University doctoral (PhD) dissertation

MERCHANDISE TRADE INTEGRATION IN THE VISEGRAD COUNTRIES – LESSONS FROM A COMPLEX GRAVITY ANALYSIS

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1. Introduction, research question

The accelerating and deepening economic, social and political globalization has significantly reshaped international trade patterns since the end of the World War II. Countries have born down – within the framework of multilateral and regional trade agreements - on the dissolution of the barriers to trade in goods, services and factors, which has resulted in a significant reduction in the economic importance of borders. What is more, according to REICH (2010) this can lead to the termination of nation states.

Borders, borderlands separating the economic space have played a major role in scientific papers focusing on global economic processes for centuries. As early as the classical work of ADAM SMITH (1776) it was claimed that natural and artificial barriers tend to reduce the benefits of distant trade of goods. SMITH (1776) showed that trade on the river Danube would have been much more intensive if the river would have passed through only one country. Thus it is worth evaluating the pattern, the speed and the depth of globalization through studying the transformation of the impact of borders.

The Single Market of the European Union can be plausible example to examine the importance of borders. On the one hand, the European integration process brought dynamic and thorough changes into the life of the continent as early as the 1960s, '70s and '80s causing a drop in the punishing nature of borders. On the other hand by the 1990s the regional cooperation entered a new stage, and faced unprecedented challenges, when the eastern enlargement process of the union became the priority issue among the old members. Promoting smooth economic relations coincided with both the market expansion strategies of developed member countries and the notion of reorientation of post-communist countries. The eastern enlargement however was not only a simple event enhancing the market size of the EU in 2004, but it has been an integral process happening through several decades, which points to an ever more effective division of labor.

The events of the past three decades in Central and Eastern Europe have raised a number of questions among international trade economists. After the World War II Central and Eastern European countries followed a trade policy similar to the import substitution strategy of South America. Trade patterns were dominated by the relations to the Soviet Union and were planned within the framework of the Council for Mutual Economic Assistance. By the 1970s

and especially the 1980s it had turned out however, that the socialist system was not operable any more, thus the economy and the society started a slow transition everywhere which turned to a radical regime change in the beginning of 1990s. In line with the establishment of important institutions the region started to integrate to the EU which was materialized in the bilateral Europe Agreements. Germany became the main trading partner of the countries immediately, while Russia and the other post-soviet transition countries obtained just a marginal role in their international relations.

As for Hungary, Czechia, Slovakia and Poland, besides the regime change there was another important action, namely signing the Visegrad Cooperation Agreement. Despite the fact that people were thinking about this agreement as a useless one, it is successful in terms of joint internal programs and the ability to enforce common political and economic interests. Unsurprisingly, the economic performance of these countries are often compared and contrasted to each other.

A number of scholars have already investigated the reintegration process, the sectorial structure (MOLNÁR, 2012) or the degree of concentration (SOÓS, 2016) of international trade patterns in the Visegrad countries. The content, the depth and even the symmetry of an integration among countries can also be analyzed by looking at the intra-industry trade patterns as did JÁMBOR (2014). The size of intra-industry trade can refer to the level of the division of labor, the quality of supply chain integration or biased supplier relations. Some other topics such as the mobility of services and labor, financial integration or the uniqueness of capitalism evolved in different countries (FARKAS, 2011) can also be raised. These analyses on the one hand may over-carry us, and on the other hand they miss something so that the analysis of international markets is being conducted without any benchmark. Namely, *intranational trade patterns* are needed as standards to which international relations can be compared.

This study therefore uses a specific approach to investigate the fragmentation of international goods markets, where integrations are compared to the domestic – theoretically perfectly integrated – markets. By studying border effects in the countries we can show how far a given integration is from an 'optimal' one. This approach allows us to conduct both a micro and a macro level analysis. The former examines the law of one price based on the seminal

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paper of ENGEL – ROGERS (1996), while the latter estimates the extent of (over)preference of domestic trade partners following MCCALLUM (1995).

In this dissertation the McCallum-type methodology is adapted and developed along with a comprehensive technical literature review and a carefully conducted empirical example about the gravity model. Accordingly, this study raises the following research problem:

RESEARCH QUESTION:

> *How can we evaluate the trade integration process of the Visegrad countries on the internal market of the European Union from a true theoretic and econometric point of view?*

The uniqueness of the border effect methodology allows us to approach this problem from a specific point of view. This study actually, would like to answer the following questions: *How much has the EU drawn to a theoretically perfect integration since the 1990s in the perspective of the Visegrad countries? How quick the V4 countries have been able to join the Single Market? Do firms in the region prefer domestic trade ceteris paribus? How has this home bias in trade altered?*

Furthermore, another main goal of this study is to reach robust results and useful as well as reliable conclusions standing on strong theoretic and econometric grounds. Therefore, this paper is rather methodological, and aims to have novel results in the field of econometrics, as well. The focus is on the following problems: *What kind of biases and other inaccuracies does the OLS estimation suffer from? What are the alternatives for OLS in our model? Which estimator gives the best (unbiased, consistent and most efficient) results?*

International trade theorists have pointed to some weaknesses of OLS and introduced a number of potential estimator instead (HEAD – MAYER, 2014). Omitted variables bias, the problem of heteroscedasticity or involving zero trade flows are among the most serious threats that an up-to-date paper has to face. Thus the dissertation undertake the task to give a comprehensive gravity analysis pointing beyond an average paper in this topic.

The empirical part of the thesis conduct a reliable border effect estimation in connection with the Visaegred countries. The result are novel in the sense that this region has been out of crop in this regard.

2. Theoretical and methodological framework

Reading the word 'gravity' one can associate with SIR ISAAC NEWTON (1686) and the law of gravity which has had a great influence on the development of natural science. By the 19th century however, the basic concept has inspired social scientists, as well, leading to the so called social physics according to STEWART (1948). The formula was adapted first to examine the pattern of migration (CAREY, 1858; RAVENSTEIN, 1885; STEWART, 1948; TOBLER, 1970), then that of travelling (ZIPF, 1946; ALCALY, 1967), mate selection (HAMMER – IKLE, 1957), intercity phone calls (CLARKE, 1952), and retail trade (REILLY, 1929; ZIPF, 1946).

International economists however have designated the works of TINBERGEN (1962) and PÖYHÖNEN (1963) as the seminal papers in connection with international merchandise trade. According to them trade flows between countries follow the rule in equation (1):

$$T_{ij} = AY_i^\gamma Y_j^\delta D_{ij}^\theta \, , \tag{1}$$

where the volume of bilateral trade (T_{ij}) is positively depending on the income of the countries (Y_i és Y_j) and negatively depending on the geographical distance between them (D_{ij})[1]. Although international trade gravity studies were initially just analogies with physics, they became extremely popular thanks to their great explanatory power.

The very first microfoundation of the gravity model was conducted by ANDERSON (1979). Based on perfect competition, identical and homothetic preferences, and goods differentiated by country of origin he set the economic grounds of the gravity model. Further derivations based on monopolistic competition (KRUGMAN, 1980; BERGSTRAND, 1985, 1989), the Heckscher-Ohlin model (DEARDORFF, 1998), the Ricardian conditions (EATON – KORTUM, 2002), and oligopolistic (BERNARD et al., 2003) as well as vertically integrated (YI, 2010) international market structures have provided the model a great credibility.

The theoretical and empirical literature has proved that beside income and distance a lot of other factors can be mentioned that influence bilateral trade flows. As a result, the following generalized equation can be defined:

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[1] *A* stands for the constant term.

$$X_{ij} = G S_i^{\gamma} M_j^{\delta} t_{ij}^{\theta} \,, \qquad\qquad (2)$$

where X_{ij} means the value of bilateral export from i to j, while G is the gravitational constant term. S_i and M_j summarize country specific, mainly economic factors of the exporter and importer country, respectively such as GDP, population, per capita income, land area, dummies for landlockedness and islands, and multilateral trade resistance Finally, t_{ij} groups the factors affecting trade costs between the countries like distance, common land border, language or currency, tourism, FDI and regional trade agreements.

One of the most important theoretical findings regarding the gravity model came by ANDERSON – VAN WINCOOP (2003), when the authors emphasized the role of relative trade costs. Namely, the volume of trade between two countries is not only depending on bilateral factors, but it is also affected by how these countries are able to reach alternative trading partners. The variables called multilateral trade resistance affect bilateral trade flows positively, as the bigger the average trade costs to other countries the more profitable it will be to realize transaction in the given direction.

In addition, recent theoretical explanations showed, how trade cost can lead to zero trade flows between two countries and that it is extremely important to consider and correctly involve them into the investigation (CHANEY, 2008; BAO – CHEN, 2013).

The estimation of the model is done in most cases by OLS after a logarithmic transformation. One can involve a dummy variable representing the borders as barriers to trade, by which the size of border effects becomes estimable. The phenomenon that a country trades much more within its borders ceteris paribus was defined by MCCALLUM (1995). His followers have tried to denote how and to what extent we can explain the over-preference of domestic trading partners. The panel analyses, furthermore, showed that it is worth estimating the time trend of border effects, as well, in order to evaluate the market integration process of a given region. The aim of this paper is to shed some light on the trade integration process of the V4 countries within the EU Single Market following this methodology.

The theoretical and methodological pitfalls analyzed in the literature review, however, suggest to investigate the problem step by step. Thus the main goal of my empirical research is to provide reliable (unbiased, consistent and efficient) border effect estimates grounded by the most recent theory. The logic behind my complex research is visualized in figure 1.
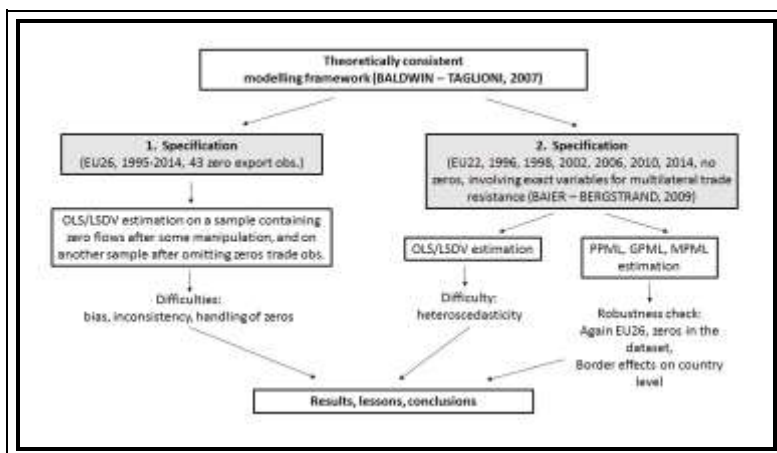
Figure 1: The algorithm of the empirical research

Source: Author's edition based on the logic of the research

The estimable fixed effect regression has been constructed a la BALDWIN – TAGLIONI (2007), where time varying exporter and importer fixed effects as well as time invariant country-pair effects are introduced to control for the majority of the factors. Firstly and most obviously, the basic specification is estimated by OLS/LSDV. The database consist of bilateral export flows among the EU26 countries and values of different factors affecting them. The sample period lasts from 1995-2014. There are 43 zero export observations, thus data need to be manipulated first as the logarithm of zero is undefined. As the first possible solution, different small values are added to each observation before taking their logarithm. Furthermore, I also look at the performancd of the estimator after omission of zeros.

After that as a second step, I build up another sample without any zero trade flow. Thus it consist of the EU22 coubtries, and only six different cross sections (1996, 1998, 2002, 2006, 2010, 2014) are utilized. In addition to that, another important modification is that multilateral trade resistance terms are controlled for by determining new variables following BAIER – BERGSTRAND (2009). The eqution in the second specification is estimated by OLS first, than the results are compared to three alternative estimator (PPML, GPML, MPML). After running differernt tests for heteroscedasticity and model mis-specification,

the trade integration process of the Visegrad countries are evaluated based on the best (unbiased, consistent and most efficient) estimation. To modulate the results I also calculate the evolution of border effects in the V4 countries separately.

Első lépésként a kézenfekvőnek látszó és egyszerűen kivitelezhető hagyományos legkisebb négyzetek (OLS/LSDV[2]) módszerével becsülöm meg az alapspecifikációt. Az adatbázis az EU26[3] országainak egymáshoz irányuló aggregált áruexportjaiból és az azokat meghatározó tényezők értékeiből áll. A vizsgált periódus az 1996-2014 időszak. Ahhoz, hogy megvalósítható legyen a becslés, módosítani kell az adatokon, hiszen a panel 43 sora zéró exportmegfigyelést tartalmaz, aminek logaritmusa nem értelmezhető. Egyik megoldási javaslatként különböző alacsony értékeket adok hozzá minden megfigyeléshez. Ezenkívül megvizsgálom, hogyan viselkedik a regresszió csonkított – azaz a nulla exportot tartalmazó megfigyelések nélküli – adatsoron.

A második lépésben egy új mintát építek fel úgy, hogy az csonkítás nélkül is csak pozitív kereskedelmi forgalmakat tartalmazzon. Ezúttal az EU 22[4] országa szerepel az adatsorban, és a panel 6 évből (1996, 1998, 2002, 2006, 2010, 2014) tevődik össze. A lényeges módosítást ezenfelül az jelenti, hogy a – gravitációs modellek kritikus pontjának számító – multilaterális kereskedelmi akadályokat nemcsak fix hatásokkal, hanem BAIER – BERGSTRAND (2009) nyomán, közvetlenül is kontrollálom. A második modellváltozatot előbb OLS-szel futtatom le, és az ott kapott eredményeket másik három lefuttatom három becslőfüggvénnyel, a poisson, gamma, multinomiális pseudo-maximum likelihood (PPML, GPML, MPML) módszerekkel vetem össze. A – különböző ellenőrző tesztek alapján – legjobbnak minősülő, azaz torzítatlan, konzisztens és hatásos eredményeket felhasználva kerül csak igazából kiértékelésre a visegrádi térség kereskedelmi integrációja. A megállapításaimat árnyalandó, egy újabb apró módosítással megbecsülöm a határhatás időbeli alakulását az egyes országok szintjén is.

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[2] Least Squares Dummy Variables
[3] Austria, Belgium-Luxembourg, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Hungary, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.
[4] Austria, Bulgaria, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

3. Results

The main results of the dissertation come from the comparison of two different model specifications and four different estimators. Conclusions from the first specification are drawn based on the OLS estimation of the following equation:

$$lnX_{ij,t} = \text{\ss}_0 + \text{\ss}_1 cur_{ij,t} + \text{\ss}_2 eu_{ij,t} + \alpha_{ij} + \varphi_{it} + \omega_{jt} + \sum_R \gamma^R border_{ij,t}^R + \varepsilon_{ij,t}\,, \quad (3)$$

where $X_{ij,t}$ denotes the value of bilateral export flows from country i to country j. β_0 stands for the constant term. $cur_{ij,t}$ is a dummy for common currency, it gets a value of 1 if either i or j do not use the euro and 0 if both countries already introduced the common currency by year t. Another dummy – $eu_{ij,t}$ - is introduced for integration membership, which is 1 if either i or j is not a member of the EU in year t and zero if both of them are members in the given year. I denoted country-pair fixed effects by α_{ij}, which wipes out the effect of time invariant factors being specific to a given country- pair. The symbols of φ_{it} and ω_{jt} represent country-year fixed effects that involve all time varying factors being specific to a given country in a given year. The variables of interest are labelled by $border_{ij,t}^R$ representing border dummies divided into years (t) and regions (R). It has a value of 0 if the transaction realized within the borders of a country in a given region R (R={V4, Baltic countries, rest of the EU}), while it gets 1 otherwise. The main objective of the estimation is to get unbiased, consistent and efficient coefficients of γ^R. These parameters show the change in border effects with respect to that in the first year. More precisely the interpretation of the γ^R can be the following:

1. the border effect is $100/e^\gamma$ percent of that in the first year of the sample, *or*
2. *the border effect is $1/e^\gamma$ of that in the first year of the sample, or*
3. *the border effect has declined by $100 - \frac{100}{e^\gamma}$ subject to the first year of the sample.*

Finally $\varepsilon_{ij,t}$ denotes the white noise error term. Estimating this model allows us to compare the border effect values of the Visegrad region with that of another homogeneous country group, the Baltic countries. The group of the rest of EU is constructed just for controlling for their domestic trade. Accordingly, the following conclusions can be drawn based on the first specification. *The OLS estimation has several weaknesses. On the one hand, involving zero exports by adding a small constant to the flows makes the results unreliable, i.e. it results in*

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biased, inconsistent parameter estimates massively depending on the exact value of the constant number. The magnitude of the bias and inconsistency ('adding up problem') can be significantly reduced by dropping zero trade observations. The sum of estimated flows are more or less equal to that of observed flows (adding up property). However, the estimation faces further problems. Truncation may cause sample selection bias (though in my case in should be a minor concern due the low number of zeros). In addition, inadequate control of multilateral trade resistance (country fixed effects only) may trigger further bias as long as we estimate the model with OLS. Thus these results does not allow us to have conclusions regarding the border effects of the V4 countries.

In the second specification the paper tries to provide useful suggestions and alternative estimation methods. On the one hand I still insist on OLS and control for multilateral trade resistance terms with exact variables following BAIER – BERGSTRAND (2009). Thus the second estimable equation looks like the following:

$$\ln X_{ij,t} = \text{ß}_0 + \text{ß}_1 cur_{ij,t} + \text{ß}_2 eu_{ij,t} + \alpha_{ij} + \varphi_{it} + \omega_{jt} + \sum_M \rho^M MR_{ij,t}^M + \sum_R \gamma^R border_{ij,t}^R + \varepsilon_{ij,t} \text{ , (4)}$$

where $MR_{ij,t}$ denotes multilateral trade resistance consisting of 6 terms (distance, adjacency, currency, language, EU and border). Each term represents weighted average costs towards third countries. Superscript M stands for different type of trade costs. The parameters of each term is labelled by ρ^M. Other variables and symbols correspond with those in equation (3).

The OLS estimate of (4) yields the following conclusions. Using exact MR terms a la BAIER – BERGSTRAND (2009) I showed that the bias due to the inadequate control of the multilateral trade resistance is not significant in my case. Nevertheless, the second specification (with exact MR terms and without zero flows) gives unbiased and consistent parameter estimates. According to the results we may conclude that the Visegrad countries showed a dynamic and continuous integration process similarly to the Baltic countries. However, post-estimation tests suggest that residuals are heteroskedastic that is our estimates are not efficient. Therefore the OLS/LSDV estimates of our log-linear specification may not be the best ones as unbiased and consistent coefficients are given that are however inefficient.

Therefore an alternative estimator is needed and based on the dissertation as a whole pseudo-maximum likelihood methods can be the only possible applicants. In my case, the Poisson, gamma and multinomial pseudo-maximum likelihood estimators are feasible to compare their performance with that of OLS. The results are based on the estimation of equations (5), (6) and (7), respectively.

$$X_{ij,t} = exp\left(\beta_0 + \beta_1 cur_{ij,t} + \beta_2 eu_{ij,t} + \alpha_{ij} + \varphi_{it} + \omega_{jt} + \sum_R \gamma^R border_{ij,t}^R + \varepsilon_{ij,t} \right), (5)$$

and

$$X_{ij,t} = exp\left(\beta_0 + \beta_1 cur_{ij,t} + \beta_2 eu_{ij,t} + \alpha_{ij} + \varphi_{it} + \omega_{jt} + \sum_M \gamma^M MR_{ij,t}^M + \sum_R \gamma^R border_{ij,t}^R + \varepsilon_{ij,t} \right), \quad (6)$$

and

$$\frac{X_{ij,t}}{Y_{j,t}} = exp\left(\beta_0 + \beta_1 cur_{ij,t} + \beta_2 eu_{ij,t} + \alpha_{ij} + \varphi_{it} + \omega_{jt} + \sum_R \gamma^R border_{ij,t}^R + \varepsilon_{ij,t} \right), (7)$$

where *exp* is the natural exponential function, the other labels are equivalent to those of the specifications above. Note that MR terms constructed through a Taylor-series expansion a la BAIER – BERGSTRAND (2009) are involved only in the gamma estimation (6), as FALLY (2015) proved that in case of PPML/MPML methods multilateral trade resistance can be perfectly controlled for by using time varying country fixed effects.

Several specification tests, other indices and estimated parameters suggest that *although all three PML method outperform OLS PPML estimates are the best ones because they are unbiased, consistent and the most efficient. Based on the PPML coefficients we can conclude that the size of home bias in trade of the Visegrad countries have been continuously and dynamically decreasing through the examined period.* The region has dismantled ¾ of its border effect by 2002 while in 2014 the magnitude of over-preference of domestic partners were only 1/10 of that in 1995. *Consequently the V4 countries could join the Single Market of the EU more effectively year by year.* The results also suggest that in the year of accession (2004) there was no significant change in the trend of border effect which is not surprising

as the trade integration process of the region started much earlier with a set of agreements in the 1990s.

Furthermore, the PPML estimator performed well in the robustness check as it was reliable and gave similar result when zero trade observations were present in the sample. In addition, I have widened the analysis and estimated the border effect on the country level, as well. *According to the PPML results the home bias in trade could be decreased the most quickly in Hungary. However, Poland and Czechia showed a similar trend which means that their integration within the Single Market was considerably dynamic, too. The fall of border effect stared later in Slovakia, but by the end of the period the country could dismantle most of its home bias in trade.*

4. Novel scientific results

The dissertation has been written in the harmony of trade theory and econometrics. The aim of the paper was not only to underline the trade integration process of the V4 countries by using some numbers but also to give a comprehensive and credible empirical example and answer the question raised in the beginning. I did not want to mix different approaches and conduct an interdisciplinary research as I thought it would have disabled an in-depth analysis and hurt the quality of the results. The novelty of the paper can be found in its complexity i. e. the way I conduct the analysis about the gravity model and border effect estimation in a theoretical and econometrical perspective.

The historical, theoretical and empirical literature review in the first part of the dissertation has led to the first statement of the thesis:

1. Thesis statement: Studies in connection with the gravity model of international trade suffer from several weaknesses (controlling for multilateral trade resistance, involving zero trade observations, heteroscedasticity, bias, inconsistency and omitting country pair heterogeneity) that have to be systematically considered and controlled for in an up-to-date paper. Although the model has become the workhorse method among international trade economists there is no paper in the literature where these potential problems are systematically revealed and solved.

The dissertation tries to evaluate the trade integration process of the Visegrad countries through the evolution of border effects that is the change in the preference of domestic trade. The critical review of the border effect literature allows us to draw up the second main statement of the paper:

> *2. Thesis statement: Lessons drawn from the empirical finding of the border effect literature suggest that the preference of domestic trade cannot be fully explained by observable factors such as geographical proximity, use of common language and currency or lack of tariffs and other barriers to trade. Accordingly, countries show an excessive preference towards domestic trading partners even within a deep economic integration. The hindering nature of state borders therefore can be partially explained by unobservable country pair specific factors.*

The empirical example of the dissertation has tried to answer the research question raised in the beginning by finding the best possible (theoretically based, unbiased, consistent and efficient) estimator. This part yielded three more statements. The third statement of the thesis is the following:

> *3. Thesis statement: The empirical analysis underlines the notion of SANTOS SILVA – TENREYRO (2006) as well as HEAD – MAYER (2014) i.e. considering zero trade flows not only makes it difficult to estimate the model by OLS and some other estimator (Heckman-type, Tobit) but also results in unreliable estimates. In addition the findings also show that the method of OLS should be rejected even if there is no zeros in the database as parameter estimates are inefficient due the heteroscedasticity of the residuals.*

The econometric analysis has not only revealed the weaknesses of OLS but found a better alternative based on the comparison of different estimators. The results yield another statement.

> *4. Thesis statement: Out of different pseudo-maximum likelihood methods the Poisson pseudo-maximum likelihood estimator has proved to be the best one as it resulted in unbiased, consistent and the most efficient coefficients. Thus the analysis underlines the*

notion of the most recent literature that the PPML seems to be the best applicant as the workhorse estimator of the gravity model.

Finally, I evaluated the trade integration process of Czechia, Hungary, Poland and Slovakia based on the PPML border effect estimates. The regression results suggest the fifth and final statement.

5. Thesis statement: *The Visegrad countries have shown a continuous and dynamic integration process through the examined period (1995-2014) which was materialized in decreasing border effect parameters (90% reduction). The massive fall in the border effect can be observed on the country level, as well. By 2002 the home bias in trade has decreased by 54 and 70% in case of Slovakia and Poland, respectively. At the same time the Czech and Hungarian indicators show a reduction of 74 and 86%, respectively. By the end of the examined period (2014) the size of over-preference of domestic trading partners has relapsed by 85 percent in Slovakia, 89 percent in Czechia and Poland, and 94% in Hungary subject to the initial value of 1995.*

All in all, my research sheds some light on the trade integration patterns of the Visegrad countries from a specific point of view. Moreover, an even more important novelty is that it has synthesized recent theoretical development of the gravity model with econometric methods through a complex empirical example. This work therefore can serve as a cookbook in connection with the proper empirical adaption of the gravity model.

5. The expedience of the results

Starting as a physical analogy the gravity model of international trade has become the workhorse of investigating international economics. What is more, a number Hungarian papers also relied on the method in the recent decade. Unfortunately however, rising interest has not gone hand in hand with consistency and accuracy. Most of recent studies – especially in Hungary – have systematically failed to consider and precisely control for multilateral trade resistance, zero trade observations, other weaknesses of OLS and problems of different panel structures. Therefore, their results and main conclusions can be questioned. The main reason for this may be lie behind the fact that we cannot find a comprehensive analysis systematically revealing and solving all of these problems. The theoretical and empirical results of this paper try to fill in this gap in the literature. One of the main expediencies of this dissertation is that it is able to serve as a credible example for future gravity analyses.

The main objective of my research was to evaluate the trade integration process pf the Visegrad countries, therefore this paper can be regarded as a contribution to the debate in connection with the economic integration of the V4 countries. My research sheds some light on the trade integration patterns of the Visegrad countries from a specific point of view. The trend of border effects shows that after the regime and paradigm change of the 1990s the region has been able to join the Single Market effectively projecting favorable future prospects for the countries. The analysis can be proceeded to modulate the conclusions regarding the integration process. I would like to estimate the vinerian (VINER, 1950) trade creating and diverting effects of the EU accession of the countries in order to evaluate the welfare effects of the agreement.

The comprehensive, in-depth research progress in connection with the gravity model may teem in the future. This model is and still will be the workhorse tool for trade theoreticians and politicians. Possessing the knowledge and capability to build up and estimate a gravity model allow me to join future research projects in connection with international trade even in the University of Debrecen where such skills are needed. Utilizing this model one is able to give trade policy recommendations regarding the introduction of the euro for example. Furthermore it can be also useful to analyze the patterns of foreign direct investments, international trade in services, tourism or migration.

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7. Publications of the author

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List of publications related to the dissertation

Articles, studies (3)

1. **Márkus, Á.**: Disappearing Borders in the Visegrad Countries.
   Prague Economic Papers. 27 (2), 149-168, 2018. ISSN: 1210-0455.
   DOI: http://dx.doi.org/10.18267/j.pep.635
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2. **Márkus, Á.**: Heterogén határhatások az Európai Unió egységes belső piacán: egy PPML- és OLS-elemzés tanulságai.
   Statisztikai Szemle. 96 (4), 375-402, 2018. ISSN: 0039-0690.
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3. **Márkus, Á.**: A határhatás irodalom áttekintése: torzítják-e az országhatárok a kereskedelmi kapcsolatokat?
   Competitio 16 (1), 81-102, 2017. ISSN: 1588-9645.
   DOI: http://dx.doi.org/10.21845/comp/2017/1/4

List of other publications

Articles, studies (2)

4. Bíró, F. P., Erdey, L., Gáll, J., **Márkus, Á.**: The effect of governance on foreign direct investment in Latin America: issues of model selection.
   Global Economy Journal. 19 (01), 1-19, 2019. ISSN: 1524-5861.
   DOI: https://doi.org/10.1142/S2194565919500064

5. Bíró, F. P., Erdey, L., **Márkus, Á.**: A kormányzás hatása a közvetlen külföldi tőkebefektetésekre Latin-Amerikában = The effect of governance on foreign direct investment in Latin America.
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Conference presentations (3)

6. **Márkus, Á.**: A határhatás vizsgálata a regionális gazdasági integrációkban és Közép-Kelet-Európában.
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7. **Márkus, Á.**: Disappearing borders in Central and Eastern Europe: evolution of the border effect in the Visegrad countries.
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8. **Márkus, Á.**: How much do borders still matter in regional integrations: the case of Central and Eastern Europe.
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Total IF of journals (all publications): 0,629
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