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Abstract

This paper develops a method to measure difficulties in market access over a large set of countries (both developing and developed) and industries, 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 international fragmentations 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 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.

Keywords: Market Access, North-South Trade, Regional integration, Border Effects, Gravity, Tariffs, Trade Costs, Distances.
JEL classification codes: F12, F13, F14, F15.

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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).

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 income disparities, the agglomeration phase being one where the manufacturing economic activity concentrates in a rich core, which diverges from an impoverished periphery. Then, the final dispersion phase that comes with low trade costs ends up enabling peripheral countries to catch up with the industrialized 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 market integration is also a way to measure market access. This can be useful in the debate opposing industrialized and developing economies regarding their respective contribution to the multilateral liberalization of trade flows. Particularly, in the current context of 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.[2] Despite complex and wide-ranging preferential access granted by rich countries to exporters of the poorest developing economies, there are claims that their market access remains limited. Claims from LDCs 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 is rarely above a tiny 1%. As an example, their import share in the European Union (EU) market was about 0.4% in 1990, 0.5% in 2000 and 0.55% in 2006. 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 figures in appendix A).[3] Such tiny shares are even more problematic since market access appears to be a major

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

[2] Multilateral negotiations on the issue of manufacturing tariffs seem to show no sign of progress. As a consequence, talks could be reoriented on a minimal objective for the Doha Round: to improve the market access at least for exporters from LDCs.

[3] We use BACI, the Gaulier and Zignago (2010) database of international trade, to compute the annual

determinant for economic development (see for instance Frazer and Van Biesebroeck, 2010, for a recent contribution using a clever identification strategy to derive causal estimates).

However instructive, this type of figures 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, de Palma and Thisse (1992), and a typical 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 as dictated by the theoretical framework.[4]

A second problematic issue with the use of the simple market 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 effect* 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 rich, emerging and LDC's exporters, over the period 1980-2006. This is made possible by the construction and use of large interconnected datasets. Firstly, the collection of production and trade data is an updated extension of Nicita and Olarreaga (2007), aiming to cover more countries and years. Secondly, a specific feature of our study is to identify in the border effect measurement of market access, the part to be associated with observed bilateral characteristics, such as tariffs. In particular, we compute bilateral distances (both internal and international) such that they take into account the geographic distribution of the economic activity inside each nation, in order to avoid 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. This measure of international fragmentation has however experienced a noticeable fall since 1980 in both Southern and Northern markets, and in all industries. It is twenty three times easier

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 for 2006).

[4]Alternatively, one can try to measure protection directly through the collection of formal trade barriers. Anderson and van Wincoop (2004) survey both types of works, using direct and indirect protection measures respectively.

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 an important part of the border effect. Controlling for tariffs, the tariff equivalent of the world fragmentation level is still 233%. A "by-product" of the 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 international market openness with border effects

Why do we need to study the impact of national borders on trade flows? The reason lies in the fact that international trade flows are not sufficient to gauge international markets integration. This statement is based on the simple idea that two countries could be considered perfectly integrated if the national border separating them had no specific impact on where consumers choose to source their purchases and where producers can sell their output. In fact, in the European Union, this is best summarized as the whole idea of the Single Market, which explicitly states its goal to be the abolition of the economic significance of national borders. The title of an official document of the European Commission (2003) makes it extremely clear: *The Internal Market – Ten Years Without Frontiers.*[5]

The measure of the degree of international market fragmentation is therefore linked to the assessment of the impact of national borders. In order to make that assessment, one needs to consider international trade flows as well as intra-national trade 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 of two comparable *international* locations. This model allows thus to derive what a "normal" bilateral trade flow should be. 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

[5]Available at `http://ec.europa.eu/internal_market/10years/docs/workingdoc/workingdoc_en.pdf`

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, and 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, and 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 (one only needs to consider the poverty of available statistics on non-tariff barriers even inside the European Community at the launching of the Single Market Programme). The global image is therefore useful. Related is the fact that if impediments rise because of deliberate trade policy changes, there will usually be a strong will of countries to hide this behavior by using sophisticated non-tariff barriers schemes[6] that are very hard to detect for the economist.

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, but European, goods (*trade creation*). The rise can however also come from substitution among imported goods, in favor of EU producers and reducing imports from third countries (*trade diversion*). The gravity equation in its most traditional form find 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 inside countries, and therefore separate trade creation from trade diversion effect.[7]

We will therefore use the border effects methodology, combining international and intranational 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 know turn.

[6] If only because all rules of multilateral agreements signed by countries belonging to regional integration arrangements stipulate that regional blocks should not raise their external level of protection.

[7] 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.

3 The model and estimable equation

There are several theoretical foundations to the gravity equation.[8] 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, de Palma and Thisse (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 where $i, j, h = 1, ..., C$ denotes countries. Each exporting country i produces N_i different varieties of a good.[9] 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, de Palma and Thisse, 1992).[10] We assume that Π_{ij} depends on the probability $\mathbb{P}_{ij}$ that each of the L_j heterogeneous consumers in j chooses one of the N_i varieties. 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

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

where ϵ_{ij} is the unobserved taste variation of consumers in country j for product varieties from country i. The heterogeneity, represented by $\ln \epsilon_{ij}$, is assumed to be distributed according to the 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 $v_{ij} = \ln(X_j/L_j) - \ln p_{ij} + \ln \epsilon_{ij}$, 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.

[8] Anderson (1979) probably 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.

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

[10] Head and Ries (2008) and de Sousa and Lochard (2011) use a similar strategy to model bilateral foreign direct investments. Eaton and Kortum (2002) use a related strategy for trade decisions by modeling heterogeneous industries.

Selecting the variety with the highest utility amounts to choosing a variety in country i such that $\max v_{ij} > \max v_{hj}$ 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 $(1/\theta)\ln N_i$. 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:

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

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

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

where $p_{ij} = p_i \tau_{ij}$, with p_i the 'factory gate' 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); $\Phi_j = \sum_h N_h (p_h \tau_{hj})^{-\theta}$ is a term equivalent to 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 then drops and we are left with relative numbers of firms, relative costs in i and j, and relative bilateral trade costs:

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

The key difference of this model compared with Dixit-Stigliz-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. Firstly, 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, $v_i = q p_i n_i$, and we get the first substitution to be made in equation (5): $\frac{N_i}{N_j} = \frac{v_i}{v_j}\frac{p_j}{p_i}$.

Secondly, a functional form for trade costs (τ_{ij}) has to be specified in order to get an estimable equation. Trade costs are 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

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

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 observe some of the actual tariff protection taking place between importing and exporting countries. We want in particular to be able to control for tariffs, 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 $z_{ij}^m = \{\text{contiguity}_{ij}, \text{common language}_{ij}, \text{same country}_{ij}, \text{colonial link}_{ij}, \text{common colonizer}_{ij}\}$.[11]

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:

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

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).[12] All parameters are expected to be positive, denoting tariff equivalent of non-tariff barriers. The ranking of φ, ψ and η is the primary open question we want to answer here.

[11] The "contiguity" variable sets to one if the two countries are contiguous. The "common language" variable sets to one if a language is spoken by at least 9% of the population in both countries. The "same country" variable sets 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 equals to one if countries have had a common colonizer after 1945.

[12] When we turn to the impact of regional integration, our specification of border-related costs is different: $1 + \text{brc}_{ij} \equiv (1 + t_{ij})(\exp[\eta E_{ij} - \beta \text{RTA}_{ij} - \sum_{m=1}^{M} \gamma_m z_{ij}^m])$, 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 all national borders impose transaction costs with the minimum burden of those costs being between RTA members.

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

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

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 equation (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).[13] It is clear however from equation (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.[14] See the appendix E for the list of countries, tabulated according to their income level, and industries.

Bilateral trade comes from BACI, the international trade database at the product level constructed by Gaulier and Zignago (2010). While the Nicita and Olarreaga (2007) trade data set is based on COMTRADE data, we prefer the use of BACI, to cover more countries, specially developing ones.[15] BACI takes advantage of COMTRADE mirror flows (reports for both exporting and importing countries) in order to increase the coverage and accuracy

[13] 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 than the ours but covering the period 1976-2000.

[14] We made it available, in a previous version, at `http://www.cepii.fr/anglaisgraph/bdd/TradeProd.htm` as the CEPII's *TradeProd* database. We updated here the *TradeProd* online data sets, and extended the time period by adding information for 2005 and 2006.

[15] Similarly, Giovannetti and Sanfilippo (2009) use an aggregation of BACI at the ISIC level to analyze the impact of China in African trade, often missing in other comparable databases.

of trade data at the most disaggregated international product-level, the Harmonised System 6-digit (HS6) classification.[16] At the HS6 level, BACI covers the period 1994-2009. Before their progressive adoption of the HS classification, countries reported their bilateral trade in SITC classification since the end of the sixties. Since the industrial production data starts in 1980 in the ISIC Revision 2 classification, we apply the Gaulier and Zignago (2010) reconciliation methodology to SITC data.

The United Nations Industrial Development Organization (UNIDO) database is the main source of manufacturing production data (as well 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 converted to indexes, and 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 equation (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 mismeasures 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.

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 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

[16] 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.

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.[17] 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 as the *GeoDist* datasets.[18]

Bilateral data on trade policy at the industry level come from 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.[19] 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 industrialized 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

All regressions from section 5.1 to 5.4 are pooled across the set of industries used, while subsection 5.5 gives industry-level results. In all regressions, robust standard errors are clustered by both importer and industry.

5.1 Global results

Table 1 presents results over the entire period of a simple version of equation (6). Column (1) involves the whole sample of world markets. Columns (2) and (3) give results when the

[17] `www.tlfq.ulaval.ca/axl/index.shtml`

[18] `www.cepii.fr/anglaisgraph/bdd/distances.htm`

[19] Precisely, we use the Jon Haveman's treatment of TRAINS data (UTBC Database, see Haveman, Nair-Reichert and J. Thursby, 2003).

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 11 (in appendix E).

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 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 rich and developing exporters. In the Northern markets (column 2), the estimated border effect falls to 118 (exp(4.77)) when the exporter is in the North but jumps to 503 (exp(6.22)) when the exporter is a developing country.

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 fragmentation level is then still $\exp(4.77/7) - 1 = 98\%$ while the figure is $\exp(6.22/7) - 1 = 143\%$ 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.

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 $\exp(6.59/7) - 1 = 156\%$, while the figure for upper middle income exporters is 135%. 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

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

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

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 Figure (5.2) depicts the evolution of the world average border effect over time. Based on the specification of column (1) of Table 1, this 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 eighties 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.

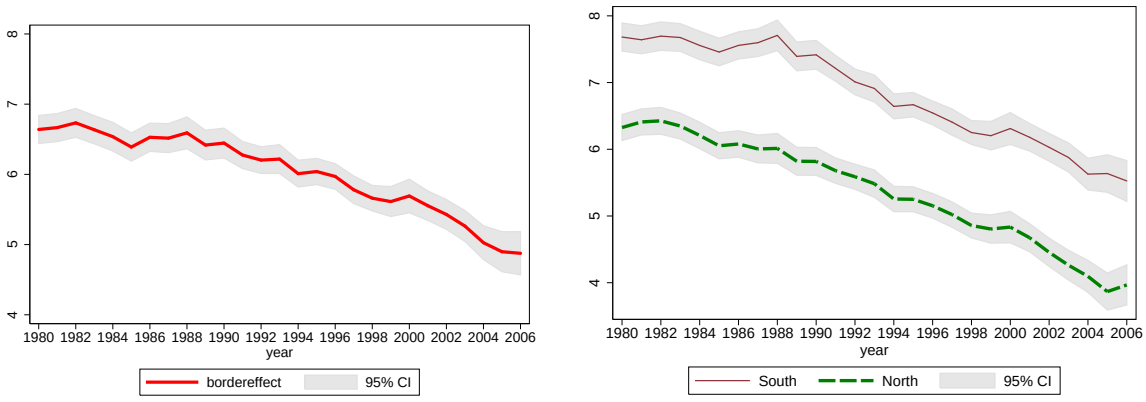

Figure 1: World (left), North and South (right) border effects 1980-2006

The right panel of Figure (5.2) depicts the evolution of the Northern and Southern border effects over time in world trade. Based on the specification of columns (2) and (4) of Table 1 (but without restricting the sample to one direction of trade), this figure plots the annual estimates of the Northern and Southern exporters variables (in absolute value) and the clustered 95% confidence interval around the point estimates. The figure shows that the Southern border effect is much larger in magnitude than the Northern the 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 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.[20] 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,

[20]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.

i.e., tariffs and NAFTA membership. The fifth column (1989-1997) restricts the sample to those observations for which tariffs are available.[21] The sixth column gives results for the same period with tariffs included.

Table 2: Difficulties for Developing Countries in Rich Countries' Market Access over Time

	Dependent Variable: Ln Imports Partner/Own						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	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

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

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 flows. A possible interpretation is that the underlying theoretical motivations of the regressions are increasingly relevant over time for the South-North trade flows. The first row of Table 2 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 what it used to be at the end of the seventies ($\exp(8.23)/\exp(5.11)$).

[21] 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.

While room for improvement is clearly large, there has been considerable increase in the access of developing countries' products on developed countries' markets.

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 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. The figure for the EU hides wide disparities among European countries, with some EU countries being much more closed 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 patterns with the developing world.

Table 3 shows the changes in the estimated border effects between each period for each developing country of the sample. Unsurprisingly, East Asian exporters, from China in particular, are among those for which changes in access to Northern markets are more favorable. EU 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 industrial 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 Tariff Measures

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+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 are used in columns (2), (4) and (6), which only cover the year 2001. The MAcMap measure, which improves notably 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 is marginal. The difference is however larger when

Table 3: Changes in Access to Northern Markets

	Border effect coefficient			Percent change between periods	
Country	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					
	(1)	(2)	(3)	(4)	(5)	(6)
Markets:	World	World	North	North	South	South
Time period:	1989-2000	2001	1989-2000	2001	1989-2000	2001
Border	-5.03^a	-5.48^a				
	(0.06)	(0.11)				
Ln Rel. Production	0.77^a	0.74^a	0.78^a	0.78^a	0.77^a	0.73^a
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln Rel. Prices	-0.05^b	-0.25^a	-0.33^a	-0.64^a	-0.30^a	-0.43^a
	(0.02)	(0.04)	(0.03)	(0.07)	(0.04)	(0.06)
Ln Rel. Distance	-0.64^a	-0.59^a	-0.56^a	-0.54^a	-0.65^a	-0.72^a
	(0.02)	(0.03)	(0.02)	(0.05)	(0.02)	(0.04)
Contiguity	1.54^a	1.36^a	1.65^a	1.79^a	1.27^a	1.40^a
	(0.04)	(0.07)	(0.05)	(0.14)	(0.04)	(0.07)
Common Language	0.41^a	0.65^a	0.29^a	0.59^a	0.74^a	0.70^a
	(0.03)	(0.05)	(0.04)	(0.10)	(0.03)	(0.06)
Same Country	0.53^a	0.96^a	0.79^a	0.83^a	1.03^a	0.95^a
	(0.05)	(0.09)	(0.09)	(0.21)	(0.06)	(0.10)
Colonial Link	0.90^a	1.00^a	0.73^a	0.76^a	0.86^a	0.93^a
	(0.04)	(0.08)	(0.06)	(0.13)	(0.05)	(0.08)
Common Colonizer	0.86^a	0.79^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)	
MAcMaps Tariffs		-4.97^a		-3.05^a		-4.38^a
		(0.34)		(0.48)		(0.38)
Northern Exporters			-4.32^a	-4.79^a	-5.35^a	-4.85^a
			(0.06)	(0.16)	(0.09)	(0.15)
Southern Exporters			-5.70^a	-5.99^a	-6.05^a	-5.66^a
			(0.07)	(0.18)	(0.08)	(0.13)
Observations	310713	76379	177271	29629	133442	46750
R^2	0.502	0.488	0.920	0.911	0.909	0.893
RMSE	2.54	2.62	2.53	2.68	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. Tariff are inserted in the specification as: ln (1+tariff).

restricting the sample to Northern or Southern importers. Table 8 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 233% ($= \exp(5.03/(4.18) - 1)$) in the first column. Note that this is the tariff equivalent of preferences and trade restrictions, *after having controlled for tariffs*, that 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 The impact of regional trade agreements

Our objective in this section is to gauge the impact of regional trade agreements (RTAs). To investigate this issue, we incorporate dummy variables capturing the lower (or higher) 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 potential arrangement between the EU and MERCOSUR is a prominent example on which the impact of the existing set of RTAs can shed light.

The impact of each RTA is expected to be quite different. The European Union 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 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).

Figure 2 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

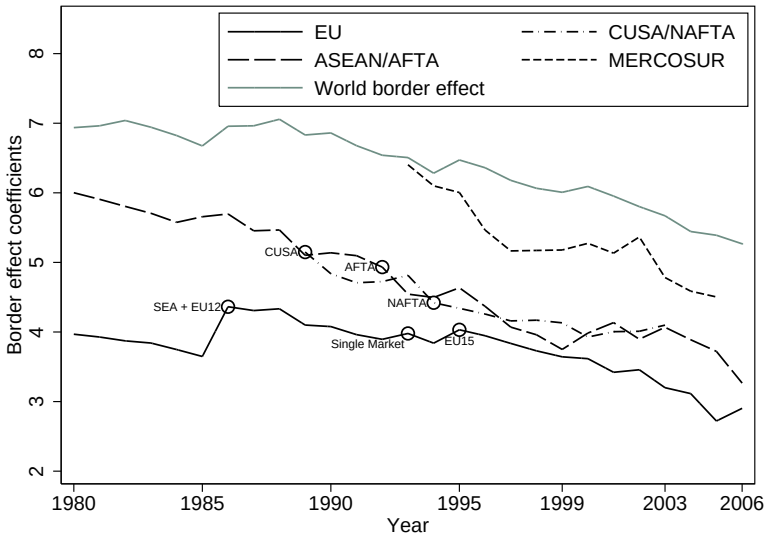

Figure 2: Evolution of the impact of regional agreements

in the absolute level of integration of the EU15, NAFTA and ASEAN until the end of the 90's. The EU starts far more integrated (exp(3.96) in 1980) than the other two zones (exp(6) in 1980 for ASEAN), but those gradually catch up and end up very close to the level of EU integration at the end of the 90's (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 in Bergstrand (2007). A higher effect of the RTA on trade translates into lower border effects. Previous literature produced contrasted of the effect 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 pre-

vious 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 9 in the appendix 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 regional trade agreement, usually seen as having been less effective in true reductions of the level of protection in those countries, 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 estimates of the border effects of the EU countries in the North-North sample in column (2) is $\exp(5.17 - 1.40) \simeq 43$. The estimate of the EU border effect 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 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 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. 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 free trade agreement between the United States and Canada also has a positive and significant impact on bilateral trade, although lower than the European Union. An interesting result on NAFTA is obtained from comparing columns (4) and (5). Mexico faces a level of fragmentation around 82 ($\exp(6.71 - 2.30)$) on the Northern American markets, while US and Canadian exporters' corresponding access is only slightly less difficult, with a level around 78 ($\exp(5.97 - 1.61)$). The estimated level of market access in the South-South combinations is extremely low (an estimated border effect of $\exp(6.60)$ on average), but it is interesting to note that, contrary to the Andean Community, MERCOSUR and ASEAN had 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 in a different setting the finding of Rose (2000).

5.5 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 for the list of industries E). Figure 3 reports border effects coefficients in industry by industry regressions.[22] We obtain those coefficients for the three different sub-periods, which enables comparisons over time.

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

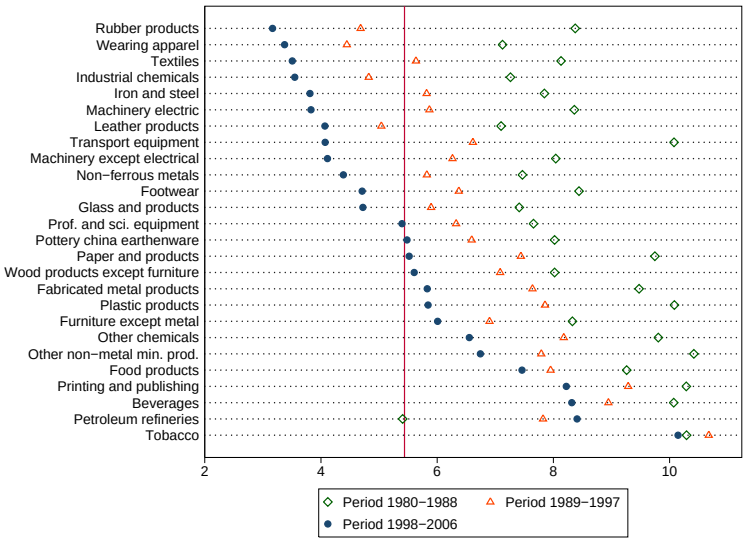

Figure 3: Evolution of market access South → North, by sector

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 years.

6 Conclusion

This paper measures difficulties in market access over a wide sample of countries (both developing and developed), industries and years. It therefore tries to put precise numbers on the extent of market fragmentation, which is one of the key parameters in spatial economics. We use a gravity-type model of trade patterns structurally grounded in theory to 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 LDC's facing the highest barriers. These international fragmentation 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 what it used to be in the end of the seventies. Japanese market appears as largely more open to developing exporters than the North-American and European ones.

Another of our results concerns the impact of tariffs on market access. While tariffs still have in general an 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 is still 233% during the period 1980-2006, with Southern exporters facing larger difficulties.

We also show that the proximity of the empirical specification with theory changes the estimates related to the impact of regional agreements and put them 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 the estimated degree of market fragmentation within those zones, with an expected ranking between the respective impact of those agreements.

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

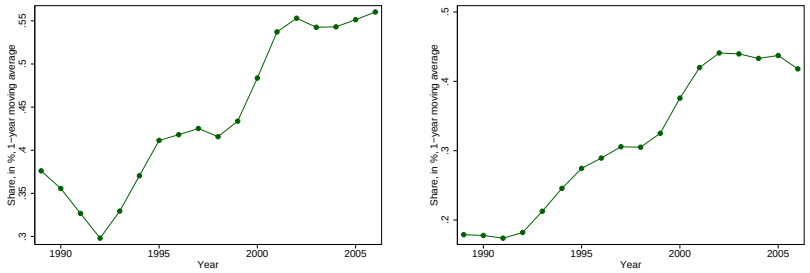

Figure 4: Share of LDCs in total (left) and manufacturing (right) imports of **European Union** (15)

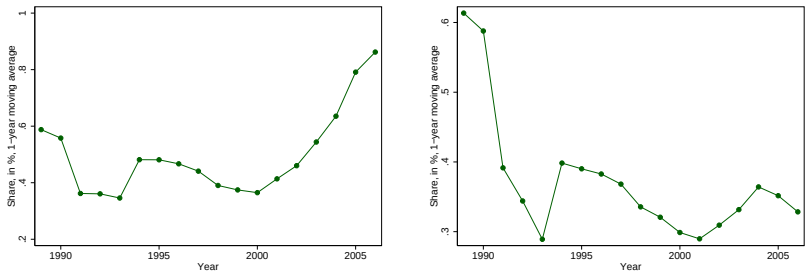

Figure 5: Share of LDCs in total (left) and manufacturing (right) imports of **Japan**

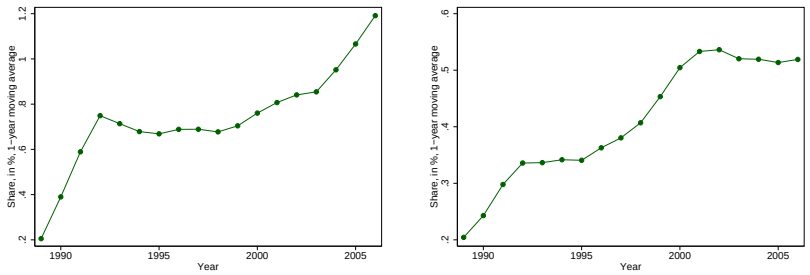

Figure 6: Share of LDCs in total (left) and manufacturing (right) imports of the **USA**

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 Variable: 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

Notes: 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 Variable: 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

Notes: 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 Variable: 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

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

C Tariff measures: robustness check

Table 8: 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	-5.91^a				
	(0.06)	(0.11)				
Ln Rel. Production	0.76^a	0.73^a	0.77^a	0.77^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	-0.42^a	-0.32^a	-0.63^a	-0.40^a	-0.56^a
	(0.02)	(0.04)	(0.03)	(0.07)	(0.04)	(0.06)
Ln Rel. Distance	-0.65^a	-0.59^a	-0.57^a	-0.54^a	-0.64^a	-0.73^a
	(0.02)	(0.03)	(0.02)	(0.05)	(0.02)	(0.04)
Contiguity	1.67^a	1.43^a	1.75^a	1.85^a	1.35^a	1.54^a
	(0.04)	(0.07)	(0.05)	(0.14)	(0.04)	(0.07)
Common Language	0.36^a	0.64^a	0.27^a	0.59^a	0.72^a	0.66^a
	(0.03)	(0.05)	(0.04)	(0.10)	(0.03)	(0.06)
Same Country	0.46^a	1.00^a	0.72^a	0.70^a	1.12^a	1.06^a
	(0.05)	(0.09)	(0.10)	(0.21)	(0.06)	(0.10)
Colonial Link	0.96^a	1.08^a	0.70^a	0.78^a	0.84^a	0.95^a
	(0.04)	(0.08)	(0.06)	(0.13)	(0.05)	(0.08)
Common Colonizer	0.51^a	0.66^a			0.71^a	0.90^a
	(0.06)	(0.08)			(0.07)	(0.09)
Northern Exporters			-4.43^a	-4.91^a	-5.66^a	-5.22^a
			(0.06)	(0.17)	(0.08)	(0.14)
Southern Exporters			-5.80^a	-6.10^a	-6.44^a	-6.14^a
			(0.07)	(0.18)	(0.07)	(0.12)
Observations	310713	76379	177271	29629	133442	46750
R^2	0.482	0.470	0.919	0.910	0.907	0.889
RMSE	2.59	2.67	2.54	2.69	2.41	2.56

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

D Reciprocity in North-South Market Access, with Regional Trade Agreements

Table 9: 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

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

E List of industries and countries

Table 10: 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
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 11: List of countries included in the sample

High income	**Upper-middle income**	**Lower-middle income**	**Low income**
High income	Middle-high income	Middle-low 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.