Institut für Ost- und Südosteuropaforschung
Institute for East and Southeast European Studies

Arbeitsbereich Ökonomie

IOS Working Papers

No. 333 August 2013

Factors of trade in Europe

Jan Hanousek*, and Evžen Kočenda**

* CERGE-EI, Charles University and the Czech Academy of Sciences, Politických vězňů 7, 11121 Prague, Czech Republic; Anglo-American University, Prague; The William Davidson Institute at the University of Michigan Business School; Center for Organizational Dynamics, University of Pennsylvania; and CEPR, London. E-mail: jan.hanousek@cerge-ei.cz; ** CERGE-EI, Charles University and the Czech Academy of Sciences, Politických vězňů 7, 11121 Prague, Czech Republic; Anglo-American University, Prague; CESifo, Munich; IOS Regensburg; The William Davidson Institute at the University of Michigan Business School; CEPR, London; and the Euro Area Business Cycle Network. E-mail: evzen.kocenda@cerge-ei.cz

Institut für Ost- und Südosteuropaforschung
Institute for East and Southeast European Studies
Landshuter Straße 4
D-93047 Regensburg

Telefon: (09 41) 943 54-10
Telefax: (09 41) 943 54-27
E-Mail: info@ios-regensburg.de
Internet: www.ios-regensburg.de

Contents

List of Tables

List of Figures

Abstract

We analyze how a set of traditional as well as new determinants affect trade among European countries over the period 1992–2008. The factors encompass variables from the areas of geography, culture, institutions, infrastructure, and trade direction. Trade is analyzed for three types of goods: primary goods, parts and components, and capital goods. For each type of good we also distinguish its definition in terms of flows, intensive margin, and extensive margin. Methodologically we first derive country-pair fixed effects over all possible pairs of export-import partners, and in the second stage we relate fixed effects with a set of influential factors. We show (i) the intuitive and varying effects of geographical, cultural, and institutional factors, (ii) the beneficial effects of soft and hard infrastructure, and (iii) the key importance of the trade between old and new EU members.

JEL-Classification: F14, F16, L24

Keywords: bilateral trade, factors of trade, panel data, European Union

A large part of this paper was written while Evžen Kočenda was a Visiting Fellow at the Institute of East and Southeast European Studies (IOS), Regensburg, whose hospitality is greatly appreciated. We acknowledge data access and constructive comments provided by Richard French. Research assistance by Stephan Huber and comments from presentation participants at IOS (Regensburg, 2013) and the SSEM Euro Conference (Famagusta, 2013) were beneficial to this study. Research support from GAČR grant No. 403/12/0080 is gratefully acknowledged. The usual disclaimer applies.

1 Introduction, motivation, and literature

How barriers to trade, trade arrangements, and specific determinants impact trade flows among countries and country growth has long been a focus of research; since the literature is expansive see for example the recent surveys by Agosin et al. (2011), Baier and Bergstrand (2004), Egger and Egger (2005), Singh (2010), and Wang et al. (2010). In this paper we focus on analyzing a set of traditional as well as new determinants that are hypothesized to exhibit a lasting effect on trade among European countries. We analyze trade during 1992–2008; this period is truly significant because it spans both European integration and the transformation of Central and Eastern European (CEE) countries and because it ends in the wake of a financial and economic crisis. How trade was affected by physical as well as institutional factors during this exceptional period is the topic of the paper. We show (i) the intuitive and varying effects of geographical, cultural, and institutional factors; (ii) the beneficial effects of soft and hard infrastructure; and (iii) the key importance of trade between old and new members of the European Union (EU).

The period under research is unique and its account helps to understand the nature of the trade patterns that generated the data analyzed. Following the collapse of the Iron Curtain many of the former command CEE economies in 1991 quickly eliminated the dubious structure of the trade links within Comecon (Bös, 1993). With unprecedented speed these transformation economies began reorienting their international trade towards the European Community (EC) that in 1993 became the EU. An important step in the process of EU integration was taken in 1992 when the Maastricht Treaty was accepted by EU members (Baun, 1995). The deepening of EU integration thus coincided with the process of economic and social transformation in the CEE countries. The transition period of changing CEE trade patterns was short and by 1995–1996 the international trade of the former command economies was redirected towards the EU (Gros and Gonciarz, 1996). The EU integration process then took on yet a new form of EU widening: after embarking on the uneasy path of economic transformation many CEE countries applied for EU membership in 1995–1996 and from 1998–1999 underwent a lengthy and thorough screening process towards EU accession (Manning, 2004); some CEE countries followed at later dates. The first round of CEE countries joined the EU in 2004, followed by a second round in 2007.

EU integration impacted international trade between the old and new EU members even before actual enlargement. First, association agreements signed in the early 1990s were found to have a positive and significant impact on trade flows between transformation and EU countries (Caporale et al., 2009; Egger and Larch, 2011). Second, despite existing economic differences among countries, the new EU members quickly became an important part of the EU-wide manufacturing and distribution network (Kaminski and Ng, 2005). In this respect Egger et al. (2008) show that the larger the difference in relative goods and factor prices of two integrating countries before integration, the larger the potential overall gains from trade. Further, lowering the fixed cost of trade during European integration has prompted trade to increase (Frensch, 2010). Last but not least, new EU members experienced substantial inflows of foreign direct investment (FDI) from the EU that produced beneficial spillovers and affected trade (Hanousek et al., 2011).

The EU is a functioning free trade area and strong tariff reduction in the EU has been shown to be trade-creating (Eicher and Henn, 2011). New EU members were accepted to the free trade area after their accession in 2004 and 2007 but, as argued earlier, they were already removing trade barriers before and during the accession process (Egger and Larch, 2011). From this perspective, we analyze a set of countries that impose no barriers on trade in terms of tariffs among themselves and for this reason the data are not contaminated by differences in tax/tariff regimes or customs rules. The establishment of the Shengen area in 1995 and its subsequent widening did not eliminate national borders in a political sense. However, the absence of national borders in terms of trade-related customs controls and the ease of transportation helps to lower bilateral trade resistance.

The two parts of Europe were separated by an economic and social-engineering experiment for decades. The trade links from earlier in the twentieth century were severed. However, since the early 1990s trade between West and East flourished and its patterns are the subject of intense research. Some of the recent results covering the period under research are in Frensch et al. (2012a, 2012b), who show that East-West European trade in final goods as well as in parts and components is driven by supply-side country differences relative to the world average; these differences are measured as wages or GDP per capita. Patterns in final goods trade reveal that many of the final goods traded between Western and Eastern Europe are still different, rather than differentiated, products. Further, the pattern of trade in parts and components and its dynamics can be taken as evidence of the existence of international production networks across Europe that are driven by trade-offs between wages and coordination costs.

Analyses of bilateral trade patterns have been fruitfully using the gravity model from Anderson (1979) as a workhorse for more than three decades. Early cross-section gravity models often yielded biased results because their specifications did not contain a sufficient structure to capture heterogeneous trading links—this is due to omitted or misspecified variables. A relatively easy solution to this problem is to introduce fixed effects into the model (Anderson and van Wincoop, 2003). This step is also appropriate for gravity specifications estimated within a panel-data framework. The fixed effects model then allows for missing, unobserved, or misspecified variables that would otherwise aid in explaining the extent of trade between countries. In the estimation, the country-pair fixed effects take the form of individual intercepts and represent the effect of variables that are cross-sectionally specific, time-invariant, and are not included in a given specification. Simply speaking, country-pair fixed effects substitute for our less-than-perfect knowledge of the factors that are potentially correlated with the extent of the analyzed bilateral trade (dependent variable) as well as with explanatory variables. These factors are supposed to be constant over the period studied (panel length) and capture geographical, cultural, historical, political, institutional, religious, and ethnic influences that are often hard to measure or quantify but that nevertheless have been shown to affect the pattern and extent of bilateral trade.

In our methodological approach we deviate from the literature in that we do not employ a traditional gravity model. In our paper we aim to study the country-pair fixed effects discussed above. In particular, we want to analyze how variables representing geographical, cultural, institutional, and infrastructural factors are able to describe country-pair fixed effects. This analysis will allow us to quantify how a set of important variables can aid in explaining the extent of trade between countries. Hence, in our approach we first derive country-pair fixed effects and in the second stage we link them to a number of factors or determinants. These factors represent various barriers to trade and relevant explanatory variables. For example, declining tariffs worldwide have made the international goods exchange cheaper and easier over time and the European Union, as a free trade area, serves as an example where barriers to trade in terms of tariffs have virtually vanished. More importantly, many improvements in trade facilitation have taken place along with the ongoing process of European integration. Trade facilitation aims at reducing the cost of trade. Beyond the obvious expenditures that are related to goods actually crossing borders, these facilitations show in the quality of the trade-related infrastructure. This is a broad concept that includes the quality and traffic-carrying capacity of roads, railways, and (air)ports, the state of telecommunications, and the condition of trade-related institutions, economic regulation, transparency, law, and the business environment. While some of the physical features and can be labeled as “hard infrastructure”, others are less material and carry the more relevant label of “soft infrastructure”. We provide more discussion on these factors in the data section.

The rest of the paper is structured as follows. In section 2 we outline our methodological approach in detail. Section 3 is devoted to a comprehensive description of the data used. We display our empirical results in section 4.

2 Methodological Approach

2.1 Overview of the standard approach

The gravity model has been a quite popular and useful tool to analyze trade patterns for many decades. According to Bernard et al. (2007), the gravity equation for bilateral trade flows established itself as one of the most successful empirical approaches in international economics. The estimation of a gravity model is usually performed in a panel setting with fixed effects. Anderson and van Wincoop (2003) accentuated the importance of using fixed effects to control for country-specific characteristics and subsequently researchers have included fixed effects in their estimation strategies in a number of gravity-model-related articles.[1] Estimation also frequently involves the use of instrumental variables. Both approaches are adopted to a) overcome the problem of the omitting-variables bias and b) control for time-invariant endogeneity and selection bias. This is done because some of the right-hand-side variables are correlated with the dependent variable. In the case of many variables, by construction, the unobserved panel-level effects are correlated with potentially endogenous independent variables that cause standard estimators to be inconsistent. The dynamic bias is even more troublesome in panels with a short time dimension because the inclusion of fixed effects or first differencing does not necessarily eliminate correlation between the lagged dependent variable and the disturbance.

Gravity models constructed to analyze international trade usually contain two parts. The first (dynamic) part captures how trade reacts to, or is affected by, changes in various conditions that are represented by relevant parameters. The second part of the gravity equation contains a set of time-invariant variables to capture the effects of factors related to geography (distances, borders, ports), culture (language, common legal origin, institutions), history (colonies, common history), policy (common currency, trade areas), common religion, and ethnic influences. These factors are rigid over time or change very slowly. The estimation of the gravity equation is usually performed in such a way that both parts are estimated at the same time, i.e., selected variables to capture the above-mentioned time-invariant effects are directly included in the model specification.

[1] For example, Helpman, Melitz, and Rubinstein (2008) and Santos Silva and Tenreyro (2006) developed nonlinear panel data models with fixed effects for both importing and exporting countries.

However, in such a case the estimates are not consistent as they may suffer from endogeneity and omitted variable bias, among other problems, as shown by Baldwin and Taglioni (2007).

We can illustrate the above reasoning in a formal way. The specification of the trade gravity equation usually has the following form:

$$\log EX(G)_{ji,t} = \alpha + \sum_{j=1,i\neq j}^{N} \sum_{i=1}^{N} \beta_{ji} x_{ji} + \sum_{j=1,i\neq j}^{N} \sum_{i=1}^{N} \gamma_{ji} z_{ji,t} + \varepsilon_{ji,t}, T = 1..T. \quad (1)$$

In specification (1) variable $EX(G)_{ji,t}$ represents exports of G type of good from country j to country i at time t. Variables x_{ji} represent selected time-invariant factors discussed above like geographical distance, common language, common trade area, colonial links, etc., while variables $z_{ji,t}$ account for dynamic variables, usually a product of the GDP of countries j and i.

Due to the fact that each country-pair in a statistical sense forms a unique cluster, we are able to apply the theoretical results of Donald and Lange (2001) and Wooldridge (2003, 2006) on the efficiency and asymptotic distribution of their cluster estimators in order to obtain efficient estimates of time-invariant effects β_{ji}. When one estimates time-invariant effects β_{ji} in the above regression (1) it has to be kept in mind that the number of degrees of freedom for β_{ji} is based on the number of clusters M $(1 \leq M \leq N(N-1))$ but not on the total number of observations in the data set. Further, let us note that there exist problems related to the proper estimation technique and the (strong) assumptions required for the joint estimation of β_{ji} and γ_{ji} in a dynamic panel setup. These problems are not treated here as we do not aim to perform a dynamic estimation of (1). Donald and Lang (2001) show that when an endogeneity problem is missing, then the estimation of specification (1) by pooled OLS, random effects, and the between regression estimators lead to the same coefficients $\hat{\beta}_{ji}$. However, it is the within regression estimator based on a cluster level regression that gives appropriate standard errors and the relevant (and smaller) number of degrees of freedom in the t-distribution.

2.2 Minimum distance chi-square estimator approach

A straightforward solution to the endogeneity issue in panels with a long time dimension is to estimate the static and dynamic parts of the trade model separately. It means that the dynamic relationship is estimated using a dynamic panel data technique using first differences. The country-pair fixed effects should then be estimated separately. The estimated country-pair fixed effects are then regressed on time-invariant variables characterizing country-pair specific variables capturing obstacles and the cost associated with international trade mentioned above. The estimation itself is then performed by using the minimum distance chi-square estimator proposed by Wooldridge (2003).

In our analysis we follow the approach outlined above in order to a) minimize the endogeneity issue and b) obtain consistent and efficient estimates of the wide set of trade determinants with lasting effects. In analyzing the factors affecting the trade patterns in the EU we proceed in two stages. First, we derive country-pair fixed effects. Second, we relate them to a set of influential characteristics. This is a similar approach as for example in Mélitz (2007, 2008) with a difference in how we derive the fixed effects in the first stage. We follow the estimation framework as described in Wooldridge (2003). First we estimate the country-pair fixed effects as the means over the pairs of countries. Specifically, we estimate the fixed effects as the sample means over all possible pairs of export-import partners by regressing the specific trade variable on a set of dummy variables that represent all possible export-import country pairs in our sample.

This step is depicted by the following specification:

$$\log\ EX(G)_{ji,t} = \sum_{j=1,i\neq j}^{N} \sum_{i=1}^{N} \mu_{ji} c_{ji} + \varepsilon_{ji,t}. \qquad (2)$$

As above, variable $EX(G)_{ji,t}$ represents the exports of G type of good (in our case primary goods, parts and components, or capital goods) from country j to country i at time t. Exports of each type of good is measured in terms of flows, extensive margin, and intensive margin, defined presently in the data section. A dummy variable c_{ji} is coded 1 for each possible export-import country pair in our sample and the associated coefficient

μ_{ji} captures the mean fixed effects. Since N represents the number of countries, we denote the number of clusters, or importer-exporter country pairs, by M, shown as $1 \leq M \leq N(N-1)$.

As a result, the bilateral fixed effects $\hat{\mu}_{ji}$ absorb the outcomes of all time-invariant standard gravity regressors. Therefore, following Wooldridge (2001) and Cheng and Wall (2005), we estimate the effects of time-invariant variables (captured by coefficients $\hat{\beta}_{ji}$) by regressing the estimates of the country-pair fixed effects ($\hat{\mu}_{ji}$) on a set of time-invariant factors (x_{ji}). Therefore, in the second step we link the estimated fixed effects ($\hat{\mu}_{ji}$) with the country pair determinants and factors (x_{ji}) in the following specification:

$$\hat{\mu}_{ji} = \alpha + \sum_{j=1,i\neq j}^{N} \sum_{i=1}^{N} \beta_{ji} x_{ji} + u_{ji}. \qquad (3)$$

In specification (3) the variables x_{ji} represent K factors that affect trade between the pair of countries j and i captured by the fixed effects. We use the following K factors divided into three groups. Group 1 contains standard geographical factors such as distance, population, common language, common legal origin, and the use of a common currency. Group 2 contains four measures of the degree of trade facilitation in terms of broadly defined types of infrastructure: physical infrastructure, information and communications technology (ICT), border and transport efficiency, and the business and regulatory environment. All four infrastructure factors are exporter- and importer-specific as they are measured from both exporter as well as importer positions. Finally, Group 3 includes factors depicting the direction of the trade: from East to East, from East to West, from West to East, and from West to West. All factors are defined in detail in the data section.

Wooldridge (2003, 2006) shows that the OLS estimation of specification (3) yields asymptotically inefficient estimates. The same applies even when a minimum distance estimator is used unless strong assumptions are satisfied. For that reason we employ the remedy suggested by Wooldridge (2003, 2006) and proceed as follows. In order to reap the benefits of the additional information contained in the standard errors of the country-specific directional fixed effects estimated in (2), we estimate (3) by employing the minimum distance chi-square estimator. Let $\hat{\sigma}_{ji}^2$ denote the sample variance for a given country pair j and i. If we assume independence between group means ($\hat{\mu}_{ji}$), then the efficient minimum distance chi-square estimator can be constructed as a weighted least squares (WLS) estimator that uses a diagonal weighting matrix. Here the weights are equal to the inverse squared standard errors ($1/\hat{\sigma}_{ji}^2$). Under general assumptions, the efficient minimum distance estimator can be obtained as a computational version of the WLS estimator, where the weighting matrix will be the inverse of the variance-covariance matrix estimated in (2). Formally, we can write that

$$\hat{\beta} = (X^T W X)^{-1} X^T W \hat{\mu}, \qquad (4)$$

where matrix X contains the time-invariant factors x_{ji} and vector $\hat{\mu}$ contains the estimated fixed effects $\hat{\mu}_{ji}$. The weighting matrix W is obtained either as $W = diag\{\frac{1}{\hat{\sigma}_{ji}}^2\}$ when independence is assumed within each cluster or as $W = (\widehat{var}\{\hat{\mu}_{ji}\})^{-1}$ in a general case; for details on the minimum chi-square estimator see Wooldridge (2002), section 14.6. In addition, Wooldridge (2003) provides the intuition behind this approach and claims that more precise estimates should be given higher weights during estimation; this is the same approach that we take during our empirical exercise. The reported *t*-statistics from the WLS regression are asymptotically standard normal as the cross-section dimension of the panel increases, which is the case of our sample (see Section 3).[2]

[2] Anderson and Yotov (2010) modify this procedure by using weighted least squares and variance-weighted least squares to take advantage of the information contained in the standard errors of the fixed effects estimates.

3 Data and variable definitions

3.1 Trade data

We consider trade in the following types of goods divided into groups as in Frensch and Gaucaite Wittich (2009): (a) primary goods, (b) parts and components, and (c) capital goods. This division reflects both the stages of the production process as well as operational trade specifics (means of transport, infrastructure requirements, contractual specifics, etc.). Bilateral trade in each type of good G covers the exports of the good from country j to country i ($EX(G)_{ji}$) over the period 1992–2008. The period spans from the year when the Maastricht Treaty was signed and coincides with the beginning of the massive transformation process in Central and Eastern Europe (CEE). It also covers the period of the deepening as well as widening of EU integration. The data span avoids the volatile period following the global economic crisis.

Table 1 Import-reporting countries and trade data availability

1	Austria (1992–2008)	11	Germany (1992–2008)	21	*Malta* (1995–2008)
2	Belgium and Luxembourg (1992–2008)	12	Greece (1992–2008)	22	*Poland* (1992–2008)
3	*Bulgaria* (1996–2008)	13	*Hungary* (1992–2008)	23	Portugal (1992–2008)
4	*Czech Republic* (1993–2008)	14	Iceland (1995–2008)	24	*Romania* (1992–2008)
5	*Cyprus* (1995–2008)	15	Ireland (1992–2008)	25	*Slovakia* (1993–2008)
6	Denmark (1992–2008)	16	Italy (1992–2008)	26	*Slovenia* (1995–2008)
7	Spain (1992–2008)	17	*Lithuania* (1995–2008)	27	Sweden (1992–2008)
8	*Estonia* (1995–2008)	18	*Latvia* (1995–2008)	28	Switzerland (1995-2008)
9	Finland (1992–2008)	19	Netherlands (1992–2007)	29	United Kingdom (1992–2008)
10	France (1992–2008)	20	Norway (1995–2008)		

Notes: Belgium and Luxembourg are treated as one country. EU-15 countries are underlined, EU-10 are in *italics*. Each reporting country's import data are given for all reporter countries for the indicated time period.

The data were compiled from the United Nations COMTRADE database. The definition of primary goods, parts and components, and capital goods follows the BEC categorization of the UN Statistics. Our data cover 29 European countries listed in Table 1, which by design leads to 812 (28 x 29) uni-directional importer-exporter country pairs.[3] In fact, we analyze 810 pairs because there were no trades available for the pairs of Malta (importer) – Romania (exporter) and Malta (importer) – Latvia (exporter). Otherwise our data do not contain any zero-trade flows.

In our analysis we employ three different measures of bilateral trade. First, we measure the trade flows of how much country *j* exports to country *i*, which is identical to how much country *i* imports from country *j*. Then, following Frensch (2010) and Head et al. (2010), we measure bilateral trade along the extensive and intensive margins. Hence, our second measure, trade along the extensive margin, represents the *variety* of goods exported from country *j* to country *i.* It is defined as a count measure over the exported categories of goods out of all 5,368 of the SITC Rev.3 categories; specifically we use the following numbers of categories: 419 (primary goods), 395 (parts and components), 702 (capital goods). Our third measure, trade along the intensive margin, describes the *intensity* of exported goods from country *j* to country *i.* The intensive margin is defined as the average volumes of the exported categories of goods and represents the *depth* of trade.

3.2 Geographical, cultural, and institutional data

Besides the trade data we employ a wide set of factors hypothesized to affect country-pair trade. First, we use variables empirically shown to play a role in gravity regressions in a similar fashion as in Head et al. (2010). All geographical, cultural, and institutional variables described below were obtained from the CEPII Gravity database available at: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8. The Gravity database is dyadic as it contains variables indicating information valid for pairs of countries. For identification and possible data merging the database employs standard country ISO codes.

Following Head and Mayer (2002) and Mélitz (2007) we include the population-weighted distance that is measured as the distance between the largest cities of the country pairs weighted by the share of each city in the country's overall population.[4] Dis-

[3] Belgium and Luxembourg are treated as one country.

[4] Alternative measures of distance include distances between countries' geographical centers, capitals, or most populous cities.

tance is hypothesized to exhibit a negative effect on trade despite the “death of distance” argument. However, our prior is that distance in Europe is likely to inhibit trade to a much lesser extent than in other parts of the world since European countries are relatively close to each other and destination substitutes are plentiful.

Brun et al. (2005) put forth the commonly observed fact that larger countries tend to trade a smaller percentage of their GDP. An intuition behind this fact is that more populous countries possess greater prospects to sell their products domestically and do not need to incur costs to trade internationally. This is supported by Klasen and Nestmann (2006; p. 615), who argue that more densely populated countries have “larger market size, which facilitates a finer division of labor and thus a greater internal trade.” We employ a population variable that is measured as natural log of the country pair populations’ multiple; populations are measured in millions of inhabitants. We believe the above arguments are too simplistic since they observe the country population only as a proxy for the potential market where the population makes purchases. However, if the countries are highly economically integrated, it should be exactly the population that would be linked to a large extent of trade.

Following Mayer and Zignago (2011) we employ a common language variable in the form of a dummy variable coded 1 if the language is spoken by at least 9% of the population, and zero otherwise. Mélitz (2008) uses a 4% threshold in his world-wide study. We opt for a more conservative level as we deal with the limited geographical area of Europe. An alternative language dummy would be coded 1 if two countries shared the same official language. Again, we do not employ this dummy as its application in Europe is limited. Finally, Mélitz and Toubal (2011) introduce the definition of a common second language and propose that it will be related to a strong (positive) effect on the extent of international trade. We acknowledge this possibility but do not explore it due to potential simultaneity bias and an inability to employ a suitable measure of a common language depending strictly on exogenous factors.

In any event, no matter what type of dummy variable is used, the ease of communication through a common language should positively affect trade. However, its effect might differ for various types of goods: a basic knowledge might be sufficient for trade in homogenous products as primary goods, while parts and components should require more sophistication in language abilities and knowledge of technical terms (heterogeneous products).

A common legal origin and common currency are both dummy variables coded 1 if a country pair shares those characteristics and zero otherwise. A common legal origin should help to alleviate problems resulting from potential disputes and exhibit a positive effect with respect to trade (Beck et al., 2003; La Porta et al., 2008). A common currency is expected to ease the accounting part of transactions and erase the costs associated with exchange rate fluctuations. Belonging to a currency union largely increases trade with other union members and as Frankel and Rose (2002) conclude, important beneficial effects of currency unions come through the promotion of trade.

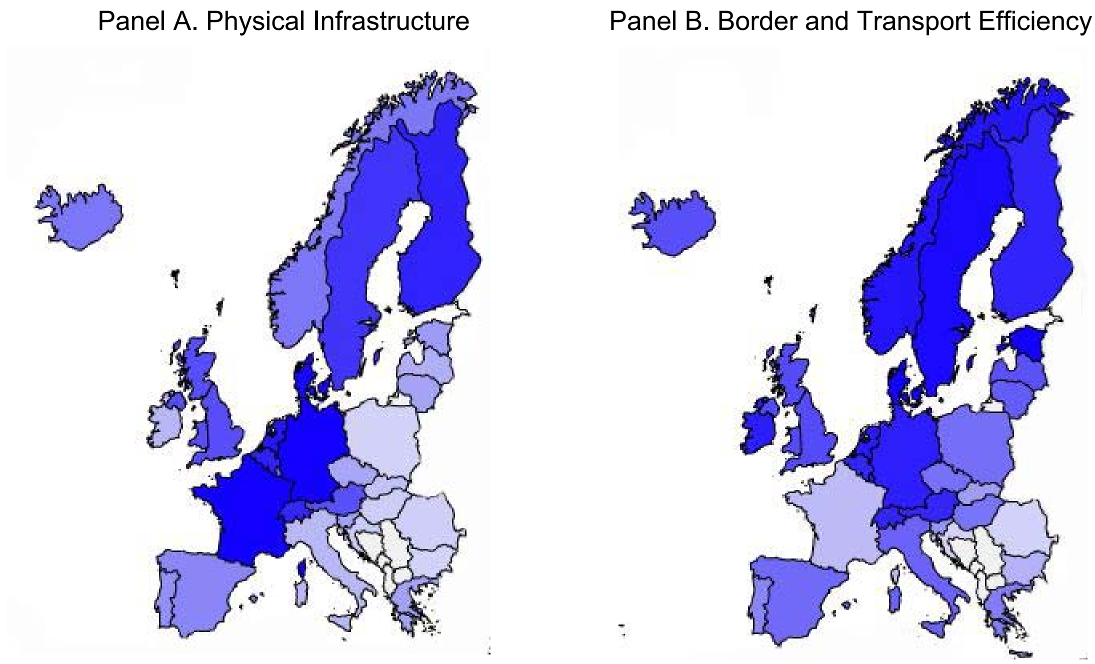
3.3 Data on hard and soft infrastructure

Second, we employ the factors related to trade facilitation developed by Portugal-Perez and Wilson (2012) and available at http://siteresources.worldbank.org/INTRES/Resources/469232-1107449512766/TF_ hard_ soft.xlsx. In order to capture the extent of trade facilitation we account for the quality of the infrastructure, the efficiency of the trade-related business conduct, and the degrees of regulation and transparency. We adhere to Portugal-Perez and Wilson (2012) and employ four aggregate indicators that capture the degree of trade facilitation in terms of broadly defined types of infrastructure. When presenting four infrastructure variables we keep to the terms of Portugal-Perez and Wilson (2012; 1298–9), who define them in the following way.

Hard infrastructure: 1. Physical infrastructure measures the level of the development and quality of ports, airports, roads, and rail infrastructure. 2. Information and communications technology (ICT) infrastructure is interpreted as the extent to which an economy uses information and communications technology to improve efficiency and productivity to reduce transaction costs. It contains indicators on the availability, use, absorption, and government prioritization of ICT.

Soft infrastructure: 1. Border and transport efficiency aims at quantifying the level of the efficiency of customs and domestic transport that is reflected in the time, cost, and number of documents necessary for export and import procedures. 2. The business and regulatory environment measures the level of the development of regulations and transparency. It is built on indicators of irregular payments, favoritism, government transparency, and measures to combat corruption.

Figure 1 Measures of the Infrastructure Quality across the Europe



Note: Darker shades correspond to higher quality of infrastructure. Figure is using the data from Portugal-Perez and Wilson (2012), maps were created by a web interface at http://www.openheatmap.com.

The infrastructure indicators are derived from a pool of 20 primary indicators collected from different sources: Doing Business (DB), World Development Indicators (WDI), World Economic Forum (WEF), and Transparency International (TI). Each factor is standardized to values ranging from 0 to 1; a higher value means that a country exhibits better quality in the specific measure of infrastructure. A better level of infrastructure factors is hypothesized to positively affect trade. In Figure 1 we present a graphical overview of the infrastructure quality across Europe in terms of the physical infrastructure (Panel A) and border and transport efficiency (Panel B). Darker shades denote countries possessing better quality of infrastructure. On average, old EU members exhibit better quality of infrastructure when compared with new EU countries. Still, we can witness some deviations from the average pattern. First, some new EU members possess physical infrastructure at quality close to old EU countries (Panel A) and number of both old and new EU members exhibit border and transport efficiency at comparable level (Panel B). Second, France shows lower border and transport efficiency than many new EU countries (Panel B).

3.4 Directions of trade

Intuition about trade deficits as well as empirically observed differences in trade deficits suggest that trade among countries varies according to the way trade flows between countries. Frensch et al. (2012a) show that the direction of trade flows in parts and components as well as in final goods (Frensch et al., 2012b) is important specifically in the EU. From the theory perspective Helpman et al. (2008) develop a simple model of international trade that predicts positive and asymmetric trade flows between country pairs. Both lines of reasoning form a basis to account in our analysis for directions of trade flows among various locations within the EU. For that we introduce four directional dummy variables to capture the direction of the trade flows. Trade among new EU members is represented by the East-East direction, while trade among old EU members is captured by the West-West dummy. Trade flows between the two groups of countries are represented by the directions East-West and West-East where the point of origin is first and the destination second. The directional dummies are coded 1 for trade flows between country pairs falling under the specific direction and zero otherwise. Since it is difficult to assess the potential effects of the trade direction we formulate our hypothesis in the least binding way that trade direction exhibits no effect with respect to trade.

4 Empirical Results

Results of the estimated effects of the large set of determinants are presented in Tables 2–4. For ease of exposition we first present the results for factors from the group of geography, culture and institutions (Table 2). The impacts of infrastructure factors are shown in Table 3. Finally, we present the effects of trade directions (Table 4). In each table we distinguish three types of goods: primary goods, parts and components, and capital goods. For each type of good we also distinguish its definition in terms of flows, intensive margin, and extensive margin as defined in Section 3. Note that by the definition of the margins and as a result of the OLS estimation, the sum of the coefficients associated with the intensive and extensive margin for each factor should equal the value of the coefficient associated with the trade flow. Since we employ weighted OLS the sum of the former differs slightly from the value of the latter. However, these differences are truly negligible.

The coefficients reported in the tables should be interpreted in the following way. The fixed effects (mean fixed effects) we derive in specification (1) are based on the mean in the log of trade flows. Therefore, the coefficients of determinants estimated in specification (2) have an interpretation that is related to log linear models. Hence, coefficients associated with each determinant describe that a one-unit increase in a specific factor is linked to a percentage increase in trade. For example, the coefficient for the distance variable associated with primary goods trade flow in Table 2 is –0.07; this means that the effect of the distance is linked to a decrease in the trade flows by a marginal 7%. Distance does negatively affect trade in all three types of good. This result reflects the intuition behind the basic gravity model and is in line with a number of empirical works. However, the economic significance of the distance is quite low; the “death of the distance” might be present in our results after all. It is also interesting to see that the effect of the distance is more pronounced on the extensive margin (variety) in the case of capital goods and parts and components. Understandably, the depth of trade (intensive margin) should be much less affected by distance, especially for more sophisticated types of goods. The reason is that once production facilities of the capital goods with high value-added are set up, parts and components have to be shipped to specific destinations.

4.1 Geography, culture, and institutions

Population as a factor exhibits a positive effect on all types of goods. The combined populations of the country pairs represent the size of the market. An extremely high degree of integration through the trade among European countries might be the reason why population in this case would show a positive effect on trade. In the case of high integration more populous countries do not necessarily need to sell production domestically because integration increases market size and expands it beyond national borders. An indirect link can be made to Nitsch (2000), who documents the existence of the home bias in trade (total exports) among the subset of old EU countries during 1979–1990 and shows that an average EU country sold about 7 to 10 times more goods domestically than it exported. Our results indirectly indicate that during the period under research national borders do not matter anymore.

Due to the statistical insignificance of the coefficients, common language does not seem to matter for European trade. Our results are not in accord with the recent meta-analysis of Egger and Lassmann (2012). However, within a European context our findings make sense as it is in accord with the reasoning of Mélitz (2008), who shows that English does not facilitate trade more than other major European languages.

A common legal origin is largely statistically insignificant. It only exhibits a relatively small negative effect for primary goods on both the intensive and extensive margins. The negative effect might be due to a lack of identification and some negative correlation with the factor of geographical distance; e.g. geographically closer countries are more likely to share a legal origin. We also tested for a marginal effect that is positive, in accord with our hypothesis, yet statistically insignificant. A tentative explanation for the weak effect is that legal rules covering the protection of corporate shareholders and creditors in Europe are of three key origins: common law, French civil law, and German or Scandinavian civil law. La Porta et al. (1998) show that protection effects vary across countries depending on the law origin. In this respect, the protection effect might well transfer via shareholders and creditors to firm export and import performances. Subsequently, the weak effect of legal origin in our analysis might suffer from the problem of too many legal origins among the group of European countries.

The effect of a common currency is economically highly significant and in accord with the hypothesized impact. Not all relevant coefficients are statistically significant, though. With the exception of the parts and components category, the effect of a common currency is evident for trade flows. For margins, a key role is evidenced in the intensive margin since its coefficients are proportionally larger than those of the extensive margin that are also statistically insignificant. Still, the asymmetric impact of the result makes sense. The elimination of exchange rate fluctuations or costs associated with hedging against exchange risk should exhibit a stronger impact on the sheer volumes of exports, that is, the depth of trade captured by the intensive margin rather than on the variety of (smaller amounts of) goods captured by the extensive margin.

Table 2 Geographical, Cultural, and Institutional Factors

Factors	Primary goods			Parts and Components			Capital goods		
	Trade flows	Intensive margin	Extensive margin	Trade flows	Intensive margin	Extensive margin	Trade flows	Intensive margin	Extensive margin
Distance	–0.07**	–0.03**	–0.03**	–0.08**	–0.03**	–0.05***	–0.08***	–0.02*	–0.06***
	(0.03)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)
Population	0.61***	0.25***	0.41***	0.76***	0.40***	0.38***	0.71***	0.28***	0.46***
	(0.13)	(0.06)	(0.04)	(0.13)	(0.05)	(0.05)	(0.12)	(0.05)	(0.05)
Common Language	1.20	0.69	0.53	1.06	0.74	0.33	1.11	0.67	0.44
	(1.23)	(0.53)	(0.41)	(1.23)	(0.46)	(0.49)	(1.15)	(0.45)	(0.47)
Common Legal Origin	–1.06	–0.61**	–0.43**	–0.63	–0.31	–0.37	–0.50	–0.19	–0.27
	(0.65)	(0.26)	(0.18)	(0.60)	(0.22)	(0.24)	(0.54)	(0.21)	(0.23)
Common Currency	1.37*	0.80**	0.40	1.12	0.82***	0.29	1.29*	0.86***	0.39
	(0.81)	(0.35)	(0.27)	(0.80)	(0.30)	(0.31)	(0.74)	(0.29)	(0.31)
Constant	7.81***	5.55***	1.81***	7.97***	4.00***	3.84***	8.88***	4.40***	4.32***
	(0.92)	(0.40)	(0.29)	(0.94)	(0.35)	(0.37)	(0.84)	(0.33)	(0.35)
Observations	810	810	810	810	810	810	810	810	810
R^2	0.42	0.30	0.46	0.53	0.51	0.47	0.56	0.39	0.55
Adjusted R^2	0.39	0.28	0.45	0.50	0.49	0.46	0.53	0.37	0.54

Note: Table contains results for the determinants of the country-pair fixed effects estimation using selected geographical, cultural and institutional variables. Standard errors are shown in parentheses. ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

4.2 Hard and soft infrastructure

The values of the coefficients presented in Table 3 show that the soft factor of border and transport efficiency positively affects trade most. This simple concept of the ease with which goods can actually move across borders represents the single most important trade flow-related type of infrastructure. Some differences can be recognized for trade on margins. The factors of border and transport efficiency dominate the depth of trade in primary goods and parts and components (intensive margin), while its effect is more important for the variety of traded capital goods (extensive margin). Hence, a more sophisticated type of good can be linked with border and transport efficiency via variety rather than volume.

Table 3 Hard and Soft Infrastructure Factors

Factors	Primary goods			Parts and Components			Capital goods		
	Trade flows	Intensive margin	Extensive margin	Trade flows	Intensive margin	Extensive margin	Trade flows	Intensive margin	Extensive margin
Physical Infrastructure	4.66***	1.97***	2.59***	4.50***	1.92***	2.54***	3.90***	1.19**	2.63***
	(1.35)	(0.58)	(0.46)	(1.32)	(0.51)	(0.50)	(1.24)	(0.50)	(0.49)
ICT	3.67***	1.74***	1.88***	4.19***	2.31***	1.80***	3.18***	1.66***	1.51***
	(1.33)	(0.58)	(0.44)	(1.26)	(0.47)	(0.49)	(1.14)	(0.45)	(0.47)
Border and Transport Efficiency	9.34***	4.92***	4.02***	7.42**	3.93***	3.31***	6.08**	2.70**	3.16***
	(2.84)	(1.22)	(0.93)	(2.91)	(1.08)	(1.12)	(2.70)	(1.07)	(1.09)
Business and Regulation	3.69***	1.68***	1.98***	4.14***	2.04***	2.06***	3.04***	1.33***	1.73***
	(1.16)	(0.50)	(0.39)	(1.10)	(0.42)	(0.42)	(1.02)	(0.41)	(0.41)
Observations	702	702	702	702	702	702	702	702	702
R^2	0.42–0.45	0.32–0.35	0.39–0.42	0.52–0.56	0.51–0.55	0.42–0.49	0.49–0.52	0.33–0.37	0.50–0.56
Adjusted R^2	0.35–0.39	0.29–0.32	0.37–0.41	0.49–0.51	0.48–0.52	0.39–0.46	0.44–0.47	0.30–0.34	0.50–0.54

Note: Table contains results for the determinants of the country-pair fixed effects estimation using hard and soft infrastructure indicators as defined in Portugal-Perez and Wilson (2012). ITC denotes information and communication technology. Because of muticolinearity issues we list above the marginal effects with the range of R^2 for all factors. Malta and Cyprus data are missing; therefore in this decomposition we have a lower number of observations than in Table 2. Standard errors are shown in parentheses. ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

The factor of hard physical infrastructure is second in importance and its effect in margins is homogenous across all types of good. Still, physical infrastructure exhibits a larger impact on the variety of goods rather than on the depth of trade.

With the combined value of the coefficients it is interesting to see that the directly related trade infrastructure (border and transport efficiency and physical infrastructure) is about twice as beneficial to trade facilitation than indirect infrastructure (business and regulatory environment plus ICT). Moreover, the impact of ICT and business and regulation factors is about same but the differences are in terms of margins. The impact of both factors is proportionally similar for primary goods where both factors dominate the extensive margin (variety of goods). On the other hand, ICT dominates the intensive margin (depth of trade) for parts and components and capital goods, while the opposite is true for the business and regulation factor.

A key finding is that the infrastructure effect is much larger than the impact of the conventional factors shown in section 4.1. The quality of the broadly defined infrastructure and its improvements are decisively beneficial to bilateral European trade and in this sense our results are in line with those produced by Portugal-Perez and Wilson (2012) or De (2006), who shows the importance of the infrastructure in playing a role in trade among a large group of Asian countries.

Still, further interesting inferences are possible to draw. For example, Portugal-Perez and Wilson (2012; p. 1296) argue that “investment in physical infrastructure and regulatory reform to improve the business environment are particularly important at the intensive margin of trade.” This argument is fully supported by our results since the intensive margin coefficients for the physical infrastructure factor and business and regulation factor are smaller than the corresponding coefficients on the extensive margin across all three types of good. This indicates that further improvements in both factors open room for a larger effect of both factors. Scope for improvements in physical infrastructure is clearly evidenced in Figure 1 (Panel A) for new EU countries where its quality is lower than in old EU members. Since some range of the physical infrastructure may be also connected with FDI projects the infrastructure improvements are in interest of both investors as well as host countries. Portugal-Perez and Wilson (2012; p. 1296) also claim that “investment in improving border efficiency is important at the extensive margin.” Our results support this claim for primary goods plus parts and components where lower coefficients at the extensive margin denote a potential for an increase in the effect of the border efficiency factor. This finding is further supported by the evidence presented in Figure 1 (Panel B). However, in the case of capital goods the factor exhibits its effect quite strongly without apparent further need for improvement.

4.3 Directions of trade

The results presented in Table 4 show that the direction of trade does matter and we reject our hypothesis of a zero effect. Some differences in the extent of the impact can be traced for how each type of good is defined and what margin is inspected. However, these differences are negligible. In the results the key directions stand out. West-West and East-East are the most and least important directions of trade, respectively, no matter what type of good is considered; these directions also, on average, correlate with quality of infrastructure shown in Figure 1. However, this feature should not be overstated as the difference between highest and lowest impact of the specific direction is about 25%. Further, the differences among the direction's impact become much less pronounced when trade in terms of intensive and extensive margins is considered.

Table 4 Directions of Trade

Direction of Trade	Primary goods			Parts and Components			Capital goods		
	Trade flows	Intensive margin	Extensive margin	Trade flows	Intensive margin	Extensive margin	Trade flows	Intensive margin	Extensive margin
East → East	7.27***	5.35***	1.62***	7.38***	3.77***	3.51***	8.16***	4.11***	3.94***
	(0.90)	(0.41)	(0.26)	(0.89)	(0.35)	(0.34)	(0.81)	(0.33)	(0.32)
East → West	7.89***	5.61***	1.89***	7.76***	3.95***	3.69***	9.16***	4.72***	4.42***
	(0.97)	(0.44)	(0.29)	(0.95)	(0.37)	(0.37)	(0.88)	(0.35)	(0.36)
West → East	9.16***	5.90***	2.92***	9.42***	4.46***	4.84***	10.16***	4.64***	5.48***
	(0.99)	(0.44)	(0.31)	(0.96)	(0.37)	(0.38)	(0.88)	(0.35)	(0.36)
West → West	10.10***	6.59***	3.21***	10.06***	4.97***	4.99***	11.01***	5.40***	5.61***
	(1.06)	(0.47)	(0.33)	(1.02)	(0.40)	(0.40)	(0.94)	(0.37)	(0.39)
Observations	810	810	810	810	810	810	810	810	810
R^2	0.52	0.37	0.58	0.64	0.58	0.60	0.65	0.46	0.66
Adjusted R^2	0.48	0.34	0.57	0.60	0.56	0.58	0.61	0.44	0.65

Note: Table contains results for the determinants of the country-pair fixed effects estimation using directions of trade between a pair of countries as explanatory factors. Standard errors are shown in parentheses. ***, **, and * denote statistical significance on 1%, 5% and 10%, respectively.

The key finding is that the combined impact of trade running from West to East and from East to West is the most important one. This finding has a straightforward implication about the importance of trade within Europe, specifically between old and new EU members. It is also supported by related empirical research. There is empirical evidence in Frensch et al. (2012a), who show that the majority of the trade flows in parts and components within the EU is carried along the East-West alignment and so is the trade in final goods (Frensch et al., 2012b). Further, multinational firms investing in new EU members in form of FDI are likely to purchase most parts and components on local markets to contain their costs. This would create pressure for the production of higher quality intermediate goods by local suppliers and via this “pull effect” lead to the improved performance of local firms. Uzagalieva et al. (2012) show this innovation effect in the case of firms in high-tech industries and Hanousek et al. (2012) document beneficial effects of the FDI at the microeconomic level. Finally, the differences in the impact of the trade directions is also in accord with asymmetric trade flows among countries as shown in Helpman et al. (2008).

5 Conclusions

We study the effects of a large set of factors on bilateral trade among European countries over the period 1992–2008. The factors encompass variables from the areas of geography, culture, institutions, infrastructure, and trade directions. Trade is analyzed for three types of good: primary goods, parts and components, and capital goods. For each type of good we also distinguish its definition in terms of flows, intensive margin, and extensive margin. In our methodology we deviate from the standard gravity approach and analyze the factors affecting trade patterns in the EU in two stages. In the first stage we derive country-pair fixed effects over all possible pairs of export-import partners. In the second stage we relate fixed effects to a set of influential factors.

Our results show that geographical, cultural, and institutional factors impact European trade in accord with the underlying theories, but individual effects vary across types of goods and trade definitions. Among our findings we provide evidence to support the beneficial effect of a common currency but no need for a common language. Infrastructure factors exhibit comparably larger effects than the former group and the factor of border and transport efficiency positively affects trade most, followed by the factor of physical infrastructure. Hence, even in the well-functioning free-trade area of Europe the key aspect of the trade is how well the goods can be transported along with efficient border transfer. In terms of trade directions we show that the trade running from West to East and from East to West is the most important one. This result indicates the key importance of trade between old and new EU members. Our analysis brings forth some new results on bilateral European trade that is one of the vital parts of European integration. We credit our results to the methodological approach we take as well as to rich variable selection and the informative data set we employ.

References

Agosin, Manuel R., Roberto Alvarez and Claudio Bravo-Ortega, 2012. Determinants of Export Diversification Around the World: 1962–2000. *The World Economy*, 35(3), 295–315.

Andersson, J.E, 1979. A Theoretical Foundation for the Gravity Equation. American Economic Review, 69(1), 106–116.

Anderson, J. E., and E. van Wincoop, 2003. Gravity with Gravitas: A Solution to the Border Puzzle. American Economic Review, 93(1), 170–192.

Anderson, James E. & Yoto V. Yotov, 2010. "Specialization: Pro- and Anti-globalizing, 1990–2002," NBER Working Papers 16301, National Bureau of Economic Research, Inc.

Baier, S., and J. Bergstrand (2007). Do Free Trade Agreements Actually Increase Members International Trade? *Journal of International Economics*, 71(1), 72–95.

Baier, S., and J. Bergstrand (2004), Economic determinants of free trade agreements. *Journal of International Economics*, 64(1), 29–63.

Baldwin, R., Taglioni, D., 2007. Trade Effects of the Euro: a Comparison of Estimators. *Journal of Economic Integration*, 22(4), 780–818.

Baun, Michael J., 1995. The Maastricht Treaty as High Politics: Germany, France, and European Integration. *Political Science Quarterly*, 110(4), 605–624.

Beck, T., Asli Demirgüç-Kunt, Ross Levine, 2003. Law and finance: why does legal origin matter? Journal of Comparative Economics, 31(4), 653–675.

Bernard, A. B., S. J. Redding, and P. K. Schott (2011). Multiproduct Firms and Trade Liberalization. *The Quaterly Journal of Economics*, 126(3), 1271–1318.

Brun, Jean-François, Céline Carrère, Patrick Guillaumont, Jaime de Melo, 2005. Has Distance Died? Evidence from a Panel Gravity Model. *World Bank Economic Review*, 19(1), 99–120.

Bös, D. (1993). Privatization in Europe: a comparison of approaches. *Oxford Review of Economic Policy*, 9(1), 95–111.

Cheng, I-Hui, and Wall, Howard J., 2005. Controlling for Heterogeneity in Gravity Models of Trade and Integration. *Federal Reserve Bank of St. Louis Review*, 87(1), 49–63.

De, Prabir, 2006. Trade, Infrastructure and Transaction Costs: The Imperatives for Asian Economic Cooperation. *Journal of Economic Integration*, 21(4), 708–735.

Egger, H., Egger, P., 2005. The Determinants of EU Processing Trade. *The World Economy*, 28(2), 147–168.

Egger, Peter H., Lassmann, A., 2012. The language effect in international trade: A meta-analysis. *Economics Letters*, 116(2), 221–224.

Frankel, J. and Rose, A., 2002. An Estimate of the Effect of Common Currencies on Trade and Income. *Quarterly Journal of Economics*, 117(2), 437–466.

Frensch, Richard, 2010. Trade liberalisation and import margins. *Emerging Markets Finance and Trade*, 46(3), 4–22.

Frensch, Richard, and Vitalija Gaucaite Wittich, 2009. Product variety and technical change. *Journal of Development Economics*, 88(2), 242–257.

Frensch, R., Hanousek, J., Kočenda, E., 2012a. Incomplete Specialization and Trade in Parts and Components. William Davidson Institute WP 1044.

Frensch, R., Hanousek, J., Kočenda, E., 2012b. Specialization, gravity, and European trade in final goods. Specialization, gravity, and European trade in final goods. IOS WP 320.

Gourdon, Julien, 2009. Explaining Trade Flows: Traditional and New Determinants of Trade Patterns. Journal of Economic Integration, 24(1), 53–86.

Gros, D., Gonciarz, A. (1996). A note on the trade potential of Central and Eastern Europe. *European Journal of Political Economy*, 12(4), 709–721.

Hanousek, J., Kočenda, E., Maurel, M., 2011. Direct and indirect effects of FDI in emerging European markets: Survey and Meta-analysis. *Economic Systems*, 35(3), 301–322.

Hanousek, J., Kočenda, E., Mašika, M., 2012. Firm Efficiency: Domestic Owners, Coalitions, and FDI. *Economic Systems*, 36(4), 471–486.

Head, Keith, and Thierry Mayer, 2002. Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade. CEPII Working Paper 2002-01.

Head, K. and T. Mayer, (2013), "Gravity Equations: Toolkit, Cookbook, Workhorse." Handbook of International Economics, Vol. 4,eds. Gopinath, Helpman, and Rogoff, Elsevier.

Head, Keith, Thierry Mayer, and John Ries, 2010. The erosion of colonial trade linkages after independence. *Journal of International Economics*, 81(1), 1–14.

Helpman, E. and Marc Melitz and Yona Rubinstein, 2008. Estimating Trade Flows: Trading Partners and Trading Volumes. *Quarterly Journal of Economics*, 123(2), 441–487.

Klasen, S. and T. Nestmann, 2006. Population, population density and technological change. *Journal of Population Economics*, 19, 611–626.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2008. The Economic Consequences of Legal Origins. *Journal of Economic Literature*, 46(2), 285–332.

La Porta, R., Lopez de Silanes, F., Shleifer, A., Vishny, R.W., 1998. Law and Finance. *Journal of Political Economy*, 106(6).

Manning, N. (2004). Diversity and change in pre-accession Central and Eastern Europe since 1989. *Journal of European Social Policy*, 14(3), 211–232.

Mélitz, Jacques, 2007. North, South and distances in the gravity model. *European Economic Review*, 51(4), 971–991.

Mélitz, Jacques, 2008. Language and foreign trade. *European Economic Review*, 52(4), 667–699.

Mélitz, Jacques, Toubal, Farid, 2012. Native language, spoken language, translation and trade. CEPR Discussion Paper No. 8994.

Nitsch, Volker, 2000. National borders and international trade: Evidence from the European Union. *Canadian Journal of Economics*, 33(4), 1091–1105.

María Pía Olivero, Yoto V. Yotov , 2012. Dynamic Gravity: Endogenous Country Size and Asset Accumulation, Canadian Journal of Economics, 45(1), 64–92.

Mayer T. and S. Zignago (2011), Notes on CEPII's distances measures: The GeoDist database, CEPII Working Paper 2011-25.

Portugal-Perez, Alberto, and Wilson, John S., 2012. Export Performance and Trade Facilitation Reform: Hard and Soft Infrastructure. *World Development*, 40(7), 1295–1307.

Sanots Silva, J. M. C. and S. Tenreyro, 2006. The Log of Gravity. *Review of Economics and Statistics*, 88(4), 641–658.

Singh, T., 2010. Does International Trade Cause Economic Growth? A Survey. *The World Economy*, 33(11), 1517–1564.

Wang, Chengang, Yingqi Wei and Xiaming Liu, 2010. Determinants of Bilateral Trade Flows in OECD Countries: Evidence from Gravity Panel Data Models. *The World Economy*, 33(7), 894–915.

Wooldridge, Jeffrey M., 2002. *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press, 2002.

Wooldridge, Jeffrey M., 2003. Cluster-Sample Methods in Applied Econometrics. *American Economic Review*, 93(2), 133–138.

Wooldridge, J., 2006. Cluster-Sample Methods in Applied Econometrics: An Extended Analysis, manuscript, Michigan State University Department of Economics. Available at http://econ.ucsb.edu/~doug/245a/Papers/Cluster%20Sample%20Methods%20in%20Applied%20Econometrics.pdf (accessed June 20, 2013).

Uzagalieva, A., Kočenda, E., Menezes, A., 2012. Technological Innovation in New European Union Markets. *Emerging Markets Finance and Trade*, 48(5), 48–65.