Border Effect Estimates for France and Germany Combining International Trade and Intranational Transport Flows

Article *in* Review of World Economics · February 2007

DOI: 10.1007/s10290-007-0116-x · Source: RePEc

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HEI Working Paper No: 13/2006

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JEL Classifications: F15
Keywords: Border Effect, Gravity Equation, Transport Infrastructure

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1 Introduction

In his seminal contribution McCallum (1995) studied trade flows between Canadian provinces and US states and found that the Canadian trade was heavily biased toward trade within its national borders. This so-called "border effect" between Canada and the US was confirmed in several other studies (Helliwell, 1996; Hillberry, 1998; Anderson and Smith, 1999). Since then researchers have been interested to know whether similar border effects exist for trade between other country pairs. However, they have been confronted with a key data problem: data on regional trade flows are extremely rare.

Wei (1996) introduces an ingenious way to estimate border effects in the absence of detailed data on intranational trade flows. He uses the difference between the industrial production of a country and its exports to estimate trade flows within a country. His methodology allows determining border effects for countries that do not record regional trade flows. His study and various subsequent studies (e.g. Chen, 2004) demonstrate that the border effect also exist for other OECD countries, including countries of the European Union (EU).

However, Head and Mayer (2002) show that the estimation of the border effect with the methodology of Wei (1996) depends crucially on certain distance measures, called internal distance. Estimating internal distance differently changed the magnitude of the border effect substantially. As a consequence, for countries with the before-mentioned data limitation the precise influence of national borders on trade is still unknown.

The main purpose of this paper is to develop a methodology that allows us determining border effects for EU countries with higher precision. We show how to improve the estimation of border effects at the example of France and Germany. For both countries there exists extensive data on trade flows between each region (Région or Bundesland) and the 14 member States of the European Union prior the enlargement (EU 14). In addition, transportation flows (by road, rail, inland navigation, and pipeline) between the regions within France and Germany are documented. Even though these transportation flows are not recorded in monetary units, but in weight, we demonstrate that this data can serve as an appropriate approximation for intranational trade flows. Combined with the first data source, namely the trade flows between regions and the EU 14, we possess the necessary data to estimate the border effects for both countries. Using this new approach we study the trade flows between 22 French regions, 'Régions', and the EU 14 as well as the trade flows between German Regions, 'Bundesländer', and the EU 14.

The paper is organized as follows. In section 2, we review the relevant trade literature on the gravity equation as well as on the border effect. Section 3 describes the different data source that we have exploited for our research and explains the methodology used. Section 4 presents the estimation of the border effect in the case of France and Germany. In section 5 we introduce a new methodology to approximate the value of intranational trade flows. Before concluding, section 6 studies the evolution of the border effect in the case of Germany during the years 1997 to 2003.

2 The Border Effect Literature

Although the importance of national borders was known long before, it was only with the contribution of McCallum (1995) that the size of the border as trade barrier was estimated empirically. McCallum (1995) analyzes trade between Canadian provinces and between Canadian provinces and US states. His study is based on the Statistic Canada data set that reports interprovincial trade flows as well as trade flows between each Canadian province and each state of the United States. He uses a simple gravity equation and includes a dummy variable that controls for intranational trade. For the year 1988 he estimates that a Canadian province traded on average about 20 times more with another Canadian province than with a US state which had the same economic weight and which was located at the same distance as the corresponding Canadian province.

The magnitude of the border effect between Canada and the US was most surprising. Before the empirical investigation of McCallum (1995) the economies of both countries were thought to be heavily integrated. However, subsequent studies confirmed the results of McCallum (Helliwell (1996), Hillberry (1998), Anderson and Smith (1999)).

In order to estimate empirically the border effect one needs to know the trade flows within a country, since they are compared to the trade flows leaving the country. The availability of data on intranational trade flows is however very limited. For example, intranational trade flows are not recorded in EU countries. This data limitation is disappointing for trade economists since research on border effects for other countries could yield important insights. The only possibility to overcome this data problem is to estimate intranational trade flows, but how?

It is Wei (1996) who provides an appealing answer to this question. His idea is the following: What is traded within a country must be equal to the difference between its total production and its total exports to foreign countries. In order to obtain an estimate of the total production, Wei (1996) takes the GDP and subtracts the services and the transport sector, which do not fall under bilateral trade data. This methodology allows Wei (1996) to approximate the volume of intranational trade flows. In order to approximate the distance over which these goods are shipped, the author assumes that within a country the average distance is half of the distance from the economic center to the border. When a country has a land border with a neighbor, the author uses a quarter of the distance to the center of the nearest neighboring country. Finally, to calculate the distance between the economic centers of a country pair, the great-circle formula is used. Using this approach to study the magnitude of the border effect for OECD countries during the years 1982 to 1994, Wei (1996) finds that OECD countries traded about 10 times more with themselves than with foreign countries as predicted by the gravity model. When using a dummy variable for common language the border effect drops to 2.6 times. The magnitude of the border effect estimated by Wei (1996) is therefore considerably smaller than the one calculated by McCallum (1995) and Helliwell (1996) for the Canada-US border. What is the reason for this large difference?

Helliwell (1997) uses the same data as Wei (1996), but separates in a more complete way the border effect and the common language effect. His result for the year 1990 indicates a border effect of 12.7 (exp(2.54)). Although this result was closer to the one found by McCallum (1996), economists realized that the methodology proposed by Wei (1996) hinged crucially on the measurement of internal distance.

An overestimation of internal distance with respect to international distance inflated substantially the border effect. It also became apparent that the methodology of Wei (1996) could be highly inconsistent. Nitsch (2000) takes the example of Denmark and Germany to illustrate the problem of Wei's (1996) approach. Since Denmark has only a land border with Germany, the internal distance of Denmark is calculated taking 0.25 of the distance between Copenhagen and Bonn which certainly overestimates the internal distance of Denmark. Another problem arises when the economic centers of two countries, which are very different in size, are close to each other. According to Wei's (1996) approach both countries have the same internal distance. This implies that for example France and Belgium have the identical internal distance.

In order to tackle these problems researchers have developed two new ways to measure internal distance. The first approach consists in taking measures of internal distance that are based on the geographic area of the country. The purpose of this approach is to approximate the distance between firms and consumers within the country's territory. It is Leamer (1997) in his survey on growth perspectives of Central and Eastern European countries (CEEC) who introduced the first area-based measure.[1] Using the same measure of internal distance, Nitsch (2000) estimates that from the year 1979 to 1990 intranational trade in the EU was about eleven times higher than international trade controlling for distance, economic size, common language, and adjacency. He also observes a gradual reduction in the border effect of the years. Head and Mayer (2000) also use an area-based measure for their estimation of market fragmentation in the EU. Following Nitsch (2000) by approximating the geographic shape of a country by the shape of a disk, the authors assume that all production is concentrated in the center of the disk and that consumers are randomly distributed over the disk. For a uniform distribution they obtain the following formula for internal distance: $\sqrt{area/\pi}$. Studying the trade flows in the EU during the years 1984 to 1986 the authors report a border coefficient of 2.84, which correspond to an approximately 17 times higher intranational trade compared to international trade.

The second approach to measure internal distance is based on actual data on the geographic distribution of economic activity within countries. Wolf (1997) asks the question, whether a "border effect" can also be observed at the borders of one US states which other US states. To improve the approx-

[1] He asks the question whether there is a relationship between per capita GDP and the distance of the country to the world's markets. In order to calculate the distances between countries, it is necessary to estimate how close a country is to itself. Leamer (1997, p. 517) therefore assumes that countries are circular and that the average distance between two randomly chosen points within one country follows approximately the following formula: $\sqrt{area/\pi}$. Having determined the internal distances of countries allow the author, by using a slightly modified gravity equation, to estimate the relationship between per capita GDP and being close to world's markets. He comes to the conclusion that there is a clear relationship between the two dimensions and therefore predicts high growth rates for CEEC due to their closeness to markets in the EU.

imation of distance between US states he uses the road distance between the largest cities (Wolf 1997). In order to estimate the intra-state trade flows he calculates the internal distance as the distance between the largest and the second largest city within the US state. Using a similar specification to McCallum (1995) he finds, most surprisingly, a "border effect", of 1.34, which means that a US state trades nearly four times more within itself than with other US states. Given that US states have been constitutionally prevented from erecting trade barriers, this border effect is difficult to explain. The study by Wolf (2000) uses an alternative distance measure and finds very similar results.

Head and Mayer (2000) study the fragmentation of the internal market of the EU for the years 1976 to 1995. In order to obtain an appropriate measure of internal distance the authors use the distance between two regions and weigh it by the economic size of the regions (Head and Mayer 2000). Following this approach the scholars hope that the fact that economic activity is geographically dispersed is captured in a more accurate way. Pooling the years 1984 to 1986 the results indicate that the border effects were large. However, for the entire time period 1976 to 1995 the border effect seems to decrease slowly and halves from about 25 in 1976 to around 12 in 1995.

Finally, Chen (2004), investigating in how far national borders matter in the EU 1996, takes a similar approach. She follows the EUROSTAT's division of the EU 15 into 206 regions. In order to estimate international distances, she calculates all bilateral distances between the main cities of both countries using the great circle formula. Then she weighs all distances by the GDP share of both regions in total. For internal distances she follows a similar approach. She calculates the great circle distances between the main cities for each pair of region and weighs the distance by the GDP share of both regions, giving more weight for economically relevant regions in the country. Finally, she constructs the average of these distances. Using this approach, she reports a border effect coefficient of 1.80 for seven EU countries (Finland, France, Germany, Italy, Portugal, Spain, and the UK) for the year 1996.

The different methods to approximate internal distance show that until today there has been little consensus among trade economists on how to measure correctly internal distance. This dissent is very troublesome, since the estimated magnitude of the border effect is very sensitive to the value of the assumed internal distance. Table 1 provides an overview of the border effects estimated for EU countries in the literature so far. The countries

Table 1: *Overview of Literature on Border Effects in the EU*

Author(s)	Countries	Time Period	Border Effect	Variables inclu.
Wei(1996)	EU 10	1982-1994	0.97-0.45	adj, lang, rem
Nitsch(2002)	EU 10	1979-1990	2.51-1.99	adj, lang, rem
Head & Mayer(2000)	EU 9	1978-1995	3.04-2.41	lang
Head & Mayer(2002)	EU 12	1993-1995	1.44*	adj, lang
Chen (2004)	EU 7	1996	1.80	adj

**Pooled Regression*

covered by the empirical investigations span from nine (Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, Netherlands, and UK) in Head and Mayer (2000) over ten (including Greece) in Wei (1996) and Nitsch (2000) to twelve (adding Spain and Portugal) in Head and Mayer (2002). Chen (2004) examines the trade flows between Finland, France, Germany, Italy, Portugal, Spain, and the UK. The last column shows the variables used in addition to the corresponding gravity equation (adj stand for adjacency, lang for language, and rem for remoteness).

Even though the studies cover different number of countries and different time periods, it is striking how much the estimated border effects are diverging. The main reason for this divergence resides in the fact that the estimation results depend crucially on the measurements used for internal distance. For example, Head and Mayer (2002) deduce a new measure on internal distance and find a much lower border effect that compared to their approach the methodology chosen by Wei (1996).

Therefore, we conclude that a reliable method to estimate the border effect in absence of intranational trade data is still missing. This paper presents an approach that allows us determining the border effect with high precision. We use data on regional transportation flows to approximate regional trade flows. A good approximation of regional trade flows it not only helpful to improve the estimations of the border effect; it also provides new opportunities for empirical investigations in the field of trade and new economic geography.

If we find a considerable border effect for the two countries studied, how can it be explained? The empirical studies undertaken so far have had little success in finding causes for the border effect in the EU. Border effects may be related to border related trade costs, such as tariffs, contracting and enforcement costs, different currencies, non-tariff barriers (NTB) to trade, different consumer preferences and languages. However, in the case of the EU all formal trade barriers, such as tariffs and quotas already were already removed in 1968. With the increasing common legislation contracting and enforcement costs should have lost their trade-impeding role. The introduction of a common currency for eleven out of fifteen member States in 1999 should make the use of different currencies in the EU irrelevant for trade as well. However, for our estimation we will test whether for the year 2002 the EURO was already trade promoting or not.

Trade within the EU should neither suffer from NTB. In 1986 the EU initiated the Single Market Programme (SMP) in order to reduce all non-tariff barriers. Since the end of the program in 1992 there have been two empirical studies on the impact of the SMP on intra-European trade. Fontagné et al. (1998) investigate whether the removal of NTB have increased the inter- and intraindustry trade in the EU. They observe that the trade volume did not increase substantially with the SMP, but that the composition of trade changed considerably. While the volume of intra-industry trade was reduced, the share of inter-industry trade increased. Head and Mayer (2000) study the evolution of the border effect over the time period from 1976 to 1995 and find a significant reduction of the border effect. However, their findings indicate that the SMP had no influence on the decline.

Chen (2004) focuses on technical barriers to trade, one element of NTB, in order to explain border effects in the EU. She finds that technical barriers to trade, indeed, increase border effects. However, for our estimations we do not possess the necessary data to construct a measure of NTB. Linguistic differences could still play a role for trade in the EU. In the EU 15 countries we encounter 11 official languages. In order to control for the different languages, we include a dummy variable for common language between trading partners.

Finally, there has been some empirical evidence that consumer preferences are biased towards domestic products (Head and Mayer, 2000) in the EU. Head and Mayer (2000) find a higher border effect for goods of final consumption than for other commodities. When we present our results in section 4, we further exploring the possible reasons for the border effect in France and Germany.

3 Methodology and Data Sources

3.1 The Gravity Equation

McCallum (1996) used a traditional gravity equation, including country specific variables (like GDP) as well as bilateral variables (like adjacency), plus a dummy variable for intra-Canadian trade to estimate the border effect. However, as Anderson and van Wincoop (2003) point out this traditional specification of the gravity equation neglects the different price indices between countries. The authors show that since the difference in price indices can be related to trade barriers, the estimation results are biased in equilibrium. In order to incorporate their critique, we follow their suggestion and estimate our gravity equation using fixed effects for each exporting and importing unit. This specification controls for all differences that are specific to the trading unit. All country-specific differences are therefore left out and only bilateral variables are included.

The first gravity equation we estimate has the following form:

$$t_{ij} = \alpha + \beta_1 dist_{ij} + \beta_2 intra_{ij} + \gamma_i ex_i + \delta_j im_j + \mu_{ij} \tag{1}$$

$dist_{ij}$ measures the log of the great circle distance, as described above. $intra_{ij}$ is a dummy variable which is unity if the trade flow takes place between two regions of the same country and zero if not. The fixed effects for exporting and importing countries are denoted ex_i and im_j, respectively. Finally, μ_{ij} denotes a Gaussian white noise error term.

We have to recall that when we derive this gravity equation theoretically, we assume identical preferences across countries. Therefore, since there is no preference for homemade goods in the utility function, all bias in consumption has to come from some sort of barriers to trade. In order to know which trade barriers contribute to the border effect, we try to control for the trade costs, that are not related to distance, but may arise when crossing the border. For this purpose we use an augmented gravity equation of the following form

$$t_{ij} = \alpha + \beta_1 dist_{ij} + \beta_2 intra_{ij} + \beta_3 adj_{ij} + \beta_4 cur_{ij} + \beta_5 day_{ij} + \gamma_i ex_i + \delta_j im_j + \mu_{ij} \tag{2}$$

The variables β_3 to β_5 control for the following bilateral relationships:[2]

[2] Deardorff (1998) discovered that not only the absolute distance between the two

- Common border: The dummy variable "adj" becomes unity if i and j share a land border.
- Common currency: The dummy variable "cur" is unity if i and j are members of the European Monetary Union.

The empirical studies on the border effect in EU countries (see above) have included several or all of these three additional variables and found that the border effect remains remarkably stable.[3]. We introduce a new variable that potentially help to explain the border effect.

The first variable, called *day*, tries to capture the quality of the business infrastructure between regions or regions and other EU countries. With business infrastructure we mean the opportunities for business people to travel to other destinations. A high-quality infrastructure between regions or countries facilitates traveling and as a consequence, firms' representatives might meet more easily and frequently, which at the end might stimulate trade.

In order to measure the quality of infrastructure, we study which destinations in other regions or countries can be reached in a one-day round trip. In other words, is it possible to travel to the other country or region in the morning and come back the same day? To construct this dummy variable we check if it is possible to travel from one center by road, rail or airplane to the corresponding center and return the same day. It is obvious that this measure is somewhat arbitrary and reflects what we thought to be reasonable, as we have no possible data on the preferences of business people concerning the time spent on business trips. As a rule of thumb we assume that a one-way trip by car or train should not take more than four hours and that the flight time should not exceed two hours.

Finally, it has to be noted that in order to take care of the possibility of heteroskedasticity, the White's covariance estimator is applied for all estima-

countries matters for bilateral trade, but also their geographic positions relative to all other countries. For example, even though the distance between Spain and Sweden is about the same as between Australia and New Zealand, we expect the second pair to trade more due to their remoteness from other markets. We do not include a measure for remoteness since the appropriate measurement and the theoretical underpinning of remoteness remains a topic of active debate and in the European case no pair of trading partners is located far from all other trading partners.(Anderson and van Wincoop, 2003).

[3] We have tested other bilateral variables like language or cultural linkages. However, they were all strongly correlated to the dummy variable 'Region' and therefore without additional explanatory power

tions. We test the robustness of our results using different specifications of the trade variable, as explained below. Since in the case of Germany some observations are zero, we also check whether the inclusion of this variables, using a Tobit estimation, affects the results.

3.2 Bringing Together International Trade Flows and Intranational Transportation Flows

One of the main contribution of this study is to introduce several methodologies how to combine international trade flows with intranational transportation flows. The absence of data on intra-national trade flows prevents the empirical analysis of important questions in the field of trade or economic geography. This paper show how we can overcome the data problem with the example of the border effect.

The purpose of our study is to measure the border effects in the case of France and Germany with respect to other EU countries. This means we compare to what extent French 'Régions' or German 'Bundesländer' trade more with themselves than with the other EU 14 countries. In France as well as in Germany data on international trade flows are recorded on the regional level. This means each of the 22 'Régions' and each of the 16 'Bundesländer' documents all ex- and import flows from and towards all EU countries. For example, we know what Alsace trades with Italy, or Bavaria with Sweden. The data include the value in currency units (in thousand Euros) and in weight (in tons). The data exists at the aggregate, but also at sectoral level (various digit levels) allowing for a detailed analysis. In the case of France it is the 'Direction générale des douanes et des droits indirects' that collects the data. In Germany the statistical office of each 'Bundesland' records the data and the National Statistical Office of Germany, called 'Statistisches Bundesamt', collects the data. [4]

As we have stated above, data on intranational trade flow do not exist in the case of the EU countries. However, for France and Germany detailed data (including the mode of transportation) is recorded on intranational commodity flows. In both countries inter-regional commodity flows, including the origin and destination of the flows, are estimated by drawing from stratified random samples of actual shipment. In the case of France these commodity flows are documented by the 'Ministère de l'Equipement, des Transports,

[4] In both cases the data is not freely available.

du Logement, du Tourisme et de la Mer, Direction des Affaires économiques et internationales'.[5] The data is recorded according to the 'Nomenclature Statistique des Transports' (NST) and available at the 2-digit level for 10 sectors. In the case of Germany, the commodity flow statistic is recorded by two national offices. The 'Kraftfahrt-Bundesamt' in Flensburg reports commodity flows which are transported by road. The 'Statistisches Bundesamt' in Wiesbaden collects the data on commodity transport by rail, waterway, pipeline and aviation. In contrast to France, in Germany no reliable sectoral data on transportation are available according to the information of the 'Kraftfahrt-Bundesamt'.

Both data sets provide valuable information about the economic exchange between regions and countries. However, the data sets can not be combined directly for two main reasons. First, whereas customs data reports the final destination of the shipment, national transport data does report a destination, which is not necessarily the final one. Second, data on interregional commodity flows is that it is only recorded in weight units and not in currency units. How can we tackle both problems?

The first problem is extremely difficult to solve. The fact the national transport data does not report the final destination can have severe implications. To illustrate the possible effects, let us assume that a good is produced in Stuttgart (Germany, Baden-Württemberg) and then transported to the harbor of Bremerhaven (Germany, Bremen) in order to shipped to Ireland. Whereas customs will record the value and weight of the shipment from Baden-Württemberg to Ireland, the national transport authorities will report simultaneously a transport intra-national transport flow from Baden-Württemberg to Bremen.

In order to know what stays in Bremen and what leaves the country, detailed data on production and trade is required. However, we do not possess this type of data on the level of regions, neither on the country level. The only way to control for this possible source of error is to omit the intranational trade flows that could be affected by this error. Therefore we test the robustness of the border effect using only those intranational trade flows that are most probably free of this potential error. All intranational trade flows that are directed towards a region within France or Germany without a border to another country or major harbor most probably stay in that region. For

[5] Combes et al. (2005) use this rich data to measure the effect of business and social networks on trade within France.

example, there is no obvious reason to assume that a considerable fraction of commodities transported to the region Auvergne (landlocked and in the center of France) should leave the region again to be exported to European countries.

An obvious solution for the second problem would be to use all trade flows in tons instead of Euros. However, this method seems to be an clumsy way to remedy the lack of information we face. Due to the different economic structures of the regional units in France and in Germany, the average value of one ton exported to EU member countries can differ substantially between regions. This certainly comes at no surprise when we compare, e.g., the exports of the highly industrialized Ile-de-France (Paris region) with the exports of the agriculture prone Languedoc-Roussilon.

In addition to this drawback, using weight units also means that we ignore the information we have on the monetary value of trade between regions and EU countries. Exploiting this information, we might obtain a more appropriate approximation of the monetary value of the intranational trade flows.

The first possibility to approximate the value of intranational trade flows is highly simple. We assume that the average unit value of an export flow from one subnational unit towards the 14 EU member countries corresponds to the unit value of an export flow from this unit to another subnational unit. For example, the average unit value of exports from the region Normandy to the rest of the EU is 1700 Euros. By assuming that this unit value corresponds to the unit value of goods traded within France, we can estimate the value of intra-national trade flows. One might argue that this is a strong assumption, however, we think that it performs better than models which are based on the measurement of internal distance.[6]

The assumption of identical unit value for EU and intranational implies that trade between regions corresponds to what regions trade with the EU 14. From a theoretical point of view, this assumption might be well justified. For example, if we assumed identical factor endowments for all countries or regions within the EU 14 and only intra-industry trade.

[6]Instead of taking the simple average of all unit values, one could also calculate an average weighted by the magnitude of trade flows. For example, since France is particularly important for the Bundesland Saarland, the unit value to France is attributed special weight.

However, studying closely the data on trade flows between subnational units and EU 14 countries, we make an interesting observation that contradicts this possibility: the unit value increases considerably the further the trading partner is located.[7]

For example, a ton exported from Baden-Württemberg to France is worth only a third compared to a ton exported to Ireland or Greece. The economic weight of the importing country apparently does not matter, only distance does. This observation translates into the hypothesis that the unit value of trade is determined by the distance between trading partners. Or expressed differently, the further away the trading partner is located, the more valuable goods are traded.

In order to test this hypothesis empirically, we specify the following functional form:

$$cont_{ij} = \alpha + \beta_1 dist_{ij} + \mu_{ij} \tag{3}$$

In this equation $cont_{ij}$ denotes the logarithm of the unit value exported from region i to country j; $dist_{ij}$ measures the logarithm of distance between region i and country j. The parameters α and β are to be estimated, and μ_{ij} denotes a Gaussian white noise error term. If we take the example of Bavaria, we have 14 observations of export flows leaving Bavaria and going to EU 14 countries. Running a simple OLS regression for the equation specified above we obtain the result presented in Table 2

As Table 2 shows, there exists a close relationship between the unit value of trade and distance. The coefficient of $dist_{ij}$ is highly significant and its magnitude indicates that the content of trade changes considerably with distance. With reference to the gravity equation described above we find evidence that the forces of attraction literally become less important. Apparently, the further the trading partner is located the higher is the average value of one ton traded. Expressed differently, for short distances an average ton traded mainly contains low-value goods. The larger the distance gets, the more high-value goods enter in the average ton. Distance does not only influence the trade volume, as predicted by the gravity equation, but distance

[7] Hillberry and Hummels (2001) make a similar observation when measuring the weight-to-value ratio of trade flows. The ratio weight-to-value is the reverse to unit values and therefore logically their results indicate that the lower the weight-to-value ratio the further the commodities are traded.

Table 2: *Content of Trade Gravity Model, the Case of Bavaria*

Variable	Coefficient
C	***1.369
	(1.240)
Dist	***1.020
	(0.183)
N	14
Estimation	OLS
S.E.	0.384
Adj. R2	0.699

Notes: Parameters are estimated by fixed effects regressions; *** denotes significance at the 1 percent level; robust standard errors in parentheses; N denotes the number of observations.

also brings about a change in the composition of trade. We therefore call our model 'content of trade gravity model'.

A simple dummy variable approach allows us to present the results found for each region in a clearer way. We therefore construct two samples, one collecting all export flows from all Régions towards the 14 EU countries in tons as well as in Euros for the year 2002, and a second one for all Bundesländer respectively. For France we have 22x14 = 308 observations, minus one observation missing; and for Germany we count 16x14 = 224 observations. Then, we calculate the average value of one ton corresponding to each export flow. For example the average ton exported from Baden-Württemberg towards France is worth 2040 Euros. Using these two samples, we run three OLS regressions of our content of trade gravity model.

$$cont_{ij} = \alpha + \beta_1 dist_{ij} + \mu_{ij} \tag{4}$$

$$cont_{ij} = \alpha + \beta_1 dist_{ij} + \beta_2 cap_i + \mu_{ij} \tag{5}$$

$$cont_{ij} = \alpha + \beta_1 dist_{ij} + \beta_3 dum_i dist_{ij} + \mu_{ij} \tag{6}$$

Equation (4) just restates the above content of trade gravity equation. In equation (5) we add the variable cap_i which denotes the per capita GDP of the exporting region. We include this variable to test whether the level of per capita GDP of the exporting region influences the content of trade. Finally, we estimate our basic equation, but add dummy variables for each region and interact them with the distance coefficient (equation (6)). This allows each region to have its own slope coefficient.

The estimation results are presented in Table 3 for France and in Table 4 for Germany.

Despite the low values of Adjusted R-squared, equations 1F and 1G give a first hint that distance may matter for the content of trade. It is surprising that the estimated coefficients are nearly identical in the case of France and Germany. Adding the variable of per capita GDP of the exporter clearly improves the results as the Adjusted R-squared of equations 2F and 2G indicate.

Equations 3F and 3G show the results when the above-described dummy variable approach is chosen. Since we have for each region only 14 observations per region, we have not enough degrees of freedom to use a dummy variable for each region. Therefore, for France we have to "merge" several regions. We choose regions of similar economic structure and/or geographical proximity. For Germany, we put together Bremen and Hamburg, which are two important harbor cities and which share several economic characteristics. A detailed description of the dummy variables can be found in the Appendix.

Using dummy variables for all (newly defined) regions, leaving out the dummy for the regions Ile-de-France and Baden-Württemberg, and interacting them with distance yields an impressive result. Distance explains to a large extent how the average value of export flows changes. This observation holds especially in the case of Germany where the Adjusted R-squared reaches the value of 0.673.

Comparing France and Germany we find that the intercept and the distance coefficient are again very similar. The content of trade for exports from the region Ile-de-France and the region Baden-Württemberg seems to change in an identical way, holding the intercept fixed for the whole regression. What is surprising is the magnitude of the distance effect on the content of trade. The slope coefficients spread from 0.462 (Languedoc-Roussillon) to 0.723 (Ile-de-France) in the case of France, and from 0.397 (Mecklenburg-Vorpommern) to 0.812 (Berlin) in the case of Germany. Taking all these observations together confirms our first hypothesis: the content of trade changes substantially with distance. Equations 3F and 3G also indicate

Table 3: *Content of Trade Gravity Model - France*

Variable	(F1)	(F2)	(F3)
C	***3.890	***-14.102	***3.701
	(0.481)	(2.090)	(0.417)
Dist	***0.563	***0.580	***0.723
	(0.072)	(0.068)	(0.065)
ln(capex)		***1.786	
		(0.205)	
DumChaBour*ln(dist)			***-0.125
			(0.025)
DumPicCen*ln(dist)			***-0.094
			(0.028)
DumHtnBsn*ln(dist)			***-0.156
			(0.030)
DumNorLor*ln(dist)			***-0.200
			(0.023)
DumAls*ln(dist)			***-0.106
			(0.028)
DumFrc*ln(dist)			-0.037
			(0.027)
DumPayPoi*ln(dist)			***-0.171
			(0.030)
DumBre*ln(dist)			***-0.134
			(0.025)
DumAquMid*ln(dist)			***-0.117
			(0.038)
DumLimAuv*ln(dist)			***-0.102
			(0.026)
DumRho*ln(dist)			***-0.067
			(0.025)
DumLan*ln(dist)			***-0.261
			(0.030)
DumPro*ln(dist)			***-0.246
			(0.033)
DumCor*ln(dist)			***-0.134
			(0.026)
N	307	307	307
Estimation	OLS	OLS	OLS
S.E.	0.793	0.753	0.693
Adj. R2	0.169	0.251	0.366

Notes: Parameters are estimated by fixed effects regressions; *** denotes significance at the 1 percent level; robust standard errors in parentheses; N denotes the number of observations.

Table 4: *Content of Trade Gravity Model - Germany*

Variable	(G1)	(G2)	(G3)
C	***3.566	***-5.912	***3.506
	(1.240)	(1.900)	(0.400)
Dist	***0.588	***0.604	***0.710
	(0.096)	(0.085)	(0.064)
ln(capex)		***0.926	
		(0.186)	
DumBay*ln(dist)			-0.004
			(0.023)
DumBer*ln(dist)			***0.102
			(0.022)
DumBra*ln(dist)			***-0.221
			(0.029)
DumCities*ln(dist)			***-0.104
			(0.028)
DumHes*ln(dist)			-0.050
			(0.025)
DumMec*ln(dist)			***-0.336
			(0.038)
DumNie*ln(dist)			***-0.150
			(0.021)
DumNrw*ln(dist)			***-0.108
			(0.022)
DumRpf*ln(dist)			***-0.146
			(0.025)
DumSaa*ln(dist)			*-0.059
			(0.025)
DumSac*ln(dist)			-0.047
			(0.023)
DumSan*ln(dist)			***-0.295
			(0.027)
DumSho*ln(dist)			***-0.110
			(0.033)
DumThu*ln(dist)			***-0.172
			(0.029)
N	224	224	224
Estimation	OLS	OLS	OLS
S.E.	0.907	0.855	0.560
Adj. R2	0.141	0.236	0.673

Notes: Parameters are estimated by fixed effects regressions; *** denotes significance at the 1 percent level; robust standard errors in parentheses; N denotes the number of observations.

that the slope coefficients significantly vary from region to region. At first sight, there seems to be a relationship between the economic performance of a region and the steepness of the slope coefficient. Economically strong regions, like Ile-de-France or Baden-Württemberg, seem to display higher slope coefficients than regions with a low economic performance.

How does this observation help to estimate the border effect? Knowing how the content of trade changes over distance allows us to estimate the nominal value of our intranational flows. We simply have to assume that the relationship between the composition of trade and distance also holds for intranational trade flows. This would imply for example that an average ton exported from Bavaria to Luxembourg has the same value than one average ton "exported" to Sachsen-Anhalt, which is located at about the equal distance. In order to be able to approximate the trade value using this approach, we estimate the content of trade gravity equation of each of the 22 Régions and 16 Bundesländer [8]

The close relationship between content of trade and distance allows us to estimate the value of intranational trade flows. We simply use the coefficients of our content of trade gravity model (4), which we estimate for each region, to convert the trade flows in tons into Euros. Putting together all trade flows obtained by this approach, we are able to estimate the border effect.

3.3 Data Sources

For our gravity equation we necessarily need information about the distance between trading partners. For international as well as intranational distances we use the great-circle formula. Despite the fact that the great-circle formula neglects the real geography of space, we think that the great circle formula is sufficient for our purpose. To compute the distance between two units we take the longitude and latitude of the center of each region. We consider the official capital of the country or region also as the economic center with five exceptions.[9]

[8]The results are not reported. It has to be mentioned that the statistical fit is not always as good as for the case of Bavaria. The reason for low values of Adjusted R-squared lies sometimes in special trade flows between one region and one EU country. For example, in the case of Bremen or Hamburg the value of an average ton leaving for France is exceptionally high. Evidently, the influence of the aviation industry on trade flows between both regions and France blurs the picture.

[9]At the national level, we use Frankfurt as the economic capital of Germany and Milan as the economic capital of Italy. At the regional level, Reims is considered as the economic center of the 'Région' Champagne-Ardenne, Frankfurt as the economic center of the 'Bundesland' Hessen, and Mannheim as the economic center of the 'Bundesland'

Since we estimated the border effect using a fixed effects gravity equation, we omit all country specific variables, but include the following bilateral variables: adjacency, common language, common currency, culture, business infrastructure. To construct first three variables we exploit the databases of INSEE, 'Statistisches Bundesamt', as well as of CIA's World Factbook. The data for two other bilateral variables is generated using various other sources. A more precise description of how the variables are constructed will be found at the corresponding place below.

Using the above-mentioned sources, we construct eight samples. In the following we provide a short description of the two main samples used. The other six samples are constructed similarly and further details are provided in the respective section. The first sample covers the aggregate trade between 21 French 'Régions' (Appendix 1) and 14 European Union (EU) Member countries in the year 2002. Thus, we have 21x20 = 420 observations for interregional trade, plus 21x14x2 = 588 observations for 'Régions'-EU 14 trade flows, plus 14x13=182 EU-EU trade flows, which sums up to 1190 observations.

The second sample consists of the aggregate trade flows between 16 'Bundesländer' (Appendix 2) and 14 EU Member countries in the year 2002 and comprises of 870 observations. There are 16x15 = 240 observations for commodity flows between German Bundesländer, plus 16x14x2 = 448 observations for Bundesländer-EU 14 trade flows, plus 14x13 EU-EU trade flows. In 5 cases no trade was recorded. In order to have a more precise estimation we include these zero observations in our sample. The next section reports the results of the various estimations made for the case of France and Germany.

4 Estimation Results

4.1 The Case of France

Applying the methodology described in section 3, we obtain the results summarized in Table 5 for France and in 6 for Germany.

Equation 1F reports the border effect when the trade flows in weight units (tons) are considered. The value of the variable 'regions' states that French regions trade about 15 times (exp(2.723)) more with each other than predicted by the gravity equation. In equations 2F to 7F the variable trade is now expressed in Euros. As described before, interregional commodity

Rheinland-Pfalz.

Table 5: *The Border Effect in the Case of France*

Variable	(1F)	(2F)	(3F)	(4F)	(5F)	(6F)	(7F)
Constant	***19.715	***25.749	***23.971	***24.033	***24.750	***22.023	***19.882
	(0.475)	(0.063)	(0.458)	(0.535)	(0.734)	(0.546)	(0.615)
Distance	***-1.703	***-1.359	***-0.986	***-0.925	***-0.896	***-0.527	***-0.406
	(0.057)	(0.050)	(0.063)	(0.067)	(0.098)	(0.091)	(0.101)
Regions	***2.723	***2.598	***2.181	***2.239	***3.254	***2.131	***1.943
	(0.087)	(0.071)	(0.117)	(0.131)	(0.753)	(0.125)	(0.137)
Dist.*Regions					-0.174		
					(0.121)		
Adjacency						***0.910	***0.869
						(0.104)	(0.102)
Currency						***0.450	***0.465
						(0.104)	(0.078)
Day Travel							***0.294
							(0.076)
Nbr. of obs.	1190	1190	1190	994	1190	1190	1190
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Adj. R2	0.673	0.604	0.817	0.850	0.837	0.850	0.852

Notes: Parameters are estimated by fixed effects regressions; ***,**,* denote significance at the 1, 5, 10 percent level, respectively; robust standard errors in parentheses.

flows are only recorded in weight units. In order to make a conversion in Euros, we assume that one weight-value of exports to EU 14 corresponds to a weight-unit of interregional trade flows. Using these trade flows the border effect remains remarkably stable. Equation 2F indicates that trade between French regions is about 13 times (exp(2.598)) larger than trade between a French region and a EU 14 country when adjusted for economic size and distance.

In equation 3F we use the trade flows that have been obtained applying the conversion of the content of trade gravity model. This decrease in the border effect corresponds to our expectation since the different conversion results in lower values for intranational trade flows and hence in a smaller border effect. The mechanism behind lower nominal intranational is the following: Before, we have simply assumed that the value of an average ton exported to the EU 14 equals the value of an average ton traded within a country. If our hypothesis on the change in the content of trade is correct, the conversion method applied in section 4 systematically overstates the nominal value of intranational trade flows. The conversion used in this section leads to lower nominal values for intranational trade and therefore we would expect a smaller border effect.

Equation 4F estimates the border effect leaving aside all intranational transportation flows that might be overestimated because the goods are shipped further to other EU countries. For example, intranational transportation flows to the region Haute Normandie might be overestimated since goods are transported to Haute Normandie and then shipped to other destinations. In equation 4F we leave out all those dubious intranational transportation flows and reestimate the border effect using the remaining 994 observations. Applying the content of trade conversion we obtain a border effect of the magnitude 2.239 and therefore nearly identical to the border effect in equation 3F.

In equation 5F we check whether distance plays a more prominent role for interregional trade than for trade between French regions and EU countries. However, we do not find any empirical evidence for this possibility. Equations 6F and 7F estimate the gravity equation with additional variables in order to identify possible reasons for the border effect.

In equation 6F we add the dummy variable for adjacency and common currency. Using the same legal tender seems to imply an additional border cost. Out of the 14 possible trading partners, Denmark, Sweden and the UK have not adopted the EURO. Our estimation indicates that the French regions do trade more with EU countries that are member of the European Monetary Union (EMU) than with others. It is interesting to observe that when these dummy variables are included the border effect decreases slightly to 2.131.

In equation 7F the *day* variable is put into the gravity equation. Including both variables in our gravity equation yields an interesting result. The coefficient of the variable is highly significant and of considerable magnitude. An excellent transportation infrastructure seems to enhance trade by about 34 percent (exp(0.294)). The border effect now falls to 1.943.

In summary, our estimation results suggest that the French economy is still very much inward biased and not very well integrated into the European market. The transportation infrastructure which seems to follow more national than European concerns helps to explain part of the border effect.

Table 6: *The Border Effect in the Case of Germany*

Variable	(1G)	(2G)	(3G)	(4G)	(5G)	(6G)	(7G)	(8G)
Constant	***26.430	***32.619	***30.683	***31.302	***30.693	***27.892	***28.490	***27.175
	(0.752)	(1.133)	(1.102)	(0.994)	(0.734)	(0.677)	(1.351)	(1.477)
Distance	***-2.077	***-1.837	***-1.542	***-1.549	***-1.543	***-1.150	***-1.347	***-1.334
	(0.112)	(0.167)	(0.162)	(0.132)	(0.120)	(0.099)	(0.201)	(0.228)
Regions	***1.475	***1.345	***1.129	***1.064	***1.127	***6.171	***1.130	***1.119
	(0.180)	(0.274)	(0.268)	(0.257)	(0.225)	(1.762)	(0.269)	(0.249)
Dist*Regions						***-0.846		
						(0.325)		
Adjacency							***0.489	***0.487
							(0.187)	(0.186)
Currency							0.170	0.169
							(0.158)	(0.157)
Day Travel								0.037
								(0.186)
Nbr. of obs.	870	870	870	762	870	870	870	870
Estimation	OLS	OLS	OLS	OLS	Tobit	OLS	OLS	OLS
Adj. R2	0.777	0.626	0.622	0.626	0.207	0.625	0.625	0.625

Notes: Parameters are estimated by fixed effects regressions; ***,**,* denote significance at the 1, 5, 10 percent level, respectively; robust standard errors in parentheses. For the Tobit Estimation the Adj. R^2 denotes the Pseudo R^2.

4.2 The Case of Germany

The second sample comprises 870 observations and consists of the aggregate trade flows between 16 Bundesländer (Appendix 2) and 14 EU Member countries. Applying the methodology described above we obtain the following results presented in Table 6.

n equation 1G we bluntly use the trade flows denominated in tons in order to estimate the border effect. Compared to France the border effect is surprisingly low. However, the distance coefficient is similar to the one observed for France and substantially higher than in the other equations estimated. This result indicates that distance plays a particular trade preventing role when studying trade flows denominated in tons.[10]

Equation 2G reports the border effect when we use the simple conver-

[10]This is also a hint to the evidence that the content of trade changes considerably with distance.

sion using the average unit value. In equation 3G we apply the content of trade conversion of intranaitonal transportation flows into intranational trade flows. As expected, the border effect drops to 1.129. Equation 4G leaves out again all trade flows that are potentially overestimated since they might include flows that leave Germany. Taking the remaining 762 observations and estimating the border effect again, we obtain a border effect of 1.064, which hints to the robustness of our results.

As described above, five zero trade flows are recorded between German Bundesländer. In order to incorporate these zero trade flows appropriately in our estimation, we run a Tobit estimation of equation (1). The estimation results are very close to the ones found in 3G and further corroborate the overall result.

Trade between German Bundesländer is about 3.1 times (exp(1.129)) higher than with other EU countries when controlled for economic size and distance. Although German trade is biased significantly, the border effect is less than half of the one observed for France.

In equation 6G we interact the region dummy with distance in order to know whether distance plays a more important role for trade between Bundesländer than for trade between Bundesländer and the 14 EU countries. In contrast to the case of France, distance seems to play a considerably more important role for intranational trade than for international trade.

Equations 7G and 8G again try to examine closer the reasons for the border effect. Including a dummy variable for adjacency and common currency does not bring the border effect down. Equation 8G presents the results when we add the dummy variables *day*. The dummy variable DAY is constructed in the same way as in the case of France. In contrast to France, the coefficient of the *day* variable is not statistically significant.

Including all dummy variables brings the border effect down to the value 1.119. We can conclude that controlling for various influences, German Bundesländer trade around three times more with themselves as predicted by the gravity equation.

5 Evolution of the Border Effect in the Case of Germany

Our approach to estimate the border effect by using intranational commodity flows also allows us to analyze its evolution. Learning more about the behavior of the border effect over time can give us important insights concerning the progress of integration of an economy into a common market, like the EU. A falling border effect would indicate that the country becomes less focused on itself and more willing to substitute intranational trade relations with international trade relations. Previous studies (see section 2) indeed find a declining border effect.[11]

In this section we study the evolution of the border effect in the case of Germany.[12] The time period studied covers the years 1997 to 2003. We choose this time period for two reasons: First, other studies on the border effect in the EU (Head and Mayer, 2000; Nitsch, 2000) stop their analysis on the evolution of the border effect in the year 1995 and 1990, respectively. Our work therefore intents to provide insights on the most recent development of the border effect. Second, this period is marked by a further economic, financial, legal and political integration of the EU. The introduction of the Euro as legal tender in eleven EU countries was the symbol for this movement.

We construct six additional samples for the years 1997, 1998, 1999, 2000, 2001, and 2003. The number of observations varies in the samples. The lower number of observations in the years 1997 and 1998 is due to the fact that the trade relations with Belgium and Luxembourg are documented for each region as a single record.

The particular case of Belgium and Luxembourg has also an impact on the distance measure. We consider Brussels as the economic center of both countries. All distances are then again calculated according to the great circle formula. Running separate OLS regression for each year, we obtain the results presented in Table 7.

We estimate for each year the basic gravity equation with a dummy for intranational trade and fixed effects as defined in equation (1). In order to find a nominal correspondence to the commodity flows denominated in tons, we use the simplifying assumption that the value of an average ton exported from one Bundesland to a EU 14 country is equal to the value of an average ton shipped to another Bundesland. This method might lead to a slightly inflated border effect as discussed in section 4. However, since we are more

[11] The lowest number in Table 1 not necessarily denotes the last year or pair of years of observation. Some studies (Head and Mayer, 2000) observe the lowest border effect some years before the end of the period under observation.

[12] The reason for choosing only Germany and not France is the fact that, as mentioned before, data on intranational commodity flows are not freely available. The same is true for data that report on international trade flows at the regional level. Due to financial constraints we were forced to limit our analysis to the case of Germany.

Table 7: *Evolution of the Border Effect in the Case of Germany*

Variable	(1997)	(1998)	(1999)	(2000)	(2001)	(2002)	(2003)
Constant	***32.406	***31.995	***32.146	***32.776	***31.709	***32.619	***32.090
	(0.752)	(1.083)	(0.886)	(0.734)	(0.846)	(1.133)	(0.867)
Distance	***-1.784	***-1.758	***-1.832	***-1.904	***-1.744	***-1.837	***-1.776
	(0.122)	(0.124)	(0.131)	(0.153)	(0.125)	(0.201)	(0.127)
Regions	***1.129	***0.774	***1.613	***1.410	***1.714	***1.345	***1.560
	(0.177)	(0.180)	(0.207)	(0.240)	(0.200)	(0.269)	(0.207)
Nbr. of obs.	812	812	870	870	870	870	870
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Adj. R2	0.783	0.767	0.756	0.710	0.755	0.626	0.747

Notes: Parameters are estimated by fixed effects regressions; ***,**,* denote significance at the 1, 5, 10 percent level, respectively; robust standard errors in parentheses.

interested in the evolution of the border effect than in its exact magnitude we consider the simple conversion as sufficient for this purpose.

As expected, for all years the explanatory power of the regressions is high. The intercept tends to oscillate around the value of 32 and the distance coefficient seems to remain mostly around a value of -1.8. To our greatest surprise the coefficient of the dummy variable Regions seems not to decrease over the seven years. Figure 1 depicts the evolution of the border effect graphically. If the economic integration of the EU 15 was gaining ground during this period, we should expect the border effect to decrease. The two mayor studies on the border effect in the EU (Head and Mayer, 2000; Nitsch, 2000) find for the 80s and beginning 90s indeed a considerable reduction in the border effect. A raise in the border effect in the case of Germany would indicate that the German economy disintegrates from the EU market and becomes more and more focused on itself with respect to the EU. How can we explain this development?

First of all, there may be a technical problem of comparing the results of the years 1997 and 1998 with the results of the other samples. In these two years trade flows going to and coming from Belgium are not reported separately. However, if we treat the results of these two years with some caution, we notice that the border effect is remarkably stable between 1.4 and 1.7. What could be the reason for the border effect not to decline?

One might conjecture that during the time period under consideration

Figure 1: *Evolution of the Border Effect in the case of Germany*

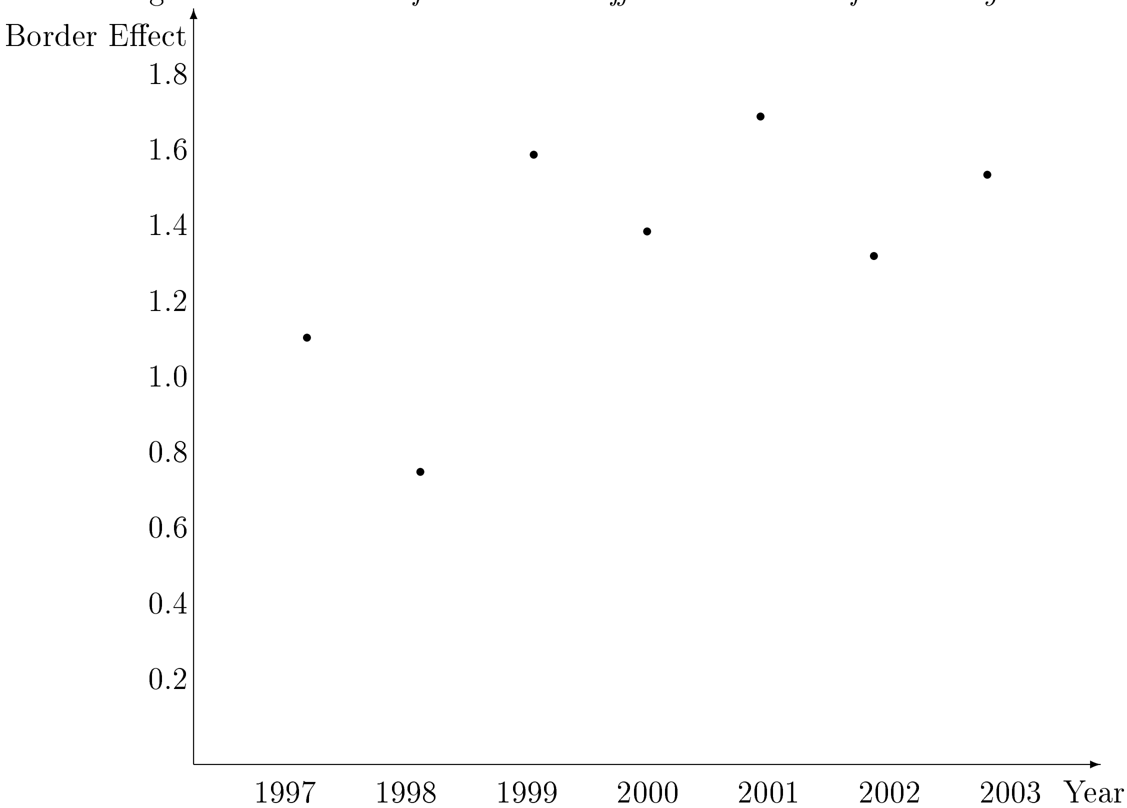

Table 8: *Evolution of the Border Effect in the Case of Germany (Interaction Dummies)*

Variable	(1997)	(1998)	(1999)	(2000)	(2001)	(2002)	(2003)
Constant	***27.507	***27.141	***28.092	***28.249	***28.292	***27.892	***28.501
	(0.630)	0.634	(0.579)	(0.734)	(0.579)	(0.677)	(0.588)
Distance	***-1.113	***-1.317	***-1.187	***-1.205	***-1.188	***-1.150	***-1.202
	(0.071)	(0.223)	(0.084)	(0.081)	(0.085)	(0.099)	(0.086)
Regions	***8.994	***8.727	***9.908	***10.407	***8.857	***6.171	***8.951
	(1.224)	(1.242)	(1.330)	(1.537)	(1.271)	(1.762)	(1.333)
Interact.	***-1.303	***-1.317	***-1.391	***-1.509	***-1.198	***-0.846	***-1.239
	0.220	0.223	0.243	0.286	0.233	0.325	0.244
Nbr. of obs.	812	812	870	870	870	870	870
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Adj. R2	0.799	0.784	0.771	0.727	0.768	0.627	0.760

Notes: Parameters are estimated by fixed effects regressions; ***,**,* denote significance at the 1, 5, 10 percent level, respectively; robust standard errors in parentheses.

the trade-impeding role of distance has fallen more for intranational trade than for EU trade. This would mean that Germany as a whole has "come closer together" due to panoply of reasons like technological progress, enhanced transportation infrastructure, etc. As a consequence, the volume within Germany increased more. To test this conjecture, we run the same seven OLS regressions as before, but now we add an interaction dummy to our basic gravity model. We interact the Laender dummy with the distance coefficient in order to allow for a different slope of the distance coefficient for trade between Bundesländer. Table 8 reports the results of these estimations.

We notice that the interaction dummy decreases. However, in order to be able to draw any conclusion we need consider two things: First, the evolution of the intercept is crucial for the interpretation of the estimation results (Buch et al., 2004). Second, we have to add the distance dummy to the interaction dummy and compare the results over the years.

Observing the intercept we notice that the resulting number remains stable around the value of 28. The distance variable is also stable around 1.2 and we may conclude that distance has played the same trade-preventing role over the whole time period. However, the interaction dummy seems to lose strength, especially the last three years. This could be interpreted as if the volume of intranational trade has been rising faster than the volume of EU trade. However, this result seems not to have it origin in a decrease in the trade-preventing role of distance.

Finally, the fast economic development of countries close to Germany, which in their majority became Member States of the EU in May 2004, could offer another explanation for the observed evolution of the border effect. In the time period under consideration total trade with these countries grew probably a lot faster than the total trade with the EU 14. In other words, the German economy shifted its attention "eastward", at the expense of an intensification of trade relations with the EU 14 countries. This development must ultimately lead to an increase in the border effect between Germany and the EU 14. However, this explanation is still very hypothetical and needs to be tested thoroughly.

6 Summary and Conclusion

The main purpose of this paper was to develop a methodology that allows us to estimate border effects with greater precision using existing data. Applying this methodology to the case of France and Germany has yielded two main results. First, the German economy is seems to be better integrated in the EU market than its French counterpart. Second, in the case of Germany the border effect has been not been decreasing over the last seven years.

However, this study constitutes only a beginning. The availability of data on intranational commodity flows in EU countries offers the opportunity to estimate border effects for other countries. Since our methodology is a more direct way to determine border effects, it allows studying closer the reasons for border effects. In our study we have identified new factors that contribute to the border effect, but much work remains to be done. However, we are now able to integrate easily more valuable data, for example on different consumer price between regions (Engel and Rogers, 1996, for the case of Canada-US trade) and come to a much richer analysis. Finally, a better understanding of the border effect would it make possible to know more about the welfare implications of border effects.

Future studies could apply our methodology to data that covers longer time periods than seven years. As our results suggest, knowing more about the evolution of the border effect can give us important insights in the dynamics of trade. Knowing if an economy integrates or disintegrates is not only a valuable piece of information for trade economists, but also for political decision makers.

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8 Appendix

Appendix 1–List of 22 French 'Régions'

Name	Name
Alsace	Ile-de-France
Aquitaine	Languedoc-Roussillon
Auvergne	Limousin
Basse-Normandie	Lorraine
Bourgogne	Midi-Pyrénées
Bretagne	Nord-Pas de Calais
Centre	Provence-Alpes-Côte d'Azur
Champagne-Ardennes	Pays de la Loire
Corse	Picardie
Franche-Comté	Poitou-Charentes
Haute-Normandie	Rhône-Alpes

Appendix 2–List of 16 German 'Bundesländer'

Name	Name
Baden-Württemberg	Niedersachsen
Bayern	Nordrhein-Westfalen
Berlin	Rheinland-Pfalz
Brandenburg	Saarland
Bremen	Sachsen
Hamburg	Sachsen-Anhalt
Hessen	Schleswig-Holstein
Mecklenburg-Vorpommern	Thüringen

Appendix 3–List of "Merged" 'Régions'

Name	Name
Champagne-Ardenne	+ Bourgogne
Picardie	+ Centre
Haute Normandie	+ Basse Normandie
Nord-Pas de Calais	+ Lorraine
Pays de la Loire	+ Poitou-Charente
Aquitaine	+ Midi-Pyrénées
Limoge	+ Auvergne
Provence	+ Corse

Appendix 4–List of "Merged" 'Bundesländer'

Name	Name
Bremen	+ Hamburg