of the panel PPML Namely, all the variables employed in the model yield the same signs and stay statistically significant with the only exception of the absolute value difference of GDP per capita. More precisely, the latter is positive in the benchmark estimations and turns negative in robustness checks. Yet, this change is logical once recalling that benchmark estimations of changes showed the statistically significant decrease in the magnitude of the coefficient since 2004.

5. CONCLUSIONS

The paper aimed to examine the early hypothesis of Baldwin (1994) predicting the formation of the "hub-and-spokes" model as a consequence of the EU enlargement. Based on the augmented gravity model we estimated the panel data of the export flows of V-4 over 1999-2014. Together with the standard gravity variables, we have included the set of dummy variables denoting the regionalism of the EU15 and V-4 countries. Besides, we controlled for the natural historically linked partners of the V-4. To illustrate the precise outcomes of the EU accession on the V-4 export performances we introduced the interaction terms of the time dummy which distinguished between the pre-2004 and post-2004 period. The latter was used to take account of the possible structural change due to the V-4 EU accession and allowed to assume the country time invariant individual effects to remain the same for the whole period of analyses. We followed the advancement in the empirical trade literature and applied the poison approach to deliver estimation results. However, unlike to the previous studies, we employed the panel PPML as the main tool. The latter allowed us to account for the country heterogeneities and therefore to deliver plausible estimates. Additionally, we provided the robustness checks by estimating the model by pooled PPML, which is equivalent to assuming the country individual effects to be zeros. The pooled PPML technique furthermore outlined the robustness of our results.

Our results indicated that unlike to the Baldwin's hypothesis, Europe Agreements were quite efficient tools for easing the trade of V-4 with all the group of countries covered in the sample. Together with the effectiveness of the Europe Agreement, our estimations also highlighted the benefits of CCP on V-4 exports since the EU accession. Through the whole period of time

V-4 traded with the NMS efficiently without being marginalized in any sense. Moreover, we found that V-4 present the most important partners for one another. Finally, post-Soviet countries still remain the important destination for V-4 exports.

Therefore, we may state that the theory introduced by Baldwin (1994) to describe the European integration processes might not necessarily illustrate the real implications of the EU enlargement. Namely, while Baldwin predicted the dominance of the EU15 in determining directions of the trade of NMS, in fact our estimations showed that the trade of NMS including V-4 is not concentrated over the EU15 but among themselves and furthermore among their natural partners. Therefore, the hypothesis of Baldwin implying the marginalization of the NMS is not verified by our estimations. Thus, we may reasonably state that the model of "hub and spokes" does not report the contemporary trade relations across the EU.

REFERENCES:

Acharya, R., Crawford, J. A., Maliszewska, M. and Renard, C. (2011), "Landscape", in Chauffour, J. P. and Maur, J.C. (eds), *Preferential Trade Agreement Policies for Development: a Handbook*, Washington DC: The World Bank.

Akhvlediani, T. and Śledziewska, K. (2015) "The Impacts of Common Commercial Policy on Export Performances of Visegrad Countries", forthcoming in *Prague Economic Papers*, 2016.

Akhvlediani, T. and Sledziewska, K. (2015), "Structural Changes in Exports of Visegrad Countries: Evidence from the Sectoral Data", Book of Proceedings of the 11th International Scientific Conference on Economic and Social Development, Zagreb, 17-18 December, 2015. ISSN 1849-7535), ed. Ante Vuletic, Rebeka Danijela Vlajov, Igor Pihir, p:234-241.

Baier, S. L. and Bergstrand, J. H. (2009), "Estimating the effects of free trade agreements on international trade flows using matching econometrics", *Journal of International Economics* 77, pp. 63-76.

Carrere, C. (2006), "Revisiting the effects of regional trade agreements on trade flows with proper specification of the gravity model", *European Economic Review* 50, pp. 223-247.

Foster, N. (2012), "On the volume and variety of intra-bloc trade in an expanded European Union", Workshop on "Revival in the 'Visegrad Countries' Mutual Trade after their EU Accession: A Search for an Explanation", Vienna Institute for International Economic Studies, Monthly Report No. 8-9, September 2012, pp. 1-6.

Ghosh, S. and Yamarik, S. (2004), "Does trade creation measure up? A reexamination of the effects of regional trading arrangements", *Economics Letters* 82, pp. 213-219.

Hornok, C. (2010), "Trade enhancing EU Enlargement and the resurgence of East-East Trade", Focus on European Economic Integration, Austrian National Bank, Vienna, pp. 79-94.

Hummels, D., Rapoport, D. and Yi, K-M. (1998), "Vertical specialization and the changing nature of world trade", Federal Reserve Bank of New York Economic Policy Review, June 1998, pp. 79-99.

Hunya, G. and Richter, S. (2011), "Mutual trade and investment of the Visegrad countries before and after their EU accession", *Eastern Journal of European Studies*, vol 2, Issue 2, December, pp. 77-91.

Janda, K. (2014), "Export Credit Agencies in the Czech Republic and Their Market Power," CESifo Forum, *Ifo Institute for Economic Research* at the University of Munich, vol. 15(3): 45-51, 08.

Janda, K., Michalíková, E. and Psenakova, L. (2013), "The performance of export credit agencies in post-communist Central European countries", *IES Working Paper*, No. 10/2013.

Magee, C. (2008), "New measures of trade creation and trade diversion", *Journal of International Economics* 75, pp. 340-362.

Silva, J. M. C. S. and Tenreyro, S. (2006), "The Log of Gravity", *The Review of Economics and Statistics* 88, pp. 641-658.

Soloaga, I. and Winters, L. A. (2001), "Regionalism in the nineties: what effect on trade?", *The North American Journal of Economics and Finance* 12, pp. 1-29.

Tinbergen, J. (1962), "Shaping the world economy suggestions for an international economic policy", New York: Twentieth Century Fund.