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Market access in global and regional trade ☆

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ABSTRACT

This paper develops a method to measure difficulties in market access over a large set of industries and countries (both developing and developed), during the period 1980–2006. We use a micro-founded heterogeneous-consumers model to estimate the impact of national borders on global and regional trade flows. Results show that difficulties faced by developing countries' exporters in accessing developed markets are 50% higher than those faced by Northern exporters. These difficulties have however experienced a noticeable fall since 1980 in all industries. It is twenty three times easier to enter Northern and Southern markets for a Southern country exporter in 2006 than in 1980. Expressed in tariff-equivalent, the level of protection implied when crossing a border fell from 180% to 89% for this same sample. While tariffs still have an influence on trade patterns, they do not seem to explain an important part of the border effect. Last, our theory-based measure offers a renewal of the assessment of the impact of regional trading arrangements. The EU, NAFTA, ASEAN and MERCOSUR agreements all tend to reduce the estimated degree of market fragmentation within those zones, with the expected ranking between their respective trade impact.

1. Introduction

> "There is a wide agreement that the space-economy may be viewed as the outcome of a trade-off between different types of scale economies in production and *the mobility costs* of goods, people and information.", Thisse (2012, emphasis added).

The present paper is a contribution to the measurement of the second part of the trade-off emphasized by Jacques Thisse in the quoted paper (a chapter surveying the history of thought of spatial economics). More precisely, we focus on measuring the level and recent evolution of how goods move across space, and in particular how impeded they are by national borders even in the modern era, which seems characterized by a fall of all kinds of transaction costs. If the existence of trade costs seems essential to any economic theory that claims to be "spatial", their actual level is also crucially important. The extent of market integration (or dis-integration) is central in particular when the theory tries to assess the level of geographical disparity in economic activity. This is true for the Krugman-type models of course, but a larger class of mechanisms predicts that the organization of the world economy will move through a bell shape curve of dispersion-agglomeration-dispersion as trade costs fall. This pattern has consequences in terms of

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income disparities. The agglomeration phase is one where the manufacturing economic activity concentrates in a rich core (call it the North), which diverges from an impoverished periphery (the South). Then, the final dispersion phase that comes with low trade costs ends up enabling peripheral countries to catch up with the developed world.[1] Knowing "where in the bell" is the world economy is therefore quite important to predict what comes next, should we continue to integrate markets further.

Measuring the extent of market integration is also useful in the debate opposing developed and developing economies regarding their respective contribution to the multilateral liberalization of trade flows. Particularly, in the current context of World Trade Organization (WTO) negotiations seemingly stalled, and rising protectionist pressures (since the crisis), a rigorous measure of market access difficulties, encountered by different exporters, can contribute to the policy debate. A good illustration is the case of Least Developed Countries (LDCs), on which current WTO talks are largely focused. Despite complex and wide-ranging preferential access granted by rich countries to LDC's exporters, essentially dropping all tariffs and quotas on manufacturing goods, there are claims that Northern market access remains limited. Those claims are seemingly backed up by the apparently low level of their market shares in rich countries. The share of LDCs in total imports of the most developed countries offers a simple, although very crude, measure of their market access. This import share is rarely above a tiny 1%. As an example, the import share of LDCs in the European Union (EU) market was about 0.4% in 1990, 0.5% in 2000 and 0.55% in 2006. Moreover, the evolution of both the total and manufacturing import shares of the 50 LDCs, between 1989 and 2006, in the EU, the USA and the Japan markets gives credits to the Southern's claims (see Figs. 4–6 in Appendix A).[2]

However instructive, the market shares cannot be sufficient to draw conclusions on the level of market access experienced by Southern exporters on Northern markets. The first limitation is that we do not know *a priori* what to compare those numbers to. Any assessment of market access based on trade flows needs to specify a benchmark of trade patterns, to which actual international exchanges of goods will be compared. Such a benchmark can only be provided by theory. We use here a theoretical framework to give an empirically estimable gravity-type equation. The theoretical framework is derived from a logit demand system, described in Anderson et al. (1992), combined with a traditional monopolistic competition market structure. Difficulties in market access are measured as a (negative) deviation from this theoretical benchmark. We therefore rely on an indirect measure of protection. Market access difficulties are revealed by distortions in trade flows, after having controlled for supply and demand capacity, and bilateral frictions such as tariffs as dictated by the theoretical framework.[3]

A second problematic issue with the use of the simple import shares to assess market access is that they usually miss most of the action. When saying that in 2006, the EU countries had on average 0.55% of their imports originating from LDCs, one is in fact only comparing relative access among foreign producers on the EU market. The problem is that, for most products, the large majority of overall demand in a country is met by domestic producers, not foreign. A more sensible index of market access must take into account the market share of foreign producers in the overall demand. This is what the *border effects* method does. It considers trade flows within countries as well as among countries and compares imports from foreign countries to "imports" from domestic producers. This gives a benchmark based on a situation of the best possible market access, the one faced by domestic producers.

We follow this method of market integration measurement and expand it so that it provides new results on access difficulties of world markets, distinguishing between Northern and Southern exporters, over the period 1980-2006 and a large set of industries. This is made possible by the construction and use of large interconnected data sets. In particular, the collection of production and trade data is an updated extension of Nicita and Olarreaga (2007), aiming to cover more countries and years. A specific feature of our study is to identify, in the border effect, the part to be associated with observed bilateral characteristics, such as tariffs. To this end, we use the UNCTAD's TRAINS and the CEPII's MAcMap datasets to control for bilateral tariffs at the industry/time level.[4] Moreover, we compute both internal and international bilateral distances in a consistent way such that they take into account the geographic distribution of the economic activity within each nation. This avoids mis-measurement in relative distances.

Results show that difficulties faced by developing countries' exporters in accessing developed markets are substantial and higher than those faced by Northern exporters. These difficulties have however experienced a noticeable fall since 1980 in both Southern and Northern markets, and in all industries. It is twenty three times easier to enter those markets for a Southern country exporter in 2006 than in 1980. While tariffs still have an influence on trade patterns, they do not seem to explain a large part of the border effect. Controlling for tariffs, the tariff equivalent of preferences and trade restrictions is still 233% and the difference between Northern and Southern exporters holds. This observed difference could be attributable to differences in infrastructure and trade facilitation such as cumbersome documentation requirements, restrictive administrative regulations, and other unwieldy border procedures, all of which impose high costs on trade. Since mid-2004, these obstacles to trade facilitation have been added to the list of subjects in the Doha multilateral round of trade negotiations. A "by-product" of our method is the provision of new estimates of the impact of Regional Trading Arrangements (RTAs), both involving Northern and Southern countries' combinations, on trade patterns. The benchmark against which trade patterns inside the RTA are compared is the domestic market, supposedly highly integrated.

The remainder of the paper is as follows. In Section 2, we motivate the use of the border effects methodology when measuring market access. In Section 3, we specify the theoretical foundations of our work as well as the derived empirical specification. In Section 4, we expose the data requirements. In Section 5, we provide results for overall market access to Northern and Southern producers and for the impact of regional trade agreements and give details concerning the evolution of this access over recent years as well as differences across industries.

2. Measuring market access with border effects

The measure of market access is linked to the assessment of the impact of national borders on trade. In order to make that assessment, one needs to consider international as well as intra-national trade

[1] The first paper emphasizing the bell shape curve (Krugman and Venables, 1995) was titled "Globalization and the Inequality of Nations".

[2] We use the BACI database of international trade (see Section 4 for data details) to compute the annual import shares of the LDCs. The EU market is composed of the first 15 EU members. The 50 LDCs are retained according to the UNCTAD's list (as of 2006).

[3] Alternatively, one can try to measure protection directly through the collection of formal trade barriers (see Anderson and van Wincoop, 2004, for a survey of this type of evidence, and the data issues involved).

[4] UNCTAD's Trade Analysis & Information System (TRAINS) is the key source to the research community for panel data on policy barriers (Anderson and van Wincoop, 2004). The MAcMap data set is constructed by the CEPII and described in Bouët et al. (2008). See Section 4 for more details.

flows and compare the two. This comparison is best understood with a model of bilateral trade that compares trade between two *national* locations with trade between two comparable *international* locations. This model allows thus to derive what a "normal" bilateral trade flow should be, controlling for usual determinants of trade. The gravity equation is the ideal candidate for this derivation thanks to its old empirical success in describing bilateral trade flows. This methodology of mixing inter- and intra-national trade flows in order to measure the impact of national borders was the motivation behind the seminal work of McCallum (1995). Wei (1996) extended this methodology for the cases where intra-national trade is not available. Indeed, even in the absence of explicit intra-national flows, we can still measure the total volume of trade occurring within a country. For a given industry and year, this is simply equal to the overall production of the country minus its total exports, which gives the value of goods shipped from a country to its own consumers. This observation can then be inserted in a bilateral trade equation. This is the way we proceed here. Our framework also incorporates recent advances in the modeling of gravity equations, turning back to trade theory to guide the empirical specification (examples and surveys of those approaches include Feenstra, 2004; Anderson, 2011).

The border effects methodology has important advantages in the study of market integration. First, it offers a more intuitive benchmark of integration than the traditional gravity equation framework. Take as an example the attempts to measure the impact of EU membership on trade flows (Aitken, 1973 is one of the first such study, followed by Frankel, 1997; Frankel et al., 1995; Soloaga and Winters, 2001). The literature seeks to find a positive deviation of internal EU trade compared to a benchmark, which is usually trade among OECD countries. It seems however far more reasonable to inverse this logic and look for negative deviations from what would be a perfectly integrated zone: A nation.

Second, for a lot of issues, the border effect measure is also a useful methodology because it captures *all* impediments to trade related to the existence of national borders, through their impact on trade flows. Most of those impediments are hard to measure individually. Anderson and van Wincoop (2004) give a sense of the substantial incompleteness of UNCTAD's TRAINS data base, the key source for panel data on policy barriers. TRAINS contains information on trade control measures (tariff and non-tariff measures) at tariff line level for a maximum of 137 countries and only from 1989 onwards. However, the lack of reporting is especially pronounced for Non-tariff barriers (NTBs) and developing countries. In a given year, at most 30% of the included countries report NTBs. The global image given by the border effects methodology is therefore useful.[5]

Last, border effects are more informative in the study of the evolution of trade barriers. In a traditional gravity equation, using for instance a dummy variable for trade taking place inside the EU, how should we interpret a rise in the coefficient on this dummy variable? Using the traditional Vinerian interpretation of regional integration, this rise can first come from consumers in EU countries substituting domestic goods in favor of foreign European goods (trade creation). The rise can however also come from substitution among imported goods that is in favor of EU producers to the detriment of non-EU producers (trade diversion). The gravity equation in its most traditional form finds it hard to differentiate among the two causes (even if more elaborated forms like Fukao et al., 2003, or Carrère, 2006, have made progress possible in that direction). In contrast, the border effects methodology enables to track a potential fall in the surplus of trade taking place within countries. We are therefore able to separate the trade creation from the trade diversion effect of rise in the coefficient on a EU dummy variable. The former coincides with a border effect reduction (consumers substituting domestic goods in favor of foreign European goods), the latter does not.[6]

We will therefore use the border effects methodology, combining international and intra-national trade flows in a gravity-type equation. The precise specification of this equation stays however to be described, and this requires the presentation of our theoretical model, to which we now turn.

3. The model and estimable equation

There are several theoretical foundations to the gravity equation.[7] We will work here with a specific form of a gravity equation to get a simple structure on which to base our statistical analysis. The ingredients are as follows. The demand side is inspired by the logit demand system described in Anderson et al. (1992), and connected to gravity in Head and Mayer (2011). The supply side follows the characteristics of a typical Krugman (1980) monopolistic competition model.

Consider a multi-country framework of C countries. Each exporting country i produces N_i different varieties of a good.[8] The derivation of the gravity equation comes from the allocation of total expenditure of the importing country j (X_j) across the C origin countries. Based on the importing country budget allocation, we define bilateral exports from country i to country j, X_{ij}, as

$$X_{ij} \equiv \Pi_{ij} X_j, \tag{1}$$

where Π_{ij} is the share of expenditures allocated to country i, with $\sum_{i=1}^{C} \Pi_{ij} = 1$ and $\sum_{i=1}^{C} X_{ij} = X_j$. We specify the share Π_{ij} by resorting to discrete choice theory (see Anderson et al., 1992).[9] We assume that Π_{ij} depends on the probability $\mathbb{P}_{ij}$ that each of the L_j heterogeneous consumers in country j chooses one of the N_i varieties produced in country i. Then, each consumer consumes a quantity q_{ij} of the chosen variety and spends an amount X_j/L_j on it. The utility function associated with the consumption of the chosen variety is given by

$$u_{ij} = \ln\left[q_{ij}\epsilon_{ij}\right], \tag{2}$$

[5] It should be noted that this "catch-all" feature of border effects comes with a drawback. Indeed it will also capture impediments to trade that are less relevant for trade policy like consumer preferences, if they are left unobserved. We try to purge from the major part of this effect by including a vector of controls for bilateral affinity, such as common language, colonial links… described in Section 4.2.

[6] Romalis (2007) provides an intermediate approach, where a bilateral trade equation of US imports is first run, and US imports from self are then used to compute trade diversion effects of NAFTA and CUSFTA.

[7] Anderson (1979) provides the earliest derivation of the gravity equation based on the Armington assumption that goods are differentiated by country of origin. Evenett and Keller (2003) show that a theoretical prediction of the gravity will arise in virtually all trade models with complete specialization. Feenstra (2004) provides a description of the link between the gravity equation and bilateral trade patterns in a monopolistic competition framework. See Anderson and van Wincoop (2003), Eaton and Kortum (2002), and Chaney (2008) for three theoretical foundations of the gravity equation relying on very different assumptions, and Head and Mayer (2011) for a general treatment.

[8] We present here a gravity equation at the aggregate level. However, the notation and logic of the gravity model also readily apply to individual goods and disaggregation of countries into regions (see Anderson, 2011).

[9] Eaton and Kortum (2002) initiated this strategy of using discrete choice modeling in their renewal of the Ricardian trade setup. Head and Ries (2008) and de Sousa and Lochard (2011) use a similar strategy to model bilateral Foreign Direct Investment.

where $_{ij}$ is the unobserved taste variation of consumers in country j for product varieties from country i. This heterogeneity, is assumed to be distributed according to a type-I extreme value distribution, known as Gumbel, with location parameter zero and scale parameter θ. This has the cumulative distribution function $\exp\{-\exp(-\theta(\ln \epsilon_{ij}))\}$, where θ is an inverse measure of the degree of dispersion of consumers' preferences.

To specify the probability $\mathbb{P}_{ij}$, we assume that each consumer in j compares the utility of the varieties imported from all countries C. Then, she selects the variety giving her the highest utility. The corresponding indirect utility is given by $\mathcal{V}_{ij} = \ln(X_j/L_j) - \ln \mathrm{p}_{ij} + \ln \epsilon_{ij}$, since the individual demand is $q_{ij} = X_j/(L_j p_{ij})$ for the selected variety and zero on all other varieties. p_{ij} is the price consumers in country j face for products from country i.

Selecting the variety with the highest utility amounts to choosing a variety in country i such that $\max\ \mathcal{V}_{ij} > \max\ \mathcal{V}_{hj}$ for all country $h \neq i$. This choice is associated with the distribution of ϵ_{ij}. The Gumbel features an important reproductive property for its own maximum sample extreme. It is a max-stable distribution. That is, the distribution of the maximum of ϵ_{ij}, drawn from the number of product varieties N_i, is again Gumbel with the same inverse shape parameter, θ, but shifted up by $(1/\theta) lnN_i$. This implies a multinomial logit form for the probabilities of consumers in country j choosing one of the N_i varieties made in country i:

$$\mathbb{P}_{ij} = \frac{\exp\left[\ln N_i - \theta \ln p_{ij}\right]}{\sum_h \exp\left[\ln N_h - \theta \ln p_{hj}\right]} = \frac{N_i p_{ij}^{-\theta}}{\sum_h N_h p_{hj}^{-\theta}}. \quad (3)$$

The derived probability $\mathbb{P}_{ij}$ allows to determine the share Π_{ij} of expenditures allocated to country i, and, consequently, to quantify the exports from i to j (X_{ij}). With large numbers of consumers and varieties, the share Π_{ij} will equal the probability $\mathbb{P}_{ij}$. Substituting (3) in (1) we obtain

$$X_{ij} \equiv \Pi_{ij} X_j = N_i \left(p_i \tau_{ij}\right)^{-\theta} \Phi_j^{-1} X_j, \quad (4)$$

where $p_{ij} = p_i \tau_{ij}$, with p_i the 'factory gate' or 'mill' price and $\tau_{ij} \geq 1$ the iceberg-type trade costs (i.e., the units of the product that must be shipped to j in order one for unit to arrive); $\Phi_j = \sum_h N_h \left(p_h \tau_{hj}\right)^{-\theta}$ is a term equivalent to the Anderson and van Wincoop (2003)'s "multilateral resistance index" of country j. Taking the ratio of X_{ij} over X_{jj}, country j's exports to itself, the Φ_j term drops and we are left with the relative numbers of firms, relative prices in i and j, and relative bilateral trade costs:

$$\frac{X_{ij}}{X_{jj}} = \frac{N_i}{N_j} \left(\frac{p_i}{p_j}\right)^{-\theta} \left(\frac{\tau_{ij}}{\tau_{jj}}\right)^{-\theta}. \quad (5)$$

The key difference of this model compared with Dixit-Stiglitz-Krugman (see Feenstra, 2004) or Anderson and van Wincoop (2003) lies in $-\theta$, which substitutes for $-(\sigma-1)$ as the price elasticity of trade flows. An increase in the elasticity of substitution (σ) means that products are becoming more homogeneous, and an increase in θ means that consumers are becoming less heterogeneous. In aggregate, both mean that demand is less differentiated, which impacts aggregate trade in a parallel way.

To estimate (5), we need to specify more fully the model. First, we use the supply side characteristics of the monopolistic competition model. Firms producing q_i in country i employ l_i workers in an increasing returns to scale production function $l_i = F + \omega q_i$, where F is a fixed (labour) costs, and ω the inverse productivity of firms. Profits are $\pi_i = p_i q_i - w_i(F + \omega q_i)$, with w_i the wage rate in country i. Using the pricing equation, together with the free entry condition, we get the equilibrium output of each representative firm, $q_i = \frac{F(\sigma-1)}{\omega}$. With identical technologies, $q_i = q, \forall i = 1, \ldots, C$ and noting v_i the value of production for the considered industry in county i, $v_i = q p_i n_i$, we get the first substitution to be made in Eq. (5): $\frac{N_i}{N_j} = \frac{v_i}{v_j} \frac{p_j}{p_i}$.

Second, a functional form for trade costs (τ_{ij}) has to be specified in order to obtain an estimable equation. Trade costs are assumed to be a function of distance (d_{ij}, which proxies for transport costs), "border-related costs", and u_{ij} that represents unobserved determinants. Noting the *ad valorem* equivalent of all border-related costs as brc_{ij}, we specify (τ_{ij}) as

$$\tau_{ij} \equiv d_{ij}^{\delta} \left(1 + \mathrm{brc}_{ij}\right) u_{ij}.$$

Border-related costs must be allowed to be quite flexible in our framework. Our primary goal is to assess a possible North-South divide in market access, we therefore need to allow for different levels of broadly defined protection in each direction of trade, i.e., North–South and South–North. An important issue is also the impact of regionalism. We want to control for the impact of membership of Regional Trading Arrangements (RTAs) in the assessment of North markets' access by Southern exporters. Finally, we want to control for the actual tariff protection taking place between importing and exporting countries, in order to assess the share of border effects that can actually be explained by this simple determinant.

Additional measures of border-related costs are introduced to account for 'bilateral affinities' among countries. Such affinities result in general from cultural and historical bilateral links. They can promote trade either through a positive effect on bilateral preferences or through more complex channels involving the existence of business networks or similarity in institutional frameworks that potentially reduce border-related costs. We thus introduce a vector z_{ij}^m of observable binary arguments, $m = 1, \ldots, M$, that affect bilateral trade such as $z_{ij}^m = \{\text{contiguity}_{ij}, \text{common language}_{ij}, \text{same country}_{ij}, \text{colonial link}_{ij}, \text{common colonizer}_{ij}\}$.[10]

In the most general formulation, we assume the following structure for border-related costs, which vary across country pair and depend on the direction of the flow for a given pair:

$$1 + \mathrm{brc}_{ij} \equiv \left(1 + t_{ij}\right) \left(\exp\left[\eta E_{ij} + \varphi \mathrm{NS}_{ij} + \psi \mathrm{SN}_{ij} - \sum_{m=1}^{M} \gamma_m z_{ij}^m\right]\right).$$

[10] The "contiguity" variable is set to one if the two countries are contiguous. The "common language" variable is set to one if a language is spoken by at least 9% of the population in both countries. The "same country" variable is set to one if the two countries were or are the same state or the same administrative entity for a long period. The "colonial link" dummy refers to countries that have ever had a colonial link. The "common colonizer" dummy is one if countries have had a common colonizer after 1945.

In this specification, t_{ij} denotes the *ad valorem* bilateral tariff. NS_{ij} is a dummy variable set to one when $i(\neq j)$ belongs to the North and j belongs to the group of Southern countries. SN_{ij} is a dummy variable set to one in the reverse case. E_{ij} is a dummy variable set to one when both partners belong to the same group of countries (North or South depending on the model estimated).[11] All parameters are expected to be positive. The ranking of φ, ψ and η is the primary open question we want to answer here.

We obtain an estimable equation with home bias. In its more general form, the estimated equation used in the next sections will be:

$$\ln\left(\frac{X_{ij}}{X_{jj}}\right) = -\theta\eta + \ln\left(\frac{v_i}{v_j}\right) - (1+\theta)\ln\left(\frac{p_i}{p_j}\right) - \theta\ln\left(1+t_{ij}\right)$$
$$-\theta\delta\ln\left(\frac{d_{ij}}{d_{ii}}\right) + \theta\sum_{m=1}^{M}\gamma_m z_{ij}^m - \theta[\varphi-\eta]\mathrm{NS}_{ij} - \theta[\psi-\eta]\mathrm{SN}_{ij} + \epsilon_{ij}, \quad (6)$$

with $\epsilon_{ij} = \theta(u_{ij} - u_{jj})$. The constant of this regression $(-\theta\eta)$ gives the border effect of international trade for countries that belong to the same group, the North for instance. It includes the level of protection of the importing country (η). The coefficient on NS_{ij} indicates the additional difficulty for developing countries in their access to Northern markets. Symmetrically, SN_{ij} indicates the additional difficulty when Northern exporters want to sell their products on Southern markets.

We will estimate various versions of Eq. (6), depending on data constraints and on whether focus is in Northern or/and Southern markets. In particular, we face some data constraints on tariffs (see below).[12] It is clear however from Eq. (6), that omitting the $\ln(1+t_{ij})$ term will result in the "missing trade" (caused in reality by tariffs) being attributed to the impact of crossing national borders (the ones where there are observed protection implemented).

4. Data requirements

4.1. Production, trade and prices

The required data sets involve primarily bilateral trade and production figures in a compatible industry classification for developed and developing countries. Inspired by the *Trade, Production and Protection 1976-2004 database* made available by the World Bank (Nicita and Olarreaga, 2007), we construct an exhaustive trade and production data set covering 26 industrial sectors in the ISIC (International Standard Industrial Classification) classification Revision 2, and 151 exporting and importing countries for the period 1980-2006.[13] See Appendix E for the list of countries, tabulated according to their income level, and industries. There are essentially three crucial variables in this dataset, trade on the one hand, and production and prices on the other hand.

4.1.1. Trade

To construct this data set, we mostly use bilateral trade data and methods from BACI, the international trade database at the product level of Gaulier and Zignago (2010). This allows us to cover a very large set of countries, in particular more for developing countries than in comparable datasets, such as Nicita and Olarreaga (2007). BACI starts from the United Nations' COMTRADE data, and takes advantage of mirror trade flows (reports for both exporting and importing countries) in order to increase the coverage and accuracy of trade data at the most disaggregated international product-level, the 6-digit Harmonised System (HS6) classification.[14] BACI is directly converted from HS6 to ISIC for the years 1995 to 2006. For 1980 to 1994, the BACI methodology is applied to COMTRADE data in original SITC classification before conversion to ISIC.

4.1.2. Production and prices

The United Nations Industrial Development Organization (UNIDO) database is the main source of manufacturing production data (as in Nicita and Olarreaga, 2007). UNIDO data sets provide worldwide information for the industrial production at the three and four digits levels. The 4-digit data covers the most recent period 1985-2006, but must be converted from ISIC Revision 3 into the Revision 2 classification. Additionally, STAN production data was used to fill some missing data. The relative prices are captured by the price level of GDP expressed relative to the United States. These data come from the Penn World Tables v.6.3.

4.2. Trade cost

As shown in Eq. (6), we need measures of bilateral distance between countries (dist_{ij}) and within countries (dist_{ii}). How to define internal distances of countries and how to make those constructed internal distances consistent with 'traditional' international distances calculations? The second question is crucial for obtaining a correct estimate of the border effect. Take the example of trade between the United Kingdom and Italy. The GDPs of the two countries being quite comparable, this will not have a significant impact on the ratio of domestic to international trade. The first reason why the UK and Italy might trade more with themselves than with each other is that the average distance (and therefore transport costs) between a domestic producer and a domestic consumer is much lower than between a foreign producer and a domestic consumer. Suppose now that for some reason, one mis-measures the relative distances and thinks distance from Italy to Italy is the same as distance from UK to Italy. Then the observed surplus of internal trade in Italy with respect to the UK-Italy flow cannot be explained by differences in distances and has to be captured by the only remaining impediment to trade in the equation, the border effect. Any overestimate of the internal/external distance ratio will yield to a mechanic upward bias in the border effect estimate (see Head and Mayer, 2010).

We have developed a new database of internal and external distances, which uses city-level data in the calculation of the distance matrix to assess the geographic distribution of population inside each nation. The basic idea, inspired by Head and Mayer (2010), is to calculate distance between two countries based on bilateral distances between cities weighted by the share of the city in the overall country's population. This procedure can be used in a totally consistent way for both internal and international distances, which solves

[11] When we turn to the impact of regional integration, our specification of border-related costs is different: $1+\mathrm{brc}_{ij} \equiv (1+t_{ij})\left(\exp\left[\eta E_{ij} - \beta \mathrm{RTA}_{ij} - \sum_{m=1}^{M}\gamma_m z_{ij}^m\right]\right)$, where RTA_{ij} is a dummy variable set to 1 when $i(\neq j)$ and j belongs to a regional integration agreement and E_{ij} is the intercept. We expect $\beta > 0$ to be the lowest of those parameters. This will be true if the RTA promotes trade between members, by reducing their intra-national trade, resulting in lower border effects (i.e., lower β) for RTA members compared to non-members.

[12] Not many papers in the literature incorporate the level of bilateral tariffs in border effects' equations on a worldwide basis. Fontagné and Zignago (2007) is one of those, using a similar sample but covering the period 1976-2000.

[13] We make it publicly available at http://www.cepii.fr/anglaisgraph/bdd/TradeProd.htm as the CEPII's *TradeProd* database.

[14] Gaulier and Zignago (2010) estimate CIF ratios, in order to obtain FOB import values which can be compared to export FOB values. To average this double information on each flow, authors estimate the accuracy of each reporter and use it as weights.

the problems highlighted above. We use latitudes, longitudes and populations data of main agglomerations of all countries available in the world-gazetteer.com web site, which provides current population figures and geographic coordinates for cities, towns and places of all countries.

We account also for different levels of 'bilateral affinity' and construct various dummy variables: contiguity, common language, same country, colonial link and common colonizer links. The first source of the language dummy is the ethnologue.com web site, which allows us to calculate the share of the population of each country speaking any languages but mainly as a mother tongue. Hence, to have precise idea about the lingua francas and second languages spoken in each country, we used two other valuable sources: the CIA world factbook and Jacques Leclerc web page.[15] Sources for colonial variables came from worldstatesmen.org. See Mayer and Zignago (2011) for a detailed description of the above geography and distances constructed variables, available online.[16]

Bilateral data on trade policy at the industry/year level come from the UNCTAD's TRAINS and the CEPII's MAcMap database and cover different periods: 1989–2000 and 2001 respectively. The TRAINS database, from UNCTAD, provides tariffs measured at the bilateral level and for each product of the HS6 nomenclature from 1989 to 2000.[17] We aggregate those tariffs in order to match our ISIC Revision 2 industry classification using the world imports as weights for HS6 products. The obtained variable is a rather crude measurement of protection, when compared for instance with MAcMap datasets made available by Bouët et al. (2008). MAcMap provides a disaggregated, exhaustive and bilateral measurement of applied tariff duties. It takes into account the complex system of bilateral preferences across countries in the world. This type of data however lacks a consistent time coverage, which is an important issue here. We thus use MAcMap (aggregated at the relevant ISIC level as for the TRAINS data) to confirm our results for 2001. These data show that even in manufactured goods and between developed countries, tariffs are not negligible and vary quite substantially across industries and countries combinations. Tariffs in South–North and North–South combinations are of course even larger and we are interested in assessing their impact on trade flows and market access.

5. Market access between Northern and Southern countries

This part is organized as follows. After a general overview of border effects (5.1), we present their evolution over time (5.2) and check whether border effects are explained by tariffs (5.3). Then we provide industry-level results (5.4). This is followed by a section that evaluates the impact of regional trade agreements on aggregate manufacturing trade (5.5). All regressions from Subsections 5.1 to 5.5 are pooled across the set of industries used, while Subsection 5.4 gives industry-level results. In all regressions, robust standard errors are clustered by both importer and industry. Several robustness checks are also provided in Appendix C. In particular, we include a relative institutional quality variable that might affect the performance of different exporting countries, and an alternative specification allowing for zero trade values, following Santos Silva and Tenreyro (2006).

5.1. Global results

Table 1 presents results over the entire period of a simple version of Eq. (6). Column (1) involves the whole sample of world markets.

Table 1
North–South market access, by income levels, 1980–2006.

	Dependent variable: Ln imports partner/own				
	World	North imp.	North imp.	South imp.	South imp.
Border	−5.97[a]				
	(0.02)				
Ln rel. production	0.73[a]	0.76[a]	0.76[a]	0.73[a]	0.73[a]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ln rel. prices	−0.32[a]	−0.39[a]	−0.52[a]	−0.27[a]	−0.31[a]
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Ln rel. distance	−0.56[a]	−0.53[a]	−0.53[a]	−0.62[a]	−0.63[a]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Contiguity	1.61[a]	1.81[a]	1.81[a]	1.26[a]	1.28[a]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Common language	0.33[a]	0.37[a]	0.37[a]	0.49[a]	0.48[a]
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Same country	0.58[a]	1.15[a]	1.08[a]	0.97[a]	0.95[a]
	(0.02)	(0.04)	(0.04)	(0.02)	(0.02)
Colonial link	1.02[a]	0.67[a]	0.68[a]	1.04[a]	1.07[a]
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
Common colonizer	0.49[a]			0.76[a]	0.78[a]
	(0.02)			(0.02)	(0.02)
Northern exporters		−4.77[a]	−4.77[a]	−6.08[a]	−6.02[a]
		(0.03)	(0.03)	(0.03)	(0.03)
Southern exporters		−6.22[a]		−6.55[a]	
		(0.03)		(0.02)	
Upper middle inc. exp.			−5.98[a]		−6.32[a]
			(0.03)		(0.03)
Lower middle inc. exp.			−6.59[a]		−6.71[a]
			(0.03)		(0.02)
Low inc. exporters			−6.49[a]		−6.59[a]
			(0.04)		(0.03)
Observations	1818773	811472	811472	1007301	1007301
R^2	0.465	0.912	0.913	0.890	0.890
RMSE	2.63	2.57	2.56	2.50	2.50

Note: Robust standard errors in parentheses, clustered by importer-industry, with [a] denoting significance at the 1% level.

Columns (2) and (3) give results when the sample is restricted to imports of developed (or Northern) countries. Columns (4) and (5) take the reciprocal case, considering imports by developing (or Southern) countries. Columns (2) to (5) distinguish between different exporters in terms of market access. Following the World Bank classification of economies, Northern countries are defined as high-income countries and the South is defined as the group of countries with a low or medium income. The list of countries by income category (low, middle and high) is reported in Table 12 (in Appendix E).

Before discussing the border effects estimates, we comment on the impact of various covariates. The coefficient on relative production is reasonably close to the unitary value predicted by theory and often found in the gravity equation literature. As expected, the relative prices are negative and significant in all estimations. The coefficient on distance is in line with the common findings in the literature (see Disdier and Head, 2008). Coefficients on contiguity have a higher magnitude than usual, while coefficients on language have the usual sign and magnitude.

The first row of the first column in Table 1 gives the world average border effect. This estimate implies that, on average during the period 1980–2006, each country traded around 391 times more (exp(5.97)) within its national borders than with another country of the world, ceteris paribus. One of our main objectives is to investigate the market access difficulties faced by developed and developing exporters. In the Northern markets (column 2), the estimated border effect falls to 118 (exp(4.77)) when the exporter is a developed country but jumps to 503 (exp(6.22)) when the exporter is a developing country.

[15] www.tlfq.ulaval.ca/axl/index.shtml.
[16] www.cepii.fr/anglaisgraph/bdd/distances.htm.
[17] Precisely, we use Jon Haveman's treatment of TRAINS data (see Haveman et al., 2003).

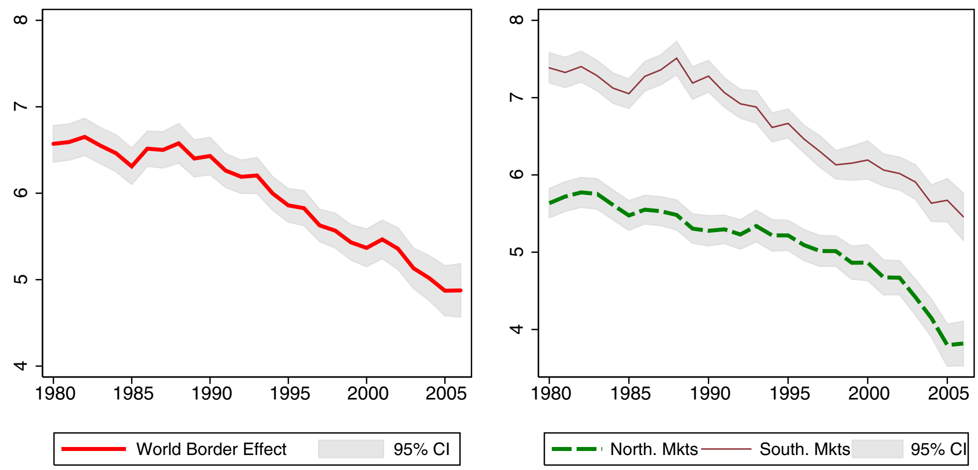

Fig. 1. World, North and South border effects 1980–2006. Note: Annual estimates of column (1) of Table 1 and their clustered 95% confidence interval. The left panel plots the Border variable, whereas in the right panel the constant is replaced by Northern and Southern importer dummies.

The tariff equivalent of the difference in market access is quite substantial. The calculation of tariff equivalent requires an estimate of the elasticity θ. The coefficient on the price variable is a possible source for this parameter. While negative, the coefficient on the price term is however disappointing here, with a lot of volatility and very small values. This result of low price elasticities when using directly proxies for prices is usual in the literature (see Erkel-Rousse and Mirza, 2002, for instance). The literature provides estimates of the trade elasticity (interpreted as a demand or a supply side parameter depending on the precise model). Head and Ries (2001), Eaton and Kortum (2002) and Lai and Trefler (2002), for instance, suggest that it might be around 8 for developed countries in recent years. Using this estimate, we find that the tariff equivalent of North-North border effect is still $exp(4.77/8)-1=82\%$ while the figure is $exp(6.22/8)-1=118\%$ for imports coming from Southern countries. Although North–North trade is far from free, column (2) reveals that, expressed in tariff equivalent, South–North trade is about 50 percentage points harder.[18]

Column (3) details the revealed additional difficulties of Southern countries in market access by income level. It appears that the more restricted access in Northern markets is encountered by lower middle and lower income exporters. The point estimates indicate that the lower income exporters face a tariff equivalent of the border effect of $exp(6.59/8)-1=128\%$, while the figure for upper middle income exporters is 111%. We find that these tariff equivalents are statistically different. Note that the "same country" variable and the colonial links, proxying bilateral North–South affinities, tend to strongly promote access to Northern markets.

The contrast with the results in Southern markets, shown in columns (4) and (5), is important. The overall level of openness of those markets is lower than the Northern markets. However, the border effect is still lower when the exporter originates from a Northern country (6.08) than from a Southern country (6.55). Southern exporters therefore face a quite similar high level of access difficulty both on Southern (6.55) and Northern (6.22 in col. 2) markets.

5.2. Evolution

Results in this section detail the evolution of market access over time, starting from 1980 and going to 2006. Specifications are run on individual years. The left panel of Fig. (1) depicts the evolution of the world average border effect over time. Based on the specification of column (1) of Table 1, the figure plots the annual estimates of the Border variable (in absolute value) and the clustered 95% confidence interval around the point estimate. The high revealed restrictions in market access at the beginning of the 1980s tend clearly to decrease over time. The estimated border effect has decreased from 764 (exp(6.64)) in 1980 to 131 (exp(4.88)) in 2006.

The right panel of Fig. (1) depicts the evolution of the Northern and Southern border effects over time in world trade. We run the same annual regressions that in the left panel but here the constant is replaced by Northern and Southern importer dummies. The figure shows that the Southern border effect is much larger in magnitude than the Northern border effect. However, both border effects have strongly decreased from 1980 to 2006, mirroring the evolution of the average world border effect.

We now focus on the evolution of access of Southern exporters to Northern markets. We investigate whether the current high level of revealed restrictions in market access is a persistent phenomenon, and whether there has been some progress recently on this front. Table 2 gives overall results for the access to the Northern countries markets over time.[19] The first three columns provide an overview of how coefficients evolve over three successive periods of time (1980–1988, 1989–1997 and 1998–2006). The last four columns give results with additional controls included, i.e., tariffs and NAFTA membership. The fifth column (1989-1997) restricts the sample to those observations for which tariffs are available.[20] The sixth column gives results for the same period with tariffs included.

[18] Estimates of the trade elasticity exhibit some variance in the literature that might be related to different methods and/or samples consisting of different industries and countries. Costinot et al. (2012) is one of the latest examples of theory-driven estimation of this elasticity, and finds smaller values that average to slightly above 5. The tariff equivalent just calculated become $exp(4.77/5)-1=160\%$ and $exp(6.22/5)-1=247\%$.

[19] In this table, we drop imports of Hong-Kong and Singapore. Those two countries are characterized by very large openness to developing countries' exports, together with extremely small internal distance. Those two phenomena tend to bias upwards the estimate on bilateral distance and therefore also the one on borders. The trend of the border effects over time is however unchanged when including those two countries.

[20] Bilateral tariffs are only available for the period 1989-2001, with two different sources, and thus are not introduced in the first (1980–1988) and last (1998–2006) periods. See Section 5.3 for regressions including tariffs.

Table 2
Difficulties for developing countries in rich countries' market access over time.

	Dependent variable: Ln imports partner/own						
	80–88	89–97	98–06	89–97	89–97	89–97	98–06
Border	−8.23^a	−6.36^a	−5.11^a	−6.38^a	−5.98^a	−5.90^a	−5.14^a
	(0.06)	(0.06)	(0.06)	(0.06)	(0.11)	(0.11)	(0.06)
Ln Rel. Production	0.64^a	0.73^a	0.79^a	0.73^a	0.72^a	0.72^a	0.79^a
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln Rel. Prices	−0.58^a	−0.32^a	−0.35^a	−0.32^a	−0.23^a	−0.24^a	−0.35^a
	(0.03)	(0.02)	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)
Ln Rel. Distance	−0.17^a	−0.51^a	−0.78^a	−0.51^a	−0.60^a	−0.60^a	−0.77^a
	(0.02)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)
Contiguity	1.76^a	1.88^a	1.62^a	1.78^a	1.63^a	1.62^a	1.45^a
	(0.09)	(0.06)	(0.07)	(0.07)	(0.11)	(0.11)	(0.07)
Common Language	0.39^a	0.09^b	0.22^a	0.08^b	−0.05	−0.04	0.19^a
	(0.04)	(0.04)	(0.04)	(0.04)	(0.07)	(0.07)	(0.04)
Colonial Link	0.54^a	0.89^a	1.09^a	0.91^a	0.98^a	0.97^a	1.13^a
	(0.06)	(0.06)	(0.06)	(0.06)	(0.10)	(0.10)	(0.06)
NAFTA				2.28^a	2.07^a	2.03^a	1.82^a
				(0.12)	(0.16)	(0.16)	(0.10)
Ln (1 + Tariff)						−2.22^a	
						(0.55)	
Observations	102297	161866	156796	161866	53743	53743	156796
R^2	0.323	0.404	0.434	0.405	0.381	0.382	0.434
RMSE	2.70	2.63	2.79	2.63	2.66	2.66	2.79

Note: Robust standard errors in parentheses, clustered by importer-industry, with ^{a} denoting significance at the 1% level.

Noteworthy is first the substantial improvement of the fit of the regression over time. Our empirical specification of trade patterns is an increasingly good description of reality for the South → North trade, which is not the case in general when this type of regression is applied to North–North trade. A possible interpretation is that the underlying theoretical motivations of the regressions are increasingly relevant over time for the South–North trade flows. Columns (1) to (3) of Table 2 depict interesting results. We also observe an increase in the absolute value of the distance elasticity over time. This is already documented by Disdier and Head (2008) in various gravity regressions. Moreover, the first row reveals that, even if the current level of access to Northern markets is very restricted, it is twenty three times easier to enter those markets for a Southern country exporter now than it used to be at the end of the seventies (exp(8.23)/exp(5.11)). In terms of tariff-equivalent, the drop is from 180 to 89%, almost exactly halving the perceived difficulty. While room for improvement is large, there has been considerable increase in the access of developing countries' products on developed countries' markets.[21]

Whether the remaining level of difficulty in market access is due to residual protection or other factors such as preferences for Northern products or different qualities of goods is hard to identify. One thing that appears clearly by comparing columns (5) and (6) is that tariffs are not the dominant explanation of market access restrictions in this type of South-North trade flows: The border effect falls by less than 8% when tariffs are taken into account $((exp(5.98-5.90)-1)$. One dimension of the data we can use to shed more light on this issue is the different importing countries in the Northern sample. If

[21] Note that the size of this increase might seems large at first sight, but is of the same order of magnitude as the raw increase in our dependent variable (bilateral imports from a poor country over trade with self of a rich country) over the same period. The average factor of increase in the unconditional dependent variable in our sample is 16.6, against 23 for the conditional increase.

Table 3
Changes in access to northern markets.

Country	Border effect coefficient			Percent change between periods	
	1980–1988	1988–1997	1998–2006	Second/first	Third/second
Nigeria	12.2	12.9	6.4	5.7	−50.4
Fiji	6.6	7.5	3.8	13.6	−49.3
Bulgaria	8.4	7.2	3.8	−14.3	−47.2
Tajikistan		7.2	4		−44.4
Romania	6.3	5.8	3.5	−7.9	−39.7
Egypt	9.1	7.4	4.8	−18.7	−35.1
Turkey	8.5	6.2	4.1	−27.1	−33.9
China	8.9	6.7	4.7	−24.7	−29.9
India	10.8	8.7	6.1	−19.4	−29.9
Malaysia	7.8	6	4.3	−23.1	−28.3
Thailand	10.4	6.1	4.6	−41.3	−24.6
Tunisia	7.4	6.5	4.9	−12.2	−24.6
Hungary	7.1	5.9	4.5	−16.9	−23.7
Slovakia		4.7	3.6		−23.4
El Salvador	9.5	9.7	7.5	2.1	−22.7
Poland	7.5	5.5	4.3	−26.7	−21.8
Czech Rep.		5.3	4.2		−20.8
Morocco	7.7	5.5	4.4	−28.6	−20
South Africa	9.2	8.2	6.7	−10.9	−18.3
Venezuela	9.3	8.2	6.8	−11.8	−17.1
Saudi Arabia		8.8	7.3		−17
Korea	8.2	6.5	5.4	−20.7	−16.9
Armenia		11.8	10		−15.3
Brazil		6.3	5.5		−12.7
Guatemala	9.7	8.7	7.6	−10.3	−12.6
Mexico	9.6	6.7	6.2	−30.2	−7.5
Iran	10	9.8	9.3	−2	−5.1
Chile	8.3	8.3	7.9	0	−4.8
Latvia		6.6	6.3		−4.5
Mauritius	8.5	8.8	8.4	3.5	−4.5
Kyrgyzstan		10.3	9.9		−3.9
Ethiopia		8.5	8.2		−3.5
Argentina	8.6	9.1	8.8	5.8	−3.3
Cameroon	7.8	6.8	6.6	−12.8	−2.9
MEDIAN	**8.85**	**7.4**	**7.3**	**−12.5**	**−2.9**
Senegal	8.3	10.5	10.2	26.5	−2.9
Indonesia	9.2	4.1	4	−55.4	−2.4
Colombia	9.1	8.9	8.7	−2.2	−2.2
Tanzania	9.4	12.2	12	29.8	−1.6
Ukraine		6.3	6.2		−1.6
Jordan	10.8	9.2	9.1	−14.8	−1.1
Peru	8.8	9.1	9.1	3.4	0
Estonia		5.3	5.4		1.9
Kenya	10	10.8	11.1	8	2.8
Syrian Arab Rep.	12.2	10	10.3	−18	3
Oman		11.9	12.3		3.4
Mongolia		11.7	12.1		3.4
Sri Lanka	9.5	8.5	8.8	−10.5	3.5
Uruguay	7.9	6.8	7.1	−13.9	4.4
Malta	6.1	6.8	7.1	11.5	4.4
Yemen		14.3	15		4.9
Ecuador	10.9	9.4	10	−13.8	6.4
Macedonia		6.1	6.6		8.2
Philippines	8.9	7.3	7.9	−18	8.2
Russia		6	6.5		8.3
Lithuania		5.8	6.3		8.6
Bolivia	7.4	7.8	8.6	5.4	10.3
Bangladesh	7.6	7.4	8.8	−2.6	18.9
Albania		5.1	6.2		21.6
Panama	11.1	9.2	11.2	−17.1	21.7
Azerbaijan		10.5	13.2		25.7
Nepal	5	8.3	10.5	66	26.5
Eritrea		8.4	10.9		29.8
Trinidad and Tobago	9.4	6	7.8	−36.2	30
Moldova		7.3	9.6		31.5
Costa Rica	9.3	6.9	9.1	−25.8	31.9
Malawi	4.3	8.3	11	93	32.5
Niger		7.8	10.8		38.5
Ghana	8.5	5	7.1	−41.2	42
Kazakhstan		4.7	10		112.8

Table 4
Global market access: different tariff measures.

	Dependent variable: Ln imports partner/own					
	World	World	North imp.	North imp.	South imp.	South imp.
Border	-5.03^a	-5.09^a				
	(0.06)	(0.11)				
Ln Rel. Production	0.77^a	0.75^a	0.78^a	0.79^a	0.77^a	0.73^a
	(0.00)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Ln Rel. Prices	-0.05^b	-0.26^a	-0.33^a	-0.63^a	-0.30^a	-0.43^a
	(0.02)	(0.04)	(0.03)	(0.08)	(0.04)	(0.06)
Ln Rel. Distance	-0.64^a	-0.67^a	-0.56^a	-0.65^a	-0.65^a	-0.72^a
	(0.02)	(0.03)	(0.02)	(0.05)	(0.02)	(0.04)
Contiguity	1.54^a	1.43^a	1.65^a	1.59^a	1.27^a	1.40^a
	(0.04)	(0.07)	(0.05)	(0.12)	(0.04)	(0.07)
Common language	0.41^a	0.62^a	0.29^a	0.51^a	0.74^a	0.70^a
	(0.03)	(0.05)	(0.04)	(0.10)	(0.03)	(0.06)
Same country	0.53^a	0.73^a	0.79^a	0.76^a	1.03^a	0.95^a
	(0.05)	(0.09)	(0.09)	(0.19)	(0.06)	(0.10)
Colonial link	0.90^a	0.90^a	0.73^a	0.65^a	0.86^a	0.93^a
	(0.04)	(0.08)	(0.06)	(0.13)	(0.05)	(0.08)
Common colonizer	0.86^a	0.75^a			0.84^a	0.95^a
	(0.06)	(0.07)			(0.06)	(0.09)
TRAINS tariffs	-5.18^a		-4.65^a		-2.59^a	
	(0.41)		(0.41)		(0.29)	
MAcMap tariffs		-5.65^a		-3.69^a		-4.38^a
		(0.37)		(0.52)		(0.38)
Northern exporters			-4.32^a	-4.11^a	-5.35^a	-4.85^a
			(0.06)	(0.15)	(0.09)	(0.15)
Southern exporters			-5.70^a	-5.58^a	-6.05^a	-5.66^a
			(0.07)	(0.17)	(0.08)	(0.13)
Observations	310713	79813	177271	33063	133442	46750
R^2	0.502	0.489	0.920	0.907	0.909	0.893
RMSE	2.54	2.63	2.53	2.63	2.39	2.51

Notes: Robust standard errors in parentheses, clustered by importer-industry, with [a] and [b] denoting significance at the 1% and 5% levels. Tariffs are inserted in the specification as: ln (1 + tariff).

Southern exporters face highly restricted market access because their export varieties match homogeneously badly with Northern preferences, then the estimated border effects should be broadly similar across importing Northern countries. As Tables 5, 6 and 7 in Appendix B reveal, there is on the contrary wide variance in those South–North border effects. During the 1998–2006 period, EU15 countries trade on average $\exp(4.78) = 119$ times more with themselves than with a developing country of similar size and other characteristics. This figure was $\exp(5.13) = 169$ for the USA and Canada and only $\exp(2.32) = 10$ for the Japanese market. A reasonable explanation for the downward trend in South-Japan border effects is the increasing closeness of economic relations between Japan and developing Asian countries. In 2006, developing Asian countries provided 43% of Japan's imports, a share that had risen slowly from 23% in 1990 and 16% in 1970. Unreported results available upon request shows that the figure for the EU also hides wide disparities among European countries, with some EU countries more open than others to imports from the South. Note lastly that coefficients on distance are widely different, Japan, the USA and Canada being far more sensitive to distance than EU countries in their trade with the developing world.

Table 3 shows the changes in the estimated border effects between each period for 69 developing countries.[22] Unsurprisingly, East Asian exporters, China in particular, are among those for which changes in access to Northern markets are more favorable. This result is in line with the above finding that Japan has favored access to its market by increasing economic relations with the developing Asian countries. EU15 neighbors, such as Bulgaria and Romania, also improve largely their access to rich countries between the periods 1989–1997 and 1998–2006. Latin American largest economies are facing also less difficulties than before in reaching Northern markets. On the contrary, African countries are in general under the median levels except for Nigeria which has substantially reduced its border effect.

5.3. Border effects when controlling for tariffs

We benefit here from the TRAINS and MAcMap data sets providing a disaggregated, exhaustive and bilateral measurement of applied tariff duties. The introduction of bilateral tariffs ($\ln(1+\text{tariff})$) in the estimated equation restricts however the sample to the years 1989-2001. The results are reported in Table 4, with different tariff measures. Columns (1), (3) and (5) use TRAINS-based tariffs and cover the period 1989–2000. MAcMap tariffs, which cover the year 2001, are used in columns (2), (4) and (6). The MAcMap measure, which improves the way preferential trade agreements and other exceptions to the usual WTO rules are taken into account, allows us to check the robustness of the results obtained with TRAINS information.

As expected the tariff elasticity is negative in all regressions, irrespective of the tariff measures. Moreover, comparing columns (1) and (2), the difference in magnitude between the TRAINS and the MAcMap tariffs seems marginal. The difference is however larger when restricting the sample to Northern or Southern importers. Table 9 in Appendix C reports the regressions of Table 4 on the exact same sample but without the tariff variables. The comparison of both tables confirms that tariffs are not the dominant explanation of barriers faced by developing exporters when trying to enter advanced markets.

Using our estimated world trade elasticity (5.18), the tariff equivalent of the world fragmentation level is about 164% ($= exp(5.03/5.18) - 1$)) in the first column. Note that this is the tariff equivalent of preferences and trade restrictions, after having controlled for tariffs, which exert a negative impact on trade on their own. The last row of columns (3) to (6) confirms that Southern exporters face larger difficulties in both Northern and Southern markets.

5.4. Sectoral results

In the previous subsections we have pooled the data across the set of industries used. In this subsection, we provide industry-level results (see Appendix E for the list of industries). Fig. 2 reports border effects coefficients in industry-by-industry regressions.[23] We obtain those coefficients for the three different sub-periods, which enables comparisons over time.

The developed markets that are the most difficult to enter in the last period are Tobacco, Petroleum refineries, Beverages industries and Printing and publishing notably. On the opposite extreme, different types of machinery, wearing apparel, textiles and chemicals are the relatively easiest markets to export to. All those industries have been characterized by considerable improvement in market access, with Transport equipment, Rubber products and Electric machinery being among the leading examples of products which switched from one of the most difficult to export to the North, to one of the easiest in twenty-seven years. Note also that the range of market access difficulties seems to have widened quite a lot,

[22] Computing those changes between 1980 and 2006 are quite demanding in terms of data collection and observations are unfortunately missing for some of our developing countries across the whole period.

[23] As in the previous section, the explanatory variables are those of the first column of Table 1.

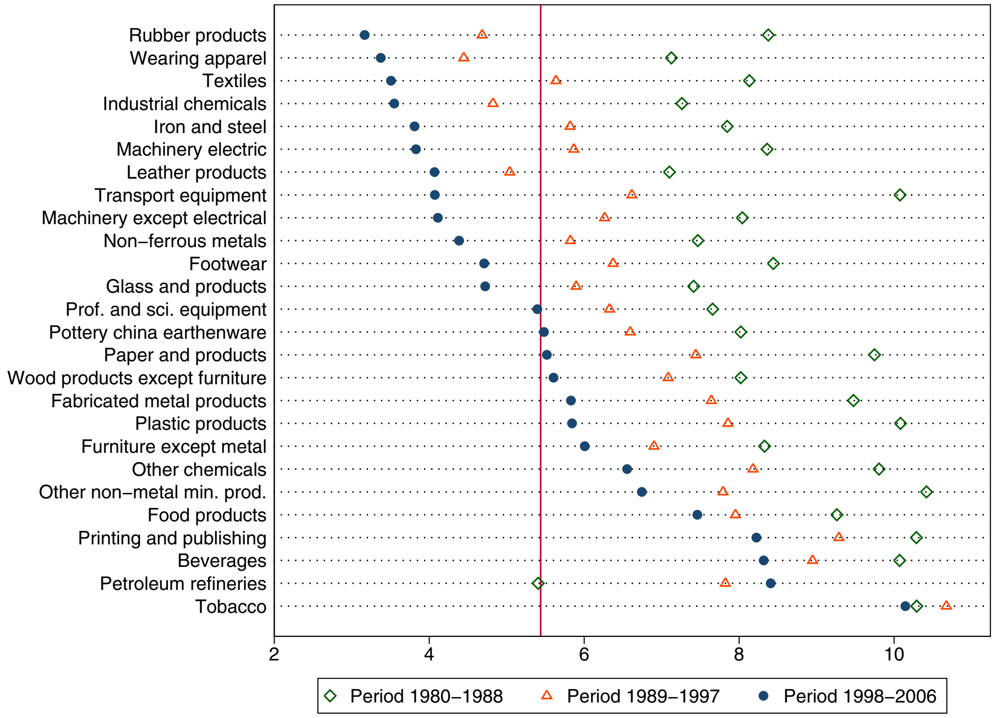

Fig. 2. Evolution of market access South→North, by sector. Note: Industry-by-industry regressions of the first column of Table 1 for three sub-periods.

some industries remaining very closed, while international trade has exploded relative to self-trade for others. Also a feature of the data seems to be that the large falls are in industries where there has been a lot of progress in the dismantling of trade barriers (apparel, textile, footwear) or where differences in preferences should be marginal (electrical machinery, industrial chemicals). On the contrary, beverages, publishing and food are characterized by much slower falls, perhaps reflecting stronger persistence in the home bias of final consumers.

5.5. The impact of regional trade agreements

Our objective in this section is to gauge the impact of regional trade agreements (RTAs) on aggregate manufacturing trade. To

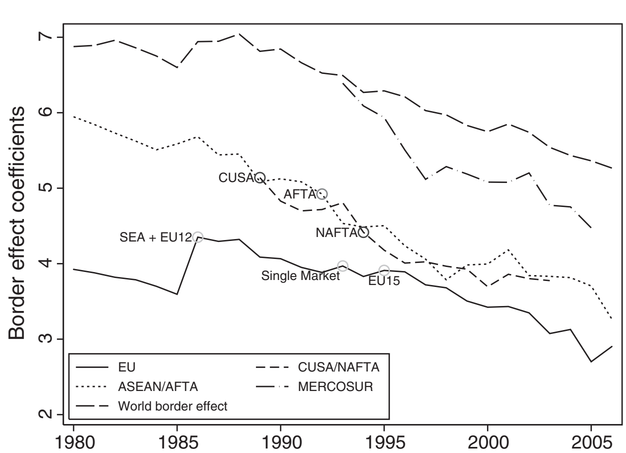

Fig. 3. Evolution of the impact of regional agreements. Note: Year-by-year regressions of the relative trade flow on the explanatory variables of the first column of Table 1 and a dummy variable for each RTA.

investigate this issue, we incorporate dummy variables capturing the impact of borders on trade inside each RTA, and thus characterizing the extent of integration of the zone, compared to trade taking place in the rest of the sample. We identify four main actual RTAs: EU, NAFTA, MERCOSUR, and ASEAN. Some of those RTAs include only Northern countries (the EU), some only Southern ones (MERCOSUR and ASEAN), and NAFTA includes two developed countries and a developing country. The impact of those agreements is interesting for our matter in the perspective of several trading arrangements that might take place in the near future, notably between Northern and Southern countries.

The impact of each RTA is expected to be different. The EU is undoubtedly the largest experiment of regional integration in the recent period, characterized by a long term commitment of member countries to achieve wide-range integration. MERCOSUR is a customs union signed in 1991 between Argentina, Brazil, Paraguay and Uruguay (during the years of our sample) but implemented in 1995, with member countries substantially liberalizing their internal trade during the transition period. The common external tariff covered 85% of tariff lines in 1995 and a schedule for convergence towards a complete common external tariff and free trade was then agreed upon but significantly disturbed by the macroeconomic problems in Brazil and Argentina at the end of the nineties. NAFTA is a free trade agreement that entered into force between the USA, Canada and Mexico in January 1994. Tariff reductions among member countries were scheduled on a 10/15 years agenda. An interesting aspect is its North–South nature. ASEAN is officially a free trade agreement between Indonesia, Malaysia, Singapore, Thailand and the Philippines since 1977, but intra bloc trade liberalization was really implemented on a large scale starting with the ASEAN free trade agreement in 1992 (Soloaga and Winters, 2001).

Fig. 3 graphs the evolution of border effects coefficients for the world and inside each of the considered RTA. Those estimates are based on regressions where, for each year, the relative trade flow is regressed on the explanatory variables of the first column of Table 1 and a dummy variable for each RTA.

This representation offers a richer picture of how market fragmentation is receding in each of the considered regional arrangements. A striking characteristic is the apparent convergence in the absolute level of integration of the EU15, NAFTA and ASEAN until the end of the 1990s. The EU starts far more integrated than the other two zones, but those gradually catch up and end up quite close to the level of EU integration at the end of the 1990s (exp(3.64), exp(4.13) and exp(3.75) for the EU, NAFTA and ASEAN in 1999 respectively). Since then, the EU has further pursued its process of integration. Note that the increase in estimated EU15 fragmentation in 1986 comes from the membership of two relatively closed economies at the time, Spain and specially Portugal. Less pronounced, the increase in 1995 is due to the entry of Austria, Finland and Sweden. For the most recent period, after 1999, there seems to be a clear ranking of integration with EU countries being the most integrated zone followed by NAFTA, ASEAN and then MERCOSUR, for which border effect coefficients fall markedly since the period 1993-1995 (which is interesting as 1995 is the date where most internal trade liberalization should have been completed).

Those results point to expected and reasonable estimates of the effect of trading arrangements, as in Baier and Bergstrand (2007). A higher effect of the RTA on trade translates into lower border effects. Previous literature produced contrasted effects of RTA on trade. Frankel (1997, Table 4.2), for instance, finds mostly insignificant effects of EU membership, once common language and overall openness are taken into account. Soloaga and Winters (2001) find an overall negative and significant impact of EU membership, no significant impact for NAFTA or ASEAN and an extremely important positive impact of MERCOSUR, roughly constant since 1980. ASEAN is found here to have a sizable impact on trade volumes, that is growing over time, the order of magnitude of the effect is comparable to what is found in Frankel (1997) and points to the dynamism of international trade in the region. Here, as stated in Anderson and van Wincoop (2003, 2004) and Carrère (2006), the rigorous link of the empirical specification with theory proves crucial for a correct assessment of the impact of both national borders and regional integration. The puzzling results in the previous literature where the deepest integration experiences did not seem to yield consistent important surpluses of trade are here qualified. The border effect methodology gives us a picture which seems to confirm the conventional view that EU and NAFTA have a large impact on trade flows (although it should again be noted that those areas are still far from perfectly integrated even in recent years).

Table 10 in Appendix D returns to the reciprocity issue in North-South market access by taking into account the above RTAs and the whole time period. The Andean Community, a rather old RTA, usually seen as having been less effective in reducing the level of protection of their members, is also introduced. Column (1) starts with an overall estimate of the impact of regional agreements in the complete world sample. The estimates reveal that the average country in a regional agreement trades $exp(6.31-2.28)\simeq 56$ times more with itself than with another country of the same RTA, while this ratio is 10 times higher when no RTA covers the bilateral trade flow (exp(6.31)). The estimate of the border effect of the EU15 countries in the North–North sample is $exp(5.17-1.40)\simeq 43$ (column 2). This estimate is higher than the most recent ones in the literature. Taking representative coefficients mostly based on EU12 or even EU9 countries, Nitsch (2000) finds a border effect of around 10 in 1990, Head and Mayer (2000) find 13 for the 1993–1995 period and Chen (2004) finds a multiplicative factor of 6 for internal trade flows in 1996. One possible reason of this difference is due to the fact that our sample includes all 15 EU countries and that trade data for Belgium — a very open country — is mostly missing at the disaggregated 3 digit level.[24] More generally, as stated above, the absolute level of estimated border effects is crucially dependent on the way international and internal distances are measured. Studies differ a lot on this aspect, which makes it very hard to compare levels across studies.

The RTA between the United States and Canada (CUSA) also has a positive and significant impact on bilateral trade, although lower than the EU. An interesting result on NAFTA is obtained from comparing columns (4) and (5). Mexico faces a border effect of around 82 ($exp(6.71-2.30)$) on the Northern American markets, while the US and Canadian exporters' corresponding border effect is only slightly lower, around 78 ($exp(5.97-1.61)$). The estimated level of market access in the South–South combinations is extremely low (with an estimated border effect of exp(6.60) on average). However, it is interesting to note that, contrary to the Andean Community, MERCOSUR and ASEAN have a very sizable impact on market access inside those agreements. Sharing a common colonizer also has a very substantial impact on reciprocal market access, confirming many results in the literature.

6. Conclusion

This paper measures difficulties in market access over a wide range of countries (both developing and developed), industries and years. It therefore tries to put precise numbers on the extent and evolution of market access, which is one of the key concepts in spatial economics. For this we use a gravity-type model of trade patterns structurally grounded in theory and estimate global and regional border effects. In particular, we analyze the impact of national borders on revealed access to Northern markets by Southern producers, which repeatedly claim the difficulties faced by their exporters in acceding rich markets.

Results show that difficulties faced by developing countries' exporters in accessing developed countries consumers are higher than difficulties faced by Northern exporters. Currently, expressed in tariff equivalent, South–North trade is about 50% harder than North–North trade, with LDCs facing the highest barriers. These difficulties in market access have however experienced a noticeable fall since 1980 in both Southern and Northern markets, and in all industries. While the current level of access to Northern markets is very restricted, it is twenty three times easier to enter those markets for a Southern country exporter now than it used to be in the end of the seventies. Expressed in tariff-equivalent, the level of protection implied when crossing a border fell from 180 to 89% for this same sample. Japanese market appears to be largely more open to developing exporters than the North-American and European ones.

Another result concerns the impact of tariffs on market access. While tariffs still have a general influence on trade patterns, they do not seem to be an important part of the border effect faced by Southern exporters on Northern markets. After having controlled for tariffs, the tariff equivalent of preferences and trade restrictions captured by the border effect falls very little. We also show that the proximity of the empirical specification with theory changes the estimates of the impact of regional agreements. They are more in line with our expectations than some results in the literature. The EU, CUSA/NAFTA, ASEAN/AFTA and MERCOSUR agreements all tend to reduce difficulties in market access within those zones, with a quite intuitive ranking between the respective impact of those agreements.

[24] This is due to the fact that our dependent variable uses as a denominator trade with self, defined as production minus total exports. Despite efforts of customs administrations to track the “true” origin and final destination of shipments, it seems that a lot of transit trade is still attributed to Belgian exports. This translates into a large number of negative values for trade with self.

Appendix A. Evolution of the import shares of Least Developed Countries on main rich markets (1989-2006)

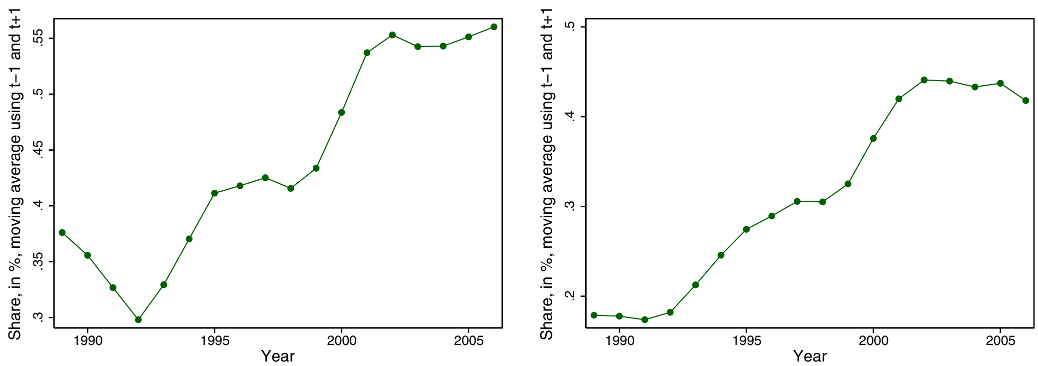

Fig. 4. Share of LDCs in total (left) and manufacturing (right) imports of European Union (15).

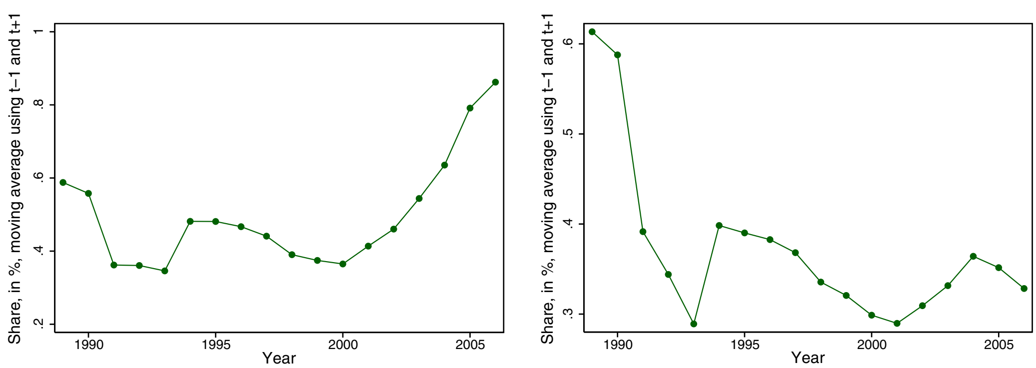

Fig. 5. Share of LDCs in total (left) and manufacturing (right) imports of Japan.

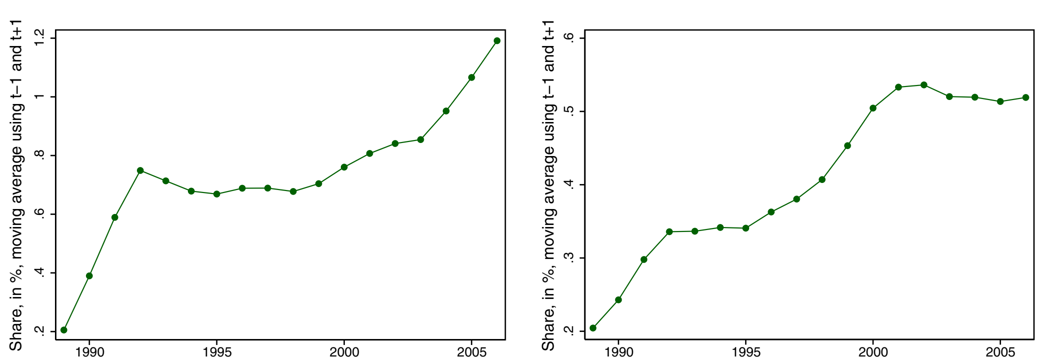

Fig. 6. Share of LDCs in total (left) and manufacturing (right) imports of the USA.

Appendix B. Difficulties for developing countries in the Quad countries' market access over time

Table 5
Difficulties for developing countries in Japanese market access over time.

	Dependent var.: Ln imports partner/own		
	1980–1988	1989–1997	1998–2006
Border	−4.10^{a}	−2.02^{a}	−2.32^{a}
	(0.22)	(0.21)	(0.19)
Ln rel. production	0.72^{a}	0.85^{a}	0.87^{a}
	(0.02)	(0.02)	(0.02)
Ln rel. prices	−0.66^{a}	−0.25^{a}	−0.53^{a}
	(0.15)	(0.08)	(0.08)
Ln rel. distance	−1.61^{a}	−1.86^{a}	−1.79^{a}
	(0.06)	(0.06)	(0.06)
Observations	5470	7879	7421
R^2	0.394	0.511	0.532
RMSE	2.72	2.52	2.62

Note: Robust standard errors in parentheses, clustered by importer-industry, with ^{a} denoting significance at the 1% level.

Table 6
Difficulties for developing countries in European market access over time.

	Dependent var.: Ln imports partner/own		
	1980–1988	1989–1997	1998–2006
Border	−8.09^{a}	−6.24^{a}	−4.78^{a}
	(0.08)	(0.08)	(0.08)
Ln rel. production	0.60^{a}	0.71^{a}	0.78^{a}
	(0.01)	(0.01)	(0.01)
Ln rel. prices	−0.72^{a}	−0.47^{a}	−0.35^{a}
	(0.04)	(0.03)	(0.03)
Ln rel. distance	−0.21^{a}	−0.54^{a}	−0.79^{a}
	(0.03)	(0.02)	(0.02)
Contiguity	1.27^{a}	1.81^{a}	1.75^{a}
	(0.10)	(0.08)	(0.09)
Common language	0.51^{a}	0.18^{a}	0.31^{a}
	(0.06)	(0.06)	(0.07)
Colonial link	0.06	0.45^{a}	0.64^{a}
	(0.07)	(0.06)	(0.07)
Observations	68531	99317	92725
R^2	0.256	0.345	0.391
RMSE	2.69	2.64	2.84

Note: Robust standard errors in parentheses, clustered by importer-industry, with ^{a} denoting significance at the 1% level.

Table 7
Difficulties for developing countries in the USA and Canadian market access over time.

	Dependent Var.: Ln imports partner/own		
	1980–1988	1989–1997	1998–2006
Border	−8.24^{a}	−6.24^{a}	−5.13^{a}
	(0.12)	(0.12)	(0.16)
Ln rel. production	0.70^{a}	0.76^{a}	0.83^{a}
	(0.02)	(0.01)	(0.02)
Ln rel. prices	−1.19^{a}	−0.31^{a}	−0.50^{a}
	(0.09)	(0.07)	(0.08)
Ln rel. distance	−0.55^{a}	−0.80^{a}	−1.02^{a}
	(0.05)	(0.05)	(0.08)
Contiguity	2.71^{a}	3.03^{a}	1.32^{a}
	(0.13)	(0.12)	(0.18)
Common language	0.66^{a}	0.42^{a}	0.53^{a}
	(0.06)	(0.05)	(0.04)
Colonial link	1.71^{a}	2.58^{a}	2.25^{a}
	(0.14)	(0.15)	(0.21)
NAFTA		1.56^{a}	1.84^{a}
		(0.15)	(0.18)
Observations	11648	17156	15944
R^2	0.317	0.394	0.482
RMSE	2.77	2.67	2.67

Note: Robust standard errors in parentheses, clustered by importer-industry, with ^{a} denoting significance at the 1% level.

Appendix C. Robustness checks

C.1. Global results

Table 8 presents two robustness checks related to the issue of zeros (columns 1, 2 and 3) and the relative quality of institutions (columns 4 and 5).[25]

Table 8
Global market access, robustness: zeros (1995–2006) and institutions (1996–2006).

Period:	1995–2006			1996–2006	
Dependent variable:	$ln\left(\frac{X_{ij}}{X_{jj}}\right)$	$\frac{X_{ij}}{X_{jj}}$	$\frac{X_{ij}}{X_{jj}}$	$ln\left(\frac{X_{ij}}{X_{jj}}\right)$	$ln\left(\frac{X_{ij}}{X_{jj}}\right)$
Border	−5.42^{a}	−2.64^{a}	−2.64^{a}	−5.37^{a}	−5.36^{a}
	(0.03)	(0.29)	(0.26)	(0.03)	(0.03)
Ln relative production	0.74^{a}	0.70^{a}	0.72^{a}	0.74^{a}	0.74^{a}
	(0.00)	(0.08)	(0.08)	(0.00)	(0.00)
Ln relative prices	−0.38^{a}	0.12	0.09	−0.39^{a}	−0.39^{a}
	(0.01)	(0.31)	(0.29)	(0.01)	(0.01)
Ln relative distance	−0.68^{a}	−0.58^{a}	−0.71^{a}	−0.70^{a}	−0.70^{a}
	(0.01)	(0.10)	(0.12)	(0.01)	(0.01)
Contiguity	1.40^{a}	0.64^{a}	0.67^{a}	1.39^{a}	1.39^{a}
	(0.02)	(0.22)	(0.26)	(0.02)	(0.02)
Common language	0.62^{a}	0.10	0.21	0.65^{a}	0.65^{a}
	(0.02)	(0.36)	(0.37)	(0.02)	(0.02)
Same country	0.83^{a}	1.07^{b}	1.16^{b}	0.81^{a}	0.81^{a}
	(0.03)	(0.45)	(0.47)	(0.03)	(0.03)
Colonial link	0.94^{a}	0.08	0.19	0.93^{a}	0.93^{a}
	(0.02)	(0.24)	(0.26)	(0.02)	(0.02)
Common colonizer	0.54^{a}	0.36^{a}	−0.07	0.53^{a}	0.53^{a}
	(0.03)	(0.13)	(0.11)	(0.03)	(0.03)
Relative rule of law					0.20^{b}
					(0.08)
Estimator	OLS	PPML	PPML	OLS	OLS
Zero trade included	No	No	Yes	No	No
Observations	904526	904526	1553966	818439	818439

Note: Robust standard errors in parentheses, clustered by importer-industry, with ^{a} and ^{b} denoting significance at the 1% and 5% level respectively.

First, the original trade data used to construct BACI is UN Comtrade, which contains no zeros in order to limit the size of an already very large database. However, reporting countries are supposed to report all their trade flows (i.e., all partners and all products for a given year). Following the assumption that they do indeed report as expected, what defines a missing value in BACI is an observation of trade between two non-reporting countries, since BACI reconciles both reports. The version of BACI available online, starting in 1995 (based on HS 6-digit classification data), provides the bilateral matrix of reporting countries. Thus, we can easily check the issue of zeros using this information to distinguish between zeros and missing flows, by restricting our sample to the period 1995–2006. Precisely, we consider a missing observation as a zero when at least one of the trading partners does report its trade to the UN. If both partners are not reporting countries to the UN, then the missing observation is considered a true missing value.[26]

Column (1) of Table 8 depicts the results of the first column of Table 1, with the sample restricted to the period 1995–2006. Column (2) reports the same version of Eq. (6) but using a Poisson Pseudo-Maximum Likelihood (PPML) estimator, as suggested by Santos Silva and Tenreyro (2006). They argue that log-linearizing the gravity equation leads to biased estimates and that PPML is preferable to OLS without further information on the heteroskedasticity of errors. This explains the differences between columns (1) and (2): we find similar results excepted for (i) the global border effect, which is lower, and (ii) estimates of prices, common language and colonial link variables, which are not statistically significant anymore. An appealing side effect of the PPML estimator is

[25] We thank an anonymous referee for inviting us to consider these two points.
[26] We end up with an almost 16 million observations database, which is however reduced to over 1.5 million when merged with information regarding production and prices.

that it allows to include in the estimation the zero trade flows, which is done in column (3). Results are very close to those of column (2) excepted for the common colonizer variable, which turns to be not significant when zero flows are considered. Inclusion of the zeros therefore does not alter the results. PPML does lower the estimated level of the border effect. Poisson is however not the only possible PML estimator. It has been shown by several studies that Poisson is quite specific in its departure from OLS, and that other PML like Gamma or Negative Binomial, gave results much close to log-linear OLS. Thus, since our feeling is that the dust has not settled yet on the preferred estimator for this kind of problem, we retain OLS as our main estimation technique, if only for comparison purposes with previous work.

Second, the theoretical model assumes firms to be equally productive in all countries, developed or developing (see Section 3). This simplifying assumption is standard in theory but may not be met in practice. The ratio of fixed to marginal costs may be higher for firms in developing countries because overhead costs are higher due to institutional inefficiencies, more bureaucracy or political instability, among others. As a consequence, we check the robustness of our results by adding a control variable to Eq. (6) that controls for the relative quality of institutions in the respective countries *i* and *j*. We use the composite index of rule of law developed by Kaufmann et al. (2010) as in Levchenko (2007). This aims to capture the quality of contract enforcement, security of property rights, and predictability of the judiciary. The index ranges between −2.5 (lowest institutional quality) and 2.5. Despite the quality of the data and the country coverage (125 out of our 151 countries are available) there is one limitation since the data are only available for the period 1996–2006. Using this new sample, we reproduce the first regression of Table 1 in the column (4) of Table 8. Then, in column (5), we add the relative rule of law variable. As expected, an increase in the quality of the rule law promotes trade. The other results are qualitatively unaffected by this additional control.

C.2. Tariff measures

Table 9
Robustness: results of Table 4 without tariff measures.

	Dependent variable: Ln imports partner/own					
	World	World	North imp.	North imp.	South imp.	South imp.
Border	−5.44[a]	−5.50[a]				
	(0.06)	(0.11)				
Ln rel. production	0.76[a]	0.75[a]	0.77[a]	0.78[a]	0.78[a]	0.75[a]
	(0.00)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Ln rel. prices	−0.29[a]	−0.45[a]	−0.32[a]	−0.62[a]	−0.40[a]	−0.56[a]
	(0.02)	(0.04)	(0.03)	(0.08)	(0.04)	(0.06)
Ln rel. distance	−0.65[a]	−0.68[a]	−0.57[a]	−0.66[a]	−0.64[a]	−0.73[a]
	(0.02)	(0.03)	(0.02)	(0.05)	(0.02)	(0.04)
Contiguity	1.67[a]	1.54[a]	1.75[a]	1.65[a]	1.35[a]	1.54[a]
	(0.04)	(0.07)	(0.05)	(0.12)	(0.04)	(0.07)
Common language	0.36[a]	0.60[a]	0.27[a]	0.51[a]	0.72[a]	0.66[a]
	(0.03)	(0.05)	(0.04)	(0.10)	(0.03)	(0.06)
Same country	0.46[a]	0.72[a]	0.72[a]	0.60[a]	1.12[a]	1.06[a]
	(0.05)	(0.10)	(0.10)	(0.19)	(0.06)	(0.10)
Colonial link	0.96[a]	0.98[a]	0.70[a]	0.66[a]	0.84[a]	0.95[a]
	(0.04)	(0.08)	(0.06)	(0.13)	(0.05)	(0.08)
Common colonizer	0.51[a]	0.58[a]			0.71[a]	0.90[a]
	(0.06)	(0.08)			(0.07)	(0.09)
Northern exporters			−4.43[a]	−4.19[a]	−5.66[a]	−5.22[a]
			(0.06)	(0.15)	(0.08)	(0.14)
Southern exporters			−5.80[a]	−5.67[a]	−6.44[a]	−6.14[a]
			(0.07)	(0.17)	(0.07)	(0.12)
Observations	310713	79813	177271	33063	133442	46750
R^2	0.482	0.466	0.919	0.906	0.907	0.889
RMSE	2.59	2.69	2.54	2.65	2.41	2.56

Note: Robust standard errors in parentheses, clustered by importer-industry, with [a] denoting significance at the 1% level.

Appendix D. Reciprocity in North–South market access, with regional trade agreements

Table 10
North-South market access, with regional trade agreements.

	Dependent variable: Ln imports partner/own				
	World	N⇒N	S⇒S	N⇒S	S⇒N
Border	−6.31[a]	−5.17[a]	−6.60[a]	−5.97[a]	−6.71[a]
	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
Ln rel. production	0.72[a]	0.77[a]	0.75[a]	0.72[a]	0.73[a]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ln rel. prices	−0.30[a]	−0.26[a]	−0.26[a]	−0.28[a]	−0.45[a]
	(0.01)	(0.03)	(0.01)	(0.01)	(0.02)
Ln rel. distance	−0.49[a]	−0.49[a]	−0.60[a]	−0.63[a]	−0.42[a]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Contiguity	1.16[a]	1.34[a]	1.42[a]	1.60[a]	2.26[a]
	(0.01)	(0.02)	(0.02)	(0.03)	(0.04)
Common language	0.32[a]	0.51[a]	0.50[a]	0.67[a]	0.41[a]
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Colonial link	1.16[a]	0.87[a]		0.85[a]	0.63[a]
	(0.02)	(0.02)		(0.01)	(0.04)
Common colonizer	0.57[a]		0.71[a]		
	(0.02)		(0.02)		
Same country	0.64[a]	0.36[a]	0.84[a]		
	(0.02)	(0.04)	(0.03)		
RTAs	2.28[a]				
	(0.02)				
EU		1.40[a]			
		(0.02)			
CUSA		0.43[a]			
		(0.05)			
MERCOSUR			1.17[a]		
			(0.06)		
ASEAN			1.03[a]		
			(0.05)		
Andean Community			−0.53[a]		
			(0.04)		
NAFTA				1.61[a]	2.30[a]
				(0.13)	(0.08)
Observations	1818773	378260	437623	569678	433212
R^2	0.482	0.521	0.437	0.420	0.391
RMSE	2.58	2.26	2.64	2.39	2.76

Note: Robust standard errors in parentheses, clustered by importer-industry, with [a] denoting significance at the 1% level.

Appendix E. List of industries and countries

Table 11
List of the 26 ISIC 3-digit industries included in the sample.

Code	ISIC (International Standard Industrial Classification) Rev. 2 3-digit
31	**Food, Beverages and Tobacco**
311-312	Food
313	Beverage
314	Tobacco
32	**Textile, Wearing Apparel and Leather Industries**
321	Textiles
322	Wearing apparel, except footwear
323	Leather and products of leather, leather substitutes and fur
324	Footwear, except vulcanized or moulded rubber or plastic footwear
33	**Wood and Wood Products, Including Furniture**
331	Wood and cork products, except furniture
332	Furniture and fixtures, except primarily of metal
34	**Paper and Paper Products, Printing and Publishing**
341	Paper and paper products
342	Printing, publishing and allied industries
35	**Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products**
351	Industrial chemicals
352	Other chemical products
353	Petroleum refineries
355	Rubber products
356	Plastic products not elsewhere classified

Table 11 (*continued*)

Code	ISIC (International Standard Industrial Classification) Rev. 2 3-digit
36	**Non-Metallic Mineral Products, except Products of Petroleum and Coal**
361	Pottery, china and earthenware
362	Glass and glass products
369	Other non-metallic mineral products
37	**Basic Metal Industries**
371	Iron and steel basic industries
372	Non-ferrous metal basic industries
38	**Fabricated Metal Products, Machinery and Equipment**
381	Fabricated metal products, except machinery and equipment
382	Machinery except electrical
383	Electrical machinery apparatus, appliances and supplies
384	Transport equipment
385	Professional and scientific, and measuring and controlling equipment not elsewhere classified, and of photographic and optical goods

Table 12
List of countries included in the sample.

High income	Upper-middle income	Lower-middle income	Low income
Australia	Argentina	Albania	Afghanistan
Austria	Bahrain	Algeria	Armenia
Bahamas	Barbados	Belize	Azerbaijan
Belgium-Lux.	Brazil	Bolivia	Bangladesh
Bermuda	Chile	Bulgaria	Benin
Canada	Croatia	Cape verde	Bhutan
Cyprus	Czech Rep.	China	Burkina faso
Denmark	Estonia	Colombia	Burundi
Finland	Gabon	Costa rica	Cambodia
France	Hungary	Cuba	Cameroon
Germany	Korea	Dominican Rep.	Central African Rep.
Greece	Lebanon	Ecuador	Congo
Hong kong	Libya	Egypt	Cote d'ivoire
Iceland	Malaysia	El salvador	Eritrea
Ireland	Malta	Equatorial Guinea	Ethiopia
Israel	Mauritius	Fiji	Gambia
Italy	Mexico	Guatemala	Georgia
Japan	Oman	Honduras	Ghana
Kuwait	Panama	Iran	Haiti
Macau	Poland	Iraq	India
Netherlands	Saint Lucia	Jamaica	Indonesia
New Zealand	Saudi Arabia	Jordan	Kenya
Norway	Seychelles	Kazakhstan	Kyrgystan
Portugal	Slovakia	Latvia	Lao Dem. Rep.
Qatar	South Africa	Lithuania	Liberia
Singapore	Trinidad and Tobago	Macedonia	Madagascar
Slovenia	Uruguay	Morocco	Malawi
Spain	Venezuela	Papua New Guinea	Moldova
Sweden		Peru	Mongolia
Switzerland		Philippines	Mozambique
Taiwan		Romania	Nepal
United Arab Emirates		Russia	Nicaragua
United Kingdom		Sri Lanka	Niger
USA		Suriname	Nigeria
		Syria	Pakistan
		Thailand	Rwanda
		Tonga	Senegal
		Tunisia	Sierra Leone
		Turkey	Somalia
			Sudan
			Tajikistan
			Tanzania
			Togo
			Turkmenistan
			Uganda
			Ukraine
			Viet nam
			Yemen
			Zambia
			Zimbabwe
Total: 34	28	39	50

Note: World Bank classification of countries by income level in 2001.

References

Aitken, N., 1973. The effect of the EEC and EFTA on European trade: a temporal cross-section analysis. American Economic Review 63 (5), 881–892.

Anderson, J., 1979. A theoretical foundation for the gravity equation. American Economic Review 69 (1), 106–116.

Anderson, J., 2011. The gravity model. Annual Review of Economics 3, 133–160.

Anderson, J., van Wincoop, E., 2003. Gravity with gravitas: a solution to the border puzzle. American Economic Review 93 (1), 170–192.

Anderson, J., van Wincoop, E., 2004. Trade costs. Journal of Economic Literature 42 (3), 691–751.

Anderson, S., de Palma, A., Thisse, J.-F., 1992. Discrete Choice. Theory of Product Differentiation. The MIT Press, Cambridge, MA.

Baier, S., Bergstrand, J., 2007. Do free trade agreements actually increase Members' International Trade? Journal of International Economics 71, 72–95.

Bouët, A., Decreux, Y., Fontagné, L., Jean, S., Laborde, D., 2008. Assessing applied protection across the world. Review of International Economics 16 (5), 850–863.

Carrère, C., 2006. Revisiting the effects of regional trade agreements on trade flows with proper specification of the gravity model. European Economic Review 50 (2), 223–247.

Chaney, T., 2008. Distorted gravity: heterogeneous firms, market structure and the geography of international trade. American Economic Review 98 (4), 1707–1721.

Chen, N., 2004. Intra-national versus international trade in the European Union: why do national borders matter? Journal of International Economics 63 (1), 93–118.

Costinot, A., Donaldson, D., Komunjer, I., 2012. What goods do countries trade? A quantitative exploration of Ricardo's ideas. Review of Economic Studies 79 (2), 581–608.

De Sousa, J., Lochard, J., 2011. Does the single currency affect foreign direct investment? The Scandinavian Journal of Economics 113 (3), 553–578.

Disdier, A.-C., Head, K., 2008. The puzzling persistence of the distance effect on bilateral trade. The Review of Economics and Statistics 90 (1), 37–48.

Eaton, J., Kortum, S., 2002. Technology, geography and trade. Econometrica 70 (5), 1741–1780.

Erkel-Rousse, H., Mirza, D., 2002. Import price-elasticities: reconsidering the evidence. Canadian Journal of Economics 35 (2), 282–306.

Evenett, S., Keller, W., 2003. On theories explaining the success of the gravity equation. Journal of Political Economy 110 (2), 281–316.

Feenstra, R., 2004. Advanced International Trade: Theory and Evidence. Princeton University Press, Princeton.

Fontagné, L., Zignago, S., 2007. A re-evaluation of the impact of regional trade agreements. International Economics 109 (1), 31–51.

Frankel, J.A., 1997. Regional Trading Blocs. Institute for International Economics, Washington.

Frankel, J., Stein, E., Wei, S.-J., 1995. Trading blocs and the Americas: the natural, the unnatural, and the supernatural. Journal of Development Economics 47 (1), 61–95.

Fukao, K., Okubo, T., Stern, R., 2003. An econometric analysis of trade diversion under NAFTA. North American Journal of Economics and Finance 14, 3–24.

Gaulier, G., Zignago, S., 2010. BACI: international trade database at the product-level. The 1994–2007 version. CEPII Working Paper, 23.

Haveman, J., Nair-Reichert, U., Thursby, J., 2003. How effective are trade barriers? An empirical analysis of trade reduction, diversion and compression. The Review of Economics and Statistics 85 (2), 480–485.

Head, K., Mayer, T., 2000. Non-Europe: the magnitude and causes of market fragmentation in Europe. Weltwirschaftliches Archiv 136 (2), 285–314.

Head, K., Mayer, T., 2010. Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade. In: Brakman, S., van Bergeijk, P. (Eds.), The Gravity Model in International Trade: Advances and Applications. Cambridge University Press, Cambridge.

Head, K., Mayer, T., 2011. Gravity, market potential and economic development. Journal of Economic Geography 11 (2), 281–294.

Head, K., Ries, J., 2001. Increasing returns versus national product differentiation as an explanation for the pattern of US–Canada Trade. American Economic Review 91 (4), 858–876.

Head, K., Ries, J., 2008. FDI as an outcome of the market for corporate control: theory and evidence. Journal of International Economics 74 (1), 2–20.

Kaufmann, D., Kraay, A., Mastruzzi, M., 2010. The worldwide governance indicators: a summary of methodology, data and analytical issues. World Bank Policy Research Working Paper, 5430.

Krugman, P., 1980. Scale economies, product differentiation, and the pattern of trade. American Economic Review 70, 950–959.

Krugman, P., Venables, A., 1995. Globalization and the inequality of nations. Quarterly Journal of Economics 110 (4), 857–880.

Lai, N., Trefler, D., 2002. The gains from trade with monopolistic competition: specification, estimation, and mis-specification. NBER Working Paper, 9169.

Levchenko, A., 2007. Institutional quality and international trade. Review of Economic Studies 74 (3), 791–819.

Mayer, T., Zignago, S., 2011. Notes on CEPII's distances measures: the GeoDist database. CEPII Working Paper, 25.

McCallum, J., 1995. National borders matter: Canada–US regional trade patterns. American Economic Review 85, 615–623.

Nicita, A., Olarreaga, V., 2007. Trade, production and protection, 1976–2004. World Bank Economic Review 21 (1), 165–171.

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

Romalis, J., 2007. NAFTA's and CUSFTA's impact on North American Trade. The Review of Economics and Statistics 89 (3), 416–435.

Santos Silva, J., Tenreyro, S., 2006. The log of gravity. The Review of Economics and Statistics 88 (4), 641–658.

Soloaga, I., Winters, A., 2001. Regionalism in the nineties: what effect on trade? North American Journal of Economics and Finance 12, 1–29.

Thisse, J., 2012. Economic Geography. In: Faccarello, G., Kurz, H. (Eds.), Handbook of the History of Economic Analysis. Edward Elgar, Cheltenham.

Wei, S.-J., 1996. Intra-national versus international trade: how stubborn are nations in global integration? NBER Working Paper, 5531.