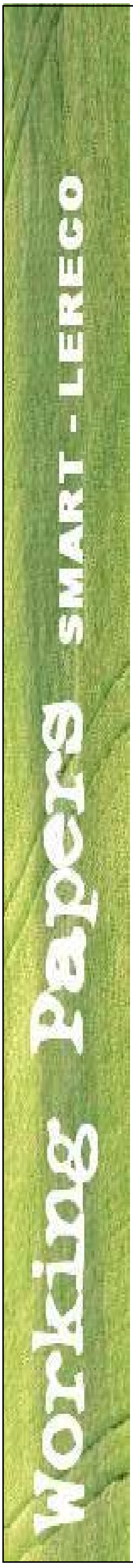

Border Effects and East-West Integration

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Abstract

A new method for measuring trade potential from border effects is developed and applied to manufactured trade between the old fifteen European Union (EU) members and twelve Central and East European (CEE) economies. Border effects are estimated with three theoretically compatible trade specifications, and much larger trade potentials are obtained than predicted by usual trade potential models. Even after a decade of regional trade liberalization, the integration of CEE and EU economies is two to three times weaker than intra-EU integration, revealing a large potential for East-West European trade.

Keywords: Trade potential, regional integration, border effects

JEL classifications: F10, F12, F14, F15

Effets frontière et intégration Est-Ouest européenne

Résumé

Ce papier propose une nouvelle mesure du potentiel de commerce à partir des effets frontière. On l'applique au commerce de produits manufacturés entre les quinze anciens membres de l'Union Européenne et douze pays de l'Europe Centrale et Orientale. On estime les effets frontière à partir de trois spécifications des échanges dérivées de modèles théoriques et on trouve des potentiels d'échanges considérablement plus élevés que la plupart de la littérature. Même après une décade de libéralisation régionale, l'intégration des pays Est et Ouest-européens reste deux à trois fois plus faible que l'intégration à l'intérieur de l'Union européenne à quinze, indiquant un grand potentiel pour le commerce de la région.

Mots-clefs : Potentiel de commerce, intégration régionale, effet frontière

Classifications JEL : F10, F12, F14, F15

Border Effects and East-West Integration

1 Introduction

Economic relationships between Central and Eastern European (CEE) countries and their Western partners during the 1990s have been marked by the premises of EU enlargement. In the early 1990s most CEE countries have formulated officially their desire to integrate the Union, and have received an affirmative response conditional on the fulfillment of several economic criteria. About a decade later, they have acquired the membership status and benefit from all insiders' advantages. The evolution of their economic exchanges between these two dates reflected a gradual elimination of trade costs, and a concentration of trade with 'old' (core) EU partners. Regional integration between Eastern and Western European nations has been accompanied by important trade creation effects, that continue even after CEE countries have joined the European Union. Indeed, it takes time for firms to grasp trading opportunities offered by the modified economic environment. The economic literature employs the term *trade potential* to designate these effects.

The additional trade arising from an economic integration initiative is traditionally estimated in the literature by trade potential models that rely on the empirical success of the gravity equation. The essence of these models consists in comparing actual trade to the gravity-predicted or so-called "normal" level of trade, with the difference between the two capturing the trade potential. Wang and Winters (1991), Hamilton and Winters (1992), Baldwin (1993), Gross and Gonciarz (1996), Fontagné et al. (1999), Nilsson (2000), and Papazoglou et al. (2006) use this approach to estimate European trade potential during the 1990s. One drawback of this method is the misspecification of the gravity equation used in these models with respect to trade theory, and the sensitiveness of results upon the gravity specification employed. Another weakness of trade potential models is that they disregard the large amount of trade taking place inside national borders and base their predictions on an analysis carried exclusively on international trade.

The present paper introduces a new method for measuring trade integration and quantifying future increases in intra-regional trade. Differently from traditional trade potential models, I define the level of trade integration of two or more countries by referring to their domestic trade. The closer is the volume of trade between two countries to their domestic trade, when controlling for standard variables such as supply, demand, and trade costs, the more integrated are the two countries. In other words, I compute trade potentials from all cross-border trade costs, taking into account domestic trade.

Technically, the method consists of two steps. Firstly, I estimate the level of cross-border trade costs using each country's domestic trade as benchmark for its trade with partner countries. The rationale for this is the following: A country is a highly integrated and homogeneous economic space, where full economic integration is achieved. Indeed, in the light of some recent studies (e.g. Brunetti et al., 1997, Rauch, 2001), the presence of a single legislative system, central administration, currency, communication network and set of economic policies contributes to an important reduction of transaction costs and fosters exchange. This argument is confirmed by empirical works revealing that higher volumes of trade take place inside countries (i.e. within national borders) than between them (i.e. across borders). McCallum (1995) refers to this as the *border effect* and finds that even highly integrated countries as Canada and US trade about twenty times less with each other than with themselves. Later work has proven this figure to be unrealistically high: e.g. Anderson and van Wincoop (2003) find a border effect ranging between 2.24 and 10.7 for the same countries. Still, domestic trade remains a convenient benchmark for international trade flows. In this paper I make the assumption that trade costs other than those induced by the distance are null for transactions taking place within the same country, and express international trade costs in terms of border effects, i.e. the ratio of international-to-domestic volume of trade.

Secondly, I compare international trade costs for the integrating and the reference group of countries. The group of countries with the lowest level of intra-group trade costs serves as reference for all other regional trade flows. I compute the level of trade integration or trade potential as the ratio of estimated within- and cross-group border effects, with a lower ratio corresponding to a higher level of trade integration. I choose the reference group to be formed by countries with the lowest international trade costs and I assume that further integration within the region reduces trade costs to the level observed for the reference group. In the particular case of European integration, trade between the fifteen core-EU members is subject to lower distortions and I use it as a reference for other European flows, as in the literature on trade potentials. The fact that the share of intra-EU trade in total EU trade remained at a steady level during the last two decades suggests that the latter might well correspond to the long term equilibrium. The East-West European trade creation may or not be accompanied by trade diversion in the detriment of intra-CEE integration. After the EU enlargement in 2004 and 2007 trade between new member states (NMS) became intra-EU trade, and trade costs associated with these flows should also converge, at least in the long run, to the level of intra-EU costs prior to enlargement.

Another question tackled in this paper is that of the correct specification of the gravity equation. Although gravity is shown to be compatible with both traditional and new trade theories, each theoretical model produces a different final trade specification. This aspect, ignored by trade potential models, is incorporated here through the use of theoretically derived trade equations in the estimation of border effects. One can estimate border effects from a national product differentiation setting as Anderson and van Wincoop (2003), with monopolistic competition and firm-specific varieties like Wei (1996) and Head and Mayer (2000), or, yet, estimate an average bilateral border effect as Head and Ries (2001). Accordingly, I use three alternative specifications for domestic and foreign trade flows. The first approach consists in using country-specific effects to capture importer and exporter groups of variables, allowing the estimation of coefficients on bilateral variables alone; the second involves the incorporation of a Dixit-Stiglitz-Krugman (DSK) monopolistic production model; and the last approach implies the computation of average trade 'freeness'.

Thus, the method presented in the current paper eliminates the two drawbacks characterizing the traditional trade potential models mentioned above: (i) the use of border specific costs permits to account for the fact that a lot of trade is already "missing" at the international level, and (ii) the estimation of border effects with theoretically derived trade equations corrects for specification problems. For the simplicity of the exposal I refer hereafter to trade between old/core EU countries as *intra-EU trade*, to trade between NMS that joined the EU in the last decade as *intra-CEE trade*, and to trade between the two groups of countries as *CEE-EU* or *East-West European trade*. Thus, the CEE-EU trade potential or trade integration is obtained as the ratio between the border effect estimated for CEE-EU trade and for intra-EU trade.

Trade of the twelve NMS, both with other NMS and with the fifteen core-EU countries improved remarkably during the last decade of the twentieth century. The results predict much higher trade potential values for CEE-EU and intra-CEE trade than usually found in the literature with traditional trade potential models. Results are very robust, with the three theoretically sound specifications producing the same conclusions. Thus, at the beginning of the XXIst century trade between CEE and EU countries represented less than half of its attainable level, suggesting a possible two to three fold increase with further EU integration. The possible upsurge of intra-CEE trade in the following years, despite the impressive reduction of bilateral border effects reached by the beginning of the century, is even higher.

The paper is organized as follows. The next section describes the new trade potential measure introduced by this paper. Section 2 describes the theoretical trade model and three different specifications used to estimate border effects. Border effect estimates within and between country groups are presented and discussed in section 3. The main results of the paper are displayed in section 4. Trade potentials for European trade flows produced by the different approaches and their evolution in time are compared. Section 5 summarizes the conclusions.

2 Theoretical Discussions

I start by describing an underlying preference structure for trade in differentiated goods. The obtained trade equation includes variables that are unobserved or inaccurately measured, i.e. is unsuitable for direct estimations. To solve this issue I follow Combes et al. (2005) and consider three different trade specifications.

A differentiated-goods trade structure

First, I consider a trade structure with a differentiated good and n_i varieties produced in each country i. The model has a slightly different interpretation depending on the used data. Each industry (when using industry-level data) or the entire manufactured sector (when using aggregate data) is considered to be composed of a single differentiated product of which multiple varieties are available. Product differentiation can be at country or firm level. National product differentiation was introduced by Armington (1969) who proposed an utility function in which consumers distinguish products by their origin. It can also arise from a Heckscher-Ohlin model with no factor price equalization as in Deardoff (1998). An alternative approach is that of Dixit-Stiglitz-Krugman (DSK) type monopolistic competition models. In the latter each variety is produced by a distinct firm, and the number of varieties n_i (identical to the number of firms) is endogenously determined by the model.

Consumer preferences are homothetic and represented by a CES utility function. Importing country j's representative consumer utility is given by:

$$u_j = \left[\sum_i n_i \left(a_{ij} x_{ij} \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{1}$$

with a_{ij} representing country j consumers' preference for country i products, x_{ij} the volume of goods produced in i and consumed in j, and σ the substitution elasticity between any two varieties. Coefficients a_{ij} are introduced in order to allow for different preferences across countries.[1]

I assume that consumers of each product are charged with the same price augmented by trade costs. The difference in the price of the same good in two different locations is therefore entirely explained by the difference in trade costs to these locations. For simplicity an 'iceberg' trade costs function is used. The price to country j consumers of a good produced in i, p_{ij}, is the product of its mill price p_i and the corresponding trade cost t_{ij}. Two elements of bilateral trade costs are considered: transport costs proportional to the shipping distance d_{ij}, and costs due to the presence of trade barriers such as tariffs, non-tariff barriers, information costs, partner search costs, institutional costs, etc:

$$t_{ij} = \underbrace{d_{ij}{}^{\rho}}_{\substack{\text{transport}\\ \text{costs}}} \underbrace{\exp\left[\left(1 - home_{ij}\right) b_{ij} \right]}_{\substack{\text{border-specific}\\ \text{costs}}}. \tag{2}$$

The second type of costs arises exclusively for trade across national borders. $home_{ij}$ is a dummy variable equal to one for internal trade and to zero for trade between countries. $[\exp(b_{ij}) - 1] \times 100$ gives the tariff equivalent of border-specific trade barriers on country i exports to j. In section 3 I introduce a more complex trade cost function by decomposing the second left hand side term of equation (2) in order to account for the presence of a common land border or language, and different trade flow types.

Consumers of each country j spend a total sum E_j on domestic and foreign products:

$$\sum_i n_i x_{ij} p_{ij} = E_j, \tag{3}$$

and choose quantities that maximize their utility function (1) under the budget constraint (3). Country j's total demand for country i products is given by:

$$m_{ij} \equiv x_{ij} p_{ij} = a_{ij}^{\sigma-1} \left(\frac{p_i t_{ij}}{P_j} \right)^{1-\sigma} n_i E_j, \tag{4}$$

$$\text{where} \qquad P_j \equiv \left[\sum_k a_{kj}^{\sigma-1} \left(p_k t_{kj} \right)^{1-\sigma} n_k \right]^{\frac{1}{1-\sigma}} \tag{5}$$

[1]Two forms of preferences are usually found in the literature: identical for all countries, $a_{ij} = a_i \ \forall j$, yielding symmetric utility functions (e.g. Anderson and van Wincoop, 2003), and more pronounced for domestic products, $a_{ij} = \exp(e_{ij})$ if $i \neq j$ and $a_{jj} = \exp(e_{jj} + \beta)$, producing asymmetric demand functions (e.g. Bergstrand, 1989, Head and Mayer, 2000).

is a price index of the importing country j nonlinear with respect to the unknown parameter σ. The estimation of equations (4)-(5) is possible only for particular values of the substitution elasticity σ. But even then the presence of a non linear price index P_j, and the difficulty of measuring the number of varieties produced in each country limit the accuracy of results. Slightly different specifications are reached with national and firm level product differentiation.

I adopt the following notation $\phi_{ij} \equiv (t_{ij}/a_{ij})^{1-\sigma}$, imported from the economic geography literature, and representing trade freeness (or ϕ-ness). Consumer preferences can also be expressed as a function of bilateral variables, similar to trade costs. However, I have no means to disentangle the impact of the same variable on preferences from its impact on trade costs. Estimated coefficients on the latter will actually reflect the global effect on both trade costs and consumer preferences. For exposal simplicity I assume throughout the rest of the paper identical preferences for all products and consumers and interpret any increase (drop) in trade freeness as a reduction (raise) of trade costs. The main implication of this assumption is that our border effect measures will capture the trade gap arising from stronger preferences of consumers for domestic goods, in addition to the effect induced by larger costs for trading across borders.[2] Alternatively, one could consider that an identical equally-priced good from source country s is perceived differently by consumers in country i and consumers in country j. A strong (weak) taste for good s leads consumers to overvalue (undervalue) the virtues of the product and shifts their demand function upward (downward). Thus, the actual price to which consumers in country j respond is $a_{sj}^{\sigma-1} p_{sj}$ rather than p_{sj}.

The rest of this section is reserved to the presentation and discussion of three alternative specifications of bilateral trade flows. The first consists in using country-specific effects to capture importer and exporter variables, allowing the estimation of coefficients on bilateral variables alone. We shall refer to it as the *fixed-effects* approach. The second procedure involves a deeper use of the theoretical framework, in particular the production side of a DSK monopolistic model, and the last approach refers to the computation of an average trade 'freeness'. We call those the *odds* and *friction* specifications, respectively.

The fixed-effects specification

The method presented below relies uniquely on the differentiated-good structure presented above. As a result, it holds independently of the specific market structure and the production side assumptions, and is equally compatible with constant and increasing returns to scale, national and firm level differentiation of products. As implied by the name, it resides in using importer and exporter specific dummies to account for market and supply capacities, as in Rose and van Wincoop (2001) and Redding and Venables (2004).

An estimable trade specification can be derived directly from (4) by grouping i and j terms of the equation, using the definition of trade freeness, and taking logarithms on both

[2] The assumption of identical preferences does not alter the main conclusion of the paper. The aim of the paper is to illustrate the integration between old and new EU countries over the past two decades. While differences in consumer preferences may inflate the level of border effects estimated for each year, they leave unaffected the evolution trend. Indeed, changes in tastes and consumption habits arise on much longer time horizons than the one considered in the paper.

sides:

$$\ln m_{ij} = FE_i + \ln \phi_{ij} + FM_j. \tag{6}$$

Country fixed effects are used as proxies for supply and demand terms of the equation with $FE_i \equiv \ln(n_i p_i^{1-\sigma})$, and $FM_j \equiv \ln(E_j P_j^{\sigma-1})$. Under this approach only bilateral variables are left in the equation, and all structural parameters, in particular the elasticity of substitution between varieties σ, cannot be estimated. This represents the major drawback of this approach.

Differently from the cited authors, I am interested in the estimation of border specific effects and estimate equation (6) for international and domestic trade. Trade costs in ϕ_{ij} are decomposed according to (2) to reach the final trade specification:

$$\ln m_{ij} = FE_i + FM_j + \rho(1-\sigma)\ln d_{ij} + (1-\sigma)b_{ij} - (\sigma-1)b_{ij}home_{ij}. \tag{7}$$

Accordingly, a higher coefficient on the last variable designates higher cross-border barriers for country i's exports to j. As suggested by equation (7) higher trade barriers can arise not only from larger trade costs (larger b_{ij}), but also from a higher elasticity of substitution. The trade loss due to country-specific trade barriers (e.g. strong non-tariff barriers, poor domestic institutions) is seized by country specific effects and not by the border effect.

Differently, one can first derive a gravity-type trade equation following Anderson and van Wincoop (2003)'s approach for national product differentiation, and only afterwards group supply and demand variables separately into country specific effects. This will produce identical estimation equations and results; the difference lays in the interpretation of country and partner effects FE_i and FM_j.

Summing bilateral imports (4) across destinations gives the production level at origin y_i. Then the obtained identity can be further used to express the unknown amount ${p_i}^{1-\sigma}$ ($n_i = 1$, $\forall i$ in this particular case), which is then re-introduced in the trade equation (4). Differently from Anderson and van Wincoop (2003), this can be accomplished without imposing market clearance ($y_i = E_i$) and using data on importer's expenditure.[3] A nice gravity equation is thus obtained:[4]

$$m_{ij} = \frac{y_i E_j \phi_{ij}}{\bar{P}_i^{1-\sigma}\tilde{P}_j^{1-\sigma}} \tag{8}$$

$$\text{with} \qquad \bar{P}_i^{1-\sigma} \equiv \sum_k \phi_{ik} {P_k}^{\sigma-1} E_k, \quad \text{and} \quad \tilde{P}_j^{1-\sigma} = \sum_k p_k^{1-\sigma}\phi_{kj}. \tag{9}$$

$\tilde{P}_j$ is an importer-specific price index reflecting the average price of country j's imports. A higher average price paid by consumers of the importing country increases the value of

[3]Market clearance is a quite restrictive assumption for it implies balanced international trade, which occurs only at national level and in the long run. This assumption is not completely inconsistent with the CEE-EU industry level pattern of trade. In 2000 80% of the trade between EU and CEE countries at the industry level was intra-industry trade. Trade imbalances are less important for the entire manufactured sector, but not sufficiently low to suggest that realistic predictions shall be obtained by assuming market clearance at aggregate level. Therefore, I use expenditure data computed as the sum of domestic production and foreign imports.

[4]Deardorff (1998) reaches a similar trade equation from a Heckscher-Ohlin trade model with differences in factor prices across countries and complete specialization.

exports to that market. $\tilde{P}_j^{1-\sigma}$, on the contrary, corresponds to the relative isolation of a country in terms of trade costs and/or consumer preferences, and reduces bilateral flows. $\bar{P}_i$ is an exporter-specific weighted average of price indexes of all its trading partners including itself. The expression of $\bar{P}_i^{1-\sigma}$ in (9) is very similar to the remote market access used in economic geography models: the access of country i's products to all markets, including the domestic one. In other words, $\bar{P}_i$ reflects the purchasing power of i's partners and is positively related to trade. An improved global market access for country i products translates into higher total shipments to its partners. Symmetric trade costs ($t_{ij} = t_{ji},\ \forall\ i, j$), and identical preferences across countries ($a_{ij} = a_i,\ \forall\ i, j$) yield the symmetric solution $\bar{P}_i = \tilde{P}_i$ used by Anderson and van Wincoop (2003) to reach a more elegant version of (8). In our specific case of East-West European trade this assumption is irrelevant because the two groups of countries followed uneven trade liberalization timetables, a difference that I attempt to measure in the following sections.

Writing equation (8) in logarithmic form and using country and partner binary variables to capture demand and supply terms[5], I reach again equation (6).

The odds specification

This subsection presents an alternative trade model with monopolistic competition as in Dixit and Stiglitz (1977) and Krugman (1980), increasing returns to scale and firm-level differentiated products. Similar trade models have been developed by Head and Ries (2001) and Head and Mayer (2000). In a DSK setting firms set prices as if they face a constant price elasticity of demand, equal to the elasticity of substitution between two varieties σ. Their prices, free of trade costs, are expressed as a constant markup over the marginal cost of production c_i:

$$p_i = c_i \frac{\sigma}{\sigma - 1} \tag{10}$$

I consider labor as the unique factor of production and a single equilibrium wage level w_i within any given country i. Then a unique mill price is charged for all varieties produced in the same country. Production technologies are assumed identical across countries and wages are the only source of difference in production costs. Identical production functions $qp_i = Fw_i + \mu q w_i$ are considered, with the first term on the right hand side expression denoting fixed costs and the second term marginal costs, both expressed in units of labor. Firms enter the market until all profits vanish away, and the equilibrium price equals the average cost. This implies equal outputs q for all firms and varieties:

$$q = \frac{F(\sigma - 1)}{\mu}, \tag{11}$$

where F and μ represent invariable fixed and marginal costs in labor units. The number of varieties produced and firms in each country, n, is endogenous to the model. Combining equations (10) and (11), and using the fact that a country's revenue y_i is the sum of its firms' revenues, one can express the number of varieties produced by a country as follows:

$$n_i = \frac{y_i}{w_i \sigma F}. \tag{12}$$

[5] $FE_i \equiv \ln\left(y_i \bar{P}_i^{\sigma-1}\right)$ and $FM_j \equiv \ln\left(E_j \sum_k p_k^{1-\sigma 1} \phi_{kj}\right)$.

Given the expression of the number of locally produced varieties, equation (4) rewrites to:

$$m_{ij} = p_i^{1-\sigma} \frac{\phi_{ij}}{P_j^{1-\sigma}} \frac{y_i E_j}{\sigma w_i F}, \tag{13}$$

$$\text{with} \qquad P_j^{1-\sigma} = \sum_k p_k^{1-\sigma} \phi_{kj} \frac{y_k}{\sigma w_i F}. \tag{14}$$

Using relative demands as explained variables, i.e. the ratio of trade flows to the same destination, considerably simplifies the specification by eliminating destination specific right hand side terms. Applied to our trade equation (13) this means the elimination of non linear importer's price index and expenditure. Thus the set of explained variables shrinks to the characteristics of the two origins. Particularly interesting for us is the case when the destination country is taken as reference. With bilateral flows given by equation (13), the foreign-to-internal trade ratio becomes:

$$\frac{m_{ij}}{m_{jj}} = \frac{y_i}{y_j} \left(\frac{p_i}{p_j}\right)^{1-\sigma} \frac{w_j}{w_i} \frac{\phi_{ij}}{\phi_{jj}}. \tag{15}$$

Note that assumptions on the production side imply that mill prices are equal to $p_i = \mu w_i(\sigma/(\sigma-1))$. The price ratio in (15), which can also be written as the ratio of marginal costs, becomes equal to the wage ratio. Unknown technological F and μ coefficients simplify when using relative demands.

Border specific costs can be estimated from equation (15) with destination country as reference and the sample restricted to foreign-relative-to-domestic shipments (exclude observations of the m_{jj}/m_{jj} type). Use the decomposition of trade costs (2) in (15) and take logarithms to obtain the *odds* specification:

$$\ln \frac{m_{ij}}{m_{jj}} = \ln \frac{y_i}{y_j} - \sigma \ln \frac{w_i}{w_j} + \rho(1-\sigma) \ln \frac{d_{ij}}{d_{jj}} + (1-\sigma) b_{ij} \tag{16}$$

The opposite of the constant term in the above equation reflects border-specific trade barriers. 'Missing' international trade is measured in terms of actual domestic trade, i.e. as the ratio of domestic-to-cross-border trade deflated by relative production, wage and distance. More specifically, the border effect for imports of j from i is obtained from (16) by taking the exponential of the negative free term: $\exp[(\sigma-1)b_{ij}]$.

If consumer preferences were to vary with the goods' origin, any disproportionate preference for domestic varieties would be captured by the border effect. With a generally accepted perception of positive domestic biases in preferences, one should expect larger border effects estimates with the *odds* specification.

The friction specification

The last approach regards the use of a transformation of the explained variable introduced by Head and Ries (2001). They use as left hand side variable the inverse index of 'friction' to trade, defined as:

$$\Phi_{ij} = \left(\frac{m_{ij}}{m_{jj}} \frac{m_{ji}}{m_{ii}}\right)^{1/2} \tag{17}$$

It reflects the geometric mean of foreign firms' success relative to domestic firms' success in each home market. Head and Ries (2001) assimilate the inverse of this index to the actual border effect between Canada and the United States.

To stay consistent with the theoretical setup described in the beginning of this section, trade flows in the expression of Φ_{ij} are replaced using equation (4). Take logarithms on both sides to obtain:

$$\ln \Phi_{ij} = \ln \left(\frac{\phi_{ij}}{\phi_{jj}} \frac{\phi_{ji}}{\phi_{ii}} \right)^{1/2} \tag{18}$$

Equation (18) can also be obtained following the same steps directly from (8) or even (15). Its application is not therefore restricted to a specific market structure. According to the above specification, index Φ_{ij} actually represents the average trade freeness between countries i and j relative to their internal freeness. In the light of economic geography literature which assumes unitary internal freeness (null internal trade costs) and symmetric trade costs, the inverse friction index Φ_{ij} becomes precisely the trade freeness ϕ_{ij}.

Note that equation (18) imposes unitary coefficients on production variables, as suggested by the theory, and is therefore more in line with theoretical predictions than the previous two approaches. However, it allows only for the estimation of the average border effect for any two trading partners, rather than for two distinct effects, one for each trade directions. Use the expression of trade costs (2) in the above equation to get:

$$\ln \Phi_{ij} = \rho(1-\sigma) \ln \frac{d_{ij}}{(d_{jj} d_{ii})^{1/2}} + (1-\sigma) \left(\frac{b_{ij} + b_{ji}}{2} \right) \tag{19}$$

Another advantage of the *friction* specification is that it removes the need of using even origin specific variables, which is an important gain when accurate production, price and/or wage data is not available. As previously, the constant term refers to the magnitude of border effects when unitary trade friction observations are excluded. It captures as well any bias in consumer preferences of both importing and exporting markets when preferences are allowed to vary across countries.

Border effects under all specifications have two components: one reflecting the true level of international trade costs (b_{ij} for the first two approaches and $(b_{ji}+b_{ij})/2$ for *friction*), and another coming from the elasticity of substitution between variables $(\sigma - 1)$. This means that even very small trade barriers may generate important deviations of trade towards the domestic market when the substitution elasticity is sufficiently high. None of the specifications presented in this section permits the estimation of all structural parameters. Therefore, I can only estimate overall border effects with each approach, without being able to distinguish the part ascribed to each of the two elements. In the *fixed-effects* specification unilateral origin and destination trade costs are reflected in country and partner fixed effects. The last two trade equations, therefore, might produce larger estimates of b_{ij}. In the next section I proceed to the estimation of European border effects using the three trade specifications introduced above and McCallum (1995)'s standard (atheoretical) gravity.

3 Estimating Border Effects Across Europe

The method proposed in this paper computes trade potentials from border effects within and between country groups. This section is dedicated to the estimation of border effects. I divide trade between European countries into four types: EU imports from CEE, CEE imports from EU, intra-EU trade, and intra-CEE trade, and estimate border effects for each type of flows. I use a single equation on the entire sample of countries to estimate the four border effects. This method is preferred to estimating border effects separately for each type of trade since it has the advantage of imposing the same coefficients of independent variables for all trade types and yields more comparable results. Border effects are estimated with the *fixed-effects*, *odds*, and *friction* specifications presented in section 2. For comparison, I estimate two additional specification: a simple gravity equation only on cross-border trade flows within the sample, and a simple gravity equation on both domestic and foreign flows as in McCallum (1995). Estimations are carried out separately for total manufactured imports and for industry-level imports.

I introduce a more complex structure of trade costs by decomposing the last term of equation (2) and allowing for differences across the type of trade and for countries sharing a land border or speaking the same language:

$$\begin{aligned}\ln t_{ij} &= \delta \ln d_{ij} + b_0 home_{ij} + b_1 CEEtowardsEU_{ij} + b_2 EUtowardsCEE_{ij} \\ &\quad + b_3 intraEU_{ij} + b_4 intraCEE_{ij} + c_1 contig_{ij} + c_2 comlang_{ij}\end{aligned} \tag{20}$$

As previously, $home_{ij}$ stands for domestic trade and $b_0 < 0$. Dummies $CEEtowardsEU_{ij}$, $EUtowardsCEE_{ij}$, $intraEU_{ij}$, $intraCEE_{ij}$ indicate the affiliation of each observation to a particular trade type. Variables $contig_{ij}$ and $comlang_{ij}$ denote respectively a common land border and language for countries i and j. As both linguistic and neighbor relations are likely to reduce trade costs, I expect coefficients c_1 and c_2 to be negative. Observe that the first five dichotomic variables in the above trade costs specification sum to unity. The use of (20) along with a constant term in a trade equation does not permit therefore the estimation of all parameters. I choose to drop the variable $home_{ij}$ and use domestic trade as reference for the estimation of coefficients b_1 through b_4. Thus, the constant term reflects the level of domestic trade and the other trade flows are expressed as deviations from this level. In the *odds* and *friction* specification lower trade costs for domestic shipments are directly accounted for by the specific form of the left hand side variable, and dummy $home_{ij}$ becomes irrelevant.

I use a gravity equation similar to that of McCallum (1995) as baseline:

$$\begin{aligned}\ln m_{ij} &= \alpha_0 + \alpha_1 prod_i + \alpha_2 cons_j + \alpha_3 d_{ij} + \beta_1 CEEtowardsEU_{ij} \\ &\quad + \beta_2 EUtowardsCEE_{ij} + \beta_3 intraEU_{ij} + \beta_4 intraCEEij \\ &\quad + \gamma_1 contig_{ij} + \gamma_2 comlang_{ij} + \epsilon_{ij}\end{aligned} \tag{21}$$

Exporter's production $prod_i$ and importer's consumption $cons_j$ are used as proxies for national revenues. The border effect for each type of trade is obtained as the exponential of the absolute value of the corresponding coefficient. For example, $\exp(-\beta_1)$ shows how much more does in average a EU member state buy from itself than from other EU countries.

I estimate equation (21) separately on international flows and on domestic and international flows. In the first case variables $home_{ij}$ and $intraEU_{ij}$ are dropped due to collinearity with other dummies and trade flows are expressed as deviations from intra-EU trade (captured by the constant term). This specification does not permit to estimate border effects and serves only for comparison with other estimates. It is used in section 4 to compute benchmark trade potentials since similar specifications are used in the traditional trade potential literature.

The trade equation estimated with the *fixed-effects* procedure is obtained by integrating the more detailed trade costs function (20) in equation (6). However, the use of all group dummies, country and partner specific effects is impossible due to collinearity problems. The inclusion of all country specific effects is imperative for the estimation of average effects for the entire sample, not relative to an excluded country pair. But then variable $home_{ij}$ can be obtained as a linear combination of other group, country, and partner dummies. A tractable equation is reached by replacing the variables $CEEtowardsEU_{ij}$ and $EUtowardsCEE_{ij}$ by their sum, $CEEandEU_{ij}$:

$$\begin{aligned} \ln m_{ij} &= FE_i + FM_j + \alpha \ln d_{ij} + \beta_0 + \beta_{12} CEEandEU_{ij} + \beta_3 intraEU_{ij} \\ &\quad + \beta_4 intraCEE_{ij} + \gamma_1 contig_{ij} + \gamma_2 comlang_{ij} + \varepsilon_{ij} \end{aligned} \tag{22}$$

In this case one can estimate only an average border effect for CEE-EU trade: $\exp(-\beta_{12})$. With lower relative trade costs for EU countries ($b_1 < b_2$), this method underestimates the border effect for intra-EU trade and overestimates the effect for trade between NMS.

The *odds* trade specification is reached by combining equations (16) and (20):

$$\begin{aligned} \ln \frac{m_{ij}}{m_{jj}} &= \alpha_1 \ln \frac{y_i}{y_j} + \alpha_2 \ln \frac{w_i}{w_j} + \alpha_3 \ln \frac{d_{ij}}{d_{jj}} + \beta_0 + \beta_1 CEEtowardsEU_{ij} \\ &\quad + \beta_2 EUtowardsCEE_{ij} + \beta_3 intraEU_{ij} + \beta_4 intraCEE_{ij} \\ &\quad + \gamma_1 contig_{ij} + \gamma_2 comlang_{ij} + \upsilon_{ij} \end{aligned} \tag{23}$$

Relative production values are used for output or revenue ratios. Of all specifications exposed in section 2, this is the only one that estimates distinct border effects for each of the four European trade types.

The *friction* approach estimates average two-way trade within and between the two groups of countries. Differently from the *fixed-effects* method, dummies for both CEE exports to and imports from EU are included. By construction, the coefficients on these variables are equal and reflect the average CEE-EU border effect. The equation estimated with this approach is the following:

$$\begin{aligned} \ln \Phi_{ij} &= \alpha \ln \frac{d_{ij}}{\sqrt{d_{jj} d_{ii}}} + \beta_0 + \beta_1 CEEtowardsEU_{ij} + \beta_2 EUtowardsCEE_{ij} \\ &\quad + \beta_3 intraEU_{ij} + \beta_4 intraCEE_{ij} + \gamma_1 contig_{ij} + \gamma_2 comlang_{ij} + \upsilon_{ij} \end{aligned} \tag{24}$$

Coefficients β_1 to β_4 may also capture the share of consumer preferences common to all countries of each group, including any particular preference for domestic products, common to all EU countries, and respectively all NMS. The use of relative demands in the last two specifications introduces spatial autocorrelation in the error term. This is corrected through a robust clustering procedure, which allows a correlation of residuals v_{ij} for the same importing country j.

I estimate border effects for total manufactured bilateral imports of fifteen EU countries and twelve Central and East European countries with pooled ordinary least squares and year fixed effects and report results in table 1. Standard deviations are obtained with a robust clustering technique that allows error terms for the same country pair to be correlated. This permits to control at least partially for autocorrelation in the data. All coefficients have the expected sign and most of them are statistically significant. Production and consumption coefficients are close to unity and the distance elasticity of trade is not very different from -1, similar to most empirical studies in the literature. The parameters of interest are the coefficients on group (trade type) dichotomic variables. The fist column shows estimates of international trade costs relative to intra-EU costs. Negative coefficients of group dummies indicate that intra-EU trade is subject to lowest trade costs, justifying its use as reference for other European trade flows. A core EU country exports on average 37% $[= (1 - \exp(-0.46)) \times 100]$ less to a NMS than to another EU country, imports 40% $[= (1 - \exp(-0.51)) \times 100]$ less from a NMS than from a EU partner, and two NMS trade 43% $[= (1 - \exp(-0.57)) \times 100]$ less than two core EU countries equally large and distant. Border effect estimates obtained with equation (21) are presented in column 2. Setting all group variables equal to zero yields an estimation of domestic trade and trade costs for each type of international trade flows are obtained relative to this reference level. Thus, intra-EU border effects or trade costs are 5.5 $[= \exp(1.71)]$ times larger than domestic trade costs; EU exports to and imports from NMS are 9.0 $[= \exp(2.20)]$ and respectively 9.6 $[= \exp(2.26)]$ times more expensive than trading within national borders. Trade costs between NMS from Central and Eastern Europe are the largest: 10.5 $[= \exp(2.35)]$ times domestic costs. Hence, both CEE-EU and intra-CEE trade integration lies bellow the level reached by the fifteen core-EU members.

The positive and significant coefficient on the common land border variable confirms the intuition that neighbor countries trade more with each other. This can be due to lower trade costs between these countries, as well as to more similar consumer preferences. The non significant coefficient of the common language dummy is due to its high correlation with the common border variable, the low number of dyads sharing both characteristics in the sample, and their uneven distribution across country groups.[6] Including internal trade in estimations (column 2) keeps the coefficients on all variables almost unchanged (relative to column 1), and sets forward the fact that both EU and CEE countries rely much more on domestic than foreign partners.

Border effects of similar magnitude are obtained with the other three trade specifications. The *fixed-effects* model (column 3) estimates that a EU member country buys on average about 3.8 $[= \exp(1.34)]$ times more from itself than from another EU country, while a similar NMS buys about 15.5 $[= \exp(2.74)]$ times more. Trade between EU and NMS is less than half of the intra-EU trade, when controlling for market and supply capacities, distance and common language and land border.

The next two columns present results from the *odds* approach. Figures in column 4

[6]Indeed, in Europe most countries that speak the same language share also a land border: e.g. Austria and Germany, Belgium and its neighbors. Out of the 650 distinct country-partner relationships in the panel only 20 speak a common language, and 14 of them are core EU countries.

Table 1: European trade integration: total manufactured imports

	(1)	(2)	(3)	(4)	(5)	(6)
Model :	gravity	gravity	FE	odds	odds IV	friction
Dependent variable:	$\ln m_{ij}$	$\ln m_{ij}$	$\ln m_{ij}$	$\ln \frac{m_{ij}}{m_{jj}}$	$\ln \frac{m_{ij}}{m_{jj}}$	Φ_{ij}
ln production exporter	0.84^a	0.83^a				
	(0.03)	(0.02)				
ln consumption importer	0.74^a	0.73^a				
	(0.03)	(0.02)				
ln distance	-1.09^a	-1.07^a	-1.11^a			
	(0.06)	(0.06)	(0.06)			
ln relative production				0.79^a	1.00	
				(0.05)		
ln relative wage				-0.29^b	-0.43^a	
				(0.11)	(0.11)	
ln relative distance				-0.72^a	-0.88^a	
				(0.15)	(0.15)	
ln average relative distance						-0.90^a
						(0.05)
CEE exports to EU	-0.51^a	-2.26^a		-3.36^a	-2.70^a	-2.70^a
	(0.09)	(0.22)		(0.36)	(0.35)	(0.13)
EU exports to CEE	-0.46^a	-2.20^a		-2.89^a	-2.74^a	-2.70^a
	(0.08)	(0.22)		(0.46)	(0.50)	(0.13)
CEE-EU			-2.17^a			
			(0.22)			
intra EU		-1.71^a	-1.34^a	-2.22^a	-1.86^a	-1.81^a
		(0.23)	(0.29)	(0.32)	(0.34)	(0.12)
intra CEE	-0.57^a	-2.35^a	-2.74^a	-3.61^a	-3.20^a	-3.15^a
	(0.12)	(0.21)	(0.25)	(0.38)	(0.37)	(0.15)
common land frontier	0.31^b	0.36^a	0.36^a	0.83^a	0.61^a	0.57^a
	(0.13)	(0.13)	(0.13)	(0.19)	(0.20)	(0.12)
common official language	0.06	0.06	0.22	0.46^b	0.49^a	0.51^b
	(0.25)	(0.24)	(0.25)	(0.18)	(0.17)	(0.21)
N	8360	8701	9434	7987	7987	8317
R^2	0.91	0.92	0.92	0.80	0.67	0.72
Year fixed effects	yes	yes	yes	yes	yes	yes
Durbin-Wu-Hausman χ_2					29.87	
p-value					0.000	

Note: Standard errors in parentheses: ^{a}, ^{b} and ^{c} represent respectively statistical significance at the 1%, 5% and 10% levels.

correspond to estimates of equation (23) with generalized least squares; in column 5 I correct for endogeneity induced by the simultaneous use of production and wage variables and revealed by a significant Durbin-Wu-Hausman statistic. I impose a unitary coefficient on relative production, in line with the theoretical model, and use per capita GDP, employment levels (size of labor force), and productivity as instruments for wages. Standard errors take into account the correlation of the error terms for a given importer. This is required by the specific form of the explained variable: the logarithm of the ratio between a imports from a foreign source and domestic purchases. All estimates are statistically significant at the 5% level. The low absolute value of the wage coefficient is due to the fact that wages reflect quite poorly product prices.[7] I obtain larger absolute values for wage and distance coefficients when I correct the endogeneity bias. The use of instrumental variables (IV) also induces a drop in European border effects, which approach the estimates of the *fixed-effects* model. Column 4 results confirm the relationship between CEE-EU trade costs in both directions established in columns 1 and 2: It costs less for EU countries to export to CEE partners than for NMS from Central and Eastern Europe to export to old EU. This difference vanishes with a IV estimator: CEE-EU trade in either direction is about fifteen times more expensive than trade with a domestic partner. Core EU countries with no common border or language trade with each other six times more than with themselves. More similar tastes and/or larger transaction costs lead to a higher border effect estimate for intra-CEE trade: 24.5 [= exp(3.20)].

The last column of table 1 displays the estimates of the *friction* specification. Bilateral variables used to express trade costs are the only explanatory variables in this model. By construction, error terms are not independent across observations, but are assumed independent across importer-exporter couples. Estimates of border effects are very similar to the ones in column 5. The last three columns also show an enhanced effect of the common land border and confirm that countries that speak the same language face lower trade costs. As expected, the *odds* and *friction* specifications generate larger border effects than the *fixed-effects* and standard gravity models. This difference is explained by the fact that in the *fixed-effects* approach importer and exporter dummies capture country-specific trade costs as well as some of the variance in consumer preferences, while in the *odds* and *friction* specifications they are attributed to border effects. Therefore, if one believes that country-specific trade costs are uniformly distributed and consumer preferences are highly uneven, one should rely on estimates in column 3. Estimates from columns 5 and 6 should be preferred in the opposite case. To summarize, depending on the specification, CEE-EU trade is on average 9 to 15 times inferior to domestic trade when keeping supply, demand, and trade costs constant. This ratio is 2.4 times larger than for trade between the old EU countries, but represents less than two-thirds of the similar ratio for intra-CEE trade.

Border effect estimates obtained with industry level data are shown in table 2.[8] When trade is broken down by industries, an important number of zero value trade flows is observed. The problem with nil trade flows is that they do not occur randomly, but are the outcome of a selection procedure, e.g. a low supply or demand for a particular group of products. To correct for this sample self-selection bias I give a positive weight to the zero trade mass and employ a two-stage Heckman estimator: a first-stage probit model and a second-stage pooled OLS model with year fixed effects. A statistically significant coefficient of Mills' ratio in the second stage is obtained for the *fixed-effects* and *odds* specifications, indicating the necessity of this adjustment. Compared to the results for

[7]In reality the labor is not the unique factor of production and there are many additional distortions in the price structure not captured by the model.

[8]Point estimates of all coefficients can be provided upon request.

Table 2: European trade integration: border effects with industry-level data

Country pairs that do not share a common land border and do not speak the same language					
Trade flows	gravity	FE	odds	odds IV	friction
CEE exports to EU	11.3	15.8	27.4	15.7	18.9
EU exoprts to CEE	10.1	15.8	11.2	7.6	18.9
Intra EU trade	3.8	6.4	6.6	4.2	6.6
Intra CEE trade	21.0	23.9	27.6	17.4	29.0
Country pairs that share a common land border and speak the same language					
Trade flows	gravity	FE	odds	odds IV	friction
CEE exports to EU	6.0	6.5	7.7	5.5	6.5
EU exports to CEE	5.4	6.5	3.2	2.7	6.5
Intra EU trade	2.0	2.6	1.9	1.5	2.2
Intra CEE trade	11.2	9.8	7.8	6.1	10.0

Note: Border effects are computed using estimated coefficients of equations (21), (22), (23) and (24) for each year with industry level data. Effects for countries with no common land border or language are represented.

the aggregate manufactured sector, estimated coefficients are slightly lower for supply and demand variables but larger in absolute terms for distance and common land border. The positive and significant pro-trade effect of a common language spoken by the exporter and the importer appears in all the three specifications compatible with the theoretical model.

Estimated border effects for all trade types and all specifications except the *odds* are larger when industry level data are employed. This finding testifies that most European trade liberalization was concentrated in a small number of large size industries. The use of aggregate manufacturing data underestimates the amount of 'missing' international trade because it disproportionately reflects large sectors with low barriers to trade. Lower border effects with industry level data and the *odds* specification are due to the larger selection bias. The *odds* specification uses domestic trade of the same importing country and in the same industry as reference for international flows. Differently, in gravity and *fixed-effects* models domestic trade of any country in the sample and any sector may serve as reference after controlling for market supply, demand and trade costs. Therefore, industry level border effects obtained with the *odds* method are more accurate. The preference over results with the *friction* model is due to the fact that the *odds* specification allows for different border effects for CEE exports to core EU and CEE imports from EU.

With industry data the gap between East-West European and intra-EU trade is very prominent under both gravity and *odds* specifications, the only ones that separate the two types of trade. However, the simple gravity produces erroneous results even when industry level demand and supply data are used because it ignores remote resistance terms implied by the theory, particularly strong at the industry level. Different from the aggregate case, with industry data the theoretically consistent *odds* specification shows that CEE exports to EU face higher trade barriers than flows in the opposite direction. This counterintuitive result is robust to changes in the estimation procedure or country panel. The apparent paradox can be explained by the fact that EU countries liberalized first their domestic markets for small and medium size industries, and kept until late 1990s relatively important barriers in several key CEE industries such as textiles and food products, while CEE countries have adopted a distinct policy towards EU partners.

4 Trade Potential and East-West European Integration

The important steps undertaken by Eastern and Western European countries for the removal of politically imposed distortions on bilateral exchanges at the beginning of 1990s, as well as efforts engaged with the scheduled EU enlargement translated into a continuous increase in trade between these countries. The drop in European cross-border trade costs is well pictured by the evolution on regional border effects. Figure 1 show that border effects for both CEE-EU and intra-EU trade reduced considerably from 1994 to 2007. This conclusion is reached regardless of the trade specification employed. The *odds* specification suggests that by the end of the period intra-EU trade costs were less than twice the level of costs for domestic trade, while intra-CEE and CEE-EU trade costs where respectively six and four times larger than this reference level. The reduction of trade costs continued even after CEE countries integrated the European Union.

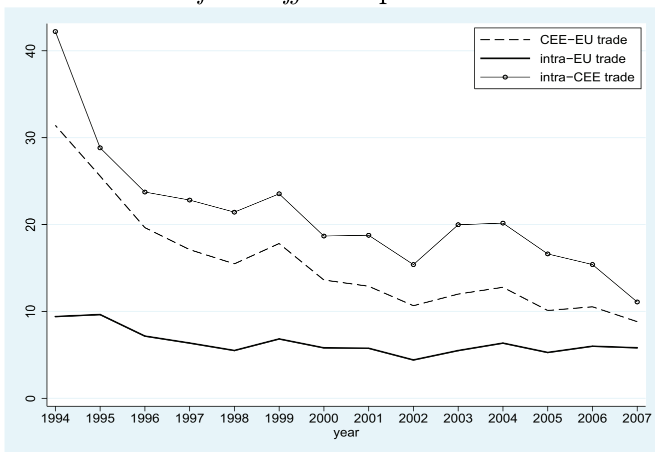
While strengthening trade between old and new members, EU enlargement affected as well trade between NMS. According to the literature (Maurel, 1998, Gros and Gonciarz, 1996, Baldwin, 1993, Nilson, 2000), the reintegration of CEE countries into the world economy in the early 1990s was accompanied by their disengagement from intra-CEE integration. The decline of trade with other CEE partners was beyond its normal level, pointing out the strong competition between former socialist economies for obtaining a higher share of the larger and more attractive core-EU market, and for increasing their chances for accession. With most of CEE countries joining the union, this rivalry has been significantly reduced, and intra-CEE trade has regained attraction. Indeed, as shown in figure 1, intra-CEE border effects dropped by over thirty points from 1994 to 2007.

The reintegration of Central and Eastern European countries in the world economy after the collapse of the communist system was accompanied by the reorientation of their foreign trade towards the European Union. The important drop in CEE-EU border effects in figure 1, especially for CEE exports to core EU countries, reflects this reinforcement of regional integration in Europe.

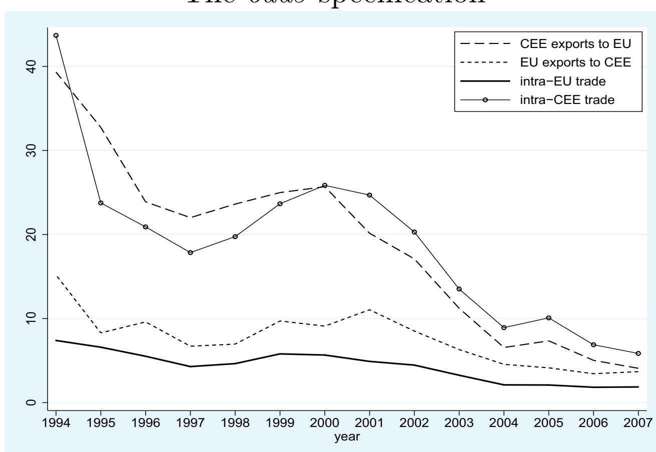
With the EU enlargement to the East, the convergence of countries from Central and Eastern Europe towards the EU market is expected to arise in all economic areas, including the manner to trade. It is thus not unreasonable to assume that in the perspective the proportion of purchases of domestic relative to foreign products of CEE countries will approach that of the fifteen core EU members. Indeed, intra-EU trade integration remained almost unchanged (figure 1), advocating its use as reference for other regional trade flows. In other words, I assume that in the long run both CEE-EU and intra-CEE trade integration will reach the intra-EU level. Therefore, I compute the level of trade integration across Europe and further increase of these flows (trade potentials) by comparing the trade costs associated with each trade type to intra-EU costs. I define the potential of CEE-EU

Figure 1: European trade integration: border effects

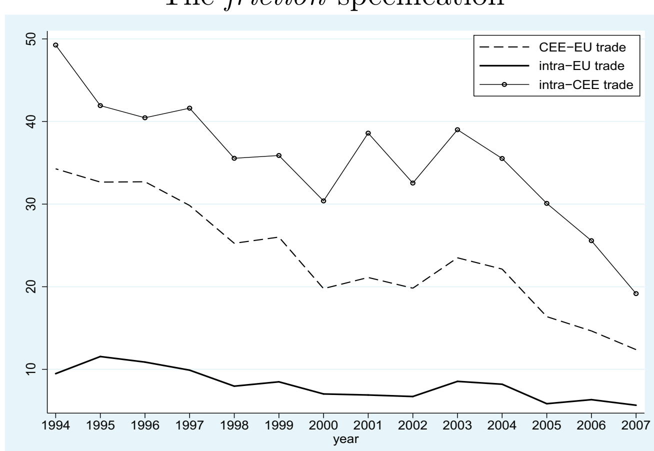
The *fixed-effects* specification



The *odds* specification



The *friction* specification



Note: Border effects are computed using estimated coefficients of equations (22), (23) and (24) for each year with industry level data. Effects for countries with no common land border or language are represented.

and intra-EU trade as the ratio of the corresponding border effects:

$$\text{CEE-EU trade potential} = \frac{\text{CEE-EU border effect}}{\text{intra-EU border effect}}, \tag{25}$$

$$\text{intra-CEE trade potential} = \frac{\text{intra-CEE border effect}}{\text{intra-EU border effect}}. \tag{26}$$

Trade potentials obtained in this way reflect a trade integration in terms of border effects. This kind of integration reaches its peak when the two groups of countries have identical cross-border trade costs and preferences. I compute trade potentials using equations (25) and (26) and border effect estimates obtained with each of the four trade specifications employed in section 3. Whenever possible, separate border effects for each type of trade (CEE exports to and imports from the EU, and intra-CEE trade) are computed. Average East-West European trade potential for flows in both directions are estimated using a single dummy for CEE-EU trade.

For comparison, I also compute trade potentials using the traditional methods employed in the literature and display the results in table 3. For comparability, I use again trade flows between the old EU countries as reference. Unlike the border effect ratio method presented above, traditional trade potential models rely exclusively on cross-border flows. Therefore I estimate equation (21) on the sub-panel of international trade and use the resulting coefficients to compare CEE-EU and respectively intra-EU trade with the level of intra-EU trade. A first method, that I call *gravity* 1, consists in expressing CEE-EU and intra-EU trade flows as percentage of intra-EU flows and attribute the difference up to 100% to the trade potential. Alternatively, *gravity* 2 computes trade potentials as the difference between the level of trade predicted by equation (21) and actual trade. Finally, in line with the literature on trade potential,[9] with *gravity* 3 I estimate (21) for trade of the reference group, intra-EU trade in our case and use obtained coefficients along with data on production, consumption, bilateral distance, and bilateral linkages (common language and land border) to predict the 'normal' level of trade for the rest of flows. The difference between actual and predicted (or 'normal') trade levels gives the potential of trade. Results with all three methods for the first and last year in the panel are displayed in the upper part of table 3. Trade potentials obtained with the innovative approach introduced in this paper are shown in the last part of table 3. The four rows correspond to the different trade specifications used to estimate European border effects.

A first conclusion that stems from table 3 is that traditional methods employed in the literature, *gravity* 1, *gravity* 2 and *gravity* 3, yield small trade potentials. For all types of trade flows these values are considerably lower than trade potentials obtained with the border effects ratio method. Thus, traditional methods overestimate the level of trade integration in the region. For example, according to *gravity* 1, in 1994 CEE-EU trade represented only 12% of the level of intra-EU trade for comparable countries, corresponding to a trade potential of 88%. Meanwhile, the ratio of border effects produces a trade potential four times larger. *Gravity* 2 and *gravity* 3 find small and non-significant variations in the CEE-EU and intra-CEE trade integration from 1994 to 2007. With

[9] Wang and Winters (1991), Hamilton and Winters (1992), Baldwin (1993), Gross and Gonciarz (1996), Fontagné et al. (1999), and Nilsson (2000).

Table 3: European Trade Potential (in % of actual trade)

Method	Type of trade flows							
	CEE to EU		EU to CEE		CEE-EU		intra-CEE	
	1994	2007	1994	2007	1994	2007	1994	2007
Traditional trade potential models with international trade flows only								
gravity 1 *	78	64	76	50	77	58	88	77
gravity 2 †	44	48	52	56	48	52	51	52
gravity 3 ‡	45	44	53	52	49	48	50	48
Border effects ratio method: equations (25) and (26)								
McCallum (1995) gravity	420	253	399	192	409	221	735	388
fixed-effects specification					334	152	449	191
odds specification	535	232	204	186	335	209	590	314
friction specification					362	219	520	339

Note: Trade potentials are computed with industry level data:
* as exponential values of estimated group dummies;
† as the difference between actual and normal trade;
‡ as the difference between actual and normal trade, using intra-EU trade as reference.

trade potentials computed as the difference between gravity-predicted ('normal') and actual volumes of trade, flows between old and new member states and flows within the NMS group in any year during this period are estimated to be only 50% under their potential level. In addition, these models predict slightly larger trade barriers for EU exports to CEE countries than for flows in the opposite direction, a finding contrary to results obtained with the other approaches.

When GDP and population data are used instead of industry-level production and consumption in equation (21), a simplification frequently adopted in the traditional literature, trade potentials predicted by traditional models are even lower (results not displayed). With these adjustments I find that East-West trade integration, if present, was very slow or only marginal. In half of the cases the trade potential for CEE-EU flows increased over the studied period, which comes at odds with the evolution of the regions' economic and political environment. As for intra-CEE trade, this approach does not predict an increased regional integration, but rather a growing reticence of CEE countries to exchange mutually.

The new method for measuring trade potentials introduced above produces similar values with border effects estimated by *fixed-effects*, *odds* and *friction* specifications. This approach situates East-West trade potential in 2007 between 152% and 219%. Depending on the trade specification, during the considered period CEE-EU trade regained between 35% and 48% of its 1994 potential. The *odds* specification is the only one to produce differentiated results by flows' direction. For all years in the sample the model exhibits CEE exports to EU more distant from their potential than opposite flows. This matches the finding of lower access of products from Eastern Europe to Western EU markets from the previous section.

According to all three approaches NMS traded very few with each other in the early 1990s. In 1994 regional intra-CEE trade amounted to 15-18% of its potential level. Regardless of the border effects estimates used to compute trade potentials in table 3, I find an important increase of the intra-CEE integration. This reflects the drastic reorientation of foreign trade of these countries in the first years following the collapse of the socialist system. Advances in the process of transition and the development of regional economic agreements (CEFTA, the Free Trade Agreement of Baltic states) encouraged regional trade, which augmented enormously in terms of its potential. Lower trade potentials under the *fixed-effects* specification, compared to *odds* and *friction* specifications, are caused by important country specific trade costs encountered by CEE partners (e.g. poor institutions or transport systems) captured by country dummies.

One can also note that using a specification compatible with trade theory is also important. Indeed, considerably larger trade potentials are obtained when one uses border effects estimated with traditional gravity: over 700% for intra-CEE trade with McCallum (1995) gravity compared to only 450% with the *fixed-effects* specification. This difference in results reminds that atheoretical models are subject to non-negligible biases.

The large difference in trade potentials between the upper and lower part of table 3 comes from the use of different criteria for evaluating trade integration. Traditional trade potential models ignore domestic trade and assign 'normal' trade to the prediction of the gravity equation. The method introduced in this paper compares directly trade costs arising in East-West European and intra-CEE transactions to costs existing between EU trade partners. Trade within the domestic market is used as benchmark for the very estimation of these costs. Thus, our method accounts for the discrepancy between domestic and cross-border trade integration. It is important to signal that not all 'missing' international trade is attributed to the trade potential, but only the proportion which corresponds to the difference in trade impediments for specific types of flows. Regional integration is evaluated here in terms of trade costs, expected to converge to the lower intra-EU level. This uniformization of costs will result in increased trade with more distant partners and weaker concentration of trade in the immediate neighborhood.

Larger potentials obtained with the new method confirm the necessity to account for domestic trade in predicting the trade creation effects of regional integration. The disregard of internal trade opportunities is likely to largely underestimate trade potentials. Our method has the advantage of accounting for total international barriers to trade and therefore produces results more in compliance with integration efforts made by countries. Globally, the access of CEE goods to the old EU markets improved considerably from 1994 to 2007, and a large part of the potential European trade creation was already accomplished. Nevertheless, by the year 2007 the left CEE-EU trade potential was significantly larger than actual trade, implying more than a twofold possible increase of trade in the years to follow.

In table 4 of the Appendix A I show industry-level effects on trade of European integration with the *fixed-effects*, *odds* and *friction* specifications.[10] The first six columns refer to trade potentials in 1994, and the last six for the year 2007. The first thing to notice is that with a few exceptions trade creation effects are observed for all industries, both CEE-EU and intra-EU trade, and under all specifications. The largest trade creation for both two-way East-West European trade and intra-CEE trade was observed for rubber products and

[10] The term European integration is used for all 26 European countries considered in this paper. This is different from its wide but inaccurate employment in the literature to designate only EU integration.

electrical machinery. Non-electrical machinery and iron and steel products also enjoyed important trade creation. Trade between NMS increased largely in industrial chemicals and textiles. The lowest trade integration is found in the tobacco industry, subject to specific domestic regulations especially in core EU countries. In the case of intra-CEE trade, however, this is due to the fact that trade in tobacco production between CEE countries was below its potential level even in 1994. For other chemical products and wearing apparel European trade has even lost some of its potential. This can be explained by the increased competition in these industries with products from emerging Asian countries and in particular China. Moderate effects on trade are obtained for the rest of industries. By the year 2007 CEE-EU trade remains largely inferior to its potential (less than one third) only in seven: food products, beverages, tobacco, chemicals, iron and steel industries, professional and scientific and measuring and controlling equipment, leather products and printing and publishing. As expected, their number is larger for intra-CEE trade.

The reduction of both trade barriers and trade potentials for CEE-EU trade coincided with an even more impressive evolution for trade between NMS. These results disseminate the fears formulated by politicians and some authors that that CEE-EU trade integration will be accompanied by a lower commitment of CEE countries to regional integration, reflected by larger intra-CEE border effects and trade potentials at the beginning of the period. Still, figures in table 3 show that manufactured trade between CEE countries may expand to as much as two to three times the actual volume.

5 Conclusions

Trade both between CEE and between CEE and EU countries improved remarkably during the last two decades, both in terms of border effects and trade potentials. The paper shows that there is still place for important growth in bilateral CEE-EU transactions. This result contradicts with most trade potential gravity models that claim that East-West European trade has already reached its highest integration level. Much higher trade potentials for both CEE-EU and intra-CEE trade are obtained when one controls for the amount of trade within national borders. Results are very robust and are confirmed by three different theoretically compatible trade specifications used. Thus, at the beginning of the twenty-first century trade between CEE and EU countries represented less than half of its attainable level, suggesting a possible 150% to 200% increase with further EU integration. As for trade between NMS, its potential ranges depending on the model between 190% and 340%, despite the strong reduction of bilateral border effects between these countries achieved during the 1990s.

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A Data and additional results

The empirical application of theoretically derived trade equations encounters both data availability and comparability problems. The use of different classifications, definitions and registration criteria even for such standard economic variables as production and trade may represent an additional source of errors and biases in results. The latter are yet more pronounced in the estimation of border effects when internal trade volumes are computed as the difference between national production and total exports in absence of regional data.

The present study carries over a sample of 27 countries: fifteen core EU members with Belgium and Luxembourg aggregated under a single observation, and twelve Central and East European countries, and a fourteen-year period from 1994 to 2007. Of the twelve CEE countries of the panel ten have joined the EU in May 2004 and two in January 2007. Two levels of aggregation are considered: total manufacturing industry, and 26 product industries according to the ISIC Rev.2 classification.

Data on total manufactured bilateral imports is obtained from the BACI database of Cepii. GDP in current US dollars are from the World Development Indicators (World Bank) database. Total manufacturing and industry-level production, wages, labor force and expenditure are from Eurostat and Trade and Production database of UNIDO (World Bank). Missing Eurostat data are complemented with UNIDO data. In order to ensure compatibility of different data sources, data has been adjusted by applying a conversion rate equal to the average ratio of the value from the base source and the value from the secondary source, and estimated separately for each country on observations present in both databases. Industry-level expenditures are computed as the sum of demand for domestic goods and imports from all trading partners.

Table 4: Trade potential with respect to intra-EU trade (% of actual trade)

Industry	CEE-EU trade						Intra-CEE trade					
	FE 1994	odds 1994	friction 1994	FE 2007	odds 2007	friction 2007	FE 1994	odds 1994	friction 1994	FE 2007	odds 2007	friction 2007
Food	411	469	461	257	320	316	402	799	592	365	448	436
Beverage	876	652	891	518	786	810	980	673	929	530	837	963
Tobacco	106	98	124	1371	2145	1778	63	23	30	3993	719	852
Textiles	335	294	373	92	98	101	597	1058	995	193	185	154
Wearing apparel, except footwear	76	106	163	81	275	171	62	255	497	132	1524	686
Leather	314	272	235	127	369	675	807	1064	959	175	1124	823
Footwear	169	156	143	59	149	138	223	327	257	27	905	387
Wood, except furniture	234	296	297	118	105	104	257	466	402	153	120	122
Furniture	303	438	457	105	123	126	1011	115	905	271	284	276
Paper and paper products	437	412	441	139	177	174	321	372	311	112	140	131
Printing and publishing	469	653	441	202	273	272	440	657	349	358	514	511
Industrial chemicals	385	356	418	169	191	188	410	298	479	123	108	122
Other chemical products	433	438	368	451	431	584	180	726	333	511	288	669
Rubber products	500	567	509	87	117	112	764	1230	1229	77	115	80
Plastic products	451	378	488	202	224	216	574	604	817	394	429	410
Pottery, china and earthenware	444	395	488	183	217	222	1153	989	1956	233	346	275
Glass and glass products	449	485	457	138	148	134	554	1029	770	230	228	199
Other non-metallic mineral products	403	323	337	164	253	250	606	532	477	157	301	252
Iron and steel basic industries	1216	1349	1111	263	229	231	3260	3588	1822	429	196	307
Non-ferrous metal basic industries	572	637	696	182	224	163	855	602	578	224	198	162
Fabricated metal products	209	220	207	69	75	78	340	632	431	87	112	116
Machinery except electrical	347	428	392	132	134	138	473	972	707	199	136	253
Electrical machinery and appliances	412	322	387	71	86	83	928	862	723	81	98	72
Transport equipment	696	399	610	141	171	144	899	959	943	213	176	115
Professional, scientific, measuring, and controlling equipment, photographic and optical goods	497	765	664	263	242	279	871	1748	909	811	509	867
Other manufacturing	410	376	395	97	122	102	802	1702	1333	136	108	105

Note: Trade potentials are obtained as in (25) and (26) using border effects obtained with Heckman estimations for each industry.

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