Institutions, Infrastructure, and Trade[☆]

Abstract

We work with a panel of bilateral trade, exploring the influence of infrastructure and institutional quality on patterns of trade with a Poisson estimator, extended with the Baier and Berstrand method for multilateral resistance and accounting for firm heterogeneity and selection. Trade depends on institutional quality and exporter and importer access to well developed transport and communications infrastructure. While we emphasize exports of developing countries, low institutional and infrastructure quality in the South also limits market access for exports from the North. The pattern of results implies that policy emphasis on developing country market access while not providing enough support for trade facilitation, may be misplaced.

Keywords: export underperformance, trade, institutions, infrastructure

JEL: O19, F10, F15

1. Introduction

While "globalizers," as defined by Dollar and Kraay (2004), appear to be catching up with the OECD, the countries that are not are instead falling further behind in both trade and income terms. Indeed, many developing countries are consistent under-performers in trade. This begs the obvious question "why?" In part, the pattern of export performance is linked to the political economy of policy reform, to institutional development, colonial history, development assistance, and the general North-South dialog.

Given relatively low participation by lower-income countries in the world economy, negotiators within the World Trade Organization have been given a "leave no country behind" mandate focused on integration of developing countries into the trading system. More broadly, in terms of development assistance linked to trade emphasis has been placed on North-South tariffs and non-tariff measures (NTMs). A shift of focus toward policy determinants of market access for developing countries, in a world of limited development resources, implies shifting those same resources away from other priority issues, like local institutional development and improvements to physical infrastructure. Yet the evidence suggests that physical and institutional conditions at home are basic determinants of effective market access abroad.

Recent literature focusing on trade (largely based on gravity models) supports the view that better institutions can foster trade. Levchenko (2004) argues that differences in institutional quality can themselves be a source of comparative advantage, finding that institutional differences across countries are important determinants of trade patterns. Using a gravity model, Anderson and Marcoullier (2002) find that bilateral trade volumes are positively influenced by the trading countries' institutional quality. Ranjay and Lee (2003) look at a particular aspect of institutions, the enforcement of contracts, and its impact on the volume of international trade. They construct a theoretical model to show how imperfect enforcement of contracts can reduce the volume of trade in goods for which quality issues are important. Using a gravity equation that incorporates proxies for the enforcement of contracts, they find that measures of contract enforcement affect the volume of trade in both differentiated and homogeneous goods. However, the impact

is larger for differentiated goods. Also employing a gravity model, Depken and Sonora (2005) estimate the effects of economic freedom on U.S. consumer exports and imports for the years 1999 and 2000. They find that better institutional quality of the partner country has a positive effect on the amount of exports from the U.S. to that country. Helbe et al (2007) look at the impact of institutional transparency on trade of countries in the Asia-Pacific Region. They find that higher transparency of the trading environment through greater predictability and simplification of regulations has an important impact on trade costs. Groot et al (2004) also find that institutional quality and the quality of governance has a significant, positive and substantial impact on bilateral trade flows. Nunn (2007) analyses whether countries with better contract enforcement export relatively more in industries for which relationship-specific investments are important. The paper finds that contract enforcement explains more of the global pattern of trade than countries' endowments of capital and skilled labor combined. Democratic institutions have also been shown to have positive effects on trade. For example, Yu (2010) estimates an augmented gravity model with a measure of democracy based on a theoretical framework, and finding that democratization significantly increases trade, potentially contributing by 3-4 percent overall to bilateral trade growth.

The literature also offers evidence on infrastructure and its impact on trade. Limão and Venables (2001) show that infrastructure is quantitatively important in determining total transport costs. They estimate that poor infrastructure accounts for 40 percent of predicted transport costs for coastal countries and up to 60 percent for landlocked countries. Using a gravity model, Bougheas et al (1999) also provide evidence from European countries linking infrastructure to transport costs and hence trade. Wilson et al (2005) have quantified the effects of trade facilitation by considering four aspects of trade facilitation effort: ports, customs, regulations, and e-business (which is a proxy for the service sectors of telecommunications and financial intermediation, which are key for all types of trade). The authors find that the scope and benefit of unilateral trade facilitation reforms are very large and that the gains fall disproportionately on exports. Brun et al (2005) also highlight the importance of the quality of physical infrastructure for trade. Using separate

infrastructure measures (measuring the quality of rail, roads, telecommunications, ports and airports) Nordas and Piermartini (2004) find that all measures are important with ports having the biggest impact on trade. Focusing on logistics, Behar et al (2009) find that a one standard deviation improvement in logistics could increase exports by approximately 46 percent for an average-size developing country. Focusing on Africa, Iwanow and Kirkpatrick (2007) construct aggregated indicators of trade facilitation and infrastructure and find a positive impact of the indicators on exports, while Portugal-Perez and Wilson (2012) examine the impact of so-called soft and hard infrastructure on the export performance of developing countries. Their results suggest that trade facilitation measures have a positive impact on export performance.

In this paper we examine the influence of infrastructure, institutional quality, colonial and geographic context, and trade preferences on the pattern of bilateral trade. We match bilateral trade and tariff data and control for tariff preferences, country size, and standard trade cost measures, and find that infrastructure, and institutional quality, are significant determinants of export levels. Our contributions relative to the literature reviewed above include the following. We work with a Poisson estimator, allowing us to look not only at country-pairs where trade takes place, but also at those cases where country-pairs do not actually trade. By using a Poisson estimator, we address recent concern in the gravity literature about the robustness of selection-based gravity models.[1] We take account of multilateral resistance by employing the Baier and Bergstrand (2009) method on our sample. We also mix principal components (to condense our institutional and infrastructure measures into broad measures) with more detailed analysis of institutional indicators. Using a first stage Probit regression we also control both for firm heterogeneity and selection in the second stage Poisson regressions. [2]

Working with a gravity model applied to a relatively extensive global panel of bi-

[1] Silva and Tenreyro (2006) have shown that the Poisson performs best, and is more robust to specification errors. It is also consistent in the presence of heteroskedasticity.

[2] Recent related work involving thresholds, zeros in bilateral trade, and trade growth along extensive and intensive margins in a gravity context, includes Baldwin and Harrigan (2007), Hummels and Klenow (2005), Evenett and Venables (2002), Helpman, Melitz and Rubinstein (2008), and Felbermayr and Kohler (2004).

lateral trade flows (compared to the literature reviewed above), we provide a breakdown of the estimated overall impact of institutional and infrastructure variables in our sample on trade flows between various country cohorts. Our results predict that around sample means, differences in institution and infrastructure quality alone imply trade volumes between low income countries (South-South trade) being roughly 74% below trade volumes between high income countries (North-North trade). They imply trade between low and high income countries (North-South trade) roughly 55% to 64% below North-North trade. In the case of South-South trade, it is a combination of low institutional and infrastructure quality on both the importer and exporter side that leads to this result. While we emphasize exports of developing countries, low institutional and infrastructure quality in the South also effectively limits market access for exports from the North to low-income markets. For high income countries, low institutional and infrastructure quality in destination markets in the South implies exports 44% below North-North volumes in the case of low-income destination markets, and 28% below in the case of middle-income countries. These results support the notion that trade volumes in general, and the propensity of low income countries in particular to take part in the trading system at all, depends on institutional quality and access to well developed transport and communications infrastructure.

The paper is organized as follows. In Section 2 we discuss our dataset and the basic estimating framework. Results are discussed in Section 3, robustness checks or the results are presented in Section 4 and conclusions offered in Section 5.

2. Data and Estimating Equation

Our estimation strategy follows the recent gravity-model based literature. There are many paths that lead to the now standard functional relationship we use here. The first to propose a gravity equation for trade flows as an empirical specification for trade without theory was Tinbergen (1962). Anderson (1979) was the first to provide microfoundations based on the Armington assumption. Among the more recent literature, Anderson and van Wincoop (2003) elaborate on Anderson (1979) adding a practical way to estimate

the gravity equation structurally.[3] A basic point of Anderson and van Wincoop (2003) is multilateral resistance. Not accounting for multilateral resistance terms in a gravity model can lead to biased parameter estimates. This can be addressed with country-level fixed effects, but one then loses scope for analysis of country-level factors. To get around this, a recent strategy involves Taylor approximations of the multilateral resistance terms to solve for the multilateral resistance terms (Baier and Bergstrand, 2009). This allows for estimation of the gravity equation, inclusive of country-level variables. In this paper we follow Baier and Bergstrand (2009), extended to include indexes of infrastructure and institutional quality influencing trade costs. Furthermore, we also account for firm heterogeneity and selection which was highlighted by Helpman, Melitz and Rubinstein (2008) to lead to potentially significant bias if not accounted for.

2.1. Data

We work with a panel of bilateral trade, trade policy, geographic characteristics, and income data. Given that the data for institutional quality is only available for 1990, 1995, 2000, 2001,2002, and 2003, we limit our panel data to these years. Our trade and tariff data were obtained from the UN/World Bank WITS system (World Integrated Trade Solution). The data in WITS come, primarily, from the UNCTAD TRAINS and COMTRADE systems and the World Trade Organization's integrated tariff database (IDB). The countries included in the sample are listed in the annex (Table A.1). There are several country combinations for which trade is not reported. Following the recent literature, we assume that these missing observations from the database represent zero trade. (See Helpman, Melitz and Rubinstein 2008, Baldwin and Harrigan 2007, Coe et al 2007, Felbermayr and Kohler 2004, Silva and Tenreyro 2006. Also see Helpman, Melitz and Rubinstein 2008 for theoretical motivation.) However, to eliminate those observations which are likely to be missing and not zero, we assume that if a country did not report any imports for a particular year its trade flows are missing.[4] (this procedure is often

[3] Other important contributions to the gravity literature include Evenett and Keller (2002), Deardorff (1988), Chaney (2008).

[4] For our final dataset this represented about 10 percent of the observations.

used, see for example Gaulier and Zignago 2010). In our final dataset about 20 percent of bilateral trade flows are zeros. We use import data as it is likely to be more reliable than export data since imports constitute a tax base and governments have an incentive to track import data. Income data are taken from the World Development Indicators database. Geographic data, together with dummies for same language and colonial links, are taken from Clair et al (2004).[5] The distance data are calculated following the great circle formula, which uses latitudes and longitudes of the relevant capital cities.

We are ultimately interested in the dual role of institutions and infrastructure. Our data include indexes produced by the World Bank on infrastructure, and by the Fraser Institute for institutions. The institution indexes are from the "Economic Freedom of the World" (EFW) database.[6] The EFW indexes are supplemented with robustness checks (with shorter panels) using data from Transparency International and Kaufmann, Kraay and Mastruzzi (2005). The EFW indexes are themselves based on several sub-indexes designed to measure the degree of 'economic freedom' in five areas: (1) size of government: expenditures, taxes, and enterprises; (2) legal structure and protection of property rights; (3) access to sound money: inflation rate, possibility to own foreign currency bank accounts; (4) freedom to trade internationally: taxes on international trade, regulatory trade barriers, capital market controls, difference between official exchange rate and black market rate, etc.; and (5) regulation of credit, labor, and business. Each index ranges from 0 to 10 reflecting the distribution of the underlying data. Notionally, a low value is bad, and a higher value is good. We work with indexes for the years 1990, 1995, 2000, 2001, 2002, and 2003.

To measure infrastructure, we have taken data from the World Development Indicators database. This includes data on the percentage of paved roads out of total roads, on the total network of roads weighted with the country's size, on the number of fixed and mobile telephone subscribers (per 1,000 people), on the number of telephone mainlines (per 1,000 people), on telephone mainlines in largest city (per 1,000 people), telephone

[5] http://www.cepii.fr/anglaisgraph/bdd/distances.htm
[6] http://www.freetheworld.com/download.html#efw

mainlines per employee, mobile phones (per 1,000 people), and freight of air transport (million tons per km).

2.2. Construction of infrastructure and institution indexes

Since both sets of indexes measuring institutional and infrastructure quality are highly correlated, we use principal component analysis to produce a set of summary indexes [7]. Principal component analysis is a useful statistical technique that has been widely applied in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension. Ideally, principal component analysis identifies patterns in the data and based on these patterns it reduces the number of dimensions of the data without a lot of loss of information. It reduces the data to a few principal components by using the variance structure of the matrix of data through linear combination of the variables.

From the results of the principal component analysis in Table 1 to Table 4, we take the first two components to produce four indexes for the exporter country and four indexes for the importer country; two institutional indexes, and two infrastructure indexes. These reflect between 73 percent and 77 percent of variation in the sample (indicated by the cumulative proportion in the tables). The tables below present the weighting factors for each index, separately for the indexes measuring institutions and the indexes measuring infrastructure for both the exporter and the importer countries. The tables also present the eigenvalues for the first two components retained which is the variance of the factor. Furthermore, the uniqueness of each variable is also shown in the tables. The uniqueness of a given variable provides the proportion of the common variance of the variable not associated with the factors (thus if uniqueness is equal to 1 it indicates communality).

Based on the weighting factors reported in Table 1 and Table 3, we interpret the first infrastructure component as measuring mostly communications, and the second compo-

[7] As a robustness check we have also tried factor analysis which did not lead to any significantly different results. Nevertheless our preferred method is to use principal components since this method allows us to apply a purely mathematical transformation without taking into account any priors about the underlying data structure. In factor analysis, on the other hand there is a structured model and some assumptions.

nent mainly physical infrastructure (air transport and roads). For the institution indexes presented in Table 2 and Table 4, the index measuring the size of the government (or in other words the government involvement in the economy) is the main determinant of the second component while not influencing the first components both for the exporter and importer countries. Thus we interpret the first institutional component as measuring general correspondence with the market-oriented legal and institutional orientation flagged by the Fraser indexes. While we interpret the second institutional component as measuring less interventionist systems with lower level of state involvement in the economy (deviations toward the Anglo-US social model).

2.3. Estimating equation

When examining the global pattern of bilateral trade flows, one striking feature of the landscape is that many country pairs do not trade. In our initial sample 42% of importer-exporter pairings had zero bilateral trade.[8] In our analysis we also include zero flows. In order to accommodate zero trade flows, we employ a Poisson Maximum Likelihood estimator. Silva and Tenreyro (2006) shows that the Poisson performs best,and is most robust to specification errors. Besides being able to include zero values of trade in our estimations, the Poisson estimator is also consistent in the presence of heteroskedasticity (see Silva and Tenreyro 2006).

The empirical literature on institutions and economic performance has a well recognized and extensively discussed problem with the endogeneity of the variables of interest. (See Eicher and Leukert 2009). For example, institutional quality may also be driven by trade and integration, rather than the other way around. Similarly, countries that enjoy relatively good market access conditions might respond by improving their infrastructure as a result of trading, because the benefits are greater. Although the causality is likely to go both ways, the evidence suggests that better infrastructural quality, such as better roads, better communication possibilities, and better quality of institutions, such as improved legal and regulatory frameworks, are more likely to have a more direct and

[8]In our final sample, given that indexes used for institutional quality are not available for several countries, particularly those that trade less, the share is only about 20 percent.

immediate effect on the probability of trading and the amount traded then the other way around. Increased economic integration resulting from increased trade might have a positive effect on institutional quality and infrastructure but this link is likely to be less direct and slower to be realized. Different strategies have been followed in the literature to handle the problem of endogeneity. While none are fully satisfactory, the fact that the different approaches yield broadly similar results is reassuring. One workaround has been to instrument institutional quality and infrastructure. For example, institutional quality has been instrumented by settler mortality (see for example Acemoglu et al 2001 or Rodrik et al 2004), by the fraction of population speaking English, and by the fraction of population speaking a major European language (for example Dollar and Kraay 2002, and Alcala and Ciccone 2001). Unfortunately, there are problems with each of the instruments in our case. We work here with a sample that includes not only some former colonies, but also developed countries that were not part of the same colonial experience. As such, using these instruments simply is not appropriate. It is also very hard to find suitable instruments for infrastructure quality, especially if you are interested in estimated effects from actual variations in infrastructure itself. For example, Ioannides et al (2008) instrument the number of telephones with the degree of competitiveness of the telecommunication sector. We define institutional quality in a wide sense including regulatory quality in our measure, and so such an approach simply would not work here. To address these potential problems we have done the following. We have first used a method similar to approaches followed by Donaldson (2010), Calderón and Servén (2010), Stone and Bania (2009), Mollick et al (2006), and Zhang and Fan (2004). This involved combining various measures of institutional and infrastructure quality from the World Bank and the Fraser Institute through principle components. Then, instead of using the current values of the principal components, we use their lagged values to reduce the potential bias arising from the possible inverse causality (Arellano and Bond, 1991). For a robustness check, we also report results where we use alternative composite measures from Transparency International and Kaufmann, Kraay and Mastruzzi (2005) (though with shorter panels). This allows for some cross-checking on the different indexes used in this paper. The basic

results remain the same using these alternative measures.

We start with the basic estimating equation, as specified in equation (1). Equation (1) is relatively general, and is used in much of the current literature as discussed below. From the gravity literature, we expect trade flows to be a function of importer and exporter income, as well as of determinants of bilateral trade costs like distance and tariffs. We also include variables of interest for the present exercise. These are measures of infrastructure and institutional aspects of exporters that we expect to impact on trading costs.

$$\begin{aligned}\ln M_{i,j,t} \quad = \quad & \alpha_0 + \alpha_1 \ln \_GDP_{j,t} + \alpha_2 \ln \_GDP_{i,t} + \alpha_3 \ln T_{i,j,t} + \\ & \alpha_4 \ln dist_{i,j} + \alpha_5 comlang\_ethno_{i,j} + \alpha_6 colony_{i,j} + \\ & + \alpha_7 \ln INF1_{j,t} + \alpha_8 \ln INS1_{j,t} + \alpha_9 \ln INF2_{j,t} + \alpha_{10} \ln INS2_{j,t} \\ & + \alpha_{11} \ln INF1_{i,t} + \alpha_{12} \ln INS1_{i,t} + \alpha_{13} \ln INF2_{i,t} + \alpha_{14} \ln INS2_{i,t} + u \end{aligned} \tag{1}$$

Our right-hand side variables are summarized in Table 5. $M_{i,j,t}$ is country i imports from country j at time t. As a proxy for market potential, GDP is included for exporter (j) and importer (i) countries. These are standard gravity variables, as is distance $dist$ and tariffs T. For bilateral import protection, we use applied tariffs, $lnT_{i,j,t} = ln\,(1 + \tau_{i,j,t})$. $\tau_{i,j,t}$ indicates the applied tariff rate offered by importer i to exporter j in period t. Distance is well established in the gravity equation literature. (See for example Disidier and Head 2008, and Anderson and van Wincoop 2003.) To capture historical and cultural linkages between trading partners several zero-one type dummy variables are included in the estimating equation. The variable *colony* takes the value of 1 if the exporting country j was a colony of the partner country i. Finally, a separate dummy, *comlang_ethno* captures if the traders of the two partner countries can speak the same language, or generally share the same linguistic heritage. Institutional and infrastructure quality for both the importer (i) and exporter (j) is measured by $INS1$, $INS2$, and $INFR1$, $INF2$ respectively. These are indexes obtained after principal component analysis, as discussed

above. In all the regressions the lagged value of these indexes are used.

In order to include multilateral resistance terms, equation (1) is extended following Baier and Bergstrand (2009). Indexing importers by (i, k, h), and exporters by (j, m, z), equations (19) and (20) on page 80 of Baier and Bergstrand (2009) are reproduced as equations (2) and (3) below.

$$P_{it} = \sum_{m \notin i} lnT_{imt} \frac{GDP_{mt}}{GDP_{wt}} - (0.5) \sum_{h} \sum_{z} \frac{GDP_{ht}}{GDP_{wt}} \frac{GDP_{zt}}{GDP_{wt}} lnT_{hzt} \tag{2}$$

$$P_{jt} = \sum_{j \notin j} lnT_{kjt} \frac{GDP_{kt}}{GDP_{wt}} - (0.5) \sum_{h} \sum_{z} \frac{GDP_{ht}}{GDP_{wt}} \frac{GDP_{zt}}{GDP_{wt}} lnT_{hzt} \tag{3}$$

Here, we have modified the basic Baier and Bergstrand specification to include time indexing. In the case of tariffs lnT_{ijt}, we can specify multilateral resistance as in equation (4) below.

$$MRT_{ijt} = P_{it} + P_{jt} = \sum_{m \notin i} lnT_{imt} \frac{GDP_{mt}}{GDP_{wt}} + \sum_{k \notin j} lnT_{kjt} \frac{GDP_{kt}}{GDP_{wt}} - \sum_{h} \sum_{z} \frac{GDP_{ht}}{GDP_{wt}} \frac{GDP_{mt}}{GDP_{zt}} lnT_{hzt} \tag{4}$$

We can easily extend equation (4) to the more general case of bilateral time varying variables G_{ijt} as in equation (5) and importer and exporter multilateral resistance terms for institution and infrastructure indexes for exporters $I_{export:jt}$ and importers $I_{import:it}$ as in equations (6) and (7).

$$MRG_{ijt} = \sum_{m \notin i} lnG_{imt} \frac{GDP_{mt}}{GDP_{wt}} + \sum_{k \notin j} lnG_{kjt} \frac{GDP_{kt}}{GDP_{wt}} - \sum_{h=1}^{N} \sum_{z=1}^{N} \frac{GDP_{ht}}{GDP_{wt}} \frac{GDP_{mt}}{GDP_{zt}} lnG_{hzt} \tag{5}$$

$$MR_{import:ijt} = lnI_{it} \sum_{m \notin i}^{N} \frac{GDP_{mt}}{GDP_{wt}} + \sum_{k \notin j}^{N} lnI_{kt} \frac{GDP_{kt}}{GDP_{wt}} - \sum_{h} \sum_{z} \frac{GDP_{ht}}{GDP_{wt}} \frac{GDP_{zt}}{GDP_{wt}} lnI_{ht} \tag{6}$$

$$MR_{export:ijt} = \sum_{m \notin i}^{N} lnI_{mt} \frac{GDP_{mt}}{GDP_{wt}} + lnI_{jt} \sum_{k \notin j}^{N} \frac{GDP_{kt}}{GDP_{wt}} - \sum_{h} \sum_{z} \frac{GDP_{ht}}{GDP_{wt}} \frac{GDP_{zt}}{GDP_{wt}} lnI_{zt} \tag{7}$$

Our estimating equation augmented by the controls for multilateral resistance for

all the variables proxying for transport costs:

$$\begin{aligned}
\ln M_{i,j,t} \;=\; & \alpha_0 + \alpha_1 \ln _GDP_{j,t} + \alpha_2 \ln _GDP_{i,t} + \alpha_3 \ln T_{i,j,t} + \\
& \alpha_4 \ln dist_{i,j} + \alpha_5 comlang_ethno_{i,j} + \alpha_6 colony_{i,j} + \\
& + \alpha_7 \ln INF1_{j,t} + \alpha_8 \ln INS1_{j,t} + \alpha_9 \ln INF2_{j,t} + \alpha_{10} \ln INS2_{j,t} \\
& + \alpha_{11} \ln INF1_{i,t} + \alpha_{12} \ln INS1_{i,t} + \alpha_{13} \ln INF2_{i,t} + \alpha_{14} \ln INS2_{i,t} \\
& + \alpha_{15} MRT_{i,j,t} + \alpha_{16} MRdist_{i,j,t} + \alpha_{17} MRcomlang_{i,j,t} + \alpha_{18} MRcolony_{i,j,t} \\
& \alpha_{19} \ln MRINF1_{export:ijt} + \alpha_{20} \ln MRINS1_{export:ijt} + \alpha_{21} \ln MRINF2_{export:ijt} + \\
& \alpha_{22} \ln MRINS2_{export:ijt} + \alpha_{23} \ln MRINF1_{import:ijt} + \alpha_{24} \ln MRINS1_{import:ijt} + \\
& \alpha_{25} \ln MRINF2_{import:ijt} + \alpha_{26} \ln MRINS2_{import:ijt} + u
\end{aligned} \tag{8}$$

where $MRT_{i,j,t}$,$MRdist_{i,j,t}$, $MRcomlang_{i,j,t}$, and $MRcolony_{i,j,t}$ have been constructed following (5),$MRINF1_{export:ijt}$, $MRINF2_{export:ijt}$, $MRINST1_{export:ijt}$, $MRIST2_{export:ijt}$, have been constructed (7), and $MRINF1_{import:ijt}$, $MRINF1_{import:ijt}$, $MRINF1_{import:ijt}$, $MRINF1_{import:ijt}$, have been constructed following (6). Also, following Baier and Bergstrand, we impose constraints linking direct terms to MR terms in the estimating equation.[9]

Following Helpman, Melitz and Rubinstein (2008) (and more recently Egger et al (2011)) we also run a specification where we control for selection and firm heterogeneity. Helpman, Melitz and Rubinstein (2008) show that not accounting for firm heterogeneity can lead to biased results. On the other hand, Egger et al (2011) using also a Poisson model in the second stage, find that not accounting for the presence of heterogeneous firms appears less relevant than not accounting for zeros. Here we account both for zeros and firm heterogeneity in our regression. This involves running a first stage Probit regression and then using the terms obtained from the Probit to control for both firm heterogeneity and selection in our main Poisson equation [10].

[9] $\alpha_1 = 1, \alpha_2 = 1, \alpha_3 = \alpha_{15}$, α_4=α_{16}, α_5=α_{17}, α_6=α_{18}, α_7=α_{19}, α_8=α_{20}, α_9=α_{21}, α_10=α_{22}, α_11=α_{23}, α_12=α_{24}, α_13=α_{25}, α_14=α_{26}.

[10] See detailed discussion about the derivation of the methodology in Helpman, Melitz and Rubinstein (2008). Similarly to Helpman, Melitz and Rubinstein (2008) we report robust standard errors but we do

Thus first a Probit regression is run from which, following Egger et al (2011) and Helpman, Melitz and Rubinstein (2008), we obtain the inverse Mills ratio ($\lambda_{i,j,t}$) to correct for the nonrandom prevalence of zero trade flows in the second stage. In addition, to control for potential unobserved firm level heterogeneity, similarly to Egger et al (2011), we use higher order polynomial controls ($\eta^2_{i,j,t}$, $\eta^3_{i,j,t}$, $\eta^4_{i,j,t}$) which are based on the linear predictions in the Probit model. Egger et al (2011) show that including higher order polynomials up to up to a fourth order (excluding the linear term for reasons of collinearity) has the added advantage that the polynomial control function captures possible nonlinearities due to the firm extensive margin. Such additional nonlinearities are present if firms are in fact heterogenous.

We have estimated equation (9) for the first stage Probit regression. Since the Probit regression is used mainly to be able to eliminate the potential bias arising from not controlling for firm heterogeneity and selection, we do not include our main variables of interest, infrastructure and institution quality, in the Probit regression. Instead, in order to reduce the potential omitted variable bias and thus to obtain better correction terms, we include exporter (ν_j), importer (ζ_i), and time dummies (θ_t) in the Probit regression. This also implies that in the Probit regression we have a different set of explanatory variables than in the second stage Poisson regressions eliminating the problem of potential multicollinearity.

$$\begin{aligned} \ln M_{i,j,t} \quad = \quad & \alpha_0 + \alpha_1 \ln \_GDP_{j,t} + \alpha_2 \ln \_GDP_{i,t} + \alpha_3 \ln T_{i,j,t} + \\ & \alpha_4 \ln dist_{i,j} + \alpha_5 comlang\_ethno_{i,j} + \alpha_6 colony_{i,j} + \alpha_7 \lambda_{i,j,t} + \\ & \alpha_8 \eta^2_{i,j,t} + \alpha_9 \eta^3_{i,j,t} + \alpha_{10} \eta^4_{i,j,t} + \zeta_i + \nu_j + \theta_t + \varepsilon_{ijt} \end{aligned} \tag{9}$$

not correct for the generated regressors in the second stage.

3. Results

Estimation results are presented in Table 6. The first three columns present results based on a Poisson estimator and including yearly fixed effects and multilateral resistance terms for all trade cost variables including the institution and infrastructure indexes. Constraints were applied as specified in equation (8), namely we constrained the GDP coefficients to be equal to 1, and all the trade cost variables to be equal to their corresponding multilateral resistance terms. The first two columns present regression results without controlling for firm heterogeneity and selection bias using the correction terms from the Probit estimation, while the third column include those terms. The last column of the table presents the Probit estimation which was used to obtain the correction terms.

Looking at the results of the regressions in the first three columns, distance has the expected sign and magnitude. When correcting for firm heterogeneity and selection (column 3), the coefficients of distance are slightly higher. This is similar for tariffs, although the significance of the variable becomes somewhat lower in column 3. The results indicate that for the exporters, both the quality of the infrastructure and institutions matter, although the first institutional index is not significant. When controlling for firm heterogeneity and selection, both infrastructure indexes has a high, positive and significant coefficient, indicating that both physical and communication infrastructure in the exporting country have an important significant effect on export performance. For institutions, more market oriented institutional systems in the exporting country foster export performance. On the importer side, similarly market oriented institutions have a positive significant impact on trade. Furthermore, both better quality of physical and communication infrastructure of the importing country have a positive significant impact on imports. The coefficients of the principal components measuring quality of the importing country's institutional and infrastructure quality are lower than the coefficients of the principal components measuring the quality of institutions and infrastructure in the exporting country. Thus our results highlight the importance of both institutions and infrastructure for trade performance. Furthermore, the results also indicate, that the quality of institutions and infrastructure in the exporting country matters slightly

more for the export performance than the quality of institutions and infrastructure of the importing country although both are important. Controlling for firm heterogeneity and selection does not change the results for most of the coefficients, although the test of joint significance of the the correction terms indicate their significance.

If we move from statistical significance to economic relevance, what do our coefficient estimates tell us? In order to better understand what our results mean for countries at different income levels, we have also calculated predicted relative bilateral trade flows at group means. We have benchmarked the calculations to the high income countries, and compared middle and low income countries to this benchmark. This is presented in Table 7. These figures show us by how much trade is lower between the different country pairs due to their lower quality of infrastructure and institution.[11]

Our results predict that around sample means, differences in institution and infrastructure quality alone imply trade volumes between low income countries (South-South trade) being roughly 26% of what their trade volumes would be if the quality of their institutions and infrastructure would be the same as high income countries'. Trade between low and high income countries (North-South trade) are also much lower than what could be achieved by having better institutions and infrastucture. When low income countries are exporting to middle income countries, trade flows are 55% below the level of high income countries' trade (North-North trade). While we emphasize exports of developing countries, low institutional and infrastructure quality in the South also effectively limits market access for exports from the North to low-income markets. For high income countries, low institutional and infrastructure quality in destination markets in the South implies exports 44% below North-North volumes in the case of low-income destination markets, and 28% below in the case of middle-income countries. On the other hand, when middle-income countries are exporting to low-income countries, their trade will be about 70% lower than that of trade between high-income countries. These results support the notion that trade volumes in general, and the propensity of low income countries in

[11]The calculations were based on using the average principal components by income groups and the coefficient results presented in column 3 of Table 6

particular to take part in the trading system at all, depends on institutional quality and access to well developed transport and communications infrastructure.

4. Robustness

As a check on the robustness of our results, we also report the regressions using other institutional variables from alternative sources in Table 8. These measures are generally available for a somewhat shorter time span than our primary indicators. Instead of using principal component analysis, as a further robustness check, we have included these institutional variables separately in the regressions.

Alternative variables measuring institutional quality were obtained from two sources. A proxy for the level of corruption was obtained from the Transparency International Corruption Perceptions Index. The Index ranks countries in terms of the degree to which corruption is perceived to exist, defining corruption in the public sector as the abuse of public office for private gain.

Several other variables measuring the quality of institutions and governance were taken from Kaufmann, Kraay and Mastruzzi (2005). The authors estimate six dimensions of governance covering 209 countries and territories for five time periods: 1996, 1998, 2000, 2002 and 2004. The following variables were available in the dataset: government effectiveness (measuring the competence of the bureaucracy and the quality of public service delivery), political stability (measuring the likelihood of violent threats to, or changes in, government, including terrorism), regulatory quality (measuring the incidence of market-unfriendly policies), rule of law (measuring the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence), voice and accountability (measuring political, civil and human rights). The six indicators are measured in units ranging from -2.5 to 2.5 with higher values corresponding to better governance. To be able to take the logarithm of these variables, we rescaled them, with the new index values starting from 1.

The results using the variables measuring different aspects of institutional quality and the index proxying the importance of corruption in the public sector reinforce the

findings in the Section 3. All the variables proxying institutional quality have a positive and significant sign. The indexes are included both for the importer and exporter country. The coefficient of the indexes are consistently higher for the exporter than for the the importer, although both have a positive impact on trade. This seems to imply that although both the importer and the exporter country's institutional quality matters for the success of exporting and the amount of exporting, it is the exporter's institutions which will have a somewhat bigger impact. Thus better institutional quality in the exporting country has a crucial role for the country's export performance.

The sample varies slightly for the different indexes as these variables were available for a slightly different set of countries. The sample is the smallest for the first variable which proxies corruption (the variable comes from the Transparency International) for which results are presented in the first column in Table 8. The coefficients are somewhat more comparable throughout the rest of the columns which present results using variables obtained from Kaufmann, Kraay and Mastruzzi (2005). Corruption and 'voice and accountability' seem to have a somewhat lower positive impact on trade flows than the effectiveness of the government, political stability, regulatory quality, or rule of low. Nevertheless, all indexes have a positive significant impact on exports and thus our results confirm and highlight the importance of institutional quality for trade performance.

5. Summary and Discussion

In this paper, we have worked with a panel of bilateral trade flows to explore the influence of infrastructure and institutional quality on patterns of trade. In contrast to the recent selection-based literature, in this paper we have used a Poisson estimator extended to include the Baier and Berstrand method for multilateral resistance related to country-specific variables. We have also used a specification where running first a Probit regression we control both for firm heterogeneity and selection in the second stage Poisson regressions. We have found that exports depend on institutional quality and exporter and importer access to well developed transport and communications infrastructure both at home and in partner countries. Hence, though our interest has primarily been

to emphasize determinants of the exports of developing countries, low institutional and infrastructure quality in the South also limits market access for exports from the North.

The recent empirical literature supports the characterization of developing countries as belonging either to a cohort of countries that are deepening linkages with the global trading system (globalizers), or to those that are not (Dollar and Kraay, 2004). The globalizers (like China and India) have seen rapid growth in trade, and this growth has been linked to accelerating growth rates, pushing incomes on a catch-up path with the OECD and driving poverty rates down in the process (Sala-i-Martin, 2006). At the same time, there is another cohort of developing countries (many in Africa) with a very different story to tell. While trade and growth may be wrapped up in a positive cycle for some countries, those left behind have not experienced rapid trade growth, or the related mechanisms that signal deeper integration into the global economy. The dependence of exports on conditions in both source and destination markets, as we find here, suggests that regionally there can be a collective problem of clustered poor regional trade performance when, individually, low income countries find themselves with regional partners in the same cohort.

Our results predict that low income countries will trade about 74% below trade volumes taking place between high income countries due to lower quality of institutions and infrastructure. Similarly, trade between low and high income countries is roughly 55% to 64% below that of high income countries' trade due to differences in institutional and infrastructure quality. As our results indicate, it is not only the quality of institutions and infrastructure of the exporter what matters but also that of the importer . This implies that low institutional and infrastructure quality in the South also effectively limits market access for exports from the North to low-income markets. For high income countries, low institutional and infrastructure quality in destination markets in the South implies exports 44% below North-North volumes in the case of low-income destination markets, and 28% below in the case of middle-income countries. These results support the notion that trade volumes in general, and the propensity of low income countries in particular to take part in the trading system at all, depends on institutional quality and access to well developed

transport and communications infrastructure.

Our results complement research on the impact of regulatory environments behind the border on economic interaction. Indeed, this is not specific to developing countries, but is emerging as a major focus on regional trade agreements between high income countries as well. For example, a combination of regulatory shortfall and poor infrastructure quality has been flagged as an important determinant of market access conditions. It points to potential impacts on goods trade linked to market structure in both international transport services and domestic distribution services. For example, Bradford (2005) has analyzed the impacts of distribution margins in eight OECD countries - defined as the ratio between the value of output in producer and consumer prices for 124 products. The focus is on deriving an estimate of the specific distribution margins (including wholesale/retail trade and transportation) by explicitly controlling for the impacts of trade barriers on producer prices. His estimates range from a low of around 60 (i.e., 60 cents to move a dollar worth of output measured at world prices) for Canada, the Netherlands, the UK and the US to a high of almost 100 for Japan. CGE model simulations suggest that inefficiencies in distribution reduce imports and impose substantial welfare costs, the magnitude of which is similar to that caused by border trade barriers. Working with regulatory data for the EU, Francois and Wooton (2010) find a similar mechanism at play in North-South trade. Market power in the North may disproportionately limit market access conditions for exporters from the South. Such results reinforce the basic message that market access, and economic integration in a broad sense, is a complex function of regulatory and institutional mechanisms at least as much as it is a function of direct trade barriers like tariffs.

References

Acemoglu, D., S. Johnson, and J.A. Robinson. (2001). "The Colonial Origins of Comparative Development: An Empirical Investigation."*American Economic Review* 9(5): 1369-1401.

Alcala, F. and A. Ciccone (2001). "Trade and Productivity."*Quarterly Journal of Economics* 119(2): 613-646.

Anderson, J. (1979). "A Theoretical Foundation for the Gravity Equation."*American Economic Review* 69(March): 106-116.

Anderson, J., and D. Marcouiller (2002). "Insecurity and the Pattern of Trade: An Empirical Investigation."*The Review of Economics and Statistics* 84: 342-352.

Anderson, J. and E. van Wincoop (2003). "Gravity with Gravitas: A Solution to the Border Puzzle."*American Economic Review* 93(1): 170-192.

Arellano, M. and Bond, S. (1991). "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations."*Review of Economic Studies* 58(2): 277-97.

Baier, S.L. and Bergstrand, J.H. (2009). "Bonus vetus OLS: a simple method for approximating international trade-cost effects using the gravity equation."*Journal of International Economics* 77(1): 77-85.

Baldwin, R. and D. Taglioni (2006). "Gravity for Dummies and Dummies for Gravity Equations."CEPR discussion paper 5850.

Baldwin R, and J. Harrigan (2007). "Zeros, Quality and Space: Trade Theory and Trade Evidence."CEPR discussion paper 6368.

Behar, A, P Manners and B Nelson (2009). "Exports and Logistics."Oxford Department of Economics Discussion Paper 439..

Boatman, K.T. (1992). *Telecommunications System Quality and Export Performance.* doctoral dissertation, University of Maryland: College Park.

Bougheas, S., Demetriades, P. and E. Morgenroth (1999). "Infrastructure, transport costs and trade."*Journal of International Economics* 47: 169-189.

Bradford, S. (2005), "The Welfare Effects of Distribution Regulations in OECD Countries."*Economic Inquiry* 43(4): 795-811.

J.-F, Carrère C., Guillaumont P. and De Melo J. (2005). "Has Distance Died? Evidence from a Panel Gravity Model."*World Bank Economic Review* 19(1): 99-120.

Calderón, C. and L. Servén (2010)."Infrastructure and Economic Development in Sub-Saharan Africa."Journal of African Economies 19 (suppl 1): i13-i87.

Chaney, T. (2005). "Distorted Gravity: The Intensive and Extensive Margins of International Trade."*American Economic Review* 98 (September): 1707-21.

Clair, G., G. Gaulier, T. Mayer, and S. Zignago (2004). "Notes on CEPII's distances measures."CEPII: Paris.

Coe, D.T., A. Subramanian, N.T. and Tamirisa (2007). "The Missing Globalization Puzzle: Evidence of the Declining Importance of Distance. "*IMF Staff Papers* 54: 34-58.

Deardorff, A. (1988). "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?"in J. Frankel ed., *The Regionalization of the World Economy.* University of Chicago for the NBER, 1998.

Depken II, C.A. and R.J. Sonora (2005). "Asymmetric Effects of Economic Freedom on International Trade Flows."*International Journal of Business and Economics* 4(2): 141-155.

Disdier, A.C. and K. Head (2008). "The Puzzling Persistence of the Distance Effect on Bilateral Trade. " *Review of Economics and Statistics* 90(1): 37-48.

Dollar, D. and A. Kraay (2002). "Institutions, Trade, and Growth."*Journal of Monetary Economics.* 50: 133-162.

Dollar, D. and A. Kraay (2004). "Trade, Growth, and Poverty."*Economic Journal* 114: F22-F49.

Donaldson, D (2010). "Railroads of the Raj: Estimating the Impact of Transportation Infrastructure."NBER working paper no 16487.

Egger, P., Larch, M. , Staub, K. and R. Winkelmann (2011). "The Trade Effects of Endogenous Preferential Trade Agreements."*American Economic Journal: Economic Policy* 3: 113-143.

Eicher, T. and A. Leukert (2009). "Institutions and Economic Performance: Endogeneity and Parameter Heterogeneity."*Journal of Money, Credit and Banking* 41(1): 197-219.

Evenett, S.J. and W. Keller (2002). "On Theories Explaining the Success of the Gravity Equation."*Journal of Political Economy.* 110(2): 281-316.

Evenett, S. and A.J. Venables (2003). "Export Growth in Developing Countries: Market Entry and Bilateral Trade.Mimeo.

Feenstra, R. (2004). *Advanced International Trade: Theory and Evidence.* Princeton University Press: Oxford.

Felbermayr, G.J. & W. Kohler (2004). "Exploring the Intensive and Extensive Margins of World Trade."*Review of World Economics* 142(4): 642-674.

Francois, J. and I. Wooton (2010). "Market Structure and Market Access."*The World Economy* 33(7): 873-893.

Gaulier et Zignago (2010). "BACI: International Trade Database at the Product-level The 1994-2007 Version."CEPII Working Paper 2010-23.

Greene, W.H. (2003). *Econometric Analysis: 5th edition* (Chapter 22). Prentice Hall: New Jersey.

De Groot, H. L. F., Linders, G.-J., Rietveld, P. and Subramanian, U. (2004). "The Institutional Determinants of Bilateral Trade Patterns "*Kyklos*: 57: 103-123.

Gwartney, J. and R. Lawson (2005). *Economic Freedom of the World: 2005 Annual Report*. The Fraser Institute: Vancouver. Data retrieved from www.freetheworld.com.

Havemann, J. and D. Hummels (2004). "Alternative Hypotheses and the Volume of Trade: the Gravity Equation and the Extent of Specialization."*Canadian Journal of Economics* 37(1): 199-218.

Heckman, J. (1979). "Sample Selection Bias as a Specification error."*Econometrica* 47: 153-161.

Helble, Matthias; Ben Shepherd and John S. Wilson (2007). "Transparency and Regional Integration in the Asia Pacific."World Bank Policy Research Paper 4401. Washington DC: World Bank.

Helpman, E., M. Melitz, and Y. Rubinstein (2008). "Estimating trade flows: trading partners and trading volumes."*The Quarterly Journal of Economics* 123(2): 441-487.

Hummels, D. and P.J. Klenow (2005). "The Variety and Quality of a Nation's Exports. "*The American Economic Review* 95(3): 704-723.

Ioannides, Y., H. Overman, E. Rossi-Hansberg, and K. Schmidheiny (2008). "The Effect of Information and Communication Technologies on Urban Structure. "*Economic Policy* 23(54): 201-242.

Iwanow, T. and Kirkpatrick, C. (2008). "Trade facilitation, regulatory quality and export performance. "*Journal of International Development* 19: 735-753.

Kaufmann, D. A. Kraay and M. Mastruzzi (2005). "Governance Matters IV: Governance Indicators for 1996-2004. "*World Bank Policy Research Working Paper Series* No. 3630.

Levchenko, A. (2007). "Institutional Quality and International Trade."*The Review of Economic Studies* 74(3): 791-819.

Limão, N. and A.J. Venables (2001). "Infrastructure, Geographical Disadvantage, Transport Costs and Trade."*World Bank Economic Review* 15: 451-479.

Martin, W. and C. S. Pham (2008). "Estimating the Gravity Model When Zero Trade Flows Are Frequent."*World Bank mimeo*

Mátyás, L. (1997). "Proper Econometric Specification of the Gravity Model."*The World Economy* 20:363-368.

Mollick, A. V., R. Ramos-Duran, and E. Silva-Ochoa (2006). "Infrastructure and FDI Inflows into Mexico: A Panel Data Approach. "*Global Economy Journal:* 6(1): Article 6.

Nordås, H. K. and Piermartini, R. (2004). "Infrastructure and Trade."*WTO Staff Working Paper No. ERSD-2004-04* .

N, Nunn (2007). "Relationship-specificity, Incomplete Contracts, and the Pattern of Trade."*The Quarterly Journal of Economics* 122 (2): 569-600.

Obstfeld, M. and K. Rogoff (1995). "Exchange rate Dynamics Redux "*Journal of Political Economy* 102(June 1995): 624-660.

Portugal-Perez, A. J.S. Wilson (2012). "Export Performance and Trade Facilitation Reform: Hard and Soft Infrastructure "*World Development* 40(7):1295-1307.

Ranjan, P. and J.Y. Lee (2003). "Contract Enforcement and the Volume of International Trade in Different Types of Goods."mimeo, UC Irvine.

Roberts, M.J. and J.R. Tybout (1997). "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs."*The American Economic Review* 87(4): 545-564.

Rodrik, D., Subramanian, A. and F. Trebbi (2004). "Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development."*Journal of Economic Growth* 9: 131-165.

Sala-i-Martin, X. (2006)."The World Distribution of Income: Falling Poverty and... Convergence, Period. "*Quarterly Journal of Economics* 121(2): 351-398.

Santos Silva, J.M.C and S. Tenreyro (2006). "The Log of Gravity."*Review of Economics and Statistics* 88(4): 641-658.

Stone, J.A. and N. Bania (2009). "Brains, drains, and roads, growth hills: complementarity between public education and infrastructure in a half-century panel of states."MPRA Paper, University Library of Munich, Germany.

Tinbergen Jan (1962). "An Analysis of World Trade Flows: in Shaping the World Economy."ed. by Jan Tinbergen, New York, The Twentieth Century Fund.

Wilson, J.S., Mann, C.L., and T. Otsuki (2004). "Assessing the potential benefit of trade facilitation : A global perspective."*World Economy*, 28: 841-871.

M. Yu (2010). "Trade, democracy, and the gravity equation. "*Journal of Development Economics* 91:289-300.

Zhang, X. and S. Fan (2004). "How productive is infrastructure? A new approach and evidence from rural India. "*American Journal of Agricultural Economics* 86(2): 492-501.

Table 1: Principal components weighting factors, Exporter's Infrastructure

Exporter's Infrastructure	$\ln INF1_{j,t}$ Component 1	$\ln INF2_{j,t}$ Component 2	Uniqueness
Airtransport	0.2466	0.78	0.3309
Fixedmobilesubscribers	0.9617	0.1254	0.0594
Mobilephones	0.8202	0.2062	0.2848
Roadspaved	0.7735	-0.0455	0.3996
Telephonemainlines	0.9529	0.1238	0.0767
Roadstotalnetwork	0.0362	0.8707	0.2406
Eigenvalue	3.35224	1.25586	
Cumulative proportion	0.5277	0.768	

Table 2: Principal components weighting factors, Exporter's Institutions

Exporter's Institutions	$\ln INS1_{j,t}$ Component 1	$\ln INS2_{j,t}$ Component 2	Uniqueness
Size of government	0.0227	0.9546	0.0882
Legal system property rights	0.7974	-0.3713	0.2263
Sound money	0.7136	0.2427	0.4318
Regulation	0.81	0.2961	0.2562
Freedom to trade internationally	0.8139	-0.0364	0.3362
Eigenvalue	2.47357	1.18767	
Cumulative proportion	0.4947	0.7322	

Table 3: Principal components weighting factors, Importer's Infrastructure

Importer's Infrastructure	$\ln INF1_{i,t}$ Component 1	$\ln INF2_{i,t}$ Component 2	Uniqueness
Airtransport	0.2082	0.8078	0.304
Fixedmobilesubscribers	0.9663	0.0961	0.0571
Mobilephones	0.8313	0.0306	0.3079
Roadspaved	0.7394	0.0306	0.4524
Telephonemainlines	0.9471	0.1355	0.0846
Roadstotalnetwork	0.0035	0.8628	0.2556
Eigenvalue	3.2201	1.31824	
Cumulative proportion	0.5367	0.7564	

Table 4: Principal components weighting factors, Importer's Institutions

Importer's Institutions	$\ln INS1_{i,t}$ Component 1	$\ln INS2_{i,t}$ Component 2	Uniqueness
Size of government	0.0343	0.9596	0.078
Legal system property rights	0.7632	-0.4429	0.2214
Sound money	0.7462	0.1487	0.4211
Regulation	0.8407	0.2078	0.2501
Freedom to trade internationally	0.8084	-0.0624	0.3426
Eigenvalue	2.50428	1.18244	
Cumulative proportion	0.5009	0.7373	

Table 5: Regression model variable description

$\ln\_GDP_{j,t}$	log of GDP of exporter(partner)
$\ln\_GDP_{i,t}$	log of GDP of importer(reporter)
$\ln T$	log of tariff: (1+t)
$\ln dist$	the log of distance (km, great circle method)
comlang_ethno	shared linguistic/cultural heritage
colony	reporter and partner had colonial relations
$\ln INF1$	exporter/importer infrastructure index 1 (component 1 for exporter and importer)
$\ln INS1$	exporter/importer institution index 1 (component 1 for exporter and importer)
$\ln INF2$	exporter/importer infrastructure index 2 (component 2 for exporter and importer)
$\ln INS2$	exporter/importer institution index 2 (component 2 for exporter and importer)

Table 6: Estimated coefficients

	(1) Poisson, Non-robust s.e.	(2) Poisson, Robust s.e.	(3) Poisson, Robust s.e. with Probit correction terms	(4) Probit
	$\ln M_{i,j,t}$	$\ln M_{i,j,t}$	$\ln M_{i,j,t}$	$Pr(\ln M_{i,j,t} > 0)$
$\ln\_GDP_{j,t}$	1	1	1	-1.341
	(0)	(0)	(0)	(1.070)
$\ln\_GDP_{i,t}$	1	1	1	1.323
	(0)	(0)	(0)	(0.818)
$\ln dist$	-0.794***	-0.794***	-0.883***	-0.153***
	(1.55e-05)	(0.0353)	(0.0257)	(0.0426)
$comlang\_ethno$	0.0947***	0.0947	0.121	0.462***
	(5.49e-05)	(0.118)	(0.175)	(0.176)
$colony$	-0.0211***	-0.0211	-0.0347	-0.323
	(5.97e-05)	(0.130)	(0.141)	(0.141)
$\ln T$	-0.0870***	-0.0870***	-0.112*	-0.0630*
	(3.73e-05)	(0.0336)	(0.0604)	(0.0363)
$\ln INF1_{j,t}$	0.467***	0.467	0.874***	
	(0.000209)	(0.407)	(0.234)	
$\ln INF2_{j,t}$	1.046***	1.046***	0.850***	
	(9.32e-05)	(0.165)	(0.182)	
$\ln INS1_{j,t}$	0.0932***	0.0932	-0.279	
	(0.000158)	(0.225)	(0.247)	
$\ln INS2_{j,t}$	0.828***	0.828***	0.590***	
	(0.000103)	(0.108)	(0.158)	
$\ln INF1_{i,t}$	0.382***	0.382***	0.381***	
	(5.41e-05)	(0.0782)	(0.0788)	
$\ln INF2_{i,t}$	0.221***	0.221**	0.289***	
	(2.18e-05)	(0.0924)	(0.0555)	
$\ln INS1_{i,t}$	0.0353***	0.0353	0.0532	
	(3.62e-05)	(0.0746)	(0.0465)	
$\ln INS2_{i,t}$	0.287***	0.287***	0.292***	
	(2.51e-05)	(0.0286)	(0.0548)	
$\lambda_{i,j,t}$			1.916	
			(1.304)	
$\eta^2_{i,j,t}$			23.53	
			(15.85)	
$\eta^3_{i,j,t}$			-31.53	
			(27.71)	
$\eta^4_{i,j,t}$			11.76	
			(13.54)	
Observations	12,097	12,097	9,020	9,020
$PseudoR2$				0.5824
$\chi^2, Pr > \chi^2$		380.92 (0.00)	4740.49 (0.00)	
$\chi^2, Pr > \chi^2 II$			39.16(0.0000)	
$\chi^2, Pr > \chi^2 III$			23.58 (0.0001)	

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Poisson regressions with time fixed effects, and multilateral resistance terms.
Probit regression with exporter, importer and time fixed effects.
The sample size is smaller due to some outcomes being perfectly predicted.
$\chi^2, Pr > \chi^2 II$ refer to a test of joint significance of $\lambda_{i,j,t}$, $\eta^2_{i,j,t}$,$\eta^3_{i,j,t}$, $\eta^4_{i,j,t}$
$\chi^2, Pr > \chi^2 III$ refer to a test of joint significance of $\eta^2_{i,j,t}$,$\eta^3_{i,j,t}$, $\eta^4_{i,j,t}$

Table 7: Relative Bilateral Flows, evaluated at group means high:high=100

	importer		
	high income	middle income	low income
exporter			
high income	100	72.48	55.82
middle income	55.09	39.93	30.75
low income	46.21	33.50	25.80

note: basis is sample average difference for infrastructure and institutions

Table 8: Estimated coefficients with alternative institutional measures

	(1) corruption	(2) control of corruption	(3) government effectiveness	(4) political stability	(5) regulatory quality	(6) rule of law	(7) voice and accountability
$\ln r\_GDP$	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\ln p\_GDP$	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\ln dist$	-0.571***	-0.590***	-0.601***	-0.561***	-0.590***	-0.594***	-0.571***
	(0.0256)	(0.0302)	(0.0296)	(0.0327)	(0.0307)	(0.0299)	(0.0330)
$\ln T$	-0.365***	-0.338***	-0.234***	-0.551***	-0.358***	-0.307***	-0.715***
	(0.0854)	(0.0737)	(0.0726)	(0.0929)	(0.0813)	(0.0662)	(0.0948)
comlang_ethno	1.082***	1.109***	1.075***	1.217***	1.037***	1.119***	1.153***
	(0.104)	(0.106)	(0.107)	(0.105)	(0.103)	(0.106)	(0.105)
colony	-0.146	-0.144	-0.187*	-0.110	-0.128	-0.156	-0.109
	(0.0983)	(0.103)	(0.103)	(0.107)	(0.104)	(0.101)	(0.105)
ln p_corruptionm	0.360***						
	(0.135)						
ln r_corruption	0.314***						
	(0.0328)						
ln p_controlofcorruption		0.699***					
		(0.100)					
ln r_controlofcorruption		0.446***					
		(0.0361)					
ln p_govteffectiveness			0.834***				
			(0.0996)				
ln r_govteffectiveness			0.631***				
			(0.0366)				
ln p_politicalstability				0.879***			
				(0.136)			
ln r_politicalstability				0.333***			
				(0.0505)			
ln p_regulatoryquality					0.880***		
					(0.124)		
ln r_regulatoryquality					0.607***		
					(0.0576)		
ln p_ruleoflaw						0.847***	
						(0.106)	
ln r_ruleoflaw						0.519***	
						(0.0444)	
ln p_voiceandaccountability							0.624***
							(0.137)
ln r_voiceandaccountability							0.0933*
							(0.0535)
Constant	11.60***	11.36***	11.30***	11.42***	11.31***	11.33***	11.42***
	(0.0782)	(0.0805)	(0.0801)	(0.0840)	(0.0847)	(0.0811)	(0.0842)
Observations	19,507	45,943	47,446	43,423	47,658	47,192	48,385
χ^2	742.99	868.63	1123.99	756.01	877.02	904.00	589.39
$Pr > \chi^2$	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Regressions include multilateral resistance terms for all trade cost variables and annual fixed effects.

Annex Table A.1: Sample countries

reporter & partner		
Albania	Guyana	Panama
Algeria	Honduras	Papua New Guinea
Argentina	Hungary	Paraguay
Australia	Iceland	Peru
Austria	India	Philippines
Bahamas, The	Indonesia	Poland
Bangladesh	Iran, Islamic Rep.	Portugal
Barbados	Ireland	Romania
Belgium	Israel	Russian Federation
Belgium-Luxembourg	Italy	Rwanda
Benin	Jamaica	Senegal
Bolivia	Japan	Singapore
Botswana	Jordan	Slovak Republic
Brazil	Kenya	Slovenia
Bulgaria	Korea, Rep.	South Africa
Cameroon	Kuwait	Spain
Central African Republic	Latvia	Sri Lanka
Chad	Lithuania	Sweden
Chile	Macedonia, FYR	Syrian Arab Republic
Colombia	Madagascar	Ghana
Congo, Rep.	Malawi	Tanzania
Costa Rica	Malaysia	Thailand
Cote d'Ivoire	Mali	Togo
Croatia	Malta	Trinidad and Tobago
Cyprus	Mauritius	Tunisia
Czech Republic	Mexico	Turkey
Dominican Republic	Morocco	Uganda
Ecuador	Mozambique	Ukraine
Egypt, Arab Rep.	Namibia	United States
El Salvador	Nepal	Uruguay
Estonia	New Zealand	Venezuela
Finland		Germany
Guinea-Bissau		Greece
partner only		
Fiji	Sierra Leone	United Arab Emirates
Haiti		
reporter only		
Angola	Djibouti	Netherlands
Antigua and Barbuda	Dominica	Saudi Arabia
Armenia	Equatorial Guinea	Seychelles
Azerbaijan	Ethiopia	Solomon Islands
Bahrain	France	St. Kitts and Nevis
Belarus	Grenada	St. Lucia
Belize	Hong Kong, China	St. Vincent and the Grenadines
Bhutan	Kazakhstan	Sudan
Bosnia and Herzegovina	Kyrgyz Republic	Suriname
Burkina Faso	Lao PDR	Swaziland
Burundi	Lebanon	Tajikistan
Cambodia	Lesotho	Turkmenistan
Canada	Luxembourg	United Kingdom
China	Maldives	Uzbekistan
Congo, Dem. Rep.	Mauritania	Vanuatu
Denmark	Moldova	Yemen