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# THE EXTENT OF ECONOMIC INTEGRATION IN EUROPE:

## BORDER EFFECTS, TECHNICAL BARRIERS TO TRADE & HOME BIAS IN CONSUMPTION

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**Abstract**

This paper brings together two important facets of current debates concerning trade policy and trade modelling: the importance of estimated border effects and the impact of technical barriers to trade. Here we try and identify the effect of technical barriers on the imports of EU countries by estimating gravity equations applied to data in which sectors are grouped according to the approach adopted by the EU to the removal of technical barriers (New Approach, Old Approach, mutual recognition) as well as an aggregate of sectors for which technical barriers are deemed to be unimportant. Our results suggest substantial border effects for all groups of sectors except for those subject to mutual recognition. The border effect is mitigated but remains considerable against trade with EU partners. High and persistent border effects are found for sectors where technical barriers are not important suggesting that factors other than policy-induced barriers are important determinants of the intensity of internal relative to external trade flows. The paper discusses the interpretation of these border effects in the context of measuring the extent of economic integration and argues that more information on the nature of preferences and on factors promoting local networks of buyers and suppliers is required before we can proceed to examine the policy implications.

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# The Extent of Economic Integration in Europe:

## Border Effects, Technical Barriers to Trade and Home Bias in Consumption

**Paul Brenton and Marc Vancauteren**

### 1. Introduction

This paper seeks to bring together in an empirical study two issues which are at the top of the agenda of trade policy discussions and at the forefront of research on trade modelling. Specifically, we consider for EU countries the magnitude of what have been called 'border effects', the extent to which internal trade exceeds international trade after controlling for the economic determinants of commerce. The size of the border effect has been used as an indicator of the extent of economic integration relative to the benchmark of perfect integration, defined as when the propensity for international trade is the same as that for internal trade. In addition we consider this issue in the context of the impact of regulatory policies on international trade flows. We look at the extent of economic integration for sectors grouped according to whether technical regulations are important and then by the approach adopted by the EU to remove technical barriers to intra-EU trade.

The importance of regulatory policies in trade policy discussions has risen in recent years. Of these regulatory issues technical barriers to trade arising from differences in national product standards and duplication of conformity assessment procedures are of primary importance. This reflects the increasing number and coverage of product standards and that as tariffs and quantitative restrictions have been progressively removed over the past 40 years the effect of these "inside the border" policies have become more visible.

Technical barriers to trade have been addressed in the GATT and the WTO. There are also a number of recent initiatives at the bilateral level. The EU has recently signed mutual recognition agreements with Australia, Canada New Zealand and the US to avoid duplication of product testing and conformity assessment for a number of products. However, the most profound attempts to address technical barriers to trade

have been made within the EU. One of the central objectives of the Single Market Programme of the EU is the removal of such barriers to trade within the EU. It is worth noting that since all tariffs and quantitative restrictions have been removed on (non-agricultural) trade between the EU and the Central and Eastern European countries, the key impact of the next enlargement on trade will be via access to the Single Market and the removal of technical trade barriers.

The principal mechanisms used by the EU to achieve the Single Market have been the principle of mutual recognition, whereby an product lawfully produced and sold in any one EU member must be given free access to all other EU markets, and where this fails through the use of harmonised standards. Prior to the Single Market, the dominant (now "old") approach in the EU was one of very detailed harmonisation subject to unanimity in the EU Council. This approach failed in that the number of new regulations appearing in the 1980s far exceeded the rate at which harmonised regulations were being generated. This led to the "new" approach, whereby technical barriers to trade are removed by the setting of minimum standards on the basis of majority voting.

In this paper we seek to estimate the extent to which the EU approach to technical harmonisation has affected the pattern of bilateral trade flows of individual EU countries. Empirical assessments of the impact of technical barriers and their removal are very rare and those that are available typically take the very unsatisfactory approach of assuming that technical barriers raise trade costs by a certain ad hoc proportion.

Here we use the gravity model of international trade flows to assess whether increasing integration in the form of the removal of technical barriers to trade has had a significant impact on the magnitude of estimated border effects in European countries. The model is applied to data that identifies separately sectors subject to the different approaches to the removal of technical barriers in the EU. The paper continues in Section 2 by briefly describing the EU approach to the removal of technical barriers to trade. Section 3 discusses the empirical approach and then the data that are used to examine the impact of technical barriers to trade in the EU. Section 4 presents our results, whilst Section 5 discusses the interpretation of the estimated border effects and the extent to which they may reflect the impact of policy induced restrictions or are the result of factors such as differences in preferences across countries and natural constraints which favour local

networks of suppliers and buyers. The final section presents some conclusions regarding measurement of the current and potential level of integration in the EU and globally.

## 2. The EU Approach to Technical Barriers to Trade

Technical barriers to trade (TBTs) can arise when exporters have to comply with requirements for, amongst other issues, health, safety, environmental and consumer protection that differ from those in the domestic market. The need to adapt product design, re-organise production systems, and the costs of multiple testing and certification can entail significant additional costs for suppliers of exported goods to a particular country. These requirements can be imposed by both governments (technical regulations) and non-governmental organisations (non-regulatory barriers, standards). Technical regulations are characterised by their legal nature whilst non-regulatory barriers or standards are voluntary and arise from the self-interest of producers or consumers, for example, to improve the information in commercial transactions and ensure compatibility between products. Technical regulations relate to technical specifications and testing and certification requirements such that the product actually complies with the specifications to which it is subjected (conformity assessment). Technical regulations are the focus of this paper, although the boundary between mandatory and non-regulatory barriers is not always clear-cut (CEC (1998a)).

The height of the bars in Figure 1 show the share of EU imports in 1998 from each member state as well as applicant countries in Central and Eastern Europe in sectors which are categorised as being prone to technical barriers to trade.[1] This figure demonstrates that a very large proportion of intra-EU trade is in sectors affected by technical regulations. On average more than three-quarters of intra-EU imports are in sectors where differences in technical regulations are important. The significance of these sectors ranges from around 62 per cent of EU imports from Greece to 82 per cent of EU imports from Germany and 87 per cent of EU imports from Ireland.[2]

The removal of TBTs due to differences in technical regulations amongst member states is central to the creation of a Single Market in Europe. EU policy related to technical

[1] We discuss the source of this categorisation later in the paper.

[2] For a more detailed analysis see Brenton, Sheehy and Vancauteren (2001).

regulations and testing and certification requirements is currently based upon two approaches: enforcement of the Mutual Recognition Principle (MRP) and if this fails, the harmonisation of technical standards across member states. The basic EU approach under the principle of Mutual Recognition is that products manufactured and tested in accordance with the technical regulations of one member state can offer equivalent levels of protection to those provided by corresponding domestic rules and procedures in other member states. Thus, once a product is legally certified for sale in any one member state it is presumed that it can be legally placed on the market of any member state, and as such has free circulation throughout the whole of the Single Market. 'Mutual Recognition' tends to apply where products are new and specialised and it seems to be relatively effective for equipment goods and consumer durables, but it encounters difficulties where the product risk is high and consumers or users are directly exposed.

Where 'equivalence' between levels of regulatory protection embodied in national regulations cannot be presumed, the EU has sought to remove TBTs through agreement on a common set of legally binding requirements. Subsequently, no further legal impediments can prevent market access of complying products anywhere in the EU market. The initial approach adopted in the EU to harmonising technical specifications was based upon extensive product-by-product or even component-by-component legislation carried out by means of detailed directives. Now known as the 'old approach' this type of harmonisation proved to be slow and cumbersome. In the 1980s the ineffectiveness of this approach was recognised when it became apparent that new national regulations were proliferating at a much faster rate than the production of harmonised EU directives (Pelkmans (1987)).

This failure arose because the process of harmonisation had tended to become highly technical as it sought to specify individual requirements for each product category (including components). This resulted in extensive and drawn-out consultations. In addition delays arose because the adoption of old approach directives required unanimity in the Council of Ministers. As a result the harmonisation process proceeded extremely slowly. The old approach applies mostly to products (chemicals, motor

vehicles, pharmaceuticals and foodstuffs) by which the nature of the risk is clearly apparent.

In the 1980s it became increasingly recognised that there was a need to reduce the intervention of the public authorities prior to a product being placed on the market. A key element in the plan to create a Single Market in Europe was the adoption of the 'new approach' to technical harmonisation under which directives can be adopted by the Council on the basis of majority voting. The new approach applies to products that have "similar characteristics" and where there has been widespread divergence of technical regulations in EU countries. The key feature of this approach is that it only indicates 'essential requirements' and leaves greater freedom to manufacturers on how to satisfy those requirements, dispensing with the 'old' type of exhaustively detailed directives. The new approach directives provide for more flexibility by using the support of the established standardisation bodies, CEN, CENELEC and the national standard bodies so that the standardisation work is achieved in a more efficient way, is easier to update and involves greater participation from industry. In addition, the new approach is characterised by the use of market surveillance and the choice of attestation methods that are available: by self-certification against the essential requirements, by using generic standards or by using notified bodies for type approval and testing of conformity of type.

## 3. Modelling the Impact of Technical Barriers to Trade

### 3.1 Overview

Modelling the impact of tariffs and quantitative restrictions is relatively straightforward, both raise the costs of traded goods relative to domestic substitutes driving a wedge between international and internal prices. Given normal demand and supply curves the removal of such barriers will stimulate the volume of trade. To date the principal estimates of the impact of technical barriers have been based upon the same methodological approach, although precise estimates of the impact of technical barriers to trade on costs are not available.

Using calibrated simulation models or estimated demand schedules, researchers typically assume that technical barriers result in an (ad hoc) increase in trade costs. For

example, Gasiorek, Smith and Venables (1991) and Brenton and Winters (1992a) in different exercises assume that the completion of the Single Market implies a 2.5 per cent reduction in trade costs for all EU members. This assumption also encapsulates the impact of the removal of internal border controls and (supposedly) the end of bias in government procurement decisions. More recently, Francois (1998), takes accession to the EU for CEECs to entail an across the board reduction in trade costs of 10 per cent. These studies provide ex ante predictions rather than careful ex post analyses of what actually happened following harmonisation of technical barriers to trade.

An alternative, and widely used, approach to modelling the impact of economic integration is to use the gravity model.[3] This provides an explanation of bilateral trade flows with the impact of integration being identified through the use of country and country group specific dummy variables that pick up deviations from the 'normal' pattern of trade. This obviates the need for precise estimates of the impact of trade barriers on costs. Thus, for example, the impact of the EU on trade can be measured via a dummy variable for all bilateral trade flows between EU member countries. This measures the extent to which trade between EU members is higher than 'normal' as determined in the gravity model by the income and proximity of trading partners.

Recently, following initial work by McCallum (1995) the gravity model has been used to assess the extent of 'border effects' in terms of the propensity for trade within a country to exceed international trade. McCallum reports results suggesting that Canadian provinces are more than twenty times more likely to trade amongst themselves than they are to trade with US States after allowing for economic size and distance between economic centres. The dataset used by McCallum appears to be unique in identifying trade amongst the regional subsets of two trading partners. For other countries researchers have attempted to identify border effects by including in the gravity model observations for home sales and identifying the border effect via a dummy variable for those observations. Nitsch (2000), for example, finds evidence of substantial border effects in Europe, with internal trade being on average larger by a factor of ten than trade with EU partners, and that the magnitude of this effect declined

[3] This approach to modelling economic integration was instigated by Aitken (1973) and subsequently followed by many others.

during the 1980s. As we shall discuss in more detail below it is important to clarify what is meant by the border effect. For now we simply note that in the context of the gravity model the dummy variable for home sales could capture the effects of a range of factors which constrain trade relative to domestic exchanges. These include border trade barriers, differences in regulatory regimes, for example, regarding technical regulations, differences in institutional and legal frameworks, which generate insecurity for international traders[4], as well as differences in preferences.

Head and Mayer (2000) apply a gravity approach to sectoral data for the EU countries and then assess whether there is any correlation between the size of the estimated border effect and a crude classification of sectors according to the magnitude of non-tariff barriers. They find that the indicator of non-tariff barriers cannot explain the variation across industries in the size of estimated border effects and that there is no relation between declines in the size of the border effect since the creation of the Single Market and indicators of NTBs. They conclude that bias in preferences towards domestically produced goods must underlie the border effects that were identified.

Here we start from sectoral data but differentiate sectors into broad groups according to a more recent classification which specifically identifies sectors according to whether differences in technical regulations amongst countries are important or not, and if so, by the approach adopted within the EU to the removal of technical barriers to trade, the old approach, mutual recognition and the new approach. We then apply the gravity model to these separately identified groups of sectors and look for differences in border effects between the different groups of sectors and also whether the magnitude of these effects has declined over time.

Unlike Nitsch we use the gravity model to explain the pattern of bilateral trade flows of EU countries with countries throughout the world, not just trade amongst EU partners. Hence, we are also able to assess whether the intensity of intra-EU trade flows relative to external imports differs across our different groups of sectors and whether the magnitude of this intra-EU affect has changed over our sample period. To summarise the objectives of this paper we look to see whether:

[4] See Anderson and Marcouiller (1999).

- There are significant differences in the parameter values of the gravity model when applied to sectors where technical regulations are not deemed to be a potential barrier to trade, to sectors where technical regulations are important, and within this latter group whether there are differences between sectors according to the approach adopted in the EU for the removal of technical barriers to trade.
- To see whether there are differences in the size of estimated border effects between the different groups of sectors and whether the magnitude of the border effect has changed over time. Within this we wish to investigate whether
  - the degree of the border effect is lower for sectors which have already been subjected to the harmonisation of technical regulations, old approach sectors
  - sectors subject to the new approach in the EU, where we might expect the impact of economic integration in the form of the Single Market to be strongest, have experienced the greatest fall in the border effect during our sample period of 1988 to 1998. The policy environment in sectors subject to detailed harmonisation under the old approach has changed little over this period.
- Whether the impact of the preferential treatment of imports from EU partners relative to third countries differs across our groups of sectors and whether there are any definite patterns of change in this EU effect over time.

## 3.2 Data and Econometric Approach

### 3.2.1 The Sectoral Incidence of Technical Barriers

We utilise information on the sectoral incidence of technical barriers and the particular approach adopted by the EU to their removal. The data come from the detailed study undertaken for the Commission's review of the impact of the Single Market in the EU (CEC (1998)). This study provides information, at the 3-digit level of the NACE classification (about 120 manufacturing industries), of whether trade is affected by technical regulations and the dominant approach used by the Commission to removal

such barriers in the EU.[5] For sectors where technical regulations affect trade, the study classifies them as those where the barriers are overcome using mutual recognition (MR), and those sectors where mutual recognition is insufficient or unsuitable so that either the old approach (OA) or the new approach (NA) to overcoming technical barriers is used. For these sectors it is assumed that all trade is affected by the technical regulations and by the identified approach to the removal of the barriers. There are however, a small number of sectors where a combination of approaches is identified. In the main, we ignore these in the analysis that follows.

### 3.2.2 The Gravity Model

The gravity model is a well-known and widely applied model of bilateral trade flows. The essence of the model is that trade between two countries is promoted by their economic mass and constrained by the friction between them. Friction is generated by trade costs, such as the costs of transportation, which are usually proxied by physical distance. The theoretical underpinning of the model is broad but imprecise. A number of recent applications of the model are motivated by an application of monopolistic competition models of trade (see, for example, Anderson and van Wincoop (2000)) although Deardorff (1995) has shown that gravity type equations are also consistent with a Heckscher-Ohlin approach and indeed that "just about any plausible model of trade would yield something very like the gravity model, whose empirical success is therefore not evidence of anything, but just a fact of life". We return to discuss the theoretical framework of the gravity model and how this affects the interpretation of measured border effects later.

We estimate the following equation:

$$\ln X_{ij} = a + b_1 \ln GDP_i + b_2 \ln GDP_j + b_3 \ln D_{ij} + b_4 \ln R_i + \sum_{ijk} g_{ijk} DUM_{ijk}$$

where

[5] Trade data according to the NACE classification were obtained from the COMEXT database. The NACE is the industrial classification used by the Statistical Office of the European Communities (Eurostat). A detailed definition of the classification is presented in NACE Rev. 1, Statistical Classification of Economic Activities in the European Communities, *Official Journal of The European Union*, L293, 1996.

$X_{ij}$ is the value of imports by country *i* from country *j*;

$GDP_i$ is the level of income in country *i*;

$D_{ij}$ is the distance between the trading centres of the two countries.

$R_{ij}$ is the remoteness of country *i* in relation to all trading partners with the exception of country *j*. The more remote is country *i* from other partners the greater the amount of trade with country *j*.

$DUM_{ijk}$ are a set of *k* dummy variables. In this exercise separate dummy variables are included to reflect the effects of adjacency between *i* and *j*, if both *i* and *j* are members of the EU, if there is a free trade agreement between *i* and *j*, and to reflect the size of the border effect ($j = i$).

The economic variables in the gravity model (incomes, distance and remoteness) define the 'normal' level of trade. On the assumption that the gravity model is well specified the dummy variables capture systematic deviations from this normal pattern of trade due to physical adjacency, trade policies (such as economic integration agreements) and the border effect.

### 3.3.3 Description of the Data

Our data set compromises trade flows for 1988, 1992, 1994 and 1997 between each of nine EU countries (Belgium and Luxembourg are treated as one) and a sample of developed (including EU partners) and developing countries. We derived the trade data according to the NACE industrial classification. Trade in each sector was then aggregated into our four broad groups of new approach sectors, old approach sectors, mutual recognition sectors, and sectors where differences in national technical regulations do not constrain trade flows, according to the classification in CEC (1998)). Countries were excluded from the sample if there were zero entries in our different categories of aggregate sectors. The number of countries in the sample differs across years primarily due to the integration of the former Comecon countries into the world economy during the 1990s.

We use a definition of remoteness that has been commonly used in the gravity literature (Wei(1996), Nitsch(2000), Deardorff(1998), Soloaga and Winters(2000)). The

remoteness of importing country *i* in relation to trading partner *j* is given as the weighted average distance between country *i* and all trading partners other than *j*, where the weights are given by the GDP of the trading partners:

$$R_{ij} = \sum_{k \neq j} D_{ik} / GDP_k$$

Domestic sales are given by the differences between domestic production and the value of exports. Internal distances *dii*, are taken from Head and Mayer (2000) and which were calculated by using the disk area procedure to obtain the average distance between economic centers. For distances between countries *dij*, we follow the conventional method in the gravity literature and measure the direct (great circle) distance between the economic centres (capital cities).

For our sample years we extracted production data from the EUROSTAT New Cronos database with reference to the domain of the 'business structural database'. Observations "covering enterprises with 20 persons employed and more", in NACE revision 1 were converted to NACE70 so as to provide a consistent series and to match the trade data..

## 4. Econometric Results

We start our discussion of results by presenting in Table 1 an application of the gravity model to total imports of the 9 EU countries in our 4 years, 1988, 1992, 1994 and 1997. This gives us an impression of the magnitude of the border effect in aggregate before we proceed to the more disaggregate analysis and provides for a comparison with previous studies. The estimated coefficients on the economic variables, GDP and location, are all significant, and strongly so with the exception of distance in 1994. The magnitude of the coefficient on the distance variable is typically smaller than in previous studies, where the consensus estimate is 0.6 (see Leamer (1997)).

However, these studies usually do not include a variable for remoteness and make no allowance for home sales and the border effect. Our results on the distance variable differ from those of Nitsch (2000) who obtains a much larger coefficient on distance but a small and barely significant impact of remoteness. This probably reflects that Nitsch's

sample only includes trade between EU countries where variation in remoteness is more limited than in our broader sample of trade partners for the EU countries.

These aggregate results suggest strongly significant and large border effects. These effects are mitigated for EU partners but not for trading partners who have signed a free trade agreement with the EU, with the exception of 1994. The estimates suggest that in 1988 internal trade within individual EU countries was more than 25 times more intensive than those countries' trade with partners in the rest of the world after taking into account incomes, distance and remoteness. On the other hand internal trade was 9 times more intensive than trade with EU partners (derived as the exponential of the difference between the coefficients on the home and the EU dummy variables). The level of the border effect was slightly lower in 1997, but the impact of EU membership in dampening the border effect had waned somewhat relative to 1988.

However, it is worth noting the increase in the border effect in 1994. This may reflect the change in the recording of trade in Europe after 1992 from customs documentation to VAT returns. This may have removed some of intra-EU trade that was being recorded prior to the removal of border frontiers in 1992. Hence, it not certain that we can make precise comparisons between the magnitude of the estimated border effect over time. Nevertheless, in our final year, 1997, the magnitude of the border effect against third countries was a factor of twenty-two whilst internal trade was 13 times more extensive than trade with EU partners. Our estimates of the border effect in the EU are slightly larger than in previous studies (Head and Mayer (2000) and Nitsch (2000)).

We now turn, in Table 2, to the results of applying the gravity model to two broad sectoral aggregates, those where technical regulations do not cause barriers to trade and the sum of sectors subject to the new approach, the old approach or mutual recognition, sectors where differences in national regulations are important. The income variables are strongly significant for both groups of sectors in all years. The income effect for the exporter is larger for sectors subject to technical regulations than for sectors with no technical barriers to trade. The same is true for importer GDP in the last two years of our sample. Hence, the share of sectors where differences in technical regulations are important is likely to increase over time as incomes rise. In general distance and remoteness are significant but the magnitudes of the coefficients are not stable across

the different years of our sample. Adjacency is not important in sectors where technical regulations are important, but is significant for the other group of sectors.

The estimated parameters for the border effect are large and strongly significant in all years for both groups of sectors. There is some suggestion of a decline in the magnitude of the border effect for sectors where technical regulations are important, although there was a big jump in the magnitude of the border effect in 1994. The border effect for sectors where there are no technical barriers seems to be larger and more persistent. Being a member of the EU mitigates the dampening effect of the border on trade whilst the dampening effect of the border on intra-EU trade is greater for sectors with no technical barriers to trade. The magnitude of the EU preference relative to the border effect for non-EU partners has, with the exception of 1994, remained relatively constant for sectors with technical regulations but has fallen a little for sectors with no technical barriers.

Thus, we find no evidence that the Single Market has increase the intensity of intra-EU trade relative to internal trade for products where differences in technical regulations are important, the focus of the Single Market Programme. For sectors where technical barriers are not important, globalisation and external trade liberalisation may have reduced the preferential treatment of imports from EU partners relative to non-EU countries but have done little to reduce the intensity of internal relative to external trade. Membership of a free trade agreement with the EU does little to offset the effects of the border for sectors with no technical barriers but has become important for sectors with important differences in technical regulations in the final two years. This may reflect the impact of the Single European Area (SEA) which granted access to the Single Market to EFTA countries, but is also likely to be the result of the foreign direct investment by EU firms in free trade partners in Central and Eastern Europe which stimulated trade in sectors such as machinery, where technical barriers to trade can be important. Much of this investment probably led to production consistent with EU standards.

Finally in Table 3 we provide results for the three groups of products where technical regulations are important, grouped according to the approach adopted in the EU to the removal of technical barriers to trade. In all three cases distance and incomes are strongly significant determinants of trade flows. The magnitude of the parameters on

income are broadly similar across the three groups of sectors whilst distance has a much greater dampening effect on trade in mutual recognition products. Remoteness is significant for Old Approach products but, in general, not for those under the New Approach and mutual recognition.

The border effect is large and strongly significant for New and Old Approach products but is smaller and not always significant for products under mutual recognition. Being a member of the EU partly offsets the border effect for the New and Old Approach products but not for mutual recognition products. However, the intensity of internal trade relative to EU trade has increased for New Approach sectors, exactly those sectors where we would anticipate that the impact of the Single Market would be most pronounced and has fallen only mildly for Old Approach products when 1997 is compared with 1988. However, it may be that the full impact on trade of directives issued during the 1990s under the New Approach has yet to be felt. Membership of a free trade agreement with the EU is important for New and Old Approach products but is insignificant for mutual recognition products.

Thus, these results suggest that the border effect is important but that the extent of this bias against trade with third countries relative to internal trade and its magnitude towards EU partners varies according to the approach to the removal of technical barriers in the EU. We find no evidence of an increase in the intensity of intra-EU relative to internal trade for New Approach sectors. However, we would argue that these results should be treated with a degree of caution. There are very few studies that have addressed the issue at the heart of this paper so that suitable comparisons by which to assess the robustness of the results presented here are not available. At present we would conclude that the presence of the border effect appears to be relatively robust, being consistently found in several studies, but the precise magnitude of this estimated border effect is uncertain. We also anticipate that the estimates may suffer from the presence of errors in measurement in internal distances, although the use of alternative measures did not generate substantially different results.[6]

[6] We also checked the robustness of the results by instrumenting the income variables by population. Again, the results were very similar to those obtained using OLS.

## 5. Interpreting the Border Effect and the Link to Economic Integration

As in this paper, a number of authors have found evidence of substantial border effects so here we spend a little time reflecting on exactly what the border effect means and what the dummy variable we have called the border effect might actually be measuring. It is here that the fragility of the theoretical underpinnings of the gravity model proves to be a hindrance. Firstly, however, we wonder if the architects of closer economic relations in Europe might have been a little perplexed to be told that after over forty years of closer integration European consumers may still be around 10 times more likely to choose domestically produced products than substitutes available from partners. This is perhaps even more surprising since the creation of the Single Market in Europe is supposed to have led to substantial convergence of prices across European markets.

The key issue regarding the estimated levels of the border effect is to what extent they reflect genuine policy-induced constraints upon trade between countries or are primarily the result of natural economic factors. First of all, the magnitude of the border effect that we, and others, have identified seems to be too large to be consistent only with the presence of trade barriers. The tariff equivalent of the estimated border effects depends upon the elasticity of substitution between domestically produced goods and imports. Taking a representative value of the border effect from this study of 3 and an elasticity of substitution of 20 generates a tariff equivalent of over 16 per cent, way in excess of the current levels of average tariffs in the EU of around 4 per cent. A lower value of the elasticity of substitution, nearer to that estimated in empirical studies leads to much higher tariff equivalents. For example, an elasticity of substitution of 10 generates a tariff equivalent of 35 per cent, an elasticity of five leads to a tariff equivalent of over 80 per cent. An elasticity of substitution of 1.5, still towards the upper end of empirical estimates, generates a tariff equivalent of over 600 per cent!

Further, in this project we have found larger and more persistent levels of the border effect for sectors where technical regulations do not constitute major barriers to trade. This is suggestive that factors other than regulatory policies are necessary in this case to explain the presence of the border effect. However, the fact that being an EU member appears to mitigate the effects of the border for these sectors is difficult to explain if

policy-induced barriers are not significant. We tentatively postulate here that for many of the sectors in this group external tariff barriers remain relatively high (textiles, clothing and footwear), which helps to explain why the border effect is higher than for other groups of sectors and that rules of origin are important. EU membership renders rules of origin redundant but they still act to constrain trade with free trade partners relative to home consumption. Satisfying rules of origin in these relatively low value-added sectors maybe costly.[7]

In a study of trade between US states, Wolff (1997) finds evidence of border effects within the US. Again, barriers to trade can not explain this phenomenon. For Wolff the explanation lies in the clustering of production within political boundaries. In this context our results would suggest that clustering within national boundaries in Europe is more prevalent in sectors where there are no regulatory barriers, which seems unlikely. Perhaps of greater relevance is the argument of Rauch (1996) that the nature of most manufactured products, in terms of differentiation by characteristics and quality, precludes the matching of buyers and sellers in organised exchanges. As a result, agents indulge in a costly search process leading to the establishment of trading networks. Search costs are limited by proximity and existing links within a network. The spread of such networks across national boundaries will also be constrained by differences in legal systems and the uncertainty that this can generate, including insurance for transactions which is much easier for national commerce rather than for international trade. In addition, differences in language, currencies and culture are amongst a range of factors that may promote national networks rather than international trade. Some of

[7] There is little direct evidence on the costs of satisfying rules of origin. However, snippets of information suggest that they may be significant. A large proportion of EU imports that are eligible for preferential treatment under the GSP do not actually benefit from reduced duties. Sapir (1998) reports that 79 per cent of dutiable imports from GSP beneficiaries in 1994 qualified for preferential access to the EU market, yet only 38 per cent actually entered the EU market with a duty less than the MFN rate. One of the reasons for this difference being the effects of rules of origin. Unfortunately data are not generally available on the amount of trade from free trade partners which is not accorded duty free treatment. However, Herin (1986) reports that in the 1980s for about one quarter of trade between the EU and EFTA duties were paid to avoid the costs of proving origin. In 1999 around one fifth of EU imports of footwear from Central and Eastern European countries were declared as being after outward processing yet the EU duty on imports of footwear from these countries was zero. Hence there was no fiscal incentive to declare goods for outward processing. One explanation seems to be that by declaring goods for outward processing producers in the EU avoid difficulties in proving origin when the goods are reimported.

these factors, such as differences in the legal environment, could be addressed by policy makers. But it is first necessary to identify how important they are in actually constraining trade relative to other possible factors, such as differences in consumer preferences, and whether intervention could be effective. In this regard we return to the gravity model to see if any further light can be shed on this issue.

Deardorff (1995) and Anderson and van Wincoop (2000) show that after controlling for economic size, bilateral trade will be determined by bilateral trade costs relative to average or multilateral trade costs. These, and almost all other theoretical derivations of the gravity model, are based upon CES representations of underlying preferences. This imposes homotheticity on preferences and makes the derivation of gravity type equations tractable and feasible since all countries will consume all products in the same proportions. However, homotheticity is an extreme assumption which has received regular empirical rejection.[8]

Deardorff (1995) shows how in a simple frictionless world that non-homotheticity will lead to deviations in bilateral trade flows from that suggested by country size. In essence bilateral trade will be more intense than economic size suggests where an exporting country produces goods for which demand is more intense than on average in the importing country. In low income countries necessities will form a higher proportion of the consumption bundle than on average whilst in high-income countries it is luxury goods that will be consumed in higher proportions than on average across the world. Countries which specialise in producing luxury goods are likely to trade more intensively with rich countries than economic size would suggest. These are likely to be other rich countries.

Further, if along the lines first suggested by Linder (1961) new products are first introduced by firms in response to domestic demand and, if as is likely, new products are (at least initially) highly income elastic in high-income countries, then such countries are likely to consume a higher proportion of domestically produced goods to

[8] "Empirical evidence is abundant that the Santa Claus hypothesis of homotheticity in tastes and in technical change is quite unrealistic. Therefore we must not be bemused by the undoubted elegances and richnesses of the homothetic theory…. We must accept the sad facts of life and be grateful for the more complicated procedures that economic theory devises" Samuelson and Swamy (1974) as quoted by Reinsdorf (1998).

foreign produced goods than would be suggested by that country's share of world income alone. Thus, since countries specialise in producing those goods that are consumed relatively intensely at home, internal trade will be greater than that suggested by economic size alone. This implies that some of the deviation of trade flows from the magnitude predicted by economic size which authors such as Wei (1996) and Anderson and van Wincoop (2000) attribute to trade frictions may be, at least in part, due to non-homotheticities in demand.

This suggests that demand and incomes matter for trade. So far we have assumed that although non-homothetic tastes are everywhere identical. A further step is to assume that there are differences in preferences across countries and within this that consumers are biased towards home produced goods.[9] Specifically home bias entails that (at least) some of the parameters in the utility function differ across countries so that at given relative prices and incomes the ratio of consumption of home produced goods to foreign produced goods is higher in the home country than in the foreign country (Warnock (2000)). Such bias in preferences has been recognised by legislators in Europe as a distinct possibility. The Court of Justice has ruled that mandatory labelling of goods with their national origin is not consistent with Community law since this would have an effect equivalent to a quantitative restriction. The Court felt that marks of national origin would 'prompt the consumer to give his preference to national products', and would thus contribute to 'slowing down economic interpenetration in the Community'.[10]

Clearly, if consumers were completely rational in a strict neo-classical economic sense, and made their choices only on the basis of relative prices and their income, then such rulings would not be necessary. So, if consumers are able to ascertain the national origin of products then some of the estimated border effects in applications of the gravity model will reflect the presence of home bias in preferences. In fact, whilst there are no mandatory rules on product labelling in Europe, voluntary labelling of national origin is extremely common. Indeed, there is a large literature in the context of marketing that

[9] Trefler (1995) suggests that home bias in consumption, one of the factors that may underlie estimated border effects, is one of the reasons why the Heckscher-Ohlin-Vanek model tends to over-predict the amount of trade, as Trefler refers to it "the case of the missing trade".

[10] Case 207/83 recently quoted in Official Journal of the European Communities, C46E/169.

documents the presence and importance of home bias on the basis of consumer surveys. For example, Knight (1999) reports the results of a survey of US consumers' preferences regarding microwave ovens and dishes and concludes that US made products were preferred over products made in Japan and interestingly this was regardless of whether the company was American or Japanese owned. Thus, from this source of information it would appear that the country of location of production not the country of ownership of production matters in consumer preferences.[11]

What does this imply for economic integration? One way of assessing the success of policy initiatives such as the Single Market in Europe is to compare the current level of trade with a hypothetical level that would arise under conditions of perfect integration with no border effects.[12] Thus, for example, one could conclude that if trade between EU countries were to take place on exactly the same basis as trade within EU countries then inter-country trade flows would expand massively by factors of around 5 to 10. However, if differences in preferences, industry location factors and constraints upon the spread of networks across borders are the main factors behind border effects then this level of perfect integration is unlikely ever to be achieved. It may be that over time there will be a tendency towards some harmonisation of preferences across EU countries, and indeed this may underlie some of the reduction in the border effect that we very tentatively identify in certain cases, but this is likely to be slow and entails little or no role for policy-makers.

If the reason for the estimated level of the border effect were policy-related constraints then clearly there is an important role for policy makers in removing such barriers and the impact on welfare of further integration would be substantial. Thus, being able to distinguish policy related from 'natural' factors in the estimated border effects is of crucial importance in determining the policy implications. Our results here provide a suggestion, a mere one at present, that policy related barriers are of relatively minor importance. Firstly, we find substantial estimated border effects for sectors where

[11] In future empirical work it would be useful to distinguish between trade in final and intermediate products and identify whether the magnitude of the border effect differs accordingly. One might anticipate that network effects will dominate the border effect for the latter whilst differences in preferences will be more important for final goods.

[12] Frankel (2000) uses such an approach to assess the current level of globalisation in the world economy.

differences in technical regulations are not thought to be important barriers to trade. Secondly, where technical barriers are deemed to be present we find that sectors with the lowest levels of supranational intervention to remove such barriers, mutual recognition sectors, exhibit the smallest and least significant border effects. Sectors where there have been substantial efforts to remove regulatory barriers to trade still reflect large border effects.

## Conclusions

The consistent finding of substantial border effects in applications using the gravity model is a bit of an anathema. Deardorff (1984) concluded that gravity models of bilateral trade flows 'tell us something important about what happens in international trade, even if they do not tell us why'. The same is true for border effects. Recent applications of the gravity model demonstrate that the border effect is an important feature characterising the international exchange of products even between countries with apparently high degrees of integration, but we do not clearly understand what generates this effect. One possibility is policy-induced trade restrictions, such as technical barriers to trade. However, these cannot be the only factor involved since in this study we find substantial and persistent border effects for sectors where technical regulations are not expected to constrain trade flows. Thus, the border effects that we identify are likely to reflect factors such as differences in preferences and home bias in consumption, factors promoting local networks of buyers and sellers and perhaps differences in production structures and the spatial location of production within and between countries.

Comprehending the border effect is important if we wish to understand economic integration and its limits. Policy makers in Europe would like to know to what extent the approaches that they have adopted are successfully removing technical barriers to trade and integrating European markets. One way to do this would be to derive a benchmark of what integration would be in the absence of trade barriers and compare this with the actual level of integration. This would require us to identify the extent to which estimated levels of the border effect capture differences in preferences and production structures and the importance of local buyer-seller relationships. A similar exercise could also be undertaken to show the limits of globalisation. This would be

useful in the debate concerning the extent to which globalisation will undermine the scope for independent national policy-making and the probability that the seamless world with no significant national borders that some envisage is a realistic possibility. In addition, we also need to assess to what extent integration itself may affect preferences, buyer-seller relationships and the location of production.

It is here that the current state of economic research is very underdeveloped. Research on buyer-seller relationships and the organisation of wholesale trade is scant. There is, in general, very little effort towards the estimation of consumer demand equations. Which is surprising given the fundamental role of the underlying preference parameters in determining the welfare effects of policy changes. The evidence that is available suggests that the assumption of identical tastes is untenable even for countries with similar income levels (Pollak and Wales (1987) and Selvanathan and Selvanathan (1993)) and that there maybe substantial differences between price and expenditure elasticities for imported and domestically produced goods (Brenton and Winters (1992b)). Preliminary work on Sweden suggests that home bias in preferences is important (Anderton et al (1999)). In the particular case considered in this paper these demand parameters are important in determining whether there is a policy issue or not. Thus, a clear understanding of the nature of preferences across countries is necessary if we are ever to be able to properly interpret the finding of substantial border effects in trade.

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*Table 1. Estimates of the gravity model applied to total trade*

| | 1988 | 1992 | 1994 | 1997 |
|---|---|---|---|---|
| Ln $GDP_i$ | 0.533** | 0.736** | 0.967** | 0.729** |
| | (0.063) | (0.051) | (0.118) | (0.052) |
| Ln $GDP_j$ | 0.769** | 0.870** | 0.920** | 0.892** |
| | (0.029) | (0.024) | (0.036) | (0.023) |
| Ln $D_{ij}$ | -0.318** | -0.556** | -0.199* | -0.527** |
| | (0.071) | (0.050) | (0.098) | (0.056) |
| Ln $R_i$ | 0.801** | 0.228* | 0.154 | 0.659** |
| | (0.057) | (0.101) | (0.259) | (0.126) |
| Adjacency | 0.621** | 0.494** | 0.826** | 0.632** |
| | (0.200) | (0.163) | (0.218) | (0.157) |
| FTA | 0.032 | -0.371* | 0.676** | 0.054 |
| | (0.194) | (0.166) | (0.222) | (0.122) |
| EU | 1.097** | 0.370** | 1.315** | 0.545** |
| | (0.153) | (0.108) | (0.203) | (0.123) |
| Home | 3.320** | 2.973** | 4.563** | 3.078** |
| | (0.364) | (0.313) | (0.505) | (0.334) |
| $R^2$ | 0.782 | 0.873 | 0.783 | 0.865 |
| N | 456 | 505 | 514 | 569 |

*Notes*: Bounded influence estimation. Robust (White Heteroskedasticity consistent) standard errors are reported. ** denotes significance at 1 per cent and * denotes significance at 5 per cent.

*Table 2*

| | Sectors subject to technical regulations | | | | Sectors where there are no technical barriers to trade | | | |
|---|---|---|---|---|---|---|---|---|
| | 1988 | 1992 | 1994 | 1997 | 1988 | 1992 | 1994 | 1997 |
| Ln $GDP_I$ | 0.495** | 0.733** | 1.073** | 0.814** | 0.963** | 0.780** | 0.833** | 0.644** |
| | (0.078) | (0.070) | (0.142) | (0.072) | (0.109) | (0.027) | (0.039) | (0.061) |
| Ln $GDP_j$ | 0.982** | 1.056** | 1.100** | 1.103** | 0.631** | 0.723** | 0.816** | 0.774** |
| | (0.035) | (0.035) | (0.043) | (0.031) | (0.042) | (0.059) | (0.128) | (0.028) |
| Ln $D_{ij}$ | -0.483** | -0.853** | -0.352** | -0.806** | -0.156 | -0.379** | -0.073 | -0.398** |
| | (0.094) | (0.069) | (0.114) | (0.071) | (0.132) | (0.054) | (0.104) | (0.067) |
| Ln $R_{ij}$ | 0.991** | 0.206 | -0.012 | 0.468** | 0.530** | 0.326** | 0.454** | 0.988** |
| | (0.069) | (0.129) | (0.310) | (0.166) | (0.088) | (0.111) | (0.279) | (0.145) |
| Adjacency | 0.430* | 0.070 | 0.591** | 0.198 | 0.709* | 0.907** | 1.071** | 0.934** |
| | (0.252) | (0.189) | (0.239) | (0.188) | (0.327) | (0.181) | (0.224) | (0.169) |
| FTA | 0.247 | -0.132 | 1.023** | 0.327** | 0.187 | -0.512** | 0.607** | -0.103 |
| | (0.205) | (0.190) | (0.251) | (0.138) | (0.346) | (0.195) | (0.242) | (0.153) |
| EU | 1.365** | 0.235* | 1.445** | 0.459** | 0.841** | 0.225* | 1.060** | 0.412** |
| | (0.183) | (0.133) | (0.230) | (0.140) | (0.279) | (0.122) | (0.215) | (0.150) |
| Home | 2.898** | 1.898** | 3.971** | 2.024** | 3.964** | 3.845** | 5.295** | 3.764** |
| | (0.455) | (0.418) | (0.605) | (0.415) | (0.630) | (0.304) | (0.510) | (0.352) |
| $R^2$ | 0.776 | 0.834 | 0.772 | 0.833 | 0.537 | 0.817 | 0.730 | 0.809 |
| N | 456 | 505 | 514 | 569 | 456 | 505 | 514 | 569 |

*Notes*: Bounded influence estimation. Robust (White Heteroskedasticity consistent) standard errors are reported.

*Table 3.1. Estimates of the gravity model applied to New Approach Sectors*

| | 1988 | 1992 | 1994 | 1997 |
|---|---|---|---|---|
| Ln $GDP_I$ | 0.415** | 0.867** | 1.290** | 0.984** |
| | (0.101) | (0.088) | (0.159) | (0.103) |
| Ln $GDP_j$ | 1.103** | 1.230** | 1.275** | 1.315** |
| | (0.048) | (0.039) | (0.044) | (0.042) |
| Ln $D_{ij}$ | -0.583** | -0.824** | -0.507** | -0.712** |
| | (0.140) | (0.091) | (0.132) | (0.112) |
| Ln $R_I$ | 1.139** | 0.027 | -0.576* | 0.213 |
| | (0.088) | (0.156) | (0.342) | (0.231) |
| Adjacency | 0.443 | 0.280 | 0.759** | 0.502* |
| | (0.339) | (0.276) | (0.282) | (0.269) |
| FTA | 0.183 | 0.785** | 1.633** | 1.405** |
| | (0.326) | (0.228) | (0.278) | (0.230) |
| EU | 1.910** | 1.030** | 1.812** | 1.172** |
| | (0.272) | (0.185) | (0.266) | (0.229) |
| Home | 3.783** | 3.325** | 4.813** | 3.760** |
| | (0.659) | (0.540) | (0.684) | (0.609) |
| $R^2$ | 0.714 | 0.812 | 0.773 | 0.775 |
| N | 456 | 504 | 514 | 569 |

*Table 3.2. Estimates of the gravity model applied to Old Approach Sectors*

| | 1988 | 1992 | 1994 | 1997 |
|---|---|---|---|---|
| Ln $GDP_I$ | 0.486** | 0.763** | 1.125** | 0.858** |
| | (0.093) | (0.092) | (0.168) | (0.100) |
| Ln $GDP_j$ | 0.963** | 0.991** | 1.037** | 1.080** |
| | (0.043) | (0.047) | (0.050) | (0.045) |
| Ln $D_{ij}$ | -0.430** | -0.732** | -0.446** | -0.701** |
| | (0.102) | (0.097) | (0.133) | (0.098) |
| Ln $R_I$ | 1.104** | 0.413** | 0.141 | 0.684** |
| | (0.192) | (0.169) | (0.369) | (0.223) |
| Adjacency | 0.587* | 0.217 | 0.657** | 0.444* |
| | (0.282) | (0.238) | (0.262) | (0.239) |
| FTA | 0.820** | 0.283 | 1.159** | 0.586** |
| | (0.246) | (0.258) | (0.301) | (0.227) |
| EU | 2.255** | 1.266** | 2.280** | 1.524** |
| | (0.211) | (0.190) | (0.266) | (0.199) |
| Home | 4.551** | 3.891** | 5.322** | 3.633** |
| | (0.500) | (0.520) | (0.679) | (0.526) |
| $R^2$ | 0.740 | 0.761 | 0.740 | 0.764 |
| N | 456 | 504 | 514 | 568 |

*Table 3.3. Estimates of the gravity model applied to Mutual Recognition Sectors*

| | 1988 | 1992 | 1994 | 1997 |
|---|---|---|---|---|
| ln $GDP_i$ | 0.420** | 0.755** | 1.196** | 0.911** |
| | (0.103) | (0.089) | (0.170) | (0.108) |
| ln $GDP_j$ | 1.056** | 1.172** | 1.192** | 1.229** |
| | (0.044) | (0.041) | (0.050) | (0.046) |
| ln $D_{ij}$ | -0.941** | -1.184** | -0.871** | -1.258** |
| | (0.129) | (0.090) | (0.140) | (0.107) |
| ln $R_i$ | 1.220** | 0.123 | -0.410 | 0.508* |
| | (0.082) | (0.170) | (0.367) | (0.247) |
| Adjacency | 0.008 | -0.346 | -0.019 | -0.405 |
| | (0.323) | (0.228) | (0.273) | (0.255) |
| FTA | 0.009 | -0.297 | 0.561* | -0.167 |
| | (0.295) | (0.232) | (0.304) | (0.209) |
| EU | 0.437* | -0.460** | 0.519* | -0.444* |
| | (0.242) | (0.182) | (0.275) | (0.210) |
| Home | 1.714** | 0.826 | 2.400** | 0.729 |
| | (0.596) | (0.507) | (0.696) | (0.579) |
| $R^2$ | 0.682 | 0.773 | 0.709 | 0.719 |
| N | 456 | 505 | 514 | 568 |

**Figure 1: Trade Coverage of Techncical Barriers: EU Imports in 1998**