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PATTERNS AND DETERMINANTS OF INTERNATIONAL TRADE COSTS IN THE FOOD INDUSTRY

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[Preliminary draft]

Abstract

This paper documents patterns in international trade costs in processed foods for a large cross-section of developing and developed countries, during the 1976-2000 period. A trade costs index is inferred from a micro-founded gravity equation that incorporates bilateral 'iceberg' trade costs. For 2000, the weighted average tariff equivalent of trade costs ranges from 73% for the North to 134% for the South countries. The time patterns show an average reduction of about -13% in the observed period, that rises to -26% for the Emerging countries. However, the same does not apply for South countries. On ranking the trade costs determinants we find that, on average, geographical and historical factors seem to dominate those of infrastructure and institutions. However, trade policy emerges as an important determinant of the North-Emerging trade costs. Finally we find strong evidence that demand-side considerations also matter to explain trade costs.

JEL classification: F1, F13, F14

Keywords: Trade costs, Gravity, Processed Foods, Geography, Infrastructure, Trade Policy, Inequality

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1. Introduction

International trade costs are large, and vary widely across countries and sectors. At the same time they strongly affect economic welfare through their effect on trade flows. Anderson and van Wincoop (2004) recently documented that the tariff equivalent of international trade costs is about 75% at the aggregated level. However, the contribution of policy variables, such as tariffs and non-tariff variables, are only 8%, leaving transport costs, information related costs and cultural ties as the underlying main factors. A similar pattern of trade costs at the aggregate level was recently documented by Novy (2007a) who found about a 26.5% reduction in trade costs for the G7 countries between 1960 and 2002. Moreover, the author, in studying the determinants of the dispersion of trade costs, confirmed that geographical and historical factors largely dominate the role played by trade policy, like tariffs and free trade agreement.

Disentangling the alternative explanations of trade costs is an important policy issue as actual tariffs and other protective measures can be negotiated in the multilateral context, whereas differences in cultural ties, geographical and infrastructural factors are obviously not subject to such negotiation. This point appears particularly important for the agri-food sector, given its centrality in the on-going WTO multilateral talks. However, most of the actual literature on trade costs has been applied at the aggregated level, and not to specific industry or commodities such as processed foods (Wang et al., 2000).¹ Thus, in order to better understand these issues, a deeper exploration of trade costs determinants in processed foods appears important, especially from the point of view of the developing countries and their relationship with the developed ones.

The purpose of this paper has been to document patterns of international trade costs for processed foods for a large cross-section of developing and developed countries observed over the 1976-2000 period. Our computation of trade costs is done in a very broad sense, considering not only shipping costs and trade policies but also many other informational, institutional and geographic barriers to trade; we used an index of trade costs recently developed by Novy, (2007a) and Jacks et al. (2006). The index is inferred

¹ Exceptions to this rule exist. For example, Hummels (2001, 2007) conducted extensive research on direct and indirect evidence of trade and transport costs, also at the disaggregate level. Instead, Fontagné et al. (2005) and Olper and Raimondi (2007), focus on the indirect estimation of trade costs incurred when crossing a national border, working at the 3 digit and 4 digit of the ISIC industry classification, respectively. However, the country coverage of these studies typically covered only a few developed countries.

from a micro-founded gravity equation based on a multi-country general equilibrium trade model that incorporates bilateral ‘iceberg’ trade costs.

The main advantage of this index over other approaches, like, for example, the estimation of border effect through a gravity equation (see Mc Callum, 1995; Wai, 1996; Feenstra, 2004), is that it can be easily computed for specific country pairs and for specific years. Indeed aggregate measures of trade costs mask the underlying heterogeneity across country pairs and industries, rendering it quite difficult to answer questions like: do trade costs differ between developed and developing countries? If so, to what degree and in which industries? What are the main reasons - policy associated factors such as tariffs, free trade agreements and quality of institutions, - or other factors like historical, and geographical constraints ?

With the objective of shedding some light on this important policy issue, the analysis also gives an assessment of the trade costs determinants rely on possible explanations like geography, history, infrastructure and trade policy, as well as on preferences due to across-country differences in income distribution. The main objective is to re-challenge earlier aggregated evidence by testing new hypotheses placing particular emphasis on the potential differentiated effect the supposed determinants have on country pairs at different development stages.

The main results can be summarized as follows. For 2000, the weighted *average* tariff equivalent of estimated trade costs ranges from 73% for the North to 134% for the South, showing a strong underlying variation. The time patterns display an average reduction of about -13% in the observed period, that rises to -26% for the Emerging countries. However, the same does not apply for the South countries, where the trade costs remain very high without any discernable trend pattern. On ranking the trade cost determinants we find that geographical and historical factors seem to dominate infrastructure and institutional ones. However, trade policy emerges also as an important determinant, especially in the transactions of the North-Emerging countries. Finally, and interestingly, we find strong support for the idea that demand-side considerations, captured by income inequality, play a sizable role in shaping trade cost patterns, in line with the prediction of recent trade models based on non homothetic preferences.

The paper is organized as follows. Section 2 presents, in summary form, the gravity equation from which the index of trade costs is derived. Section 3 describes the data needed to implement the trade costs index, as well as summarize the data sources.

Section 4 takes a look at the cross-country and time-series variation in trade costs, while Section 5 tries to explain it. Finally the concluding Section discusses the main implications and draws some conclusions.

2. Conceptual framework

This section summarizes the underlying theoretical framework used to measure an ‘overall’ index of trade costs. The index, recently developed by Novy (2007a) and Jacks et al. (2006), comes from a micro-founded gravity equation from which implied trade costs can be simply measured using observable data.

The underlying logic follows that of the gravity models of Bair and Bergstrand (2001) and, especially, of Anderson and van Wincoop (2003, 2004). Thus, the model recognizes the important role played by the so-called ‘multilateral resistance indices’. However, it differs from the above gravity models in that it greatly simplifies the complex unobservable price index embedded in multilateral resistance, but still takes it into account.

On the demand side of the model we find an optimizing representative consumer with CES preferences over tradable and non-tradable goods, with s_j the exogenous fraction of tradable ($0 < s_j \leq 1$), and $\sigma > 1$ the elasticity of substitution between home and foreign goods. On the supply side we have monopolistic competition, i.e. each firm is the sole producer of one type of differentiated goods. Each firm i has a linear production function with constant return to scale, and uses labour as the only input. Consumers and firms inhabit j countries with $j = 1, 2, \dots, j \geq 2$.

Bilateral ‘iceberg’ trade costs $\tau_{j,k}$, considered exogenous, are incurred to ship goods from country j to country k , with $\tau_{j,k} \geq 0$ for $j \neq k$ and $\tau_{j,k} = 0$ for $j = k$. Thus, it is assumed that intra-national trade costs are equal to zero.

Under this setup, Novy (2007a) derives the following gravity-like equation that incorporates trade costs

$$x_{j,k}x_{k,j} = s_j(y_j - x_j)s_k(y_k - x_k)(1 - \tau_{j,k})^{\sigma-1}(1 - \tau_{k,j})^{\sigma-1} \quad (1)$$

where y_j is the gross output of country j , and $x_j \equiv \sum_{k \neq j} x_{j,k}$ the total exports from j .

As in traditional gravity equations, the bilateral trade flows, $x_{j,k}$ $x_{k,j}$, are a decreasing function of the bilateral trade costs $\tau_{j,k}$ and $\tau_{k,j}$. Moreover, bilateral trade is an increasing function of the number of firms that produce tradable goods, through the terms s_j and s_k in equation (1). The key point of departure from the traditional gravity equation is that bilateral trade flows are not a simple function of their mass terms, y_j and y_k , but are functions of the terms $(y_j - x_j)$ and $(y_k - x_k)$. These terms capture *intranational* trade and are interpreted by Novy (2007a) as ‘market potential’ because they represent the j -country output which is potentially tradable but not yet traded. An increase in ‘market potential’ due, for example, to an increase in the mass terms, y_j and y_k , or a decrease in the overall export, x_j and x_k , increases bilateral trade between country j and k .

The main advantage of gravity equation (1) is that the terms $(y_j - x_j)$ and $(y_k - x_k)$ implicitly capture, through *observable*, the important role played by the *unobservable* multilateral resistance terms first introduced, explicitly, by Anderson and van Wincoop (2003).² These authors stress that trade between two countries, after controlling for size, depends on the bilateral trade barriers between them *relative* to the average trade barriers that both countries face with all their trading partners. This is exactly what happens in relation (1) as there exists an explicit relationship between intranational trade, and multilateral resistances. To see this, and following Novy (2007a), let us suppose that all trade costs $\tau_{j,l}$ between j and countries l , with $l \neq k$, go up while maintaining all other things constant. Then the total export x_j decreases, and in accordance with equation (1) the bilateral trade between j and k increases despite there being no *absolute* change in their trade costs.

Next, under the standard assumption of symmetric trade costs, $\tau_{j,k} = \tau_{k,j}$, it is very simple to rearrange the gravity equation (1) to give an intuitive computable index of overall bilateral trade costs³

$$\tau_{j,k} = \tau_{k,j} = 1 - \left(\frac{x_{j,k} x_{k,j}}{(y_j - x_j)(y_k - x_k) s^2} \right)^{\frac{1}{2\sigma-2}} \quad (2)$$

² For a generalization of the Anderson and van Wincoop (2003) gravity model that incorporates time-varying multilateral resistance terms, like equation (1), see Novy (2007b).

³ As discussed by Novy (2007a), it is conceptually possible to derive trade costs equations that differ depending on the direction of trade, thus removing the imposition of symmetric trade costs. However, computing non-symmetric trade costs yields implausibly volatile time series largely because of bilateral trade imbalances. Differently, assuming symmetric trade costs as in equation (2), cancels out this bilateral imbalance and gives focus to total trade flows relative to total bilateral absorption, which are more likely to be driven by a long-run relationship than transitory imbalances (see, also, Jacks et al., 2006).

where it is also assumed that the fraction of firms producing tradable goods is the same across countries, so that $s_j = s_k = s$.

The interpretation of the trade costs equation (2) is straightforward. Indeed, when bilateral trade between j and k goes up, but all other things remain constant, there is a reduction in bilateral trade costs. Moreover let us suppose that, all other things being constant, there is a reduction in the trade costs that the countries j face with the other trading partners l , with $l \neq k$. In this situation there will be an increase in the total export term, x_j , inducing a reduction in the denominator of equation (2). However, despite this reduction, the bilateral trade costs between j and k , $\tau_{j,k}$, remain totally unaffected, simply because the reduction in the denominator will be offset by the reduction in bilateral trade between j and k in the numerator of equation (2), preserving the same level of estimated bilateral trade costs.

3 Data and parameters

Equation (2) is applied to compute bilateral trade costs in the food industry across a large sample of more than 70 developing and developed countries (see Appendix for country coverage). The needed data primarily involve bilateral exports and production data in a comparable industry classification. The production data derive from the improved version of the Trade and Production Database of the *World Bank* recently made by Mayer and Zignago (2005). The World Bank data compiled by Nicita and Olarreaga (2001) refers to bilateral trade and production for 67 developing and developed countries at the ISIC rev2 3-digit industry level, over the period 1976-1999. This World Bank data, based on UN-Comtrade and UNIDO, was greatly extended by Mayer and Zignago (2005) using more recent versions of the UNIDO CD-ROM, together with OECD STAN data, and international trade data from BACI.⁴ From this database we extract ISIC code 311 production data that refers to *Food Manufacturing*.

In theory, the database covers more than 90 developing and developed countries over the period 1976-2001. However, data on food industry production values are not available for all countries. For some countries it is completely lacking, while for other countries only the more recent years are reported. As our interest lies particularly in the

⁴ The BACI trade dataset is based on UNComtrade data, but significantly improves it through a harmonization of exporting and importing country declarations that, as is well known, often include many discrepancies. See www.cepii.fr/anglaisgraph/bdd/TradeProd.

time dimension of trade costs, only countries with at least 8 years of observations are included in the database. This filter resulted in a sample of more than 70 countries, classified as developed (North), developing (South) and Emerging. The first two groups are, respectively, the high-income and low- and medium-income, as defined by the World Bank, while the Emerging countries are based on FTSE group classification.⁵ The required bilateral and total export data, expressed in U.S. dollars and in the same industry classification, are taken from the same database used by Mayer and Zignago (2005), that improves on the Nicita and Olareaga (2001) data by using the CEPII database of international trade (BACI).

The main problem in computing trade costs using equation (2) is the choice of parameter assumptions related to the CES elasticity of substitution σ , and the fraction s of firms that produce tradable goods. The first parameter σ is set equal to 7. In general, there is marked disagreement concerning the right value of the elasticity of substitution (see Anderson and van Wincoop, 2004). For the aggregate food industry, most studies find a σ value in the range 2.6-8.9 (see Erkel-Rousse and Mirza, 2002; Lai and Trafler, 2004; Olper and Raimondi, 2006). In general, higher values emerge from cross-section estimates when endogeneity (Olper and Raimondi, 2006) or endogeneity and dynamic issues (Lai and Trafler, 2004) are accounted for. Thus, because our trade costs measures are derived from a general equilibrium model in a long-run context, an elasticity value of $\sigma = 7$ appears reasonable. Obviously, the levels of the trade costs estimate are quite sensitive to the choice of the elasticity of substitution; indeed the higher the elasticity, the smaller the required domestic-foreign price gap, induced by trade costs, to have the consumer switch to domestic products. However, it is important to note that both the rank and the percentage change of trade costs over time, as well as their determinants, are largely unaffected by the value of σ (see Jacks et al., 2006).

Finally, the second assumed parameter is the fraction s of the firms producing tradable goods. Here, given the uncertainty on this parameter, we follow Novy (2007a) and set $s = 0.8$. This implies that the fraction of processed food goods that are not tradable is 20% across all countries. Note that, once again, the across-country patterns of trade costs and their determinants are not sensitive to this choice.

⁵ FTSE group is an independent company owned by the Financial Times and the London Stock Exchange. See www.ftse.com/index.jsp.

4. The evidence

4.1 A glance of trade cost patterns and trends

The analysis of average trade costs across countries and over time is based on their implied trade weighted average tariff equivalent, measured as $\theta_{j,k} = \tau_{j,k} / 1 - \tau_{j,k}$, where the weights are the respective exports share of the country pairs in the sample. This will simplify the comparison of our results with previous findings. Figure 1 shows the evolution of the weighted average tariff of the trade costs for the overall sample, and considers the samples of the developed (North), developing (South) and Emerging countries separately. Note that, due to the lack of data, the time period covered by the figures of the Emerging and, especially, the South countries, is often shorter, starting for most countries around the 1980-1982 period (see Table A1).

Let us first consider the full sample for the period 1978 to 2000: the weighted average tariff of trade costs changes from a value of 85% to a value of 74%, corresponding to a 13% reduction in trade costs.⁶ However, this average figure masks substantial across-country differences. For example, the weighted average levels of trade costs range from the lower value of 21% for Macao to a higher value of 206% for Ethiopia, with a median value of 129%. Instead, the time variation shows a range from -105%, for Uruguay, to +44%, for Jordan, with a median value of -10%.

Looking at the differences in across-country groups, the Emerging countries display a strong trade costs decline, passing from 133% to 98%, with an average reduction of 26%. The North countries strongly mimic both the levels and the trend of the full sample, confirming that processed foods trade is still largely dominated by high income country transactions. The situation in the South group is less clear. Not surprisingly, they display a very high level of trade costs characterized by a high degree of volatility, partially due to country entry and exits into a group with much higher (or lower) trade costs than average. In the 1980-2000 period the average tariff equivalent was 139%, ranging from 125% for Cameroon to 206 for Ethiopia (see Table A1). Given this high volatility, the time variation in trade costs tends to depend on which year one selects to

⁶ The time trend when measured as 'iceberg' trade costs, instead of equivalent tariff, are somewhat smaller. For example, the 12 percent reduction of the average equivalent tariff will be equal to 7 percent when measured as 'iceberg' trade costs. Normally, we consider levels and variations in trade costs expressed as equivalent tariff, simply because this is the form normally used by previous authors (see Anderson and van Wincoop, 2004). However, Table A1 in the appendix reports data expressed in terms of 'iceberg' trade costs.

measure it. In any case, from 1989 until 1999, also the South group experiences a clear decrease in average trade costs.

Are these figures comparable with previous evidence? And, if so, by how much? The answer is yes, and quite a lot. First, Anderson and van Wincoop (2004), in their review on trade costs, report a representative figure in industrialized countries equal to 21% in terms of transport costs, plus 44% border related costs, reaching a 75% tariff equivalent. Thus, the similarity with our numbers is quite impressive. Secondly, Novy (2007a), using the same methodology as in this paper, documents a 2002 tariff equivalent of trade costs for aggregate trade in the G7 countries of 40.5%, with a 1960-2002 reduction of 26.5%. Of course, these figures are lower and display a higher time variation than ours, but this appears consistent both with the shorter time period covered by our study (1978-2000 versus 1960-2002), and by considering the well established notion of higher policy trade barriers and transport costs characterizing food products (see Olper and Raimondi, 2007).

From Figure 2 we can try to gain some more information by comparing the average bilateral trade costs relationship across our three country groups. Bearing in mind the data problems, and the less than satisfactory coverage of the South countries, the results appear interesting. First, and not surprisingly, the significant reduction in the trade costs of the emerging countries is due largely to their relationship with the rich North. However, what is more at odds here is that the same does not happen between the South-North trade costs relationship, where the trade costs do not display any discernible time pattern. Differently, and again this is interesting, the increase in the integration level of the South can be shown in its own bilateral combination (South-South) and, especially, in that with the Emerging countries. The underlying reason for these patterns is not so clear. In fact, at least from the perspective of trade protection, the actual evidence suggests that Emerging countries have higher than average tariff levels as well as having to face strong protection, especially in their export to the rich North, while the opposite holds true for the developing countries (see Kee et al., 2006; Boüet et al., 2004). Though several factors may explain these results, a possible explanation could lie in the 'quality' characteristics of the goods traded by South countries. Indeed, while the average (low) quality and safety of foods traded by developing countries encounter, on average, difficulties in meeting the high and growing standards of the developed world, they face fewer problems in penetrating the markets of

the Emerging countries, where a large part of the population expresses little concern for quality and safety issues, and seeks cheaper foods.

Finally, Table 1 allows a look at the ‘extreme’ trade costs cases, showing the lower and higher top-15 bilateral trade costs. The numbers are quite impressive, and reveal a very strong variation across the two groups. First, on the lower side of the spectrum, we find Hong Kong and Macao (China) with a tariff equivalent of only 18.5% followed, in second place, by Belgium-Lux. and the Netherlands (26.5%), and ending with Brazil and Argentina (87%). On the other side, we have Japan and Jordan, with impressive trade costs of 990%, followed by Mexico and Kenya (970%), and ending with the still very high trade costs of 764% for Finland and Bolivia.

What explains these big differences? If we look beyond the numbers of Table 1 what immediately emerges is that geography, cultural ties and development, matter. Indeed, in the lower top-15 trade costs all the country pairs are close to each other (short distances); most share a common border and/or the same language; they have sea access or are islands; and all are combinations involving at least one high income country. Not surprisingly, exactly the opposite applies to the higher top-15 trade costs.

4.2 The EU and US trade costs relationships

The EU and the US are the two major trading blocs, thus a look at their integration patterns with our three country groups could be informative. Figure 2 depicts these results, once again expressing trade costs as weighted equivalent tariffs.

Starting from the bilateral relationships with the South, the situation reproduced is close to the previous one. The estimated average trade costs are very high, reaching 155% with the EU and 148% with the US, and do not show any clear discernible reduction pattern. Moving on to the relationship with the Emerging countries, the figure shows a significant integration process with both trading blocs. Over the past 23 years, trade costs have fallen very rapidly with the US, with a reduction of about 35%, from 132% to 93%. The corresponding situation with the EU shows tariff equivalents of 132% and 119%, respectively, so that, in comparison, the EU trade costs were the same in 1978, but much higher in 2000. Note, however, that these results could be partially due to noise in the data, as discussed before.

Next, the third graph depicts the evolution of bilateral trade costs with a sample of high income countries called North ‘others’, this sample being obtained by removing both the EU and the US. The most representative countries in this group are Australia,

Canada, Japan and New Zealand, followed by Singapore and Hong Kong, plus other small high income economies. Here the pattern of trade costs is quite clear, showing only a 9.8% reduction for North-EU, that contrast with a 45% reduction for the North-US relationship. It is interesting to note how in 1994, after the EU enlargement toward Austria, Sweden and Finland, the integration process between the remaining North countries and the enlarged EU basically stopped. Thus the figures show a substantial difference in the levels of integration. In 2000, the tariff equivalent of trade costs of the North group was 122% with the EU, but dropped to 70% for the relationship with the US. This evidence strongly confirms that, in the food industry, the EU still represents a 'fortress' for its trading partners.

Confirmation of the last statement clearly emerges in the last graph of Figure 2, where we compare the intra-EU trade with that between the EU and US. The tariff equivalent of intra EU trade costs was 81% in 1977 and reached 65% in 2000, with a reduction of 13%, that however display an interruption in the mid-nineties. The pattern of (intra) EU trade costs contrasts strongly with the average value of 155% between the EU and the US, which even increases over the observed period. What emerges from these figures is a clear diverging trade effect induced by EU membership, where the integration process results in trade diverted from the US towards nearby EU countries, a result in line with Bayoumi and Eichengreen (1997) who found evidence that the EU lowered trade growth with other industrial countries. Thus, the relative nature of our trade costs index inferred from a micro-founded gravity model, seems to work quite well in capturing the trade diverting effect induced by regional integration.

5. Food trade costs explanation

5.1 Data and empirical specification

This section proposes a preliminary exploration of the determinants of trade costs across country pairs. To do this, we pooled the country pair data from three different periods, 1988-1990, 1993-1995 and 1998-2000, working with a full sample of 2,571 observations, as well as with three different sub-samples of 594 North-North, 996 North-Emerging, and 544 North-South, country-pair observations.⁷ The empirical model relies on four main groups of potential determinants, largely derived from recent developments in gravity literature (see, especially, Head and Mayer, 2000; Rose, 2000; Anderson and

Marcouiller, 2002; Anderson and van Wincoop, 2004; Dalgin et al. 2004; Wilson et al., 2004; Francois and Manchin, 2006; Jacks et al., 2006; Novy, 2007a).

Geographical factors are the first group of determinants. We use the natural logarithm of distances between countries ($Dist_{jk}$), common borders ($Border_{jk}$), the fact that one of the trading partners might be an island ($Island_{jk}$) or a landlocked ($Locked_{jk}$) country; and, finally, the natural logarithm of the product of the country pairs area ($Area_{jk}$). All these geographic features affect physical transport costs, as shown in the gravity literature, and also capture the opportunity to exchange information, as in the case of the common border dummy.

Historical and cultural linkage is the second group of determinants, captured by two dummy variables: common language ($lang_{jk}$) and colonial ties ($Colony_{jk}$). Both factors can be expected to reduce trade costs as they facilitate communication during economic transactions and, due to the established historical trade link, reduce the fixed costs of entering a new market.

Physical infrastructure is the third group of determinants, proxied by the natural logarithm of the countries' percent of paved road ($Road_{jkt}$), and by a trade facilitation index ($Port_{jk}$). The last variable is a joint (inverse) measure of port efficiency ranking (see Bagai and Wilson, 2006) constructed by multiplying the single-country ratings and then taking logarithms. For the ease of interpretation, we multiply the final variable by -1 , so that any increase in port efficiency will be associated with lower trade costs.

Institutional factors are our fourth group of determinants. First, following Novy (2007a) and Francois and Manchin (2006), we proxy trade policy with a dummy for free trade agreement (FTA_{jkt}), and a composite index called "freedom to trade internationally" ($Tariffs_{jkt}$) taken from 'Economic Freedom of the World' dataset. This variable is an inverse index of protection based on several dimensions like international trade tariffs, their standard deviation, and the difference between the official exchange rate and the black market rate. As before, we multiply the final trade policy index by -1 , so that any increase in trade protection will be associated with higher trade costs. Note that this trade policy index also displays time variation.⁸ From the same database we also use a proxy to capture the access to sound money ($Money_{jkt}$), based on the growth of money

⁷ Due to data constraints, we are unable to run consistent regressions for the sub-sample between Emerging-South and South-South countries.

⁸ We also experiment food weighted average tariffs, taken from the Trade and Production database of the World Bank. However, the country, and especially the time coverage is very limited. In the regressions

supply, inflation rate, and the possibility of owning a foreign currency bank account. We expect a negative effect of access to money on trade costs as there is evidence that sound access to credit strongly increases trade flow (see Manova, 2006). Moreover, we introduce a composite index for the quality of institutions ($Instit_{jkt}$), taken from the International Country Risk Guide, based on several dimensions such as rule of law, risk of expropriation and so on. As before, the joint measures are constructed by multiplying the single-country ratings (or values) and then taking logarithms. Institutional quality should affect trade costs negatively, being variables that directly affect the structure of transaction costs of the exchange, or indirectly condition the general environment where the transaction takes place (see Anderson and Marcouiller, 2002; Francois and Manchin, 2006).

Finally, we also check for the average level of development ($GDPPC_{ikt}$) and the natural logarithms of the country product in income inequality ($Gini_{jkt}$). The inequality variable is taken from the United-Nations World Income Inequality Database (*WIDER*). Income inequality is intended to capture the demand-side considerations, controlling for the preferences component embedded in our trade costs index. Indeed, in a world of non homothetic preferences, an increase in income inequality should bias the composition of trade toward luxury goods (see Dalgin et al., 2007), increasing the average unit value of goods traded, and thus decreasing trade costs. The data appendix gives the details of the construction of these variables and their data sources.

The general specification that links the trade costs to their potential determinants is reported in equation (3)

$$\begin{aligned} \mathcal{G}_{jkt} = & \beta_0 + \beta_1 \ln Dist_{jk} + \beta_2 Border_{jk} + \beta_3 Island_{jk} + \beta_4 Locked_{jk} + \beta_5 \ln Area_{jk} + \beta_6 Lang_{jk} \\ & + \beta_7 Colony_{jk} + \beta_8 \ln Road_{jkt} + \beta_9 \ln Port_{jk} + \beta_{10} \ln Tariffs_{jkt} + \beta_{11} FTA_{jkt} \\ & + \beta_{12} \ln Money_{jkt} + \beta_{13} \ln Instit_{jkt} + \beta_{14} \ln Gini_{jkt} + \beta_{15} \ln GDPC_{jkt} + \varepsilon_{jkt} \end{aligned} \quad (3)$$

Where, \mathcal{G}_{jkt} is the bilateral tariff equivalent of trade costs, β_0 is a common intercept, β_1 - β_{15} are the coefficients to be estimated, and ε_{jkt} is the error term.

below, the estimated coefficients of food tariffs is as expected positive and high significant, but only if we omit country fixed effects.

5.2 Regression results

Table 2 displays the OLS results of estimating equation (3) for both the full sample and the following country group combinations: North-North (N-N), North-Emerging (N-E), and North-South (N-S) countries. Each regression always includes the country fixed effects, as well as the time fixed effects to capture unobserved country- and time-specific characteristics.

Starting from the full sample, all the determinants of trade costs are strongly significant and normally display the expected signs, except for the common border dummy that have the right negative sign but is not significant. The regression explains about 52% of the trade costs variation. Because the dependent variables is our measure of the tariff equivalents of trade costs, the estimated regression coefficients (β_i), represent the percentage point changes in the equivalent tariffs due to a marginal change in each determinant (see Novy, 2007a). Thus, as is quite clear from the magnitude of the estimated coefficients, geographical and historical factors seem, on average, the most important determinants of trade costs.

Countries far apart and landlocked have higher trade costs, just as island countries have lower than average trade costs. However, quite surprisingly, large countries tend to have lower and not higher trade costs, a situation we will return to later for a possible explanation. Also history matters: two countries sharing a common language have a reduction in bilateral tariffs equivalent to about 46 percent points, while in countries with a previous colonial relationship the tariff reduction is 43 percent points.⁹

What is most impressive here is the effect geographical and historical factors have on food trade costs, compared to what happens for total trade. Novy (2007a), through a more parsimonious specification,¹⁰ estimates a distance coefficient that is about two times lower than ours, and there are even greater differences with respect to the language coefficient. Thus, on comparing trade in manufactured goods and in food, our findings suggest that the food trade is most affected by transport costs and cultural linkage. Of course, one reason for these big differences could also be due to the many developing countries included in our sample that, as shown before, have higher trade costs with respect to the developed countries.

⁹ Note that, increasing or decreasing the substitution elasticity, induce a reduction or an increase in the trade costs, that have an effect on the magnitude of the estimated coefficients reported in Table 2. However, at any degree this does not affect both their level of significance and the *ranking* magnitude of their effect.

Moving on to the infrastructure proxies, both road quality and port efficiency induce a significant reduction in trade costs, confirming the recent findings of Francois and Manchin, (2006) and Shepherd and Wilson (2006). Here, the magnitude of the economic effects are lower with respect to geographical and historical features, but they are still important.

Also trade policies appear important economic determinants of trade costs. On average, to be a member of an FTA reduces trade costs by about 26 percent points, as well as increasing by 1 percent point the value of our index of protection, that corresponds to a shift from the value of Venezuela (7.1) to that of the US (8.1) in 2000, induces a reduction in trade costs of about 50 percent points.

Less clear in the full sample is the effect of the quality of institutions on trade costs that display a positive coefficient, albeit barely significant (10% level). This result is at odds with the idea that the quality of institutions affect positively imports, as suggested by Anderson and Marcouiller (2001). We will return later to the interpretation of this puzzling result. However, we have found a significant and sizable effect of our proxy for access to sound money, a result in line with the findings of Manova (2006) who shows a sizable effect of access to credit on the volume of bilateral trade.

Finally, as shown at the bottom of table 2, controlling for per capita income level, also preferences appear important determinants of trade costs. More specifically, income inequality strongly and negatively affects trade costs, giving support to the hypothesis of Dalgin et al. (2007). These authors suggest that in a world of non homothetic preferences, an increase in income inequality induces more imports of luxury goods relative to the imports of necessary goods. Thus any increase in inequality tends to increase the average value of goods traded, inducing a reduction in average trade costs. Next, in the remaining regressions of the table, we turn to the various splits in our full sample, looking for evidence of a differential role of the determinants of trade costs. First, the distance coefficient increases on moving from N-N to N-S country group combinations, suggesting that, after controlling for infrastructure, the developing countries experience above average transport costs. A similar pattern holds true for the landlocked countries: to be a landlocked country in the South is more penalizing. Interestingly, the area of a country turns out to be positive and significant in the N-S combination, but is still significantly negative in both the N-N and N-E groups. All things being constant, one would expect a large area to increase the average transport

¹⁰ See Table A1 in Novy (2007).

costs, simply because the average internal distances covered by overland transport tends to increase; indeed overland transport is more expensive than ocean. However, a potential explanation for the negative coefficients in the N-N and N-E regressions could be due to the adoption of modern technologies that have led to a decline in overland transport costs relative to ocean shipping, as shown by Hummels (2007). This interpretation, if correct, suggests that improvement in overland transportation technology only affects developed and emerging countries, not the developing ones.

We detect a low effect of the colonial tie in the N-N group that, coherently with expectation, increases on moving from N-E to N-S. More interesting, however, are the differentiated results on the institutional proxy. Indeed, our measure of protection affects trade costs, especially in the combination between N-E countries followed by N-N combination, but the coefficient is not significantly different from zero in the N-S group. This is more or less what one would expect on the basis of the bilateral tariffs pattern in the agri-food sector (see Kee et al., 2006). Moreover, Novy (2007a), using the same trade policy index and working on total trade between developed countries, does not detect any effect of tariffs on trade costs. Thus, international food trade costs still seem significantly affected by trade policy, in line with the findings of Olper and Raimondi (2007). Another interesting result is the significant negative effect of the FTA dummy, evident especially in the combination between the North countries. Here, probably, it is the EU and NAFTA effects that drive the results.

Finally, the quality of institution variable also in the split samples tend to be understandably positive, especially for the N-N group. A reason of these puzzling results could be the findings reported by Berkowitz et al. (2006), who show that countries with a high quality of institution tend, especially, to export more complex goods, while importing simpler products. Thus, on working with processed foods, that in the Berkowitz et al. (2003) classification are classified as simple goods, we could encounter an 'off-setting' mechanism. Indeed, these authors find that for the simple goods sample, the effect of the quality of exporter institutions on trade flow is negative, partially off-setting the positive effect induced by the importer quality of institutions.

6. Conclusion

This paper applies a micro-founded gravity structure developed by Novy (2007a) to measure international trade costs in processed foods in a large cross-section of developed and developing countries. The derived computable trade costs index captures the

changes in trade costs across countries and over time in a theoretically consistent way, by taking advantage of an explicit relationship between *observable* intra-national trade flows and the *unobservable* multilateral trade barriers.

The estimated trade costs appear economically sensitive, and are in line with previous empirical literature. In 2000, the weighted *average* tariff equivalent of estimated trade costs ranges from 73% for the North to 134% for the South, showing strong underlying heterogeneity. The time patterns display an average reduction of about -13% in the observed period, that rises to -26% for the Emerging countries. However, the same does not apply for the South countries, where the trade costs remain very high without any discernable trend pattern. On ranking the trade costs determinants we find that geographical and historical factors seem to dominate infrastructure and institutional ones. However, also trade policy emerges as an important determinant, especially in North-Emerging country relationships. Finally, and interestingly, we find strong support for the idea that demand-side considerations, captured by income inequality, play a sizable role in shaping trade costs patterns, in line with the prediction of recent trade models based on non homothetic preferences.

In comparison to aggregated trade flow, the trade costs estimate at the food industry level is significantly higher and displays lower reduction patterns. At the same time, especially in the developing countries, such costs are affected more strongly by geographic and historical factors, suggesting that any policy prescription towards economic development in the developing countries should place particular emphasis on the legacy effect induced by these (exogenous) initial conditions. On the other hand, given the significant role played by trade policy in affecting the trade costs between developed and Emerging countries, efforts towards a freer trade environment should remain a top priority for the trade policy reform agenda.

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Table 1. Bilateral trade costs: Higher and lower top-15 extreme cases

Lower Top 15					Higher Top 15				
Rank	Country	Country group	Trade costs	Partner	Rank	Country	Country group	Trade costs	Partner
1	Hong Kong, China	H_income	0.16	MAC	1	Jordan	Emerging	0.91	JPN
2	Belgium-Lux.	H_income	0.26	NLD	2	Kenya	Developing	0.91	MEX
3	Malaysia	Emerging	0.27	SGP	3	Bolivia	Developing	0.90	IND
4	Netherlands	H_income	0.34	DEU	4	Honduras	Developing	0.90	TWN
5	Thailand	Emerging	0.36	SGP	5	Colombia	Emerging	0.90	HUN
6	United Kingdom	H_income	0.37	IRL	6	Iran, Isl. Rep.	Developing	0.90	THA
7	Australia	H_income	0.38	SGP	7	Bulgaria	Developing	0.89	COL
8	China	Emerging	0.40	HKG	8	Costa Rica	Developing	0.89	ZAF
9	New Zealand	H_income	0.41	SGP	9	South Africa	Emerging	0.89	CRI
10	Taiwan	H_income	0.42	SGP	10	Sri Lanka	Developing	0.89	PRT
11	Denmark	H_income	0.42	DEU	11	Trinidad and Tobago	Developing	0.89	MYS
12	Italy	H_income	0.43	DEU	12	Panama	Developing	0.89	TTO
13	France	H_income	0.43	NLD	13	Venezuela, RB	Developing	0.89	HUN
14	United States	H_income	0.45	CAN	14	Norway	H_income	0.89	HND
15	Brazil	Emerging	0.47	ARG	15	Finland	H_income	0.88	BOL

Notes: The figures are bilateral ‘iceberg’ trade costs computed using equation (2); the correspondent equivalent tariff discussed in the text is equal to: $\mathcal{G}_{j,k} = \tau_{j,k}/1 - \tau_{j,k}$, where $\tau_{j,k}$ are the reported ‘iceberg’ trade costs. (see text)

Table 2. Determinants of trade costs: Fixed effect regressions

Explanatory variables	Full sample		N-N		N-E		N-S	
	Coeff.	<i>t-value</i>	Coeff.	<i>t-value</i>	Coeff.	<i>t-value</i>	Coeff.	<i>t-value</i>
Geographical factors								
ln distance	0.708	22.44	0.551	11.91	0.682	16.82	1.116	10.68
Common border	-0.047	-0.55	-0.036	-0.49	0.426	2.23	-0.710	-1.33
Island	-0.338	-5.39	-0.626	-8.24	-0.472	-5.88	-0.263	-1.24
Landlocked	0.488	7.08	0.534	7.74	0.476	3.97	0.777	4.84
ln area	-0.107	-8.03	-0.085	-5.24	-0.182	-7.96	0.056	1.79
Historical factors								
Common language	-0.463	-5.99	-0.471	-3.88	-0.308	-2.99	-0.846	-3.17
Colonial tie	-0.433	-7.56	-0.251	-3.14	-0.330	-3.21	-0.538	-2.03
Infrastructure								
ln Road quality	-0.164	-3.58	-0.231	-2.02	-0.450	-4.91	0.001	0.01
ln Port efficiency	-0.241	-8.28	-0.114	-3.72	-0.234	-5.90	-0.248	-2.92
Institutional factors								
ln Tariffs	0.507	3.15	1.396	5.35	1.968	8.38	0.475	1.57
FTA	-0.260	-4.02	-0.259	-2.24	0.155	0.97	-1.147	-1.66
ln Institution quality	0.208	1.95	0.807	3.03	0.460	2.68	0.010	0.03
ln Sound money	-0.240	-3.81	-0.414	-2.04	-0.237	-1.88	-0.124	-0.93
ln Income Gini	-0.587	-5.84	-0.607	-3.84	-0.495	-2.98	-0.568	-1.95
ln GDPC	-0.129	-2.77	-0.647	-3.53	-0.309	-4.29	0.384	1.90
Time fixed effects	yes		yes		yes		yes	
Country fixed effects	yes		yes		yes		yes	
Number of observations	2571		582		996		544	
R^2	0.516		0.694		0.564		0.519	

Notes: OLS regressions. The dependent variable is the country-pairs equivalent tariff of trade costs. (see text)

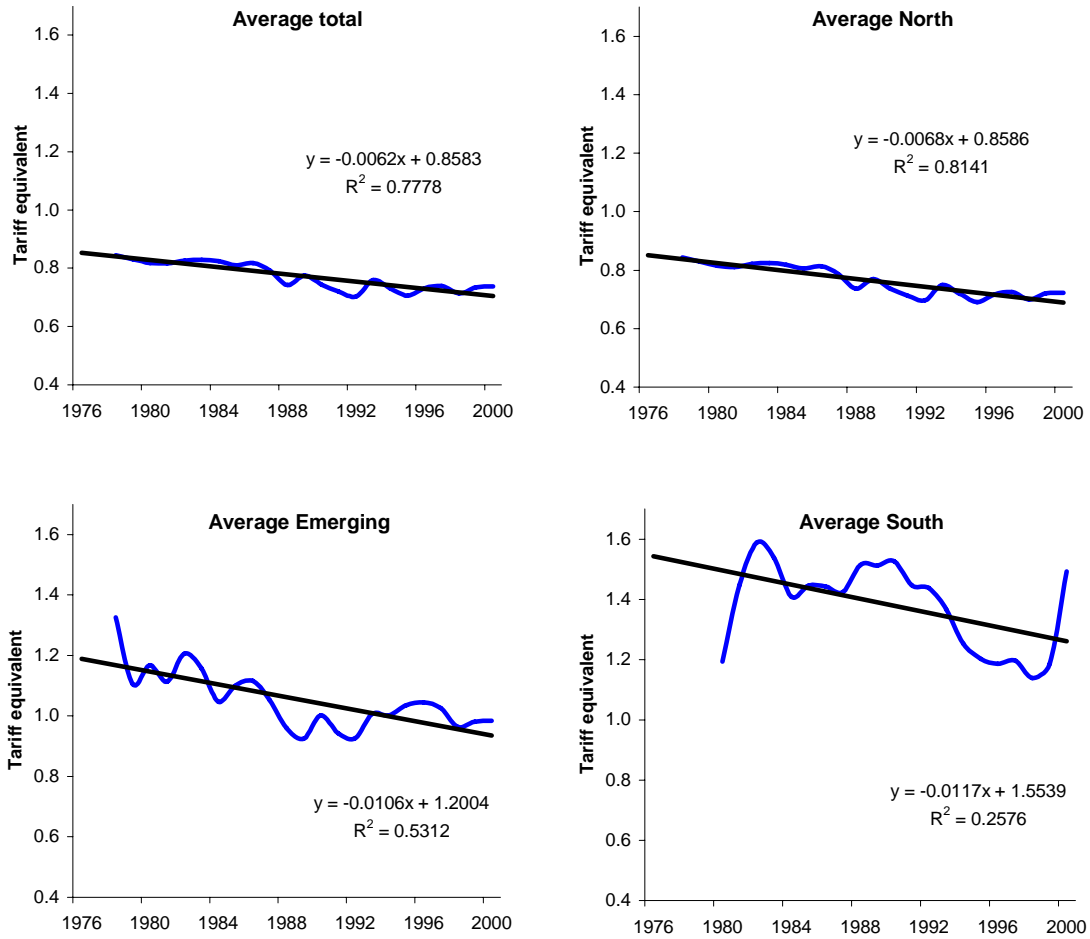


Figure 1. Weighted average equivalent tariff of the trade costs measured for the full sample and each country group. The weights used are the product of exports divided by the sum of the product of exports for all the considered trading partners.

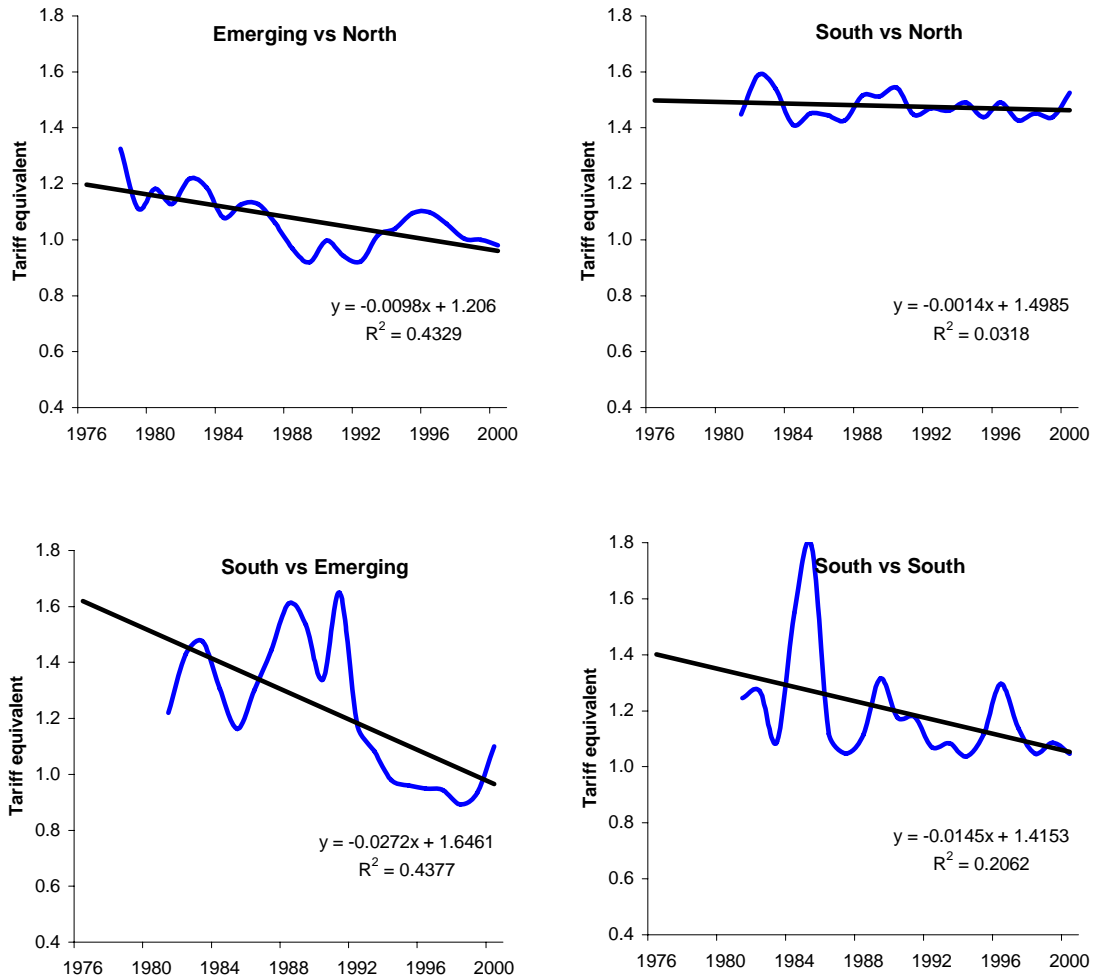


Figure 2. Weighted average equivalent tariffs of the trade costs measured for the respective country-group bilateral combinations. The weights used are the product of exports divided by the sum of the product of exports for all the considered trading partners.

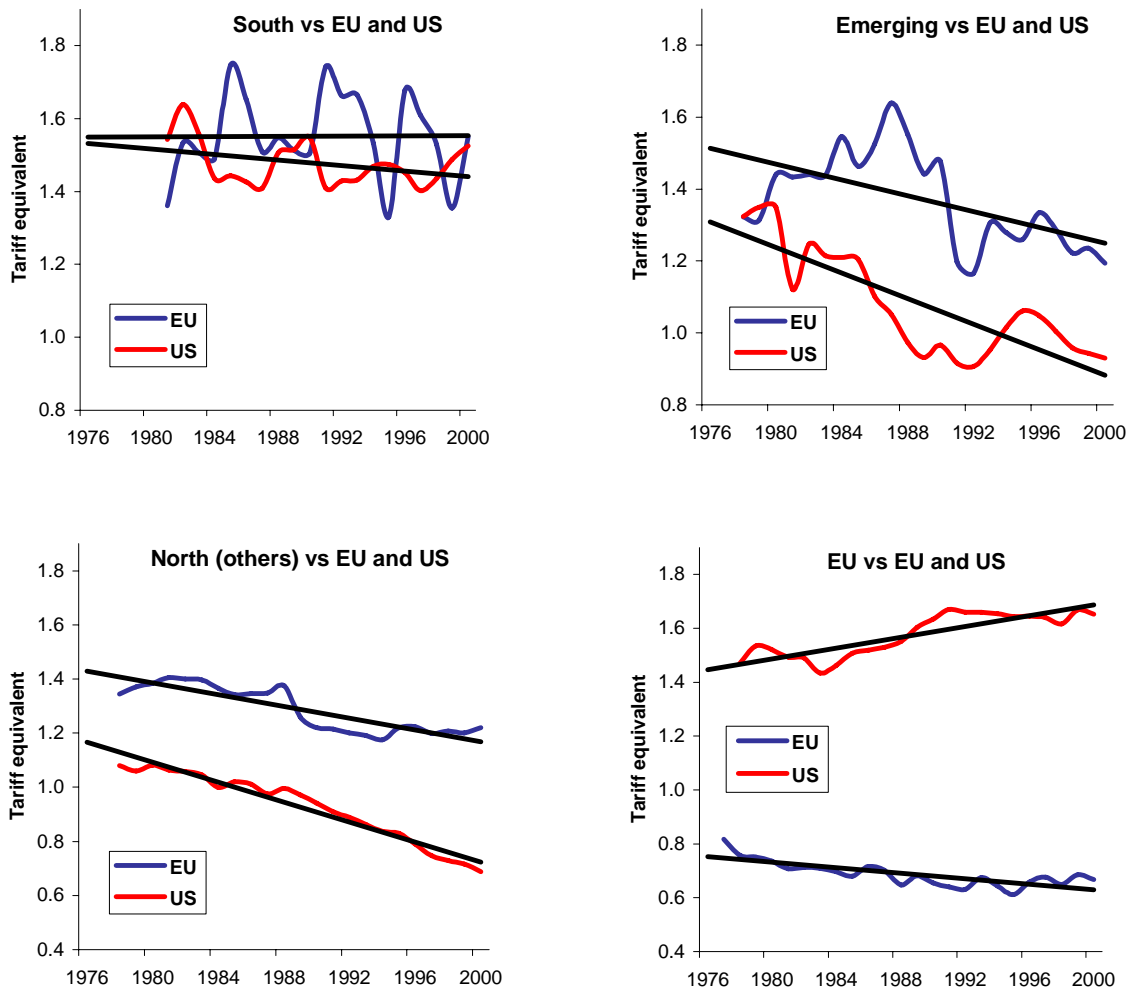


Figure 3. Weighted average equivalent tariffs of the trade costs for the EU and US with their trading partners. The weights used are the product of exports divided by the sum of the product of exports over all the considered trading partners. The North-others group is represented by all the North countries minus US and EU12 (EU15 from 1995 on ward). Thus it comprises Austria, Finland and Sweden until 1994, plus Australia, Canada, New Zealand, Japan, Norway, Iceland, Singapore, Hong Kong, Slovenia, Kuwait, Cyprus, and Taiwan.

Table A1. Patterns of trade costs across countries and time

Country	ISO code	Country group	Avg 1976-2000		Min		Max		Trade weighted average		% Change
			Simple	Trade weighted	Value	Partner	Value	Partner	1980-82	1998-00	
Australia	AUS	H_income	0.67	0.55	0.38	SGP	0.86	CRI	0.55	0.56	0.4
Austria	AUT	H_income	0.72	0.52	0.50	NLD	0.86	CMR	0.55	0.43	-24.3
Belgium-Lux.	BEL	H_income	0.63	0.39	0.26	NLD	0.80	PAN	0.40	0.38	-5.7
Canada	CAN	H_income	0.70	0.46	0.45	USA	0.84	TUN	0.49	0.40	-20.6
Cyprus	CYP	H_income	0.73	0.61	0.57	GRC	0.85	MWI	0.60	0.62	2.6
Denmark	DNK	H_income	0.65	0.45	0.42	DEU	0.82	CRI	0.45	0.43	-5.5
Finland	FIN	H_income	0.75	0.59	0.54	SWE	0.88	BOL	0.61	0.53	-14.6
France	FRA	H_income	0.66	0.46	0.43	NLD	0.85	NPL	0.47	0.45	-6.3
Germany	DEU	H_income	0.65	0.39	0.34	NLD	0.85	NPL	0.41	0.39	-6.8
Greece	GRC	H_income	0.69	0.51	0.48	NLD	0.87	ETH	0.54	0.49	-9.8
Hong Kong, China	HKG	H_income	0.66	0.46	0.16	MAC	0.88	ROM	0.50	0.47	-5.6
Iceland	ISL	H_income	0.70	0.57	0.50	DNK	0.88	NZL			
Ireland	IRL	H_income	0.70	0.40	0.37	GBR	0.86	ECU	0.38	0.36	-3.6
Italy	ITA	H_income	0.67	0.45	0.43	DEU	0.87	NPL	0.45	0.45	-0.2
Japan	JPN	H_income	0.72	0.56	0.51	SGP	0.91	JOR	0.57	0.57	-0.8
Kuwait	KWT	H_income	0.72	0.64	0.60	JOR	0.84	ETH	0.63	0.66	3.6
Macao, China	MAC	H_income	0.66	0.18	0.16	HKG	0.86	MEX	0.25		
Netherlands	NLD	H_income	0.61	0.37	0.34	DEU	0.79	BOL	0.39	0.35	-9.8
New Zealand	NZL	H_income	0.67	0.52	0.41	SGP	0.88	ISL	0.52		
Norway	NOR	H_income	0.71	0.53	0.47	SWE	0.89	HND	0.54	0.53	-2.3
Portugal	PRT	H_income	0.72	0.56	0.52	ESP	0.89	LKA	0.65	0.44	-39.9
Singapore	SGP	H_income	0.60	0.38	0.27	MYS	0.88	CMR	0.28	0.49	53.5
Spain	ESP	H_income	0.69	0.56	0.52	PRT	0.82	TTO	0.63	0.47	-29.3
Sweden	SWE	H_income	0.71	0.51	0.47	DNK	0.88	PAN	0.53	0.46	-15.6
Switzerland	CHE	H_income	0.71	0.55	0.53	ITA	0.83	CRI			
Taiwan	TWN	H_income	0.71	0.53	0.42	SGP	0.90	HND	0.54		
United Kingdom	GBR	H_income	0.66	0.45	0.37	IRL	0.86	NPL	0.45	0.43	-3.5
United States	USA	H_income	0.64	0.49	0.45	CAN	0.84	NPL	0.53	0.44	-20.0
Argentina	ARG	Emerging	0.70	0.57	0.47	BRA	0.84	LKA		0.48	
Brazil	BRA	Emerging	0.66	0.53	0.47	USA	0.82	CRI		0.51	
Chile	CHL	Emerging	0.71	0.61	0.56	ARG	0.85	HND	0.61	0.57	-6.4
China	CHN	Emerging	0.71	0.52	0.40	HKG	0.89	HND	0.57	0.54	-4.7
Colombia	COL	Emerging	0.76	0.60	0.57	ECU	0.90	HUN	0.59	0.59	0.2
Czech Republic	CZE	Emerging	0.73	0.55	0.55	DEU	0.88	MEX		0.54	
Egypt, Arab Rep.	EGY	Emerging	0.73	0.65	0.61	NLD	0.88	TWN	0.62	0.65	5.8
Hungary	HUN	Emerging	0.73	0.61	0.59	DEU	0.90	COL	0.61	0.55	-11.2
India	IND	Emerging	0.73	0.56	0.48	MYS	0.90	BOL	0.60	0.50	-18.5
Indonesia	IDN	Emerging	0.68	0.56	0.52	MYS	0.84	PAN	0.56	0.50	-11.6
Jordan	JOR	Emerging	0.74	0.63	0.60	KWT	0.91	JPN	0.58	0.69	16.1
Korea, Rep.	KOR	Emerging	0.72	0.56	0.55	SGP	0.87	VEN	0.57	0.58	0.7
Malaysia	MYS	Emerging	0.65	0.48	0.27	SGP	0.89	TTO	0.47	0.47	0.7
Mexico	MEX	Emerging	0.73	0.48	0.48	USA	0.91	KEN	0.51	0.46	-10.9
Morocco	MAR	Emerging	0.73	0.57	0.54	FRA	0.85	HKG	0.53	0.60	12.5
Pakistan	PAK	Emerging	0.71	0.59	0.51	MYS	0.85	JOR	0.64		
Peru	PER	Emerging	0.71	0.59	0.57	BOL	0.84	FIN	0.58		
Philippines	PHL	Emerging	0.68	0.55	0.49	SGP	0.84	HUN	0.55		
Poland	POL	Emerging	0.70	0.54	0.52	DEU	0.84	TWN	0.63	0.50	-22.6
South Africa	ZAF	Emerging	0.70	0.62	0.51	MWI	0.89	CRI	0.63	0.61	-2.5

Continue

Table A1 (continue). Patterns of trade costs across countries and time

Country	ISO code	Country group	Avg 1976-2000		Min		Max		Trade weighted average		% Change
			Simple	Trade weighted	Value	Partner	Value	Partner	1980-82	1998-00	
Thailand	THA	Emerging	0.65	0.53	0.36	SGP	0.86	VEN	0.55	0.48	-14.1
Turkey	TUR	Emerging	0.70	0.62	0.60	DEU	0.86	COL	0.65	0.60	-7.6
Bangladesh	BGD	Developing	0.71	0.61	0.43	SGP	0.87	FIN	0.58		
Bolivia	BOL	Developing	0.76	0.62	0.57	PER	0.90	IND	0.65	0.55	-16.9
Bulgaria	BGR	Developing	0.74	0.62	0.56	GRC	0.89	COL		0.61	
Cameroon	CMR	Developing	0.74	0.55	0.53	FRA	0.88	SGP	0.55	0.54	-0.4
Costa Rica	CRI	Developing	0.77	0.61	0.51	GTM	0.89	ZAF	0.62	0.60	-2.0
Ecuador	ECU	Developing	0.74	0.58	0.57	COL	0.86	IRL	0.58	0.55	-4.1
Ethiopia	ETH	Developing	0.77	0.67	0.63	MYS	0.88	CHN		0.69	
Guatemala	GTM	Developing	0.73	0.57	0.51	CRI	0.89	HUN	0.59	0.56	-5.5
Honduras	HND	Developing	0.76	0.60	0.54	GTM	0.90	TWN	0.60		
Iran, Islamic Rep.	IRN	Developing	0.72	0.61	0.60	DNK	0.90	THA	0.60		
Kenya	KEN	Developing	0.77	0.67	0.56	SGP	0.91	MEX		0.65	
Malawi	MWI	Developing	0.75	0.62	0.50	ZAF	0.85	CYP	0.65		
Nepal	NPL	Developing	0.77	0.61	0.59	IND	0.87	ITA			
Oman	OMN	Developing	0.72	0.64	0.61	SGP	0.83	NOR		0.65	
Panama	PAN	Developing	0.73	0.59	0.55	CRI	0.89	TTO		0.58	
Romania	ROM	Developing	0.74	0.64	0.62	HUN	0.88	HKG		0.60	
Sri Lanka	LKA	Developing	0.73	0.62	0.49	SGP	0.89	PRT	0.61	0.63	4.6
Trinidad and Tobago	TTO	Developing	0.74	0.61	0.59	GBR	0.89	MYS	0.59		
Tunisia	TUN	Developing	0.76	0.59	0.59	ESP	0.87	FIN		0.58	
Uruguay	URY	Developing	0.75	0.60	0.49	BRA	0.87	IND	0.71	0.46	-43.0
Venezuela, RB	VEN	Developing	0.76	0.60	0.62	USA	0.89	HUN	0.65	0.58	-10.9

Notes: The figures are average 'iceberg' trade costs computed using equation (2); the corresponding equivalent tariffs discussed in the text are equal to: $\mathcal{G}_{j,k} = \tau_{j,k} / 1 - \tau_{j,k}$, where $\tau_{j,k}$ are the reported 'iceberg' trade costs. (see text); Blank cell means data not available; For developing countries the average trade cost in the period is based on 1980-2000. (see text).

Data Appendix

Distances ($Dist_{jk}$) are based on bilateral distances between cities weighted by the share of the city in the overall country's population. Data on distances and area, together with the dummies on contiguity, language, colony, and landlocked, are taken from *CEPII* (Centre d'Etude Prospectives et d'Informations Internationales). Island dummy comes from Andrew Rose's (2000) dataset, available at <http://faculty.hass.berkeley.edu/arose/>. All dummies are zero-one type variables, except landlocked and island, that take value 1 if one of the trading partners is landlocked or island, and 2 if both partners are landlocked or island.

For port efficiency ($Port_{ik}$) we use Country Ranking by WMO Trade Facilitation Indicators (Bagai and Wilson 2006). The variable is designated to measure the quality of infrastructure of maritime and air ports, 1 is the best position.

Following the literature we use paved road as a proxy of road quality ($Road_{jkt}$). The percentage of paved road on total road comes from the World Bank's World Development Indicator, as well as the GDP per capita data ($GDPC_{jkt}$).

Freedom to trade internationally ($Tariffs_{jkt}$) and Sound Money ($Smoney_{jkt}$) indexes come from Economic Freedom of the World Data: 2006 Annual Report (Gwartney and Lawson 2006), available at <http://www.freetheworld.com/download.html>. The indexes are available on a five year base for 123 countries. Freedom to trade index joints information on taxes on international trade (e.g. tariff revenue as percentage of exports and imports, mean tariff rate, standard deviation of tariff) and regulatory trade barriers (e.g. non-tariffs barriers, compliance costs of importing and exporting). Sound Money index combines: growth of money supply, standard inflation variability, recent inflation rate and freedom to own foreign currency bank accounts.

Institution quality ($Instit_{ikt}$) is a composite index combining five institutional dimensions: rule of law, risk of expropriation, bureaucracy quality, corruption and government repudiation. It is based on data collected from the International Country Risk Guide (ICRG), a private international investment risk service.

The FTA_{jkt} dummy comes from Baier and Bergstrand (2004).

Finally the inequality variable is based on income inequality (Gini) data from the World Institute for Development Economics Research. (WIDER).

Following Novy (2007), joint observations of non bilateral variables for country j and k are constructed by multiplying the single-country variables and then taking the natural logarithms in order to lead to symmetric and constant interaction effects.