Paper prepared for the
Third Euroacademia International Conference
Re-Inventing Eastern Europe

Berlin, 28 – 29 March 2014

This paper is a draft
Please do not cite

Central East European Countries' Accession into the European Union: Role of the Extensive Margin for Trade in Intermediate and Final Goods

Inmaculada Martínez-Zarzoso [a)]

Georg-August University of Göttingen and University Jaume I

Anca M. Voicu [b)] and Martina Vidovic [c)]

Rollins College

Abstract

We study the effect on trade in intermediates and final goods of the Central East European countries' (CEECs) accession into the European Union (EU) for the period 1999-2009. In doing so, we estimate a gravity model that incorporates the extensive margin of trade and accounts for firm heterogeneity. We capture the importance of production networks by including imports of intermediates as a determinant of a country's exports of final goods. We find a positive and significant effect of the CEECs-accession on EU trade in intermediate and final goods. Once the extensive margin of trade is accounted for, the effect of the CEECs accession into the EU is higher on trade in intermediate goods than on trade in final goods.

JEL Classifications: F10, F14

Keywords: gravity equation; panel data; production networks; economic integration; trade flows.

Acknowledgements: The authors acknowledge the support and collaboration of Project ECO2010-15863. They also thank the participants of the research seminar held at the Universität Osnabrück, Institut für Empirische Wirtschaftsforschung, and the Seventh Annual Conference of the German Development Economics conference held in Berlin for their helpful comments and suggestions, which have been incorporated into the paper.

a) Corresponding author. Department of Economics, University of Göttingen, Platz der Göttinger Sieben 3, 37073 Germany. E-mail: martinei@eco.uji.es.Financial support from the Spanish Ministry of Science and Innovation is grateful acknowledged (ECO 2010-15863). We also would like to thank an anonymous referee for helpful comments and suggestions.

b) Email: avoicu@rollins.edu.

c) Email: mvidovic@rollins.edu.

I. Introduction

Geographical proximity as well as historical evidence suggests that Western Europe and Central-East Europe are natural trading partners. Despite this, trade between the eastern and western parts of the European continent was suppressed by two restraints before 1989. The first was explicit government policies of import licensing, state monopolies on foreign trade, foreign exchange restrictions and central planning. The second, less direct, were the growth inhibiting aspects of central planning which impacted negatively income levels in Central-East Europe. The Europe Agreements established bilateral free trade between the European Union (EU) and each individual Central Eastern European country (CEEC) in most industrial products by the end of 1994, and in 2004 and 2007 eight and two CEECs respectively have gained full accession into the EU. According to Kaminski and Ng (2001), before the CEECs became part of the EU, trade between East and West Europe mainly consisted of final products. Following accession however, the CEECs are expected to be more integrated into regional (mainly EU based) production networks and increase their exchange of intermediate products with former EU members. Indeed, recent years witnessed two interrelated developments that have transformed the nature of international trade. On the one hand there has been significant growth of world trade and on the other hand there has been growth of vertical specialization due to production fragmentation and the resulting production sharing. Since the splitting of the production process leads to products crossing borders several times, production fragmentation across borders could account for rapid growth in trade. In addition, the global gains from free trade may be enlarged due to the international

production sharing allowing stages of production processes to be allocated across countries more efficiently and with comparative advantage as in Yi (2003).

The main research issues examined in this paper are the following. First, we examine how the full accession of the CEECs into the EU in 2004 and 2007 affects the trade in intermediate and final goods between the CEECs and the OECD countries. Second, we assess whether the increase in exported final goods from the CEECs to the OECD countries can be explained in part by the increase in new intermediate products imported from the EU. By distinguishing between final and intermediate goods trade, this research is an extension of the work done by Antimiani and Constantini (2010) and Hornok (2010) who are the only authors that estimate the effects of the 2004 EU-enlargement on trade. The former paper finds that the effect of the enlargement is much more evident for high-tech than for low-tech sectors, and the second finds that the impact of the enlargement on exports of final goods is positive and greater for the new EU members than for the old EU members.

In addition to estimating the effect of the CEECs accession on trade in intermediate and final products separately and the contribution of production networks to trade in final goods, we also analyze the relative impact of both margins of trade, extensive and intensive, on exports of final products. According to the so-called new-new trade theories based on firm heterogeneity in productivity and fixed cost of exporting as in Melitz (2003), a reduction in trade costs will lead to an increase in trade in two margins: the number of traded varieties (extensive margin) and the average volume of trade (intensive margin). But not all new varieties traded are expected to be consumer goods; new intermediate inputs would be exported to countries producing the final good.

Due to 'just in time' production processes, intermediates are more likely to be traded over short distances. The recently developed model by Baldwin and Venables (2010) shows how reductions in trade costs beyond a threshold can result in discontinuous changes in location, with a relocation of a wide range of production stages. The authors highlight that there have been important empirical studies charting the rise of trade in parts and components and that formal measurement has been problematic since trade data do not make clear which goods are inputs into the production of other goods.

To analyze the trade flows, we employ a theoretically justified gravity model based on Anderson and Van Wincoop (2003) and apply the estimation procedure developed by Helpman, Melitz and Rubinstein (2008) which exploits the frequency of zeros in aggregate bilateral trade data to assess the effects of trade barriers on the extensive margin of trade and accounts for firm heterogeneity and sample selection on the intensive margin. Following Helpman et al. (2008), we define the extensive margin at the country level and measure it as the sum of the number of different items traded with each origin/destination per year. We estimate two models, one for the CEECs imports of parts and components from the OECD countries, and the other for exports of final goods from the CEECs to the OECD countries over the period 1999 to 2009. We specifically link parts and components with their corresponding final goods by using trade data disaggregated at the 5 digit Standard International Trade Classification (SITC) level to estimate the effect that an increase in imports of intermediates has on exports of the corresponding final products. To our knowledge this has not been done previously. In addition, we augment the model for trade in final goods with controls for each trade margin (extensive and intensive) to assess their relative contributions.

Our results indicate that the CEECs accession into the EU has increased trade volumes and trade varieties in both parts and components and final goods between the two parts of the European continent. Once we account for the extensive margin of trade in the regression model where the dependent variable is exports of final goods, the estimated effect of the CEECs' accession into the EU on final goods' trade is considerably reduced. This indicates that part of this effect is in fact due to trade diversification that may have emerged as a consequence of the decline in transport costs.

The remainder of the paper is organized as follows. Section 2 provides a brief discussion of the related literature. Section 3 presents the model specification and discusses several estimation issues. Section 4 describes the data and presents the main results. The conclusions and policy implications are discussed in Section 5.

II. Theoretical Background and Literature Review

Jones and Kierzkowski (1990) were the first to propose a theory of international production fragmentation that incorporates differences in comparative advantage in different locations. This new theory is based on the classical (Ricardian) and the neoclassical (Hecksher-Ohlin) trade theories. First, in line with the Ricardian theory, differences in labor skills among labor intensive countries imply that labor skills of one country may be more suitable for one stage of production process while labor skills of another country may be more suitable for another stage of production process. Second, based on the Hecksher-Ohlin theory of international trade, more labor intensive stages of production will locate in labor abundant, lower wage countries, while more capital

intensive stages of production will take place in capital abundant countries. This means that a country does not have to have a comparative advantage in every stage of production, and a firm can take advantage of country-specific differences in resource endowments and productivities through vertical specialization.

From an empirical point of view and given the diversity of forms in which international fragmentation of production can take place, measurement of this phenomenon has been done using several different indicators. One way to measure the international fragmentation of production is by using foreign trade statistics to classify goods into parts and components and finished products. This is reflected in the work done by Ng and Yeats (2001, 2003), Yeats (2001, Kaminski and Ng (2001, 2005), Athukorala (2006), Kimura et *al*, (2007), Zeddies (2011) and Hayakawa and Yamashita (2011)[1]. Most studies focus on a subset of products within the categories machinery and transport equipment and miscellaneous manufacture articles (SITC 7 and 8 respectively). Data reported under the SITC 7 provide sufficient information to separate parts and components and relate them to the corresponding final products. The SITC 8 product category data do not fully capture fragmentation as some components are recorded under other SITC categories. The examples are final products such as clothing and furniture. Similar to more recent studies done by Athukorala (2006), Kimura et *al.* (2007) and Hayakawa and Yamashita (2011), we use not only the product description of final products and components from the SITC 7 and 8 categories (Revision 3) to classify products into parts and components and final products but also the correspondence between the Broad Economic Classification (BEC) and the SITC classification. The latest

[1] The other two are the outward procession trade statistics that capture the production fragmentation by MNEs as in Baldone et al. (2001) and Egger and Egger (2005) and input-output tables that estimate vertical specialization where independent firms act together as a network as in Hummels, Ishii and Yi (2001).

SITC revision (Revision 3) has made the separation of final products and components more accurate than before.

Using trade statistics, Navaretti, Haaland and Venables (2002) assessed the extent of the EU involvement into global production networks. They found that the shares of parts and components in total EU manufacturing (both imports and exports) have grown for trade with all geographic areas over the period 1990-1997. The highest shares were for trade within the EU and with North America. In particular within the EU, there has been significant growth of networking with the CEECs following their gradual economic integration with Western Europe since 1989. According to the study, the shares of parts and components in total EU manufacturing by the Eastern European countries increased from 4.5% to 15.3% for exports and from 5.8% to 12.3% for imports between 1990 and 1997. The authors concluded that although the high-income countries display a higher share of trade in parts and components with the EU than the low-income countries, some of the less developed areas that are geographically close and integrated into the EU are increasing their involvement in global production networks.

A number of recent studies done by Athukorala and Yamashita (2006), Kimura et *al.* (2007), Bergstrand and Egger (2008), Baldwin and Taglioni (2011) and Hayakawa and Yamashita (2011) used the standard gravity trade model to examine the main factors responsible for the growth of fragmentation of trade. Based on large datasets with highly disaggregate trade data where the dependent variables are bilateral trade flows of final and intermediate goods as well as FDI flows, these studies find that the coefficients on the standard gravity variables such as economic size and distance all have the expected signs. However, Athukorala and Yamashita (2006) obtain a negative coefficient on the

difference in per capita income which is a proxy for factor endowment differences. They attribute this to the fact that most global trade in both final goods trade and parts and components is dominated by advanced economies with lower differences in comparative advantage. Kimura et al. (2007) capture differences in location advantages by the income gap between trading countries and find a positive coefficient for East Asia and a negative coefficient for Europe. They conclude that the trade in parts and components in Asia is the result of the existence of shared production networks which attempt to exploit the comparative advantage of each location, while in Europe the trade is dominated by horizontally differentiated goods which are not driven by per capita income differences between countries. Bergstrand and Egger (2008) contributed to the literature by developing a theoretical rational for estimating simultaneous gravity equations for bilateral trade in final goods, intermediate goods and FDI flows. In their empirical estimation, they find that the growth in trade in intermediates explains roughly one-fifth of the increase in FDI relative to final goods trade. Baldwin and Taglioni (2011) mainly focus on the role played by the income variables in the gravity equation for intermediate goods trade and find that GDP as a measure of economic mass works less well for bilateral trade flows characterized by relatively high shares of intermediates trade but this is only a problem in studies that do not include fixed effects.

More closely related to our work, using gravity equations, Hayakawa and Yamashita (2011) examine the effects of Free Trade Agreements (FTAs) on trade in final goods and, separately, in trade in intermediate goods. Interestingly, their results indicate that FTAs have a positive and significant effect on trade in final goods in both, the short and the long run, that materialize in higher trade in the first six years following the

agreement. In contrast, the FTAs effect on trade in intermediate goods is only positive and significant in the long run, and higher bilateral trade associated with the FTAs is first observed six years after the implementation of the agreements.

The usual approach in gravity studies is to focus only on country pairs with strictly positive trade flows. According to the gravity theory, trade is the result of mass attraction and resistance from geographical distance. However, in some cases the attraction may not be strong enough to facilitate trade and ignoring such cases will underestimate the impact of the distance barrier on trade. According to the so-called new-new trade theories based on firm heterogeneity in productivity and fixed cost of exporting as in Melitz (2003), a reduction in trade costs will lead to an increase in trade in two margins: the number of traded varieties (extensive margin) and the average volume of trade (intensive margin). Thus, the standard gravity models do not properly account for the effect of trade costs arising from geographic distance and transport on bilateral trade. Helpman et al. (2008) developed a system of gravity equations to estimate the effects of trade barriers on the intensive (trade volume) and extensive (number of exporting firms) margins of trade by exploiting the frequency of zero trade flows between pairs of countries. To avoid the bias, we estimate their proposed system of equations.

A number of studies have explored the relative impact of the extensive and the intensive margins of trade on export growth. Felbermayr and Kohler (2006) and Helpman et al. (2008) find the majority of the growth of trade between 1970 and the mid-1990s was due to the intensive margin of trade. Similarly Eaton et al. (2008) examine trade by Colombian firms and find that while up to one half of the exporting firms in any given year are new, most export growth is due to changes in sales volume by existing firms

(intensive margin). Besedes and Prusa (2011) confirm that most of the export growth is due to the intensive margin and that export survival is a significant factor in explaining the differences in the long run export performance of countries. The results by Hummels and Klenow (2005) however, come in stark contrast with the previously reported findings. The authors used data on exports for a large number of product categories with broad geographic coverage and find that the extensive margin accounts for 60% of the greater exports of larger economies. They confirm the same pattern for the U.S. data with more detailed product coverage. Similarly, Evenett and Venables (2002) examine the growth of exports of 23 developing and middle income economies and find that the expansion along the extensive margin played a significant role for the growth of exports of developing countries between 1970 and 1997.

Our work builds on the abovementioned studies and uses the gravity model to estimate the effects of the EU enlargement on trade in parts and components and final goods between the CEECs and the OECD countries.

III. Empirical Analysis

A. Model Specification and Main Hypothesis

The theoretical foundations of fragmentation, discussed above, suggest that this phenomenon can be justified by well-established trade theories. Therefore, in line with earlier contributions by Anderson (1979) and Bergstrand (1985)and more recent ones by Anderson and van Wincoop (2003), Helpman et al. (2008), Bergstrand and Egger (2008) and Baldwin and Taglioni (2011) we opted for using a gravity model of trade, which is nowadays the most commonly accepted framework for modeling bilateral trade flows.

According to the underlying theory, trade between two countries is explained by nominal incomes and the populations of the trading partners, by the distance between the economic centers of the exporter and the importer, and by a number of trade impeding and trade facilitating factors depending on whether the trading partners belong to the same regional integration agreements and whether they share a common language or a common border. Consistent with this approach, and in order to investigate the effect of production networks, we augment the traditional model of a country's exports of final goods with a measure of imports of intermediate goods. Adding the time dimension, the gravity models of trade, one for the volume of imports of intermediate goods, $MInt_{ijkt}$, and other for the volume of exports of final goods X_{ijkt} of product k from country i *(*reporter*)* to country j (partner) in period t in current Euros are given as

$$MInt_{ijkt} = \alpha_0 \; Y_{it}^{\alpha_1} Y_{jt}^{\alpha_2} YH_{it}^{\alpha_3} YH_{jt}^{\alpha_4} DIST_{ij}^{\alpha_5} F_{ij}^{\alpha_7} \; u_{ijkt} \tag{1}$$

$$X_{ijkt} = \beta_0 \; Y_{it}^{\beta_1} Y_{jt}^{\beta_2} YH_{it}^{\beta_3} YH_{jt}^{\beta_4} DIST_{ij}^{\beta_5} MInt_{ijk,t-1}^{\beta_6} F_{ij}^{\beta_7} \; u_{ijkt} \tag{2}$$

where Y_{it} (Y_{jt}) indicate the GDPs of the reporter (partner) in period t, YH_{it} (YH_{jt}) are reporter (partner) GDPs per capita in period t and $DIST_{ij}$ is the geographical distance between the capitals (or economic centers) of countries i and j. In the empirical application we use CEECs imports of parts and components from the OECD+CEECs and CEECs exports of final goods to the OECD+CEECs. $MInt_{ijk,t-1}$ denotes the volume of imports of intermediate goods in the previous period[2], F_{ij} denotes other factors that impede or facilitate trade (common language, a colonial relationship, or a common border). Finally, u_{ijkt} is an idiosyncratic error term that is assumed to be well behaved.

[2] Imports enter with one lag to avoid reverse causality issues.

Usually the model is estimated in log-linear form[3]. Taking logarithms and adding time and sectoral dummies, we specify the augmented versions of models (1) and (2), as

$$LMInt_{ijkt} = \alpha_0 + \phi_t + \lambda_k + \alpha_1 LY_{it} + \alpha_2 LY_{jt} + \alpha_3 LYH_{it} + \alpha_4 LYH_{jt} + \alpha_5 LDIST_{ij} + \\ + \alpha_7 EU_{ijt} + \alpha_8 CONTIG_{ij} + \alpha_9 LAND_i + \alpha_{10} LAND_j + \alpha_{11} CEEC_{ij} + \eta_{ijkt} \quad (3)$$

$$LX_{ijkt} = \beta_0 + \gamma_t + \tau_k + \beta_1 LY_{it} + \beta_2 LY_{jt} + \beta_3 LYH_{it} + \beta_4 LYH_{jt} + \beta_5 LDIST_{ij} + \beta_6 LMInt_{ijk,t-1} + \\ + \beta_7 EU_{ijt} + \beta_8 CONTIG_{ij} + \beta_9 LAND_i + \beta_{10} LAND_j + \beta_{11} CEEC_{ij} + \upsilon_{ijkt} \quad (4)$$

where L denotes variables in natural logarithms, *CONTIG* and *LAND* are dummy variables that take the value of 1 if the partner countries share a border or are landlocked respectively, and the other explanatory variables are described above. ϕ_t denote specific time effects that control for omitted variables common to all trade flows but which vary over time. λ_k and τ_k are industry fixed effects. Finally, η_{ijkt} and υ_{ijkt} are idiosyncratic error terms that are assumed to be well behaved.

Next, trading-partner effects δ_{ij} and κ_{ij} could also be specified as fixed effects. According to Baier and Bergstrand (2007) trading-partner unobservable effects are used to control for the potential endogeneity of the formation of free trade agreements. In this case, the influence of the variables that are time invariant cannot be directly estimated. This is the case for distance and contiguity; therefore, their effects are subsumed into the country dummies.

With respect to the specification of the multilateral resistance terms, as theoretically suggested by Anderson and van Wincoop (2003), we consider a modification to the previous specification that includes country-and-time effects to account for time-variant, multilateral price terms, as proposed by Baldwin and Taglioni

[3] We also estimate the model in its original multiplicative form.

(2006) and Baier and Bergstrand (2007). As stated by Baldwin and Taglioni (2006), the inclusion of time-varying country dummies should completely eliminate the bias stemming from the 'gold-medal error' (the incorrect specification or omission of the terms that Anderson and van Wincoop (2003) called *multilateral trade resistance*).

The specification which accounts for the potential endogeneity of the EU dummy and for the multilateral price terms in a panel data framework is given by the following equations:

$$LMInt_{ijkt} = \alpha_0 + \delta_{ij} + \lambda_k + \alpha_1 EU_{ijt} + \sum_{1}^{NT} P_{it}^{1-\delta} + \sum_{1}^{NT} P_{jt}^{1-\delta} + \varepsilon_{ijkt} \quad (5)$$

$$LX_{ijkt} = \beta_0 + \kappa_{ij} + \tau_k + \beta_1 EU_{ijt} + \beta_2 LMInt_{ijk,t-1} + \sum_{1}^{NT} P_{it}^{1-\delta} + \sum_{1}^{NT} P_{jt}^{1-\delta} + \mu_{ijkt} \quad (6)$$

where $P_{it}^{1-\sigma}$ and $P_{jt}^{1-\sigma}$ are time-variant, multilateral (price) resistant terms that are proxied with country-and-time dummies, and ε_{ijkt} and μ_{ijkt} denote the error terms that are assumed to be independent and identically distributed. The other variables are defined as in equations (3) and (4), above. Income and income-per-capita variables cannot be estimated because they are collinear with the exporter-and-time and importer-and-time dummy variables.

Two remaining issues related to the estimation of gravity models of trade that may give rise to biased estimates are the presence of zeros in the dependent variable (bilateral trade) and the omission of the extensive margin of trade. To approach these problems we consider an alternative specification that is based on Helpman et *al*. (2008). The authors develop a theory of international trade that predicts positive, as well as zero, trade flows across pairs of countries and accounts for firm heterogeneity while allowing the number of exporting firms to vary across destination countries. The model yields a

generalized gravity equation which corrects for the self-selection of firms into export markets and their impact on trade volumes. The authors derive from this theory a two-stage estimation procedure that decomposes the impact of trade resistance measures on trade volumes into intensive (trade volume per exporter) and extensive (number of trading firms) margins. The authors propose a system of equations consisting of a selection equation in the first stage and a trade-flow equation in the second. They show that the traditional estimates are biased and that the bias is primarily due to the omission of the extensive margin, rather than the selection into trade partners.

In line with Helpman et al. (2008), we also estimate the proposed system of equations. The first equation specifies a latent variable that is positive only if country *i* imports parts and components or exports final goods to country *j* (equations 7 and 9, respectively). The second equation specifies the log of bilateral imports or exports from country *i* to country *j* as a function of standard variables (distance, common language, landlocked, common border)[4], and a variable, $\omega_{ijkt,}$ that is an increasing function of the fraction of country *i's* firms that export to or import from country *j* (equations 8 and 10, respectively). The resulting equations are the following:

$$\rho^{1}_{ijkt} = P(MInt_{ijkt}) = \Phi(\vartheta_0 + \psi_t + \delta_{ij} + \lambda_k + \vartheta_1 LY_{it} + \vartheta_2 LY_{jt} + \vartheta_3 LYH_{it} + \vartheta_4 LYH_{jt} + \vartheta_5 EU_{ijt}) \tag{7}$$

$$LMInt_{ijkt} = \alpha_0 + \omega^{1}_{ijkt} + \alpha_5 LDIST_{ij} + \alpha_6 MInt_{ijk,t-1} + \alpha_7 EU_{ijt} + \alpha_8 CONTIG_{ij} + \alpha_9 LAND_j + \sum_{1}^{NT} P_{it}^{1-\delta} + \sum_{1}^{NT} P_{jt}^{1-\delta} + \varepsilon_{ijt} \tag{8}$$

[4] Alternatively, equations (8) and (10) are estimated with dyadic fixed effects.

$$\rho^{2}_{ijkt} = P(X_{ijkt}) = \Phi(\theta_0 + \zeta_t + \kappa_{ij} + \tau_k + \theta_1 LY_{it} + \theta_2 LY_{jt} + \theta_3 LYH_{it} + \theta_4 LYH_{jt} + \\ + \theta_5 MInt_{ijk,t-1} + \theta_6 EU_{ijt}) \quad (9)$$

$$LX_{ijkt} = \beta_0 + \omega^{2}_{ijkt} + \beta_5 LDIST_{ij} + \beta_6 MInt_{ijk,t-1} + \beta_7 EU_{ijt} + \beta_8 CONTIG_{ij} + \\ + \beta_9 LAND_{j} + \sum_{1}^{NT} P_{it}^{1-\delta} + \sum_{1}^{NT} P_{jt}^{1-\delta} + \mu_{ijt} \quad (10)$$

where δ_{ij} and ξ_{ij}, are dyadic random effects to control for unobserved heterogeneity, and ψ_t , φ_t denote time-specific effects.

The new variables, ω^{1}_{ijkt} and ω^{2}_{ijkt} are inverse functions of firm productivity. The error terms in all equations are assumed to be normally distributed. Clearly, the error terms in equations (7) and (8) and error terms in equations (9) and (10) are correlated. Helpman et al. (2008) construct estimates of the ω^{m}_{ijkt} using predicted components of equation (7) or equation (9). They propose a second stage non-linear estimation that corrects for both sample-selection bias and firm heterogeneity bias. They also decompose the bias and find that correcting only for firm heterogeneity addresses almost all the biases in the standard gravity equation. They implement a simple linear correction for unobserved heterogeneity (ω^{m}_{ijkt}) proxied with a transformed variable ($\hat{z}^{*m}_{ijkt}$) given by,

$$\hat{z}^{*m}_{ijkt} = \Phi^{-1}(\hat{\rho}^{m}_{ijkt}) \quad (11)$$

where $z^{*m}_{ijkt} = \frac{z^{m}_{ijkt}}{\sigma^{\eta}_{ijkt}}$ and Φ are the cumulative distribution functions (cdf) of the unit-normal distribution. $\hat{\rho}^{m}_{ijkt}$ are the predicted probabilities of imports and exports (m=1, 2) between country *i* and country *j*, using the estimates from the panel-probit from Equations (7) and (9). We also decompose the bias and use the inverse Mills ratio as a

proxy for sample selection, and the linear prediction of exports and imports down-weighted by their standard errors as proxies for firm heterogeneity, all obtained from equations (7) and (9). The main difference between the Heckman and the Helpman et al. (2008) procedures is the inclusion of (ω_{ijkt}^{m}) as a proxy for firm heterogeneity in the Helpman et al. (2008) procedure, since the inverse Mills ratio, also called non-selection hazard, is included in both approaches as a way to correct for selection of firms into export markets. The exclusion variables that permit identification are the landlocked dummy variables that are included in the selection equation but not in the second step equation.

B. Data Description and Stylized Facts

Our study draws upon several data sources. The bilateral flows on external trade are from the European Commission's EUROSTAT database. Based on the SITC Revision 3, and using a detailed level of disaggregation (5 digit SITC), we identified the parts and components and their corresponding final products within the machinery and transport equipment group (SITC 7) and miscellaneous manufacture articles group (SITC 8). Based on the literature on production networks, we identified 12 product categories: power generating (SITC 71) and specialized (SITC 72) machinery, metalworking (SITC 73) and general industrial (SITC 74) machinery, office machines (SITC 75), telecommunications and sound recording equipment (SITC 76), electrical goods (SITC 77), road vehicles (SITC 78), other transport equipment (SITC 79), furniture (SITC 82), measuring instruments (SITC 874) and photographic equipment, optical goods and watches (SITC 88). In order to select relevant parts and components, we first referred to the United Nations' Broad Economic Category (BEC) classification system. The BEC

classification system groups traded goods according to their main end use and it is defined in terms of the SITC system. Among seven major categories, industrial supplies (BEC 2), capital goods (BEC 4), and transport equipment (BEC 5) include a subcategory for 'parts and components'. The corresponding subcategories are BEC 22, 42 and 53. We chose only the items under these subcategories that also correspond to the SITC 7 and SITC 8 categories that we study. The final list of parts and components includes 276 items, while the list of final goods consists of 514 items[5]. Our identification of parts and components follows the work of Athukorala (2006), Kimura et *al.* (2007) and Hayakawa and Yamashita (2011).

GDP data measured at current prices and expressed in millions of Euros are from the EUROSTAT's national accounts database, while data on population are from the OECD National Accounts Statistics. Information on country-pair specific variables such as distance between countries *i* and *j*, whether they have the same colonial origin, share a common border or share a common language are from the CEPII[6]. Additional covariates include controls for regional trading arrangement[7]. Our sample consists of 32 countries (30 OECD members and Bulgaria and Romania) for which complete data were available over the period 1999 to 2009. Summary statistics of all the variables are shown in Table 1.

Table 1. Summary statistics

We analyzed the evolution of the extensive margin of trade in both intermediate and final goods between the CEECs and the EU+CEECs in our sample. The extensive

[5] The list of countries as well as parts and components are provided in Tables A1 and A2 in the Appendix.
[6] CEPII stands for Centre d'Etudes Prospectives et d'Informations Internationales. It is a French leading institute for research on the international economy.
[7] The description of all variables is given in Table A3 in the online Appendix at http://works.bepress.com/inma_martinez_zarzoso/20/.

margin is calculated as the sum of the number of different items (SITC 5-digits) traded with each origin/destination per year. Hence, an increase in the number of items over time is observed when a new item (with no bilateral trade in the previous year) is recorded for a given bilateral trade relationship[8]. With regards to the number of new intermediate products imported from the EU+CEECs, the figures increased steadily over the years, especially after 2003. This suggests that the entry of the CEECs into the EU may have stimulated imports of new varieties of parts and components that were not imported before.

Next, we examine the evolution of exported varieties of final goods by each CEEC to EU+CEECs. The figures indicate a similar increasing trend in exports of new final goods for all CEECs between 1999-2003 with a particularly sharp increase in trade between 2003 and 2004. This should not be surprising since all of the CEECs in our sample were preparing for accession into the EU in 2004. After a slight decrease in exports from the CEECs to the EU+CEECs between 2004 and 2005, the exports of final goods for most CEECs followed an increasing trend at least until the onset of the Great Recession in 2007.

Next, we also analyzed the evolution of the volume of imports and exports and observed similar trends over time. After accession, the volume of bilateral trade increased between CEECs and the EU members.

Finally, in terms of shares of trade in intermediate goods with respect to total trade in SITC categories 7 and 8, the importance of imports of intermediate goods has also grown for most CEECs trade with EU destination and decreased for non-EU

[8] Figures 1and 2 in the Appendix show the evolution over time of the extensive margins of intermediate and final goods trade between the CEECs and the EU+CEEC countries.

destinations, but remains low (between 6 and 15%) in comparison to Asian countries (Athukorala, 2006; Athukorala and Yamashita, 2006).

C. Estimation Results

We estimate the above specified models for data on 6 CEECs' exports to 32 destinations (6 CEECs+ the OECD countries) during the period 1999 to 2009. Table 2 reports the baseline estimation results for disaggregated exports and imports at 5-digit SITC level. The models in columns 1 and 2 show the results for the imports of intermediate goods and exports of final goods respectively using the pooled OLS with time and industry dummy variables (standard gravity models as specified in eqs. (3) and (4)).

All models are estimated using robust standard errors clustered across panels (exporter-importer-sector). The interest in this specification is that we are able to estimate separately the effects of accession on intra-Eastern European trade (CEEC*j* variable) from those on trade between CEECs and Western EU countries. Our findings are in line with previous studies in that we find a positive and significant effect for both types of trade, and similar to Hornok (2010) a stronger effect on intra CEECs trade. The estimated coefficients for other gravity variables show some important differences between trade in intermediate goods and trade in final goods. It is worthy to note that the coefficient on the distance variable is significantly higher in the model that estimates the trade in the intermediates than in the model that estimates the trade in final goods, while the effect of sharing a common border is twice as big in the final goods model than in the intermediate goods model.

Table 2. Determinants of Imports of Intermediate goods and Exports of Final Goods by the CEECs – Linear Models

Columns 3 and 4 in Table 2 show the results for models that include country-pair fixed effects and time-varying country dummies (Equations 5 and 6). We use the two-way fixed effect within-estimator with robust standard errors [9]. The coefficient on the EU dummy variable in column 3 indicates that imports of intermediates by CEECs following their accession into the EU have increased by about 55 percent {exp[0.436]-1)*100} with the member countries. In addition, the coefficient on the EU in the model where the dependent variable is exports of final goods (column 4) is positive and statistically significant indicating that a sizeable increase in exports is due to accession (exports of final goods are 191 percent higher than before accession). The last columns of Table 2 show the results of the gravity equations estimated for final goods augmented with imports of intermediate goods in the previous period. Column 5 shows the result for equation (4) and column 6 for equation (6). The effect of imports of intermediate goods on exports of final goods is positive and statistically significant and indicates that a 10 percent increase in imports of intermediate goods by the CEECs from the OECD countries increases exports of final goods of CEECs by 1 percent (column 6) while the coefficient on the EU dummy remains almost unchanged (column 5 versus column 2). Summarizing, controlling for multilateral resistance in the most recently recommended way indicates that there is a considerably larger EU effect for exports of final products than for imports of intermediates and that the effect of production networks is still

[9] A Hausman test indicates that the dyadic unobservable effects are correlated with the error term, hence the random effects approach, ignoring this correlation, leads to inconsistent estimators. The problem can be handled by using the fixed effects approach, which essentially eliminates the dyadic unobservable effects.

sizable. However this effect may partly account for the increase in product diversification (extensive margin of trade).

Table 3 presents the results from estimating Equations 8 and 10[10] that account for selection bias and firm heterogeneity as in Helpman et al. (2008). In each case we first estimated a random-effects probit model with exporter and importer effects and time effects (Equations 7 and 9). From these estimates we obtained the linear prediction terms down-weighted by their standard errors (zhat, where z=x,m) and the inverse Mills ratio (imills). These two elements are incorporated as regressors in the second-step estimations (Equations 8 and 10). The results from the second step estimations considering selection effects and firm heterogeneity are given in columns 2 and 3 (for parts) and 4 and 5 (for final goods). Columns 2 and 3 model bilateral effects using gravity variables, whereas columns 4 and 5 model bilateral effects by estimating a within fixed effect model. All second stage models include country-and-time fixed effects.

The coefficients on *mhat* and *xhat* are positive and statistically significant at the 1percent level indicating that the increase in imports and exports has been due in part to trade diversification (extensive margin of trade) and the effect is greater for exports of final goods. The coefficient on the inverse Mills ratio (*imills*) is also statistically significant and negatively signed showing evidence of selection effects. The estimates shown in the second and last column of Table 3 indicate that the increase in exports of final goods is partly explained by an increase in the intensive margin of imports (0.087) and partly by an increase in the extensive margin of exports (1.052).

Table 3: Determinants of Imports of Intermediates and Exports of Final Goods with Heckman Sample Selection and Firm Heterogeneity

[10] Results for the first step estimation (Equations 7 and 9) are available upon request from the authors.

With respect to the EU effect, the results in Table 3 indicate that there is a positive effect on both imports of intermediates and exports of final goods. Based on the coefficient on the EU variable in column 2, the imports of intermediates increased by about 54 percent following the accession of CEECs into the EU and the effect is almost the same as what we found based on the results in Table 2 column 3. However, the effect is much lower than before for exports of final goods. Based on the estimated coefficient on the EU in column 4 in Table 3, the exports of final goods increased by about 69 percent following the accession compared to 191 percent that we found based on the results in Table 2 column 4. A possible explanation for the discrepancy with respect to results in Table 2 is that the Helpman et al. (2008) method distinguishes between trade margins and accounts for the effect of the extensive margin (trade diversification) whereas the Baldwin and Taglioni (2006) method does not consider the effect of the extensive margin on total trade.

As a first robustness check, we estimated the model in its multiplicative form using the method proposed by Santos and Tenreyro (2006) (pseudo Poisson Maximum Likelihood) for the second step estimations which controls for zero trade flows and heteroskedasticity[11]. The main conclusions remain since the estimated coefficients are similar in magnitude and statistical significant.

As a second robustness check we estimated the same models with 5 digit SITC dummies. The results show in general higher integration effects for final goods

[11] Results can be found in Table A.4 in the Appendix.

(coefficient on EU effect is 0.661) and similar effects for intermediate goods (coefficient on EU effect is 0.384)[12].

Finally, we also estimated time-varying integration effects for intermediate and final goods. The results obtained from equations (6) and (7) show that the EU-effect for intermediate goods is due to higher imports of intermediate goods in the years 2004-2006, while the positive EU-effect on exports of final goods materialized in higher exports during the years 2007-2009[13].

It is also worth noting that we found higher EU-effects compared to Hornok (2010). This discrepancy is probably due to the fact that we used more disaggregated data (5 digits versus 2 digits) and two additional years (2008-2009).

IV. Conclusions

This paper presents evidence of the significant dynamism of the CEECs trade flows in the last decade. It shows that these economies have been very active and involved in production sharing networks, especially with EU countries. The CEECs have been able to increase their extensive and intensive margins of trade in parts and components and also in final goods. These countries appear to be an important destination for the EU exports of parts and components and have also improved their position as exporters of final goods.

Our results indicate that the accession of the CEECs into the EU has been a clear driving force behind this development. There are several possible explanations for this. First, as predicted by trade theories, a reduction in the trade cost (associated with the

[12] Results can be found in Table A.5 in the Appendix.
[13] Results are available on request from the authors.

integration process) has favored the segmentation of production processes and led to a better exploitation of comparative advantages and location. Second, integration into the EU has stimulated not only the exploitation of comparative advantages but also the production of new goods that were previously not produced. Third, due to just in time production process, geographic proximity and sea access are also important determinants of trade in intermediate goods and their absence deters trade to a higher extent than in the case of final goods.

For further research it would be desirable to incorporate into the model elements such as infrastructure and communication networks that facilitate trade by allowing the continuity of the value chain.

References

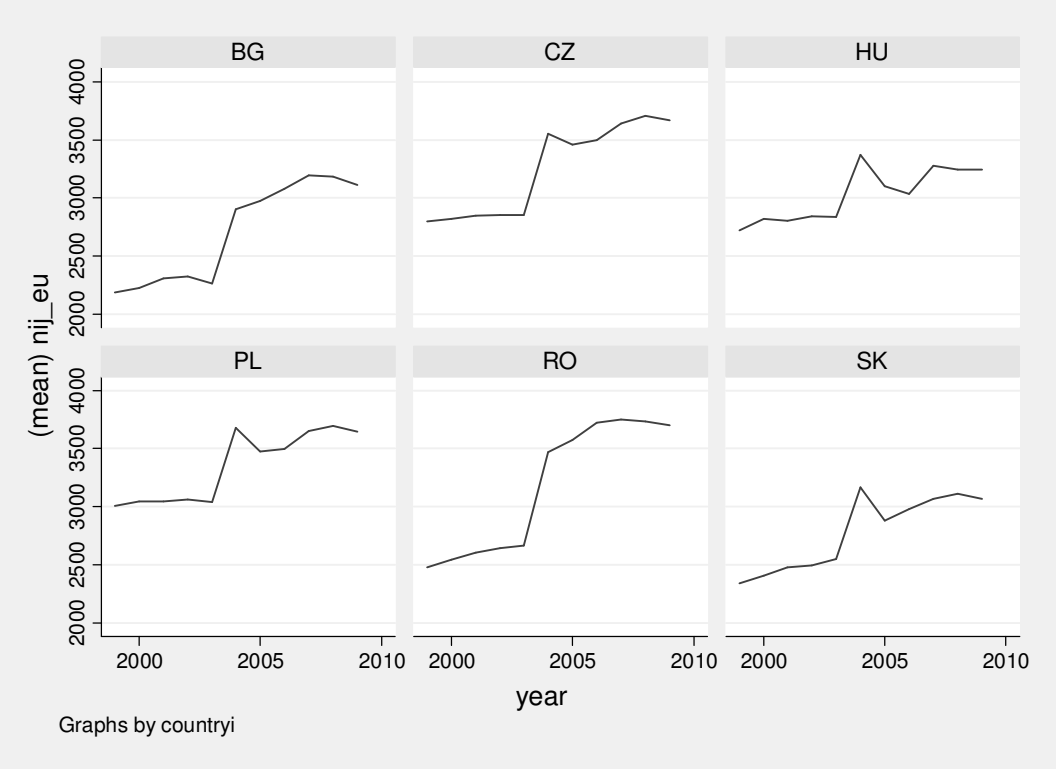
1. Antimiani, Alessandro and Valeria Costantini, "Trade performances and technology in the enlarged European Union", Departmental Working Papers of Economics - University 'Roma Tre' 0111, Department of Economics (2010).
2. Anderson, James E. and Eric Van Wincoop, "Gravity with gravitas: a solution to the border puzzle", American Economic Review 93, (2003): 170-92.
3. Anderson, James E., "A theoretical foundation for the gravity equation", American Economic Review 69, (1979): 106-16.
4. Athukorala, Prema-chandra and Nobuaki Yamashita, "Production fragmentation and trade integration: East Asia in a global context", North American Journal of Economics and Finance 17, (2006): 233–56.
5. Athukorala, Prema-chandra, "Product fragmentation and trade patterns in East Asia", Asian Economic Papers 4(3),(2006): 1-27.
6. Baier, Scott L. and Jeffrey H. Bergstrand, "Do free trade agreements actually increase members' international trade", Journal of International Economics 71, (2007): 72-95.
7. Baldone, Salvatore, Fabio Sdogati and Lucia Tajoli, "Patterns and determinants of international fragmentation of production: evidence from outward processing trade between the EU and Central Eastern European countries", Review of World Economics, Vol. 137(1),(2001): 80-104.
8. Baldwin, Richard and Anthony J. Venables, 'Relocating the value chain: off-shoring and agglomeration in the global economy', Working Paper, London: CEPR, (2010).
9. Baldwin, Richard and Daria Taglioni,"Gravity for dummies and dummies for gravity equations", National Bureau of Economic Research Working Paper 12516, Cambridge, (2006).
10. Baldwin, Richard and Daria Taglioni, "Gravity chains: Estimating bilateral trade flows when parts and components trade is important", National Bureau of Economic Research Working Paper 16672, (2011).
11. Bergstrand, Jeffrey H., "The gravity equation in international trade: some microeconomic foundations and empirical evidence", The Review of Economics and Statistics 67, (1985): 474-81.
12. Bergstrand, Jeffrey H. and Peter H. Egger, "The growth of FDI relative to trade: Measurement, determinants and consequences of international trade flows in intermediates", University of Notre Dame, mimeo, (2008).
13. Besedes, Tibor and Thomas J. Prusa, "The role of extensive and intensive margins and export growth", Journal of Development Economics 96, (2011): 371-79.
14. Eaton, Jonathan, Marcela Eslava, Maurice Kugler and James R. Tybout, "The margins of entry into export markets: evidence from Colombia", In: Helpman, Elhanan, Marin, Dalia, Verdier, Thiery (Eds.), The Organization of Firms in a Global Economy. Harvard University Press, Cambridge, MA, (2008): 231–72.
15. Egger, Hartmut and Peter Egger, "The determinants of EU processing trade", World Economy 28(2), (2005): 147-68.
16. Evenett, Simon J. and Anthony J.Venables, "Export Growth in Developing Countries: Market Entry and Bilateral Trade Flows", University of Bern Working Paper, mimeo, (2002).

17. Felbermayr, Gabriel J. and Wilhelm Kohler," Exploring the intensive and extensive margins of world trade", Review of World Economics 142 (4), (2006): 642–74.
18. Hayakawa, Kazunobu and Nobuaki Yamashita, "The role of Preferential Trade Agreements (PTAs) in facilitating global production networks", IED Discussion Paper 280, (2011).
19. Helpman, Elhanan, Marc Melitz, and Yona Rubinstein, "Estimating trade flows: trading partners and trading volumes", The Quarterly Journal of Economics 123(2), (2008): 441-87.
20. Hornok, Cecilia, "Trade-enhancing EU enlargement and the resurgence of East-East trade" Focus on European Economic Integration ZDB-ID 21714939 (3), Vienna, (2010):79-94.
21. Hummels, David, Jun Ishii and Kei-Mu Yi, "The nature and growth of vertical specialization in world trade", Journal of International Economics 54(1), (2001): 75-96.
22. Hummels, David and Peter J. Klenow, "The variety and quality of a nation's exports", American Economic Review 95 (3), (2005): 704–23.
23. Jones, Ronald and Henryk Kierzkowski, "The role of services in production and international trade: a theoretical framework" in Ronald W. Jones and Anne O. Krueger, eds., The Political Economy of International Trade: Essays in Honor of Robert E. Baldwin, Oxford: Basil Blackwell, (1990): 31-48.The political economy of international trade: Essays in honor of Robert E. Baldwin (Oxford: Basil Blackwell), (1990): 31-48.
24. Kaminski, Bartlomiej and Francis Ng, "Production disintegration and integration of Central Europe into global markets", International Review of Economics and Finance 14(3), (2005): 377-90.
25. Kaminski, Bartlomiej and Francis Ng, "Trade and production fragmentation: Central European economies in European Union networks of production and marketing", The World Bank Policy Research Working Paper Series, WPS 1/2611, (2001).
26. Kimura, Fukunari, Yuya Takahashi and Kazunobu Hayakawa, "Fragmentation and parts and components trade: comparison between East Asia and Europe", North American Journal of Economics and Finance 18, (2007): 23–40.
27. Melitz, Marc J. "The impact of trade on intra-industry reallocations and aggregate industry productivity", Econometrica 71(6), (2003): 1695-1925.
28. Navaretti, Giorgio B., Jan I. Haaland, and Anthony J. Venables, "Multinational corporations and global production networks: the implications for trade policy", Report prepared for the European Commission Directorate General for Trade, London: CEPR, (2002).
29. Ng, Francis and Alexander J. Yeats, "Production sharing in East Asia: who does what for whom, and why?" in L K Cheng, and Henryk Kierzkowski, eds., Global production and trade in East Asia, Boston: Kluwer Academic Publishers, (2001): 63-109.
30. Ng, Francis and Alexander J. Yeats, "Major trade trends in East Asia: what are their implications for regional cooperation and growth?", Policy Research Working Paper 3084, Washington DC: World Bank, (2003).

31. Santos Sylva, Jõao M. C. and Silvana Tenreyro, “The log of gravity”, The Review of Economics and Statistics 88(4), (2006): 641-58.
32. Sturgeon, Timothy J. “How do we define value chains and production networks?’, IDS Bulletin 32(3), (2001): 9-18.
33. Yeats, Alexander J. “How big is global production sharing?”, in Sven W. Arndt and Henryk Kierzkowski, eds., Fragmentation: new production patterns in the world economy,Oxford, Oxford University Press: (2001).
34. Yi, Kei-Mu “Can Vertical Specialization Explain the Growth of World Trade?” Journal of Political Economy, 111(1), (2003): 52-102.
35. Zeddies, Götz “Determinants of international fragmentation of production in European Union”, *Empirica*, Springer, 38(4), (2011): 511-37.

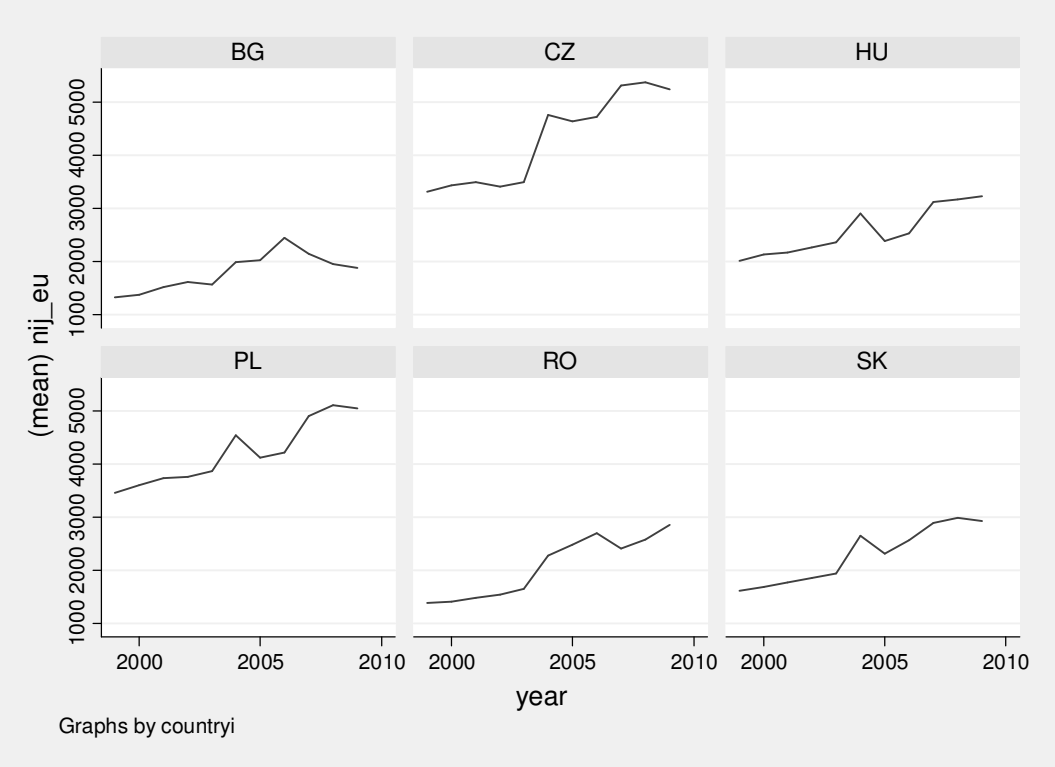
FIGURES

Figure 1. Evolution of the extensive margin of intermediate goods imported by CEECs from the EU, 1999-2009



Source: authors' calculations based on EUROSTAT data. The figures show the number of 5-digits codes imported yearly by each country (BG:Bulgary; CZ: Checz Republic; HU: Hungary; PL: Poland; RO:Romania; SK: Slovakia) from EU+CEECs countries. The maximum number per destination is 276 (5-digit) codes classified as parts and components.

Figure 2. Evolution of the extensive margin of final goods exported by the CEECs to the EU countries, 1999 – 2009



Source: authors' calculations based on EUROSTAT data. The figures show the number of 5-digits codes exported yearly by each country (BG:Bulgary; CZ: Checz Republic; HU: Hungary; PL: Poland; RO:Romania; SK: Slovakia) to EU+CEECs countries. The maximum number per destination is 514 (5-digit) codes classified as final products.

TABLES

Table 1. Summary statistics

Variable	Observations	Mean	Std. Dev	Min	Max
Exports of final goods	112530	5127050	4.20E+07	0	2.40E+09
Imports of intermediate goods	94116	5364679	4.21E+07	0	2.32E+09
Log of exports of final goods	63997	12.094	3.338	0	21.599
Log of imports of final goods	75707	12.029	3.290	0	21.566
Log of GDP_i	112530	11.094	0.840	9.406	12.801
Log of GDP_j	111210	12.625	1.540	9.011	16.257
Log of GDP per $capita_i$	112530	1.666	0.578	0.391	2.652
Log of GDP per $capita_j$	111210	2.992	0.786	0.391	4.389
EU_{ij}	112530	0.267	0.442	0	1
$CEECs_j$	112530	0.161	0.368	0	1
Log of distance	112530	7.481	1.119	4.088	9.821
$Land_j$	112530	0.177	0.382	0	1
$Land_i$	112530	0.500	0.500	0	1
Common $border_{ij}$	112530	0.102	0.303	0	1

Note: $Land_i$, $Land_j$ and Common $border_{ij}$ are dummies that equal to 1 when countries *i* or *j* are landlocked or share a border, respectively. EU_{ij} is dummy variable equal to 1 if both countries *i* and *j* are members of the EU, and $CEECs_j$ is a dummy variable equal to 1 if country *j* belongs to CEECs.

Table 2. Determinants of Imports of Intermediate goods and Exports of Final Goods by the CEECs – Linear Models

	Traditional Gravity		Gravity with dyadic FE and country-and-time FE		Gravity augmented with imports of intermediate goods	
					Traditional Gravity	Gravity with FE
	Imports of parts OLS	Exports of finals OLS	Imports of parts FE	Exports of finals FE	Exports of finals OLS	Exports of finals FE
EU_{ij}	0.486***	0.294***	0.436***	1.069***	0.063	1.078***
	(0.044)	(0.047)	(0.031)	(0.040)	(0.049)	(0.043)
$CEECs_j$	1.339***	0.894***	-	-	0.822***	-
	(0.099)	(0.104)	-	-	(0.115)	-
Log of GDP_i	0.921***	0.777***	-	-	0.581***	-
	(0.058)	(0.076)	-	-	(0.083)	-
Log of GDP_j	1.489***	0.853***	-	-	0.733***	-
	(0.017)	(0.020)	-	-	(0.028)	-
Log of GDP per $capita_i$	-0.132	1.036***	-	-	1.217***	-
	(0.145)	(0.188)	-	-	(0.205)	-
Log of GDP per $capita_j$	0.311***	-0.011	-	-	-0.147***	-
	(0.047)	(0.049)	-	-	(0.057)	-
Log of distance	-1.489***	-1.258***	-	-	-1.146***	-
	(0.026)	(0.030)	-	-	(0.039)	-
$Land_i$	0.067	0.118	-	-	-0.098	-
	(0.117)	(0.147)	-	-	(0.159)	-
$Land_j$	0.652***	-0.317***	-	-	-0.355***	-
	(0.063)	(0.068)	-	-	(0.074)	-
Common $border_{ij}$	0.212***	0.503***	-	-	0.422***	-
	(0.066)	(0.070)	-	-	(0.074)	-
Imports of $intermediates_{(-1)}$	-	-	-	-	0.158***	0.108***
	-	-	-	-	(0.011)	(0.0110)
R-squared	0.584	0.485	0.656	0.5313	0.518	0.5707
Number of observations	75076	63436	75076	63997	41963	42277
RMSE	2.118541	2.393705	1.946625	2.296179	2.226326	2.1165
SITC 3 dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Exporter-Importer effects	no	no	yes	yes	no	yes

Note: The dependent variable is bilateral imports of intermediates and bilateral exports of final goods measured at current prices. Imports of intermediates are lagged by a year. $Land_i$, $Land_j$, Common $border_{ij}$, EU_{ij} and $CEECs_j$ are dummies equal to 1 when countries are landlocked, share a border, or belong to the EU or to the group of CEECs, respectively. Robust standard errors clustered by sector-exporter-and-importer are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 3. Determinants of Imports of Intermediates and Exports of Final Goods with Heckman Sample Selection and Firm Heterogeneity

	Parts and Components Firm heterogeneity + Sample selection		**Final Goods** Firm heterogeneity + Sample selection + Imported parts	
EU_{ij}	0.465***	0.434***	0.390***	0.527***
	(0.094)	(0.072)	(0.145)	(0.141)
$CEEC_j$	-0.353*	-	0.475*	-
	(0.067)	-	(0.279)	-
Log of distance	-0.448***	-	-0.101	-
	(0.073)	-	(0.087)	-
$Land_j$	-1.141***	-	-0.873**	-
	(0.276)	-	(0.405)	-
Common $border_{ij}$	0.454***	-	0.157	-
	(0.085)	-	(0.108)	-
Imports of $intermediates_{(-1)}$	-	-	0.063***	0.058***
	-	-	(0.012)	(0.012)
Linear predictor of imports	0.087***	0.012	-	-
	(0.007)	(0.337)	-	-
Linear predictor of exports	-	-	0.954***	1.052***
	-	-	(0.085)	(0.071)
Inverse Mills ratio	-0.758***	-	-0.126*	-0.153**
	(0.047)	-	(0.067)	(0.066)
R-squared	0.632	0.645	0.550	0.550
Number of observations	73558	73558	40894	40894
RMSE	1.981191	1.946464	2.142223	2.142621
SITC 3 dummies	yes	yes	yes	yes
Exporter-Importer effects	no	yes	no	yes
Exporter-time and Importer-time effects	yes	yes	yes	yes

Note: The dependent variables are the bilateral imports of intermediates and the bilateral exports of final goods measured at current prices. $Land_i$, $Land_j$, Common $border_{ij}$, EU_{ij} and $CEECs_j$ are dummies equal to 1 when countries are landlocked, share a border, or belong to the EU or to the group of CEECs, respectively. Linear predictors of imports and exports are down-weighted by their standard errors. Robust standard errors clustered by sector-exporter-and-importer are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Appendix

Table A.1. Economic Organizations of Countries in the Dataset

Abbreviation	Title	Members
EU	European Union	Admitted before 1999: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom , Admitted in 2004: Czech Republic, Hungary, Poland, Slovak Republic Admitted in 2007: Bulgaria, Romania
OECD	Organization for Economic Co-operation and Development	Admitted before 1999: Austria, Australia, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States Admitted in 2000: Slovakia
CEECs	Central East European Countries	Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia

Table A.2. List of Parts and Components according to the Standard Industrial Classification (SITC) System Revision 3

Division	Codes for Parts and Components
Power-generating machinery and equipment (SITC 71)	71191, 71192, 71280, 71311, 71319, 71321, 71322, 71323, 71332, 71333, 71391, 71392, 71441, 71449, 71481, 71489, 71491, 71499, 71690, 71819, 71878, 71899
Machinery specialized for particular industries (SITC 72)	72119, 72129, 72139, 72198, 72199, 72391, 72392, 72393, 72399, 72439, 72449, 72461, 72467, 72468, 72488, 72491, 72492, 72591, 72599, 72635, 72689, 72691, 72699, 72719, 72729, 72819, 72829, 72839, 72851, 72852, 72853, 72855
Metalworking machinery (SITC 73)	73511, 73513, 73515, 73591, 73595, 73719, 73729, 73739, 73749
General industrial machinery and equipment, n.e.s., and machine parts, n.e.s (SITC 74)	74128, 74135, 74139, 74149, 74159, 74172, 74190, 74291, 74295, 74380, 74391, 74395, 74419, 74491, 74492, 74493, 74494, 74519, 74529, 74539, 74568, 74593, 74597, 74610, 74620, 74630, 74640, 74650, 74680, 74691, 74699, 74710, 74720, 74730, 74740, 74780, 74790, 74810, 74821, 74822, 74839, 74840, 74850, 74860, 74890, 74991, 74999
Office machines and automatic data processing machines (SITC 75)	75910, 75980, 75990, 75991, 75993, 75995, 75997
Telecommunications and sound recording and reproducing apparatus and equipment (SITC 76)	76211, 76312, 76491, 76492, 76493, 76499
Electrical machinery, apparatus and appliances, n.e.s., and electrical parts thereof (SITC 77)	77129, 77220, 77231, 77232, 77233, 77235, 77238, 77241, 77242, 77243, 77244, 77245, 77249, 77251, 77252, 77253, 77254, 77255, 77257, 77258, 77259, 77261, 77262, 77281, 77282, 77311, 77312, 77313, 77314, 77315, 77316, 77317, 77318, 77322, 77323, 77324, 77326, 77328, 77329, 77423, 77429, 77549, 77557, 77579, 77589, 77611, 77612, 77621, 77623, 77625, 77627, 77629, 77631, 77632, 77633, 77635, 77637, 77639, 77641, 77642, 77643, 77644, 77645, 776446, 77649, 77681, 77688, 77689, 77812, 77817, 77819, 77822, 77823, 77824, 77829, 77831, 77833, 77834, 77835, 77848, 77869, 77879, 77883, 77885, 77886, 77889
Road vehicles (SITC 78)	78421, 78425, 78431, 78432, 78433, 78434, 78435, 78436, 78439, 78535, 78536, 78537, 78689
Other transport equipment (SITC 79)	79199, 79291, 79293, 79295, 79297
Furniture and parts thereof (SITC 82)	82111, 82112, 82119, 82180
Measuring, checking, analyzing and controlling instruments and apparatus, n.e.s. (SITC 874)	87412, 87414, 87424, 87426, 87439, 87449, 87454, 87456, 87469, 87479, 87490
Photographic apparatus, equipment and supplies and optical goods, n.e.s; watches and clocks (SITC 88)	88112, 88113, 88114, 88115, 88123, 88124, 88134, 88136, 88210, 88220, 88230, 88240, 88250, 88260, 88310, 88390, 88415, 88417, 88419, 88421, 88422, 88431, 88432, 88433, 88439, 88551, 88552, 88571, 88591, 88596, 88597, 88598, 88599

Table A.3. Definitions of variables

Variable	Definition
Reporter	CEECs countries
Partner	EU and OECD countries
Y_i	GDP of reporter country i.
Y_j	GDP of partner country j.
YH_i	GDP per capita of reporter country i.
YH_j	GDP per capita of partner country j.
$DISTANCE_{ij}$	The distance expressed in kilometers between reporter's i and partner's j capital cities.
$LAND_i$	Binary variable that takes the value of "1" if the reporter country is landlocked, meaning they don't have access to sea or coastline, and "0" otherwise.
$LAND_j$	Binary variable that takes the value of "1" if the partner country is landlocked and "0" otherwise.
$CONTIG_{ij}$	Binary variable that takes the value "1" if the reporter country "i" and partner country "j" share a common border.
$CEECs_j$	Binary variable that takes the value "1" if the partner country belongs to CEECs and "0" otherwise.
EU_{ij}	Binary variable that takes the value "1" if both countries are members of EU.

Table A.4. Determinants of Imports of Intermediates and Exports of Final Goods with Pseudo Poisson Maximum Likelihood (Heckman Sample Selection and Firm Heterogeneity)

	Parts and Components	**Final goods**
	Firm heterogeneity + Sample selection	Firm heterogeneity + Sample selection
EU_{ij}	**0.385*** **	**0.595*** **
	(0.131)	(0.190)
$CEEC_j$	0.317	0.552
	(0.373)	(0.374)
Log of distance	-0.107*	-0.032
	(0.056)	(0.067)
$Land_i$	1.471***	0.833***
	(0.248)	(0.155)
$Land_j$	-0.290	-1.433***
	(0.391)	(0.424)
Common $border_{ij}$	0.300***	-0.399***
	(0.069)	(0.091)
Linear predictor of imports	0.133***	0.006
	(0.016)	(0.009)
Linear predictor of exports	-	0.946***
	-	(0.069)
Inverse Mills ratio	1.728***	-0.061
	(0.130)	(0.052)
R-squared	0.798	0.722
Number of observations	91494	53847
Exporter-Importer effects	no	no
Exporter-time and Importer-time effects	yes	yes

Note: The dependent variables are the bilateral imports of intermediates and the bilateral exports of final goods measured at current prices. $Land_i$, $Land_j$, Common $border_{ij}$, EU_{ij} and $CEECs_j$ are dummies equal to 1 when countries are landlocked, share a border, or belong to the EU or to the group of CEECs, respectively. Linear predictors of imports and exports are down-weighted by their standard errors. Robust standard errors clustered by sector-exporter-and-importer are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A5. Determinants of Imports of Intermediates and Exports of Final Goods with Heckman Sample Selection and Firm Heterogeneity

	Parts and Components Firm heterogeneity + Sample selection	**Final Goods** Firm heterogeneity + Sample selection + Imported parts
EU_{ij}	**0.384*****	**0.661*****
	(0.056)	(0.109)
$CEEC_j$	0.264	1.499***
	(0.166)	(0.263)
Imports of intermediates$_{(-1)}$	-	0.065***
	-	(0.005)
Log of distance	-0.328***	-0.068*
	(0.025)	(0.038)
$Land_j$	-1.035***	-2.069***
	(0.154)	(0.252)
Common $border_{ij}$	0.211***	0.01
	(0.029)	(0.044)
Linear predictor of imports	0.044***	0.027***
	(0.001)	(0.003)
Linear predictor of exports	-	0.051***
	-	(0.003)
Inverse Mills ratio	2.356***	1.023***
	(0.060)	(0.119)
R-squared	0.436	0.319
Number of observations	153030	79526
RMSE	2.320681	2.619134
SITC 5 dummies	yes	yes
Exporter-Importer effects	no	no
Exporter-time and Importer-time effects	yes	yes

Note: The dependent variables are the bilateral imports of intermediates and the bilateral exports of final goods measured at current prices. $Land_i$, $Land_j$, Common $border_{ij}$, EU_{ij} and $CEECs_j$ are dummies equal to 1 when countries are landlocked, share a border, or belong to the EU or to the group of CEECs, respectively. Linear predictors of imports and exports are down-weighted by their standard errors. Robust standard errors clustered by sector-exporter-and-importer are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.