Non-Europe: The Magnitude and Causes of Market Fragmentation in the EU*

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Abstract

In 1985 the European Commission diagnosed its member states as suffering from excessive market fragmentation, a state of affairs it later referred to as "Non-Europe." In response, the European Union launched an ambitious program to unify its internal market by removing non-tariff barriers. We examine the empirical basis for the Commission's diagnosis using a trade model derived from monopolistic competition. We then investigate the links between the initial size and subsequent evolution of border effects within the European Union. Our findings support the view that European consumers act as if imports from other members were subject to high non-tariff barriers. However, there appears to be almost no relation between market fragmentation and the barriers that were identified and removed by Europe's Single Market Programme.

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I Introduction

Trade between European Union members has been essentially free of tariffs and quotas since 1968. Nevertheless, 17 years later the European Commission argued that Europe's internal market was far from unified. The Commission issued a White Paper in 1985 that identified three primary barriers to intra-EU trade: differences in technical standards, delays and administrative burdens caused by frontier controls, and national biases in government procurement. The Commission then launched a research project to establish the costs of what they referred to as "Non-Europe" or the "present market fragmentation of the European Community" (Commission of the EC, 1988). By the time the 16 volume study was released, the member nations had already legislated the Single European Act (SEA). The Act contained roughly 300 proposals from the White Paper designed to "complete" Europe's internal market by the end of 1992.

In this paper we evaluate the success of Europe's Single Market Programme (SMP). The initial step is to establish the extent of "market fragmentation" at the time of the White Paper. We define a market as fragmented when national borders influence the pattern of commercial transactions. Borders matter when firms have greater access to domestic consumers than to consumers in other nations. We measure the effect of borders as the average deviation between actual trade and the trade that would be expected in an economy without border-related barriers. We calculate industry level border effects for the European Union and examine the extent that they can be explained by the barriers identified in the White Paper. Next, we turn to the effects of the implementation of White Paper measures during the period 1986 to 1993. How much did border effects decline as the SEA was implemented? Were the declines related to the policy changes?

Our results suggest that the European Commission may have mis-assessed the causes of "Non-Europe". Thus, we empirically validate Geroski's (1991) caveat that "...it is by no means clear that obstacles to trade are the main reason why few European firms operate on a truly European scale". We propose an alternative explanation for market fragmentation: consumers exhibit a bias towards domestic goods. This may be the outcome of cultural differences or the legacy of past protection that caused domestic suppliers to adapt their product offerings to suit local tastes. This line of argument supports Geroski's conjecture that European market fragmentation was mostly due to its diversity in national and regional tastes and that the 1992 Programme would do little to reduce this type of fragmentation.

The methodology we employ is the monopolistic competition model of trade introduced by Krugman (1980). That model establishes a relation between the relative amounts consumers spend on foreign and domestic goods and their relative prices net of transport costs. The border effect measures divergence from the predicted consumption ratios. Using data from the European Commission's own studies, we categorize industries according to importance of the three types of barriers identified by the White Paper. We then correlate these barriers to levels and changes in border effects.

The remainder of the paper proceeds as follows: Section II reviews the existing work on border effects. A theoretical model of monopolistic competition with a border effect is provided in section III. We introduce a new method to calculate internal and external distances in a consistent manner in section IV. The results for pooled data and industry-specific regressions are presented in section V and section VI concludes.

II Literature review

The objective of this paper is to measure and explain the remaining sources of market fragmentation in the European Union. Formal trade barriers should not be important in Europe as tariffs and quotas have been removed since 1968. Non-tariff barriers were still thought to be significant impediments to trade within the European Community. Neven and Roller (1991) estimate the impact of non-tariff barriers on the share of EU imports in apparent consumption of the four major European countries for the years 1975–85. Their measure for NTBs comes from Buigues et al (1990). They find no evidence that higher NTBs hampered trade within the EC but a significant negative effect on imports from the rest of the world suggesting paradoxically that the SMP might generate more benefits to firms from outside the EU.

The removal of non-tariff barriers (NTBs) was the objective of the Single Market Programme (SMP) initiated in 1986 and completed by the end of 1992. Most research on the SMP consisted of prospective studies. Smith and Venables (1988), for instance, employed a numerical calibration of an imperfect competition model to project the welfare gains achievable through greater market integration. However, there have been few *ex post* empirical studies assessing the impact of the SMP.

Fontagné et al. (1998) study the impact of the SMP on intra-European trade at a very detailed level using combined nomenclature 8-digit trade data from Eurostat. They estimate in particular whether the removal of remaining barriers to trade changed the proportion of inter-industry, horizontally differentiated, and vertically differentiated trade. They find that the removal of NTBs (here again mainly based on Buigues et al., 1990) had an important effect on the composition of intra-European trade, raising the volume of inter-industry trade while reducing the share of intra-industry trade in horizontally differentiated products. Our work differs from Fontagné et al. (1998) in that we examine how NTBs affect consumption of foreign goods relative to consumption of domestic goods. The empirical construct we employ is the border effect.

The literature on border effects was established by McCallum (1995) who analyzed trade between Canadian provinces and between US states and Canadian provinces. The border effect measures the extent that domestic subunits trade more with each other than with foreign units of identical size and distance. Using data on interprovincial and international trade by Canadian provinces, McCallum (1995) and Helliwell (1996) showed that the border effect on US-Canadian trade for the 1988–90 period was extremely large. Interprovincial trade is estimated to be more than 20 times larger than trade between Canadian provinces and American states. This large border effect is remarkable given that Canada and the US were thought to be highly integrated, with low tariffs that were being phased out by the 1988 Free Trade Agreement. Furthermore, Canada's unusual economic geography (85% of Canadians live less than 100 miles from the US border) and interprovincial trade barriers might have even delivered the opposite result.

The use of gravity equations to estimate the magnitude of the effects of various forms of regional economic integration is well established in the empirical trade literature. What made it possible for McCallum and Helliwell to estimate the importance of the Canadian Economic Union was the availability of comparable data on trade flows for subnational units. Such data are rare. McCallum and Helliwell use data from Statistics Canada's Input-Output Division. Since that data fails to identify the state of origin or destination for trade flows, they use customs clearance data to allocate trade across states. Anderson and Smith (1997) investigate whether this procedure inflates estimates of border effects by considering the US as a single source/destination. They find a border effect of 12, smaller than the earlier two studies, but still suggestive of a large trade-impeding effect of crossing the border. Hillberry (1998) also estimates Canada-US border effects using data from the 1993 commodity transportation survey carried out by the US Transportation Department. He finds border effects slightly over 20, remarkably similar to those obtained by McCallum and Helliwell.

Wei (1996) introduced a method that obviates the need for trade data on sub-national units. His procedure calculates a country's trade with itself by starting with domestic output and subtracting aggregate exports to other nations. The remainder measures the domestically made goods that are "exported" to domestic consumers. The effects of crossing a border can then be estimated by including a dummy variable indicating when trade occurs with self and when it occurs with other nations. Wei's estimate of the border coefficient for an average OECD country over the 1982–94 period is just under 10 in the traditional gravity equations and falls to only 2.6 when taking into account common language and contiguity. Helliwell (1997) revisits the OECD data, using a different remoteness measure and separating language effects from the border effect. He reports border effects of 12.

When considering the European Community, Wei's estimates imply a ratio of imports from self to imports from other European countries of only 1.7. This seems to imply that European integration succeeded in removing significant trade barriers. Moreover, Wei finds that the border effect for EC members declined by 50% between 1982 and 1994. A recent paper by Nitsch (1997) reestimates the EU border effects, including three countries omitted by Wei, using different trade data, and employing new measures of internal distance (we discuss these important measurement issues in greater detail in section IV). Nitsch estimates border effects that are larger than Wei's, but they vary substantially across specifications (from 2.5 to 16).

Wolf's (1997) study of trade between states in the US raises an important caveat in the use of Wei's methodology to estimate border effects. He finds significant state border effects (3.0 to 3.7, depending on specification) for trade within the United States. Given that states have been constitutionally prevented from erecting trade barriers, these border effects are difficult to explain. Unlike the situation in Europe, cultural and institutional differences between American states seem too small to serve as explanations for border effects. Instead, Wolf argues that geographic clusters of vertically-linked industries promote large volumes of intra-state trade. This suggests that border effects would be particularly strong for intermediate goods. When we present our industry-level results, we will reconsider Wolf's hypothesis. It is also possible that positive border effects could be estimated without actual trade barriers because the internal distance of the state is overestimated. Our paper investigates the impact of different internal distance measures on the magnitudes of estimated border effects.

Haveman and Hummels (1997) point out that the use of aggregate data could generate misleading results on border effects. This will tend to be the case when proximate nations alter their production mixes to further exploit trade opportunities with each other. For instance, they might choose to specialize in different industries. Or, as suggested by Wolf, they might both concentrate in vertically related industries. In either case, the border effect would not simply measure substitution away from costly imports by consumers. Rather it would reflect choices by producers. By working with trade and production data that has been disaggregated to 3-digit industries, we should minimize the potential for such production composition effects to influence the magnitude of the border effect.

Previous work has not been able to establish what portion of the border effect can be attributed to non-tariff barriers. This paper is, to our knowledge, the first to estimate industry-level border effects and to use industry-level data on European NTBs to assess the importance of this determinant in the tendency of countries to trade excessively with themselves. Once NTBs are taken into account in the model, the remaining border effect consists only of differences in consumers' preferences. This determinant might indeed be an important explanation of trade patterns, particularly between European countries. We now proceed to develop a trade model that includes NTBs and consumer biases as determinants of border effects.

III Border Effects in a Monopolistic Competition Model

We begin with a fairly general specification of preferences. The utility of the representative consumer in country i depends on the quantity of each variety h consumed from each country j.[1]

[1] The model we develop is one of trade in final goods. Note that an equivalent estimating equation could be derived for an industry comprising a large number of differentiated producers of intermediate goods. In that case the consumer utility function would be replaced with the downstream industry's production function. Solution of the cost minimization equation results in the same functional form as equation (5). This equivalence is valuable since a large amount of trade occurs in intermediate goods.

All varieties are differentiated from each other but products from the same country are weighted equally in the utility function. Thus, denoting quantity consumed with c and the preference weight with a, the constant elasticity of substitution utility function is given by:

$$U_i = \left(\sum_{j=1}^{N} \sum_{h=1}^{n_j} (a_{ij} c_{ijh})^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}.$$

Denoting m_{ij} as the C.I.F. value of imports of country i from country j ($m_{ij} = c_{ij} p_{ij}$) and $m_i = \sum_k m_{ik}$ as expenditures on goods from all sources (including the home country), then bilateral imports are given by:

$$m_{ij} = \frac{a_{ij}^{\sigma-1} n_j p_{ij}^{1-\sigma}}{\sum_k a_{ik}^{\sigma-1} n_k p_{ik}^{1-\sigma}} m_i. \tag{1}$$

We may derive a gravity equation from this expression. Note first that the Dixit-Stiglitz model of monopolistic competition[2] yields proportionality between production and the number of varieties. Denoting the value of production in country j as v_j, the quantity produced by each firm as q, and the mill price of each variety as p_j, we obtain $v_j = q p_j n_j$. We will use this equation to eliminate the n_j from the equation since the number of symmetric varieties produced by each country is not observed.

We now turn to the determination of delivered prices, p_{ij}, and preferences, a_{ij}. The price paid by consumers in country i for products of country j is a multiplicative function of the mill price (p_j), distance (d_{ij}), and non-tariff barriers (NTBs). We assume constant *ad valorem* NTBs of ν for all cross-border trade. Defining B_{ij} as an indicator variable taking on one for $i \neq j$, we obtain

$$p_{ij} = (1 + \nu B_{ij}) d_{ij}^{\delta} p_j. \tag{2}$$

[2]For a model investigating the consequences of home bias on trade in an oligopolistic framework, see Norman et al. (1991).

Consumer preferences consist of a random component, e_{ij}, and a systematic preference for home-produced goods (or aversion to foreign-made goods) of β. We hypothesize that a common language mitigates this *home bias* and therefore posit the following equation for preferences:

$$a_{ij} = \exp[e_{ij} - (\beta - \lambda L_{ij})B_{ij}]. \tag{3}$$

In this expression, L_{ij} takes a value of one for pairs of countries that share a common language and zero otherwise. Thus, when $L_{ij} = 1$, home bias falls from β to $\beta - \lambda$. Using $n_j p_j = v_j / q$, substituting for a_{ij}, p_{ij}, and n_j in (1), and taking logs leads to a formulation of the gravity equation:

$$\begin{aligned} \ln m_{ij} &= \ln m_i + \ln v_j - (\sigma - 1)\delta \ln d_{ij} - \sigma \ln p_j \\ &\quad - I_i - (\sigma - 1)[\beta - \lambda L_{ij} + \ln(1 + \nu)]B_{ij} + (\sigma - 1)e_{ij}, \end{aligned} \tag{4}$$

where I_i, the importer's "inclusive value," is defined as follows:

$$I_i = \ln\left(\sum_k \exp[\ln v_k - \sigma \ln p_k + (\sigma - 1)(-\delta \ln d_{ik} - [\beta - \lambda L_{ik} + \ln(1 + \nu)]B_{ik} + e_{ik})]\right).$$

The inclusive value describes the full range of potential suppliers to a given importer, taking into account their size, distance and relevant border effects.[3]

The first three terms of equation (4)—exporter output, importer expenditure, and distance between importer and exporter—appear in some form in all estimated gravity equations. However, the gravity equations estimated in the trade literature generally differ from (4) in several important respects. First, most studies omit the "inclusive value" term, I_i. In some cases a

[3]We label this term the "inclusive value" in reference to its resemblance to the utility of the whole choice set in a logit model. For an analysis on the connections between the logit model and the monopolistic competition model, see Anderson et al. (1992).

related measure consisting of the remoteness of each trading partner from other possible partners is used instead.[4] Traditional gravity equations also use the GDPs of the two trade partners instead of using a goods production measure for $\ln v_j$ and an expenditure measure for $\ln m_i$. Furthermore, the theoretical coefficients of 1 on $\ln m_i$ and $\ln v_i$ are almost never imposed. Although the theory clearly requires that we control for differences in FOB price levels (the p_j), Bergstrand (1985) is one of the only papers to do so. In contrast, while the model predicts that trade depends only on total consumption and production, it has become commonplace to augment the basic gravity equation with the product of the two trading partners' per-capita incomes.

The estimation of the influence of I_i is difficult because it depends on parameters that are already in the equation to be estimated. Another problem related to this term is that even in studies like ours that restrict the sample to a particular subset of countries, the I_i term is supposed to contain attributes of all possible origin countries for the product. The monopolistic competition model predicts that imports from a particular country in a given industry are related to alternative sources in the whole world. To avoid these difficulties, we work with log odds ratios that allow us to sidestep the problem of estimating I_i. The derivation proceeds as follows: set $j = i$ in (4) to obtain an expression for $\ln(m_{ii})$. Subtract from $\ln m_{ij}$ and one obtains

$$\begin{aligned} \ln\left(\frac{m_{ij}}{m_{ii}}\right) &= \ln\left(\frac{v_j}{v_i}\right) - (\sigma-1)\delta\ln\left(\frac{d_{ij}}{d_{ii}}\right) - \sigma\ln\left(\frac{p_j}{p_i}\right) \\ &\quad -(\sigma-1)[\beta+\ln(1+\nu)] + (\sigma-1)\lambda L_{ij} + \epsilon_{ij}, \end{aligned} \tag{5}$$

where $\epsilon_{ij} = (\sigma-1)(e_{ij} - e_{ii})$. This expression relates the decisions of consumers in a given

[4] Wei (1996), Wolf (1997), and Helliwell (1997) each adopt different formulations of the remoteness variable involving distance and GDP. They also use separate measures for the exporting and importing country whereas the theory requires only a measure for the importer.

country on how to allocate expenditure between goods from a particular foreign country and goods produced at home.[5] It exploits the Independence from Irrelevant Alternatives (IIA) property of the CES demand function to obtain a formulation in which relative demand for a given foreign country depends only on ratios of explanatory variables for that country and the home country.

The constant in equation (5) captures both the impact of NTBs (ν) and home bias (β). We estimate this negative intercept for each industry in our sample. Then we examine whether high levels of NTBs identified in a survey made by the European Commission are associated with large negative values of the intercept. This would show that in the industries where firms claimed to suffer from high NTBs, trade between European countries was really more impeded. Then a reasonable part of the observed fragmentation of the European market could be attributed to NTBs, suggesting that the 1992 programme did indeed target the correct causes of Non-Europe. The third step is an estimation of the evolution of the border effect during the implementation of the SMP.

IV The Measurement of Internal Distances

A crucial issue in the empirical implementation of the model is the measurement of distance in general and particularly the way we measure intra-national versus international distances. As pointed out by Wei (1996), the magnitude of the border effects can be strongly influenced by the method of calculating a country's distance from itself. If this internal distance is overestimated, then holding international distance constant, the negative effect of distance will be underestimated as the cost of shipping a good internally becomes closer to the cost of shipping it to another country. As a result, the border effect—which accounts for any excessive amount

[5] Using a different theoretical framework, Eaton and Kortum (1997) obtain a similar dependent variable, normalizing bilateral trade by trade with self.

of trade within a country—will be given more weight in the regression, leading *ceteris paribus* to an overestimated border effect.

We adopt an integrated measure of distance incorporating key characteristics of European economic geography. The usual way of calculating distance between two countries is to take the mileage between their respective principal cities. This amounts to assuming that all bilateral trade occur between these two cities, which means that countries are modeled as points. This sharply conflicts with actual European manufacturing geography. A better measure of distance should take into account the facts that countries consist of geographically dispersed sub-national units and that economic activity is by no means equally distributed between them. A given trade flow between France and Germany might take place between Strasbourg and Bonn but might also occur between Marseilles and Hamburg, the true distance from producer to consumer depending on the case. In addition, the relevant distance for a representative product depends on the economic size of the regions, because the volume of trade between major cities like London and Barcelona will be much higher than the trade between, say, Leeds and Malaga.

Incorporating the considerations discussed above, we construct a measure of distance using regional data available in Europe. We calculate bilateral distances between regions and weight those distances by the economic size of the regions. This method permits the calculation of both international and intra-national distances using the same integrated methodology. Considering two countries O and D (the origin and destination countries of a given flow), respectively consisting of regions indexed $i \in O$ and $j \in D$, the following formula provides both external and internal distances.

$$d_{OD} = \sum_{i \in O} (\sum_{j \in D} w_j d_{ij}) w_i$$

We define d_{ij} as the distance between the centers of regions i and j and w_i as the weight of region i, calculated as the share of two-digit industry-level employment for origin weights and

GDP for destination weights. The external and internal distances, as well as more details about the data, are given in Table 7 in the data appendix.

Our distance measures require considerable sub-national data that may be difficult to obtain for some country samples. Hence, it is worthwhile to see how much our results differ from those obtained with some of the less demanding distance measures used in previous literature. The first one follows Wei (1996) in using great-circle distances between economic centers for international distance and one quarter of the distance to the nearest foreign economic center for internal distance. We also show results following the procedure of Wolf (1997) that replaces internal distance with the distance between the two main cities of the state.

Finally, we derive a new measure of internal distance along the lines followed by Nitsch (1997) and Leamer (1997) who model internal distance as proportional to the square root of the area of the country. Suppose the economic geography of each country can be approximated with a disk in which all production concentrates in the center and consumers are randomly distributed throughout the rest of the area. Then the average distance between a producer and a consumer is given by

$$d_{ii} = \int_0^R r \cdot f(r) dr,$$

where R denotes the radius of the disk, and $f(r)$ is the density of consumers at any given distance r to the center. We obtain R as the square root of the area, A, divided by π. For a uniform distribution, $f(r) = 2r/R^2$. Integrating, we obtain

$$d_{ii} = (2/3)R = (2/3)\sqrt{A/\pi} = .376\sqrt{A}.$$

This turns out to be almost the midpoint of the two proportionality figures employed by Nitsch,

.2 and .6. It is 1/3 lower than the formula used by Leamer.[6]

For countries that are far apart, the region-weighted distances differ little from the main city distances. This is because each region in a country has a roughly similar distance to all regions of the distant country. Furthermore, the most remote countries in our sample (Greece, Portugal, Ireland, and Denmark) are small countries which reinforces this effect. How does our measure compare with the main city methodology for international distances between large and proximate countries? It appears that an important feature of European economic geography is that main cities are relatively close to each other for large countries such as Germany (Dusseldorf), France (Paris), Italy (Milan), UK (London) and Spain (Barcelona).[7] Because the main-city procedure does not give any weight to the much larger bilateral distances between smaller economic regions in these countries, bilateral distances are considerably underestimated.

Note, then, that there is a systematic relationship between the two alternative external distance measures: For peripheral countries, the distances are approximately the same. However, for the core countries, main-city distances tend to underestimate "true" (region-weighted) distances. The calculation of border effects depends critically on the *relative* magnitudes of external and internal distance. Hence, it is very important to obtain measures of internal distance that preserve the true ratio between intra- and inter-national distance.

Our internal distances are fairly similar to the ones calculated with disk-area procedure. As a consequence, the whole set of relative distances calculated using Leamer's methodology are close to ours. On the other hand, the methodologies using one quarter of the distance to the nearest neighbor and (to a lesser extent) the distance between the two main cities of the country differ in a large and non-systematic manner from region-weighted distances.

[6] We thank Jacques-François Thisse for suggesting this formula.

[7] We define main cities as the largest city of the largest GDP region of a country.

V Results

The data required to implement this specification consist of trade data classified according to industry rather than product. These data are matched with corresponding industry-level production data. Imports from self are defined as production minus exports to other countries. Both sets of data are provided by Eurostat. Unfortunately, production data omits the output of enterprises with less than 20 employees. We use a separate Eurostat database on small enterprises to calculate a scale-up ratio appropriate for each industry and country combination. More details on the construction of the database are provided in the data appendix.

In the estimation of the border effects, three questions are to be answered: How big were border effects before the launching of the SEA? How closely were they related to indicators of NTBs identified by the European Commission? To the extent that border effects have fallen over time, can this decline be attributed to the removal of NTBs under the SMP? We start by reporting the estimates obtained while imposing a common set of coefficients on all industries and then consider a regression of industry-level border coefficients on non-tariff barrier indicators.

V-A The Level of Border Effects before the SEA

We begin with an estimation of the magnitude of the border effect before the implementation of the Single European Act. We pool the years 1984, 1985, and 1986 and test several different specifications in Table 1. The regression imposes a common set of coefficients on the 98 industries in the sample. The two first columns are estimations of equation (5) that include a dummy to take into account the fact that Spain and Portugal were not members of the EC before 1986. We find substantially larger language effects than those obtained in the OECD data studied by Wei and Helliwell. Our coefficients on production, distance, and EU membership are also

Table 1: Border Effects in the EU, 1984–86 Averages, Common Coefficient Regressions.

	Dependent Variable: Ln Partner/Own Imports					
Model :	(1)	(2)	(3)	(4)	(5)	(6)
Border	-2.75*	-2.97*	-3.31*	-3.58*	-2.84*	-2.48*
	(0.05)	(0.05)	(0.08)	(0.04)	(0.05)	(0.05)
Ln Rel. Production	0.85*	0.80*	0.59*	0.66*	0.81*	
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	
Ln Rel. Distance	-1.29*	-1.06*	-0.48*	-0.65*	-1.10*	-1.45*
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Ln Rel. Price	-0.75*	-0.82*	-1.09*	-0.59*	-0.58*	-1.18*
	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)
Not an EU Member	-0.52*	-0.39*	-0.36*	-0.29*	-0.33*	-0.41*
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Common Language	1.57*	1.58*	1.76*	1.68*	1.49*	1.47*
	(0.09)	(0.09)	(0.10)	(0.09)	(0.09)	(0.09)
Mills Ratio		-2.30*	-6.20*	-3.96*	-0.89*	-0.31
		(0.25)	(0.20)	(0.23)	(0.27)	(0.23)
N	12892	12892	12892	12892	12892	12892
R^2	0.417	0.421	0.397	0.41	0.439	0.24
RMSE	2.097	2.09	2.133	2.109	2.058	2.114

Note: Standard errors in parentheses with * denoting significance at the 1% level. Distances are calculated using Wei's method in column (3), Wolf's method in column (4), and using the disk-area approximation in column (5). The other columns use the weighted sub-national distances described in the text. In column (6) a unit elasticity is imposed on relative production by passing it to the left hand of the regression equation. See text for more details.

somewhat larger than those studies.

The monopolistic competition trade model predicts positive amounts of trade between each set of partners in each industry. This prediction works remarkably well for most importers. Only Greece, Ireland, and Portugal have zeros for more than 5% of their industry-partner trade flows. The endogeneity of which country pairs have positive trade has the potential to generate selection bias. Column (2) uses Heckman's two-stage procedure to address this concern. First, we estimate a probit where the dependent variable is an indicator for positive trade. The set of explanatory variables in this equation now includes the levels of the exporter's production, price, and distance in addition to the relative values. The probit results (not reported) are similar in terms of signs and significance level to the OLS results. The exception is relative prices, which enter with a positive sign. Language effects could not be included in the probit equation because countries with a common language have positive trade in every industry.[8] Using the probit coefficients, we calculate Mills ratios and add them to the original specification. Border effects are larger (intercepts of -2.97 vs. -2.75) as a result of this selection correction. The intuition for this result may lie in the fact that countries tend to trade with themselves in every industry, i.e. the zeros in trade are concentrated in external trade. OLS ignores this while the Heckman procedure, by taking into account zeros through the probit equation, includes this effect in its estimation of the impact of the border. The expansion of the border effect appears to result in slightly lower coefficients on EU membership and distance than those obtained in column (1).

The distance coefficient is more than twice as large as the .6 figure that Leamer (1997) reports as the usual elasticity. While this paper is not alone in obtaining larger distance elasticities, we believe that part of the explanation is our use of an improved measure of distance and the use of a specification that obviates the need to control for "remoteness." The results reported

[8] "Perfect predictors" cannot be included in probit regressions.

in column (3) appear to provide some support for these claims. Using main-city distances for international distance and Wei's one-quarter the distance to the nearest neighbor for internal distance, we obtain markedly lower distance coefficients. We also observe that this specification fits worse in terms of R^2 and the standard error of the regression. Wei's rule leads to some strange internal distances for European countries. For instance, Frances internal distance of 47 miles is three times smaller than Portugal's internal distance of 157 miles. Our measure gives 247 miles for France and 100 for Portugal. The mismeasurement of distance seems to cause the regression to rely more on border and language effects to explain low external trade.

The use of Wolf's rule (internal distance equals the distance between the two largest cities) in column (4) raises the distance effect slightly compared to column (3) but also substantially inflates the border effect. Column (5) continues the use of main-city distances but substitutes the disk-area approximations of internal distance. This restores most aspects of the prior results. Border effects are larger than those obtained with region-weighted distance. The extreme sensitivity of border effects to the different internal distance measures in columns (3), (4), and (5) points to the importance of measuring internal and external distances in a consistent manner.

In the final column of table 1, we force the coefficient on the log of relative production to be one, as specified in the Dixit-Stiglitz version of the trade model (Equation 5). In the previous regressions, the coefficient on relative production has been significantly lower than one. Theoretically, this could arise because varieties from countries with larger production are manufactured at a greater scale. Thus, rises in relative production overstate rises in the number of varieties offered. On the other hand, the theory could be correct and econometric problems might lead to an underestimate of the production coefficient. This in turn could lead to bias in other coefficients of interest.

Imposition of a unit elasticity on relative production addresses two different econometric issues. First, as emphasized by Harrigan (1996), output and trade are jointly determined in equilibrium. This could lead to a correlation between relative production and the error term. Harrigan and Wei respond to the simultaneity problem by using factor endowments as instruments for outputs. We adopt a different approach that avoids the need for instrumental variables. By moving $\ln v$ to the left hand side of the equation, equation (5) becomes

$$\begin{aligned}\ln\left(\frac{m_{ij}}{m_{ii}}\right) - \ln\left(\frac{v_j}{v_i}\right) &= -(\sigma-1)\delta\ln\left(\frac{d_{ij}}{d_{ii}}\right) - \sigma\ln\left(\frac{p_j}{p_i}\right) \\ &\quad -(\sigma-1)[\beta+\ln(1+\nu)] + (\sigma-1)\lambda L_{ij} + \epsilon_{ij}. \qquad (6)\end{aligned}$$

Production no longer appears on the right hand side and therefore it cannot cause a simultaneity problem. The imposition of this restriction may also mitigate a second econometric problem—measurement error for production. To the extent that the production data is inaccurate, a bias towards zero may be exhibited in the coefficient on $\ln v$. Depending on cross-correlations, the other right-hand side variables may obtain biased coefficients as well.[9]

The restricted specification results in column (6) differ from previous columns by attributing greater trade reduction to distance and less to border effects. Price effects also become larger. The language effect remains strong and quantitatively similar. Note that the reduction in the R^2 occurs because the explanatory power of relative production no longer contributes to the calculation. The root mean squared error (RMSE) of the regression is little changed from column (2).

There are several ways to express the magnitude of border effects. First, we can follow McCallum in using the ratio of imports from self to imports from others, holding other things equal. This is just $\exp(2.97) = 19.49$ in column (2) and $\exp(2.48) = 11.94$ in column (6). Thus our results lie between the value of 20 obtained by McCallum for Canadian provinces' trade

[9]We have good reasons to expect measurement error since the original production data was adjusted to take into account unmeasured production by small enterprises. See Data Appendix.

and Wei's value of $\exp(2.27) \approx 10$. Expressed in this manner, it appears that border effects in Europe are large but also quite sensitive to specification.

A second way to quantify border effects is to convert them to distance equivalents. This approach is taken by Engel and Rogers (1996) and Helliwell (1996). Despite the differences in the data analyzed (Engle and Rogers examine price variation whereas Helliwell uses an extension of McCallum's data), both papers find that the U.S.-Canada border is equivalent to at least 2000 miles. In our study, crossing a border is equivalent to multiplying distance by $\exp(-2.97/-1.06) = 16.46$. Since the average internal distance is 140 miles, this implies an average border "width" of 2304 miles. Thus borders appear to be about three times the average external distance of 773 miles. Using the estimates in column (6) reduces the implied border width to 774 miles.

Wei considers the tariff equivalent of a border. This requires an estimate of the elasticity of substitution between varieties, or σ in the model we used to obtain the estimating equation. The *ad valorem* tariff equivalent implied by column (2) is $\exp(2.97/(\sigma-1)) - 1$. The coefficient on log of relative price would be a good candidate for $\sigma - 1$. However, our results indicate unreasonably small values.[10] Instead, we consider results obtained by Head and Ries (1999) in a study of the effects of changes in tariffs on Canada-U.S. trade in manufactures. That paper obtains values of $\sigma - 1$ ranging from 6 to 10.[11] Using $\sigma - 1 = 8$, we find the tariff equivalent of a border crossing to be 45%. Using the more conservative column (6) estimates, the tariff equivalent declines to 36%. Thus, our results suggest that crossing a border in the EU appears to involve costs that approximate those of the tariffs of the Depression era.

How can we explain such large border effects? First, it seems worth noting the importance of the common language effect. Since internal trade presumably occurs between agents that

[10] We speculate that this is because unobserved variation in relative product quality is correlated with relative product price.

[11] Using a different methodology, Hanson (1998) obtained estimates of σ that ranged between 6 and 11.

share a language, we may infer that border effects would by 79% lower ($1-\exp(-1.58)$) without the trade-impeding effects of linguistic differences. It is possible, of course, that communication problems are only part of the observed language effect. It may serve as a proxy for other shared attributes that promote trade. Our primary focus is on a second potential explanation, namely that non-tariff barriers fragmented the European market prior to their elimination by the Single European Act.

To evaluate the extent that NTBs can account for the border effect and therefore see if the barriers to trade targeted by the White Paper were actually hampering trade before their removal, the border effect must be estimated at the industry level.

We estimate border effects for each industry, allowing all the other coefficients in the specification to vary across industries. The most important reason for this approach is as follows. Suppose one industry has higher transport costs. By forcing it to have the average distance coefficient, we would underestimate the effect of distance on that industry's trade. This might cause the intercept to capture the misspecification, leading to an overestimate of border effects. The six preceding estimations are thus conducted by industry. We refer to the negative of the intercept from each regression as that industry's border coefficient.

Table 2: Correlation matrix of industry-level border effects

	1	2	3	4	5	6	Mean
1	**1.336**						2.613
2	0.998	**1.375**					2.640
3	0.739	0.748	**1.549**				3.025
4	0.938	0.942	0.759	**1.368**			3.289
5	0.971	0.971	0.746	0.959	**1.295**		2.636
6	0.952	0.950	0.689	0.913	0.935	**1.299**	2.474

Note: Correlation coefficients between estimates of border effects at the industry level, organized by specification from Table 1. The bold diagonal contains standard deviations for each set of coefficients. The last column contains the mean value of the corresponding border effect.

Table 2 summarizes the results for the six specifications. We note first that average border coefficients are similar in magnitude to the constants in the common-coefficient regressions. They also follow the same size ranking, with specification 6 (the restriction of unit production elasticity) yielding the smallest border effect. Most of the specifications lead to border coefficients that are highly correlated with one another. The exception is specification 3 which uses Wei's 1/4 rule for obtaining internal distances. The disk-area-rule provides coefficients that are generally larger but closely correlated with the weighted-average distance measure. This seems to be because internal distances are somewhat smaller than the disk radius approximation would suggest.

We verified that the patterns of industries' border effects do not hinge on the presence of any single country in the estimation sample. By sequentially removing one country at a time from the regressions, we obtained 11 sets of industry-level border effects. The resulting border coefficients differ somewhat on average (ranging from 2.48 when France is omitted to 3.06 when the Netherlands are omitted). However, the estimates from the different samples are very highly correlated with each other, ranging from .88 to .98. This exercise (suggested by a referee) provides some assurance that our results are robust to small changes in the sample.

Table 3 gives the border coefficients for specification 2 for each industry. The industries are ordered in terms of increasing magnitude of border effects. It seems noteworthy that ingestible products—food, beverages, tobacco and drugs—figure heavily among those with large border effects. Wolf's hypothesis that border effects reflect vertical industry cluster effects does not seem appropriate for these industries. Rather, we expect resistance to foreign goods in these cases might derive from the consumer's greater experience with and confidence in domestic varieties.

In order to evaluate this claim, we separate the sample into two sub-samples based on whether the output of the good goes primarily to personal consumption or intermediate input

Table 3: Border Coefficients by Industry

Industry	Coefficient	Industry	Coefficient
Motor vehicles-ass. and eng.	*0.14*	*Machine-tools*	*2.32**
Electrical apps.-indl.	0.42	**Electrical plant**	**2.36***
Asbestos	0.42	Meat	2.4*
Motor vehicles-parts	0.65	*Rubber*	*2.46**
Textile n.e.s	0.71	Paper processing	2.46*
Steel tubes	0.86	*Footwear-mass*	*2.54**
Office machinery	**0.99***	**Wires**	**2.58***
Machinery-misc	*1.02**	Clocks	2.59*
Machinery- agricultural	*1.06**	*Industrial chem. n.e.s*	*2.64**
Transmission eq.	*1.10**	Wood-processed	2.69*
Household chem. n.e.s	1.14*	Wooden furniture	2.78*
Receivers-TV and Radio	*1.14**	Fish	2.79*
Man-made fibres	1.18*	*Clothing*	*2.82**
Electrical apps.-domestic	*1.22**	Oils and fats	2.82*
Industrial chem.	*1.27**	Cork and brushes	2.89*
Steel-preprocess	1.31*	**Confectionery**	**2.97***
Optical ins.	1.32*	**Railway**	**3.03***
Machinery n.e.s	1.35*	*Aerospace*	*3.07**
Non-ferrous metals-prod.	1.41*	Metals transformation	3.18*
Abrasives	1.41*	Paint and Ink	3.26*
Lighting eq.	*1.44**	Printing	3.39*
Glass	*1.58**	Motor vehicles-bodies	3.39*
Toys and sports	1.60*	Structural metal	3.52*
Furs	1.60*	**Pharmaceuticals**	**3.61***
Musical ins.	1.69*	*Graphic labs*	*3.62**
Leather-tanning	1.71*	Foundries	3.68*
Floor coverings	*1.73**	**Shipbuilding**	**3.69***
Ceramics	*1.76**	Grain milling	3.82*
Jewellery	*1.76**	Dairy	3.92*
Starch	1.8*	**Metal containers**	**3.95***
Cycles	1.82*	Food n.e.s	4.12*
Stone	1.83*	Used tyres	4.12*
Precision ins.	1.84*	Bread	4.19*
Machinery-textile	*1.87**	Distilling	4.21*
Pulp and paper	1.93*	**Pasta**	**4.27***
Machinery-engineering	*1.96**	**Wine**	**4.43***
Transport eq. n.e.s	1.97*	**Soft drinks**	**4.58***
Tools etc.	2.01*	Clay	4.63*
Telecoms	**2.05***	Tobacco	4.64*
Wood n.e.s	2.06*	**Beer**	**4.66***
Textiles-households	*2.09**	Concrete	4.68*
Iron and steel	2.13*	Cement	4.75*
Machinery-food and chem.	*2.14**	Forging	4.78*
Vegetables	2.17*	Poultry	4.83*
Medical eq.	**2.21***	Wood-sawing	5.26*
Soap	2.22*	Wooden containers	5.55*
Leather-products	2.23*	Oil refining	5.58*
Plastics	2.27*	Carpentry	6.03*
Knitting	2.28*	Sugar	6.41*

Note: Border coefficient (Specification 2) for each industry. The industries identified by Buigues et al. (1990) as high and moderate NTBs industries are respectively in bold face and italics.

use. Using Input-Output data (see the data appendix for details), we define an industry as "Final Good" when personal consumption constitutes more than 50% of apparent consumption (output minus exports plus imports). We are then able to assess whether border effects are significantly higher in final goods industries, which we would expect if home bias on the part of consumers were important. This is done by including the Final Good dummy variable in the regression of industry-level border effects on NTB indicators.

The industry-level border coefficients are regressed on two measures of non-tariff barriers.[12] The first one comes from survey of 11,000 firms conducted by the European Commission under the "Costs of Non-Europe" project. From this survey we construct three variables representing respectively the magnitude of the NTBs in terms of standard differences, public procurement, and customs formalities. The second set of indicators comes from Buigues et al. (1990) which classified European industries into three levels of barriers : low, moderate, and high.

The results in table 4 cast doubt on the proposition that high non-tariff barriers could explain the market fragmentation found in manufacturing industries in Europe. The explanatory power is low in each case; NTBs explain at most 10% of the variation in border effects. Moreover, the effects are often insignificant. Worse, moderate NTB industries appear to have significantly *lower* border effects than low NTB industries. The results depend somewhat on which specification is used to estimate the border effects. However, none of the specifications provides support for a positive relationship between the NTBs identified by the European Commission and the border effects we estimate.

We find some relationship between the magnitude of market fragmentation and the fact that the goods of the industry are directed to final consumption. The coefficients on the final consumption variable are systematically positive and statistically significant in half the regressions.

[12] Some border effects are measured more precisely than others. This introduces heteroscedasticity. We respond to this problem by using weighted least squares estimation. The weights are the inverse of the standard error of the estimate of each border effect.

Table 4: Explaining Cross-Industry Variation in Pre-SEA EU Border Effects

	Dependent Variable: Constant from Industry Regressions					
Specification :	(2)	(3)	(6)	(2)	(3)	(6)
Intercept	6.226^a	6.476^a	6.739^a	2.552^a	3.042^a	2.387^a
	(1.768)	(2.163)	(1.615)	(0.176)	(0.213)	(0.166)
Standards Conflict	-0.030^c	-0.030	-0.031^c			
	(0.018)	(0.022)	(0.017)			
Govt. Proc. Bias	-0.023	-0.022	-0.024			
	(0.017)	(0.021)	(0.016)			
Customs Burden	-0.032	-0.028	-0.045^b			
	(0.024)	(0.029)	(0.022)			
High NTBs				0.340	-0.166	0.269
				(0.379)	(0.455)	(0.367)
Moderate NTBs				-0.774^a	-0.567	-0.729^a
				(0.285)	(0.345)	(0.271)
Final Good	0.824^b	0.674	0.966^a	0.434	0.420	0.485^c
	(0.370)	(0.441)	(0.336)	(0.272)	(0.323)	(0.255)
N	93	93	93	98	98	98
R^2	0.119	0.07	0.159	0.125	0.049	0.128
RMSE	1.232	1.478	1.126	1.209	1.453	1.146

Note: Ordinary least squares weighted by the standard error of the border coefficient in the industry-level regression. Standard errors in parentheses with ^{a}, ^{b} , and ^{c} denoting significance at the 1%, 5%, and 10% level. Specifications 2 and 6 use region-weighted distances. Specification 6 imposes the restriction that the coefficient on relative production be one. Specification 3 is the same as 2 except for using Wei's method of calculating distance.

The fact that the goods are purchased by final consumers rather than used as intermediates provides a much better explanation for the level of border effects than the NTBs identified by the European Commission.

We recognize, of course, that not all industries are subject to that interpretation of the causes of market fragmentation. It seems highly improbable, for instance, that there are large taste differences across countries for goods such as sugar. In addition, some intermediate goods industries like cement, wooden products, and forging rank among the highest border effects. We speculate that low volumes of trade in some of these industries may be the consequences of collusive industry practices, such as exclusive territories.

V-B The Evolution of EU Border Effects

We now turn to the analysis of changes in the border effect over time. We also investigate whether reductions in border effects since 1986 were higher in industries identified by the European Commission as having high NTBs. During the 1980s what was then the European Community expanded membership to include Greece (1981), Spain (1986), and Portugal (1986). Their change in status from outsiders to insiders could influence the temporal evolution of the border effect. To maintain a constant composition, we now restrict the sample to the nine first member countries. We first divide the sample into six sub-periods and use Heckman's two-stage method for each of these sub-periods. As in table 1, we impose a common set of coefficients on all 98 industries. The results by sub-period are presented in table 5, where we see that the border effect decreases over time in Europe. The implied ratio of imports from self to imports from other European countries starts at 20.9 in the late 1970s and falls to 12.68 after the SEA completion in 1993–5.

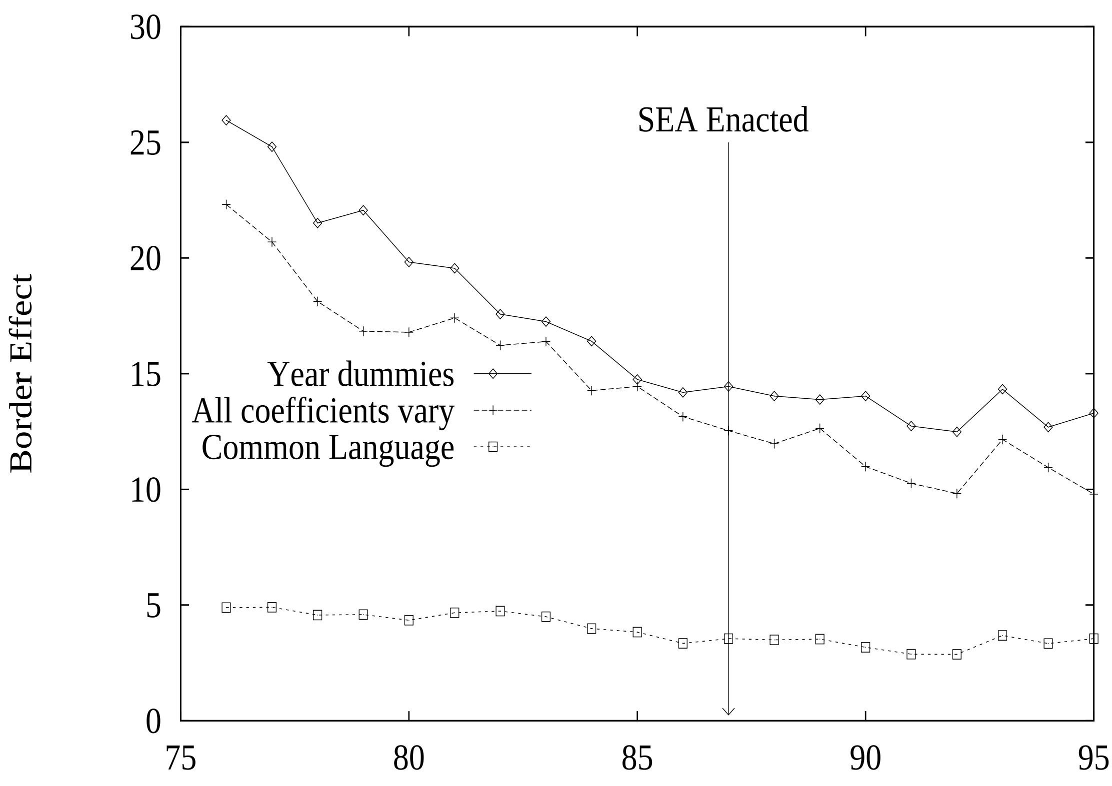
This year-by-year evolution of the border effect is better seen in figure 1. The line with square symbols shows border effects (exp(-intercept)) for a single regression where all coefficients are

Table 5: Border Effects for the EU9, 3-year Samples, Common Coefficient Regressions.

	Dependent Variable: Ln Partner/Own Imports					
Period :	[78–80]	[81–83]	[84–86]	[87–89]	[90–92]	[93–95]
Border	-3.04*	-2.99*	-2.79*	-2.65*	-2.41*	-2.54*
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.06)
Ln Rel. Production	0.80*	0.76*	0.77*	0.73*	0.75*	0.72*
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Ln Rel. Distance	-1.05*	-0.96*	-0.97*	-1.02*	-1.16*	-1.06*
	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
Ln Rel. Price	-0.87*	-0.55*	-0.18	-0.13	-0.22	-0.36*
	(0.08)	(0.13)	(0.11)	(0.09)	(0.09)	(0.06)
Common language	1.34*	1.27*	1.32*	1.26*	1.25*	1.14*
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Mills Ratio	-4.75*	-4.95*	-5.52*	-6.53*	-5.77*	-9.00*
	(0.72)	(0.77)	(0.79)	(0.89)	(1.02)	(1.14)
N	8052	7388	7729	8111	7736	7678
R^2	0.396	0.375	0.374	0.37	0.365	0.337
RMSE	1.89	1.825	1.815	1.735	1.746	1.808

Note: Standard errors in parentheses with * denoting significance at the 1% level.

Figure 1: Changes in the border effect 1976–1995



held constant from 1976 to 1995 except the constant, i.e. the line shows the coefficients on year dummies. This specification shows rapid initial decline in the border effect with relatively little movement since 1986. In fact, the year dummy for 1995 is not significantly different from 1986.

Holding all other coefficients fixed over time may not be reasonable. First, we might expect declines in transport costs to reduce distance coefficients. The results in table 5 do not provide much support for this hypothesis. They seem to indicate a ∪-shaped profile for distance costs. Second, knowledge of other European languages and notably English as a second language is increasing and might therefore reduce the trade-generating effects of both countries having a commmon language. Some evidence of this trend seems visible in table 5. The line with circle symbols is based on the intercepts (converted to McCallum-style border effects) for 20 annual regressions where every coefficient is allowed to vary across years. This method of showing annual border effects points towards greater decline in market fragmentation during the implementation of the SEA.

The line with triangles subtracts the common language effect from the border effect to obtain a hypothetical border effect for two nations that speak a common language. Thus it is comparable to border effects for Canada and the US. This line gives an idea of the level and evolution of border effects that might have prevailed if all members of the European Union had spoken the same language. After removing the effect of linguistic differences, the European Union appears to be substantially more integrated than North America.[13]

Note that in 1993 the border effect appears to jump up under all specifications. After 1992, the European Union could no longer rely on customs declarations for gathering trade data. The EU member countries adopted a new system called Intrastat in which companies report exports directly to their respective national statistical institutes. It is likely that Intrastat

[13] A potentially important caveat is that we use industry level data whereas existing work on Canada-US trade is at the aggregate level.

underestimates trade flows because not all companies report their exports. As the production data methodology did not change, there will be some upward bias in border effects since 1993 compared to previous years.

Finally we turn to the evolution of the border effect at the industry level. We saw in table 4 that the industries identified by the European Commission as characterized by higher than average NTBs were *not* the ones where the estimated border effects were higher prior to the SMP. A potential explanation would be that governments erected NTBs in those industries where "natural" border effects were small. Nevertheless, these industries could be the ones where the SMP most increased trade relative to domestic-products consumption. Thus, there may be a correlation between the initial importance of NTBs and subsequent *changes* in border effects.

The border effect is calculated for each industry the same way as for table 3 (Heckman procedure, unrestricted coefficient on relative production) for the periods 1984–86 and 1993–95. In order to keep enough degrees of freedom for individual industries, all EU12 countries are included, albeit with dummy variables for Greece, Portugal, and Spain. The change in the intercept is then regressed on the same measures of NTBs as in table 4.[14] The change in the border effect is also measured using 1990–92 as the final period in order to avoid any problems that could arise due to the switch to Intrastat.

None of the different measures of NTBs appear to explain changes in the border effect. Thus, our results suggest that the removal of different NTBs during the SEA implementation did not provide the greatest benefits to the targeted industries. In particular, the measures taken by the member countries did not lead to the expected rise in the ratio of trade over consumption of domestic products for those industries where high barriers to trade where supposed to cause

[14] As with the previous regressions of levels of border effects on NTBs, we use weighted least squares to take into account differences across industries in the precision of border effects estimates. The weights are the inverse of the square root of the sum of the variances of the initial and final border effects.

Table 6: Explaining Cross-Industry Evolution in EU Border Effects

Dependent Variable: Changes in Border Coefficients				
Model :	(1)	(2)	(3)	(4)
Final Period:	[93–95]	[90–92]	[93–95]	[90–92]
Intercept	-0.080	-0.935	-0.386^a	-0.410^a
	(1.10)	(1.010)	(0.112)	(0.103)
Standards Conflict	-0.002	0.004		
	(0.011)	(0.010)		
Govt. Proc. Bias	0.001	0.007		
	(0.011)	(0.010)		
Customs Burden	-0.005	0.003		
	(0.015)	(0.014)		
High NTBs			0.120	0.282
			(0.243)	(0.222)
Moderate NTBs			0.031	0.062
			(0.183)	(0.166)
Final Good	-0.206	-0.071	-0.187	-0.070
	(0.231)	(0.213)	(0.174)	(0.159)
N	93	93	98	98
R^2	0.022	0.014	0.014	0.018
RMSE	.772	.708	.773	.706

Note: Ordinary least squares weighted by the standard error of the border coefficient in the industry-level regression. Specifications 1 and 3 consider the evolution between 84-86 and 93-95 averages, specifications 2 and 4 consider the evolution between 84-86 and 90-92 averages .Standard errors in parentheses with ^{a}, ^{b} , and ^{c} denoting significance at the 1%, 5%, and 10% level.

an excessive aversion to foreign goods.

In addition, whereas differences in tastes among European consumers could be invoked to explain the level of border effects in the years 1984–1986, the fall in border effects does not seem to be larger in industries comprising mainly final goods.

VI Conclusion

We employ the monopolistic competition model of trade to estimate border effects for 3-digit industries in the European Union. Our results indicate wide variation in border effects across industries. The average effects are smaller than those estimated for the Canada-US border but still very large. For the average industry in 1985, Europeans purchased 14 times more from domestic producers than from equally distant foreign ones. The tariff equivalent of the border for 1984–86 indicated by the most conservative estimation method is 36%. Since actual tariffs and quotas within the EU were phased out by 1968, the border effects must stem from another cause. Our model decomposes border effects into a part due to government actions that impede trade, i.e. non-tariff barriers, and consumer preferences for domestically made products, i.e. home bias. We find that indicators of the non-tariff barriers identified and eliminated by the Single Market Programme cannot explain cross-industry variation in the pre-SMP border effects. To some extent, the magnitude of market fragmentation before the launching of the SEA is found to be larger for personal consumption goods, a result consistent with our argument that border effects are more linked to variety in tastes than to formal barriers to trade. While the impact of borders has declined over time, the reductions began at least a decade before the SMP. Furthermore, during the SEA implementation there is no relation between industry-level declines in border effects and indicators of NTBs. Consequently, our results provide indirect evidence for the consumer bias explanation of border effects.

VII Data appendix

This paper requires bilateral trade and production data in a compatible classification for 12 European countries over the period 1976–1995. The data were obtained from two Eurostat databases which disaggregate production and trade data to the 3-digit level. The Eurostat industry classification permits the use of previous work on trade impediments in Europe. The European Commission evaluated for instance the NTBs in Europe for the year 1985 at the NACE 3 digit level.

The production data for European countries is part of the VISA database, mainly consisting of the annual survey structure and activity of industry which collects many information on European countries' industries such as the number of firms, employment, and wages. The data covers all manufacturing and consists of 120 NACE 3digit industries.

The bilateral trade data is taken from the COMEXT database. The European trade data made available by Eurostat in this database is separated in two periods : 1975-1987 and 1988-1995. For the second period, a conversion of trade flows from the HS 8 digits to the NACE 3 digits classification is available. However, for the first period, only the 6 digits NIMEXE classification is available. Therefore a concordance table from NIMEXE to NACE constructed by Eurostat (available at `http://www.haveman.org`) was used to aggregate the more than 10,000 NIMEXE codes into 113 NACE industries. Consistency of the flows between the two periods was checked by verifying that the industries' total flows do not exhibit large jumps between 1987 and 1988 and that the trend does not systematically change between the two periods. The two concordances appear to be consistent with regard to both criteria.

Production data

The VISA database is mainly based on an annual survey conducted by member countries following Eurostat directives. The annual results only report the data for firms over 20 employees (except for Spain which reports data for all firms). Comparability between trade and production data would be threatened since the trade data includes exports of small firms. The underestimation of the production variable entailed by this restriction would result in an underestimation of trade with self in each country and industry.

Every 5 years member countries conduct a survey including enterprises with less than 20 employees (*Enterprises in Europe, Fourth Report, Small and Medium-sized Enterprises* database). We used this data to calculate for each country and each industry the production share of firms with less than 20 employees . The quality of the data by size classes varies depending on the country. Number of firms, total employment, turnover, value added and labor costs are the variables covered by the survey at the 3-digit level for 9 size classes. Turnover was the retained variable for the ratios calculation due to its proximity to production value. Turnover was however not available for Italy, so salaried employment was used in this case to calculate the share of firms with less than 20 employees in each industry. The industrial detail level used was the finest available: 3 digits when possible, 2 digits otherwise.

Regional data

The regional data used to calculate distances in this paper were extracted from the REGIO database also published by Eurostat. The indicator used to calculate weights was the GDP of regions in 1985 for destination regions. This variable is available at several levels of geographic disaggregation called NUTS. It goes from NUTS 0 which defines countries to the NUTS 5 city level (a little less than 100,000 NUTS units are defined under this last classification). For each country we chose the lowest degree of disaggregation that provides a reasonable number of sub-national regions. The geographic level of disaggregation is NUTS 1 for all large countries, NUTS 2 for Portugal, and NUTS 3 for Ireland. This leaves us with 77 regions. GDP is available for all the European regions we consider except those in Ireland for whom we used population as the weight.

The weights for origin regions use 2-digit industry-level employment data. The regional employment data for each industry is taken from the Structure and activity of industry database (regional data). The data spans over the 1985-1995 period. The procedure used has been to take the first year for which the data was available for all regions of the considered country/industry combination. For some country/industry combinations, there is no year for which the data is complete (employment available for all regions). In that case we 1) kept the employment of the considered combination for the year where data was most complete and 2) filled up missing figures using the available figures for other years.

The distance between two regions was calculated as the distance between the main city of each region, taking the longitude and latitude of each city and applying the greater circle formula. We use the disk approximation described in the text to calculate the internal distances of regions (.376 times the square root of the area). For reasons of both data availability and economic relevance, the French départements d'outre mer, Portuguese Azores and Madeira, and the Spanish Canarias (which are all islands of very little economic weight but very large distance to the European continent) were excluded from weighted distance calculations. Table 7 gives our bilateral distances (calculated using GDPs as weights for both countries of origin and destination) compared to the ones obtained by simply taking the distance between the economic center of each country and applying Wei's (1996) procedure for internal distance.

Prices

We obtained production price indexes for all NACE 3-digit industries from The VISA database. These indexes include exchange rate movements but they are expressed relative to country specific base years, leading to non-comparable levels. We used aggregate price levels from the Penn World Tables `http://nber.org/pwt56.html` for the first year of the sample

Table 7: Distances between European countries

	FR	BE	NE	GE	IT	UK	IR	DK	GR	PO	SP
FR	**247** (**47**)										
BE	292 (*189*)	**41** (**21**)									
NE	376 (*270*)	104 (*83*)	**59** (**21**)								
GE	411 (*258*)	221 (*103*)	227 (*113*)	**183** (**26**)							
IT	550 (*398*)	608 (*454*)	674 (*516*)	515 (*414*)	**239** (**99**)						
UK	415 (*212*)	308 (*194*)	315 (*220*)	503 (*296*)	880 (*594*)	**143** (**48**)					
IR	593 (*486*)	544 (*474*)	547 (*470*)	738 (*570*)	1093 (*880*)	270 (*291*)	**86** (**73**)				
DK	696 (*603*)	435 (*414*)	346 (*336*)	392 (*366*)	861 (*739*)	577 (*526*)	778 (*682*)	**68** (**84**)			
GR	1218 (*1306*)	1236 (*1314*)	1271 (*1348*)	1076 (*1236*)	711 (*911*)	1533 (*1487*)	1762 (*1778*)	1310 (*1404*)	**144** (**228**)		
PO	811 (*904*)	1022 (*1088*)	1108 (*1162*)	1156 (*1161*)	1096 (*1049*)	970 (*989*)	931 (*1023*)	1449 (*1497*)	1713 (*1778*)	**100** (**157**)	
SP	566 (*518*)	786 (*691*)	879 (*774*)	876 (*718*)	751 (*453*)	836 (*710*)	893 (*917*)	1209 (*1084*)	1362 (*1170*)	396 (*627*)	**260** (**113**)

Note: All distances in miles. Abbreviations for countries are the following: FR: France, BE: Belgium, NE: Netherlands, GE: Germany, IT: Italy, UK: United Kingdom, IR: Ireland, DK: Denmark, GR: Greece, PO: Portugal, SP: Spain. The figures in parentheses are the distances measured between the major city of each country. Internal figures in parentheses are equal to one quarter the distance to the nearest neighbor.

(1976) and then apply the 3-digit price indexes to determine changes in industry-level prices relative to the base year for each year after 1976.

Non-Tariff Barriers

The data on non tariff barriers is taken from two major sources. One is the paper by Buigues et al (1990) identifying the level of NTBs in Europe for 1985 for each 3-digit NACE industry. These authors isolated 14 industries characterized by high NTBs and 26 with moderate ones out of the 120 industries. We also used the results of the questionnaire completed by 11,000 European firms and conducted by the European Commission as part of the "Cost of Non-Europe" project (volume 3). The question we use is how desirable the firms find the removal of trade barriers. Eight types of barriers are stipulated and firms are asked to rank the removal of each barrier from "very important" to "satisfaction with the present situation". Coefficients of importance are then calculated ranging from 0 if all companies considered the removal to be of little or no importance to 100 if all firms considered the removal very important. This enabled us to construct three variables (out of the eight proposed in the questionnaire) accounting for the benefit of removal perceived by firms and thus, implicitly, the trade impact of the NTBs. The three variables correspond to the three main NTBs identified by the Commission in the 1985 white paper: Differences in standards, national preference in public purchases and customs formalities.

Final goods vs. Intermediate goods

We use data from the "Benchmark Input-Output Accounts for the U.S. Economy, 1992, Table 2.1" from the November 1997 issue of *Survey of Current Business* for the United States to determine the share of apparent consumption destined to personal consumption. This dataset has the advantage of a large number of industries relative to the Input-Output data available from Eurostat. We matched the US classification system for this input-output table with NACE industries in order to calculate a "finality" index for each NACE 3 digit industry. This index is (Personal Consumption Expenditures)/(Output-Exports+Imports).

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