

Institutional Quality, Infrastructure, and the Propensity to Export

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ABSTRACT: We examine the influence of institutions, geographic context, and infrastructure on trade. We are interested in threshold effects, emphasizing cases where bilateral pairs do not trade. We work with a panel of bilateral trade from 1988 to 2002. Matching bilateral trade and tariff data and controlling for tariff preferences, level of development, and distance, we find that infrastructure, and less so institutional quality, is a significant determinant not only of export levels, but also of the likelihood exports will take place at all. Landlocked countries also do consistently worse. In this exercise, we control for correlation between the general level of income and infrastructure and institutional development, focusing on country deviations from expected institutional and infrastructure development given its income cohort. Our results support the notion that export performance, and the propensity to take part in the trading system at all, depends on institutional quality and access to transport and communications infrastructure.

KEYWORDS: exports, trade, institutions, infrastructure, zero-trade

JEL CATEGORIES: F10, F15

1 Introduction

Outward oriented policies emerged as a consensus growth prescription in the 1980s. This consensus was backed by cross-country studies of openness and growth. A pioneering attempt to classify trade regimes was conducted in an NBER study directed by Bhagwati (1978) and Krueger (1978). The consensus from this work was that the degree of openness of the trade regime was positively correlated with export growth, which was in turn positively correlated with real GDP growth. A second large-scale attempt to classify countries by trade orientation was conducted by the World Bank (1987), reaching the same broad conclusion. What followed was a flood of cross-country empirical research linking trade to growth, and broadly supporting the paradigm view.

The consensus view was challenged in important papers by Edwards (1993) and Rodriguez and Rodrik (1999). The criticisms went to the foundations of the prior body of research, and were directed at the conclusions one can safely draw from cross-country studies. Rodriguez and Rodrik argued that we should not be comforted, but rather worried, by the apparent ability of highly disparate measures to capture the "same" relationship between openness and growth. Edwards argued that the basic approach to cross-country studies abstracts away from important factors better identified through studies of historical episodes. On the basis of such longer-term historical experience, both the Edwards and Rodriguez and Rodrik papers concluded that the role of trade had been overblown. However, the result has not been a paradigm shift, but rather more careful econometrics. As the dust settles, trade remains standing as a focus of attention.

The more recent body of work on export growth and economic growth has internalized earlier criticisms, and emphasis is on the role of institutions

and the record of experience within individual countries. Dollar and Kraay (2002) find that institutional quality is highly correlated with trade itself. They therefore focus on decadal changes in growth instrumented on changes in trade and institutions, and interpret their results as meaning that institutions and trade both matter in the long-run, while trade growth offers short-term advantages over institutional improvements for fostering growth. In another paper, Dollar and Kraay (2004) examine episodes of liberalization, concluding that for individual countries that underwent recent trade liberalization episodes, expansion of trade translates into rising incomes and falling poverty rates. Wacziarg and Welch (2003) also focus on liberalization episodes, and also conclude that trade growth is linked robustly to growth and investment. Greenaway et al (2002) address a different criticism of Edwards and Rodriguez and Rodrik, linked to fundamental problems with the openness indicators used in the cross-country literature. They work with a dynamic panel and three openness indicators, finding that the trade openness relationship is robust to the earlier criticisms. Finally, while Rodrik et al (2004) do not find a direct impact of trade on incomes, they do find a more complex relationship between institutions, integration, and growth. Institutions can promote integration, while integration also has a (positive) impact on institutional quality. As they find institutions important for incomes, this suggests that trade can have an indirect effect on incomes. The consensus emerging is that trade does matter, but that it is linked to the context in which it is placed. Institutions matter, as does infrastructure. Hence, the development agencies have focused on facilitation aspects of development assistance, and emphasis is again being placed on institution building. At the World Bank, for example, Freund and Bolaky (2004) stress the importance of labor and business regulation in the trade-growth mechanism, while Chang et al (2005) offer panel evidence that the broad domestic mix of policy, institutions, and infrastructure plays an important role in moderating the impact of trade.

If trade matters, what can we then say about the countries that do not trade? Africa, for example, is a consistent underperformer. While "globalizers," as defined by Dollar and Kray, are catching up with the OECD, the countries that are not are falling further behind. This begs the obvious question "why?" Why do they not trade, or why do they trade less relative to the recent set of globalizers. In part, this is linked to the political economy of policy reform, institutional development and colonial history, development assistance, and the general North-South dialog. At the same time though, we should expect physical infrastructure to play a role. This is the role explored here.

Improvements in transportation services and infrastructure can lead to improvements in export performance. Limão and Venables (2001) show that infrastructure is quantitatively important in determining 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. Bougheas et al (1999) have analyzed the effects of infrastructure on trade through its influence on transport costs. Extending the DSF Ricardian trade model by endogenising transport costs and infrastructure formation their findings predict that for pairs of countries for which it is optimal to invest in infrastructure, a positive relationship between the level of infrastructure and the volume of trade takes place. Using a gravity model the authors provide evidence from European countries which supports the theoretical findings. Wilson et al (2004) 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 that the scope and benefit of unilateral trade facilitation reforms are very large and that the gains fall disproportionately on exports.

Levchenko (2004) suggests that differences in institutional quality can them-

selves 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- enforcement of contracts-and its impact on the volume of international trade. The authors 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 the paper incorporates proxies for the enforcement of contracts and finds that the measures of contract enforcement affect the volume of trade in both differentiated and homogenous goods, but the impact is larger for differentiated goods. Also employing a gravity equation, 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.

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 are interested in threshold effects, and so emphasize those cases where bilateral country pairs do not actually trade. Recent related work involving thresholds, zeros in bilateral trade, and trade growth along extensive and intensive margins, includes Hummels and Klenow (2005), Evenett and Venables (2003), and Felbermayr and Kohler (2004). Here, we work with a panel of 284,049 bilateral trade flows from 1988 to 2002. Matching bilateral trade and tariff data and controlling for tariff preferences, level of development, and standard distance measures, we find that infrastructure, and less so institutional quality, is a significant determinant not only of export levels, but also of the likelihood exports will take place at all. Landlocked countries also do consistently worse. In this exercise, we control for correlation between the general level of income and infrastructure and institutional development,

focusing on country deviations from expected institutional and infrastructure development given its income cohort. Our results support the notion that export performance, and the propensity 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 then discuss our data and estimation framework. Results are discussed in Section 3, and conclusions offered in Section 4.

2 Methodology

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 sample 42% of importer-exporter pairings had zero bilateral trade. Thus, apart from analyzing the effects of different factors on worldwide trade, we also concentrate our attention on factors that may explain why trade does not occur at all. While some factors might be expected to be important in the decision on how much to import, the same factors may be differentially important when the trader decides whether he or she will import at all. And yet, these two decisions clearly are linked. Only if the trader decides to import can trade volumes be observed and hence examined. Analyzing the determinants of trade flows without taking into account potential trade which does not take place between country pairs may bias results. At a minimum, unobserved trade may contain information about the factors driving bilateral trade relationships.

In this section we spell-out our estimation strategy. This involves specifying a sample selection model. Employing a sample selection model allows us to take

account of the censoring process that leads to zero or missing bilateral trade flows. More precisely, in our estimating framework the outcome variable (the dependent variable in the second stage equation) is only observed if the defined selection criterion is met. In our case, the amount of the trade can only be observed if trade occurs. We therefore employ a Heckit estimator, combining Probit analysis of zero trade flows with OLS analysis of trade volumes. (Similarly, Felbermayr and Kohler (2004) employ a Tobit estimator to examine bilateral zeros).

2.1 Data

We work with a panel of bilateral trade, trade policy, geographic characteristics, and income data spanning from 1988 to 2002. Our trade and tariff 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.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 Coe et al 2002, Felbermayr and Kohler 2004, Santos and Tenreyro 2005.) 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. Whenever import data was missing we used mirrored export data if it was available

¹While trade data are available for a wide range of country pairs, the available tariff data are more limited. For this reason, we utilize a standard WITS procedure of matching the nearest adjacent year to represent otherwise missing tariff data. Interpolation is then used for wider gaps. A further complication is when tariff data are never reported for a country pair. In order to obtain an approximate tariff value applicable between these country pairs we then utilize the average applied tariff for the reporting countries for a given year.

(this represented only half percent of the observations). Trade data is deflated using the reporter country's GDP deflator. Income and population 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).² 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" database.³ These 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. The indexes are provided for 1985, 1990, 1995, 2000, 2001 and 2002. We use interpolation for the years where no data are available.

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 number of fixed and mobile telephone subscribers (per 1000 people), on the number of telephone mainlines (per 1,000 people), on telephone mainlines in largest city (per 1,000 people), telephone mainlines per employee, mobile phones (per 1,000 people), and freight of air transport

²<http://www.cepii.fr/anglaisgraph/bdd/distances.htm>

³<http://www.freetheworld.com/download.html#efw>

Table 1: Principal components weighting factors

	component 1	component 2
Institutions		
Size of government	-0.189	0.710
Legal system property rights	0.673	-0.143
Sound money	0.325	0.372
Freedom to trade internationally	0.620	0.040
regulation	0.147	0.579
<i>cummulative proportion</i>	0.349	0.697
Infrastructure		
IAirtransport	0.053	0.663
IFixedmobilesubscribers	0.463	-0.038
IMobilephones	0.302	0.166
IRoadspaved	0.347	-0.111
ITelephonemainlines	0.460	-0.047
ITelephonemainlinescity	0.436	-0.007
ITelephonemainlinesemployee	0.410	0.082
IRoadstotalnetwork	-0.055	0.714
<i>cummulative proportion</i>	0.567	0.771

Source: own calculations.

(million tons per km). Interpolation is used for years where no data are available.

Since both sets of indexes are highly correlated, we have used principal component analysis to produce a set of summary indexes. The results are reported in Table 1. Ideally, principal component analysis identifies patterns in data and based on these patterns it reduces the number of dimensions of the data without a lot of loss of information. From the results in Table 1, we take the first two components to produce four indexes; two institutional indexes, and two infrastructure indexes. These reflect between 70 percent and 77 percent of variation in the sample. From the weighting factors in the table, we interpret the first infrastructure index as measuring communications, and the second the physical transport system. We interpret the first institutional index as measuring general correspondence with the market-oriented legal and institutional orientation flagged by the Fraser indexes (in a sense the correspondence to the Anglo-US socio-economic model). The second institutional index then measures less interventionist systems with lower taxes and more market friendly regulations (deviations toward the Anglo-US social model).

2.2 The Empirical Model

We work with Heckman's two-step Heckit procedure (Heckman 1979, Greene 2003), where we estimate a probit model on trade occurring or not, and then estimate the level of trade using least squares. This is based on the following two latent variable sub-models:

$$M_1 = \alpha'X + u_1 \tag{1}$$

$$M_2 = \beta'Z + u_2 \tag{2}$$

where X is a k -vector of regressors, Z is an m -vector of regressors, and u_1 and u_2 are the error terms which are jointly normally distributed, independently of X and Z , with zero expectations. The variable M_1 is only observed if $M_2 > 0$. The variable M_2 takes the value of one if M_1 is observed, while it is 0 if the variable M_1 is missing. In our regressions M_1 is the value of imports, while M_2 is a dummy variable taking the value one if trade occurs while zero otherwise. The first equation shows how the value of imports is affected by different factors, while the second gives some insight into why trade occurs at all between two partner countries.

In specifying the underlying structure of equation (1), or identically the right hand side variables that make up X , we follow the gravity-model based literature. (See Evenett and Keller 2002; Anderson 1979; Anderson and Marcoullier 2002, Anderson and van Wijncoop 2003; and Deardorff 1988). Unlike Mtys (1997), Francois and Woerz (2006), and much of the recent literature, we do not include time varying fixed importer and exporter effects. This is because we want to work with time-varying country-specific variables related to institutions and infrastructure, which precludes the use of time-varying country dummies. Instead, we include time specific and reporter (importer) country specific dummies.⁴ From the gravity literature, we expect trade flows to be a function of importer and exporter size and income, as well as of determinants of 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 importers and exporters that we expect to impact on

⁴since for several countries the indexes measuring institutional quality or infrastructure quality do not change importantly during the period to avoid multicollinearity we include reporter fixed effects and do not include partner fixed effects.

trading costs. In terms of our Heckit model we specify the following:

$$\begin{aligned}
\ln M_{i,j,t} = & \beta_0 + \beta_1 p_pcGDP_{j,t} + \beta_2 r_pcGDP_{i,t} + \beta_3 rPOP_{j,t} \\
& + \beta_4 rPOP_{i,t} + \beta_5 T_{i,j,t} + \beta_6 dist_{i,j} + \beta_7 landlocked_i \\
& + \beta_8 contig_{i,j} + \beta_9 comlang_ethno_{i,j} + \beta_{10} colony_{i,j} \\
& + \beta_{11} INF1_{j,t} + \beta_{12} INS1_{j,t} + \beta_{13} INF2_{j,t} \\
& + \beta_{14} INS2_{j,t} + u_1
\end{aligned} \tag{3}$$

and for the probit estimation for non-zero flows we assume that $M_{i,j,t}$ is observed when we have

$$\begin{aligned}
& \beta_0 + \beta_1 p_pcGDP_{j,t} + \beta_2 r_pcGDP_{i,t} + \beta_3 pPOP_{j,t} \\
& + \beta_4 rPOP_{i,t} + \beta_5 T_{i,j,t} + \beta_6 dist_{i,j} + \beta_7 landlocked_i \\
& + \beta_8 contig_{i,j} + \beta_9 comlang_ethno_{i,j} + \beta_{10} colony_{i,j} + \beta_{11} INF1_{j,t} \\
& + \beta_{12} INS1_{j,t} + \beta_{13} INF2_{j,t} + \beta_{14} INS2_{j,t} + u_1 > 0
\end{aligned} \tag{4}$$

In equations (3) and (4), u_1 and u_2 have correlation ρ . Equation (3) assesses the determinants of the bilateral trade and shows the main factors influencing the amount of trade, given trade occurred between the two trading partners. Equation (4) sets out the selection criteria and provides information on the factors that determine whether or not we observe trade between country pairs.

All of our right-hand side variables are summarized in Table 2. $M_{i,j,t}$ is country i imports from country j at time t . As a proxy for market potential, POP is included for partner (exporter) and reporter countries, as well

Table 2: Regression model variable description

<i>p_pcGDP</i>	log of per-capita GDP of partner
<i>r_pcGDP</i>	log of per-capita GDP of reporter
<i>pPOP</i>	log of population of partner
<i>rPOP</i>	log of population of reporter
<i>T</i>	tariff
<i>dist</i>	the log of distance (km, great circle method)
<i>landlocked</i>	landlocked partner
<i>contig</i>	reporter and partner share a border
<i>comlang_ethno</i>	shared linguistic/cultural heritage
<i>colony</i>	reporter and partner had colonial relations
<i>INF1</i>	partner infrastructure index 1
<i>INS1</i>	partner institution index 1
<i>INF2</i>	partner infrastructure index 2
<i>INS2</i>	partner institution index 2

as per-capita income $pcGDP$. These are standard gravity variables, as is distance $dist$ and tariffs T . For bilateral import protection, we use applied tariffs, $\ln T_{i,j,t} = \ln(1 + \tau_{i,j,t})$. $\tau_{i,j,t}$ indicates the applied tariff rate offered by importer i to exporter j in period t . As reporter specific fixed effects are included in the regressions and these are highly correlated with the tariff data we regressed the log of the tariffs on the reporter dummies and retained the residuals. These residuals are used for the regressions and provide a measure of the effects of bilateral tariffs given other reporter specific characteristics. Distance is well established in the gravity equation literature. (See for example Disidier and Head 2003, and Anderson and van Wijncoop 2003.) The dummy *landlocked* takes the value of one if the importing country is landlocked and zero otherwise. Landlocked countries are expected to have higher transportation costs than countries with similar characteristics not being landlocked. Limão and Venables (2001) estimate that a representative landlocked country has transport costs approximately 50% greater than does a representative coastal economy.

To capture historical and cultural linkages between trading partners several zero-one type dummy variables are included in the estimating equation. The variable *Excolony* takes the value of 1 if the exporting country j was a colony of the partner country i . 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. Finally, a dummy to capture common borders *contig* is also included in the regressions.

Since both the factor proxying institutional quality of the partner country and the factor measuring the availability of infrastructure are highly correlated with income per capita and population, we regress our indexes against per-capita income and population and take the residuals as representative of deviations from income-conditional expected values for each of the four

Table 3: OLS regressions: incomes and index values

	Infrastructure 1	Infrastructure 2	Institution 1	Institution 2
cline2-5				
lGDP95percapita	1.198	0.293	0.648	0.187
0	(0.018)***	(0.008)***	(0.011)***	(0.013)***
lpPOP	0.079	0.516	0.039	-0.024
0	(0.016)***	(0.007)***	(0.011)***	(0.013)*
Constant	-9.609	-7.001	-5.11	-0.85
	(0.204)***	(0.092)***	(0.141)***	(0.174)***
R-squared	0.690	0.760	0.67	0.11

Standard errors in parentheses.

* significant at 10

indexes.

$$\begin{aligned}
 INDEX_{k,j,t} &= \alpha_{k,0} + \alpha_{k,1} pcGDP_{j,t} + \alpha_{k,2} (POP_{j,t})^2 \\
 &+ e_{j,t}, k = 1..4
 \end{aligned}
 \tag{5}$$

These deviations $e_{j,t}$ then correspond to the index values in equations (3) and (4). OLS estimates of equation (5) are reported in Table 3. Both the first infrastructure variable, mapping to communications infrastructure, and the second variable capturing physical transportation are highly correlated with income. Roughly half of the variation in the institutional variables can be represented by income levels.

3 Results

Estimation results for variables of interest for the full sample are reported in Table 4. In general, we report OLS results for the truncated sample in the second column of Tables 4 through 7, and the Heckit estimator results in the

third and fourth columns. For the full sample, communications infrastructure (*INF1*) is significant with the expected sign. This holds both for the first equation (probit) and for the second equation (the value of trade given that trade does occur). Again, there is a broad correspondence with priors. Transport infrastructure matters, and significantly, both for trade volumes, but also for the probability that trade occurs at all. The quality of the general governance has a positive effect on both trade and the probability that trade occurs. Moreover, countries with lower degrees of government intervention in the economy have higher exports than otherwise. Again, this is not surprising.

In the remaining tables, we turn to various splits on our full sample. What we are looking for is evidence of a differential role, at the margin, for institutions and infrastructure depending on the level of development. Tables 5 and 6 focus on South exports to the North, and also the export of the least developed countries. The exporters are therefore restricted to low and lower middle income countries according to World Bank definitions, and hence exclude high income countries. The importers exclude low and lower middle income countries. For developing countries overall, the message from Table 5 is again that infrastructure matters. This applies not only to physical transportation, but also to communications infrastructure.⁵ We find the same basic result for the institution variable as with the full sample. General governance has a positive effect on trade, and a smaller presence by the state in the economy of the exporter does increase exports somewhat. One cannot make the same claim though for the least developed countries in the sample. From Table 6, the involvement of the state in the economy matters for the value of exports, though does not matter for the probability of exporting

⁵This confirms the pioneering results of Boatman (1992). Boatman found that not only general export levels, but also the technology composition of exports, hinges critically on the quality of the telecommunications system. In a world with globally integrated production systems, this result is intuitively appealing.

Table 4
Full Sample OLS and Heckman estimates

	OLS	Heckman	
	imports, value	imports, value	Probit Pr(import)
<i>lnppcGDP</i>	1.223 (0.004)***	1.23 (0.005)***	0.4 (0.003)***
<i>lnppOP</i>	1.18 (0.004)***	1.185 (0.004)***	0.35 (0.003)***
<i>lnrpcGDP</i>	3.335 (0.064)***	3.326 (0.064)***	-0.111 (0.029)***
<i>lnrpOP</i>	2.014 (0.142)***	2.039 (0.142)***	-1.217 (0.082)***
<i>lnDist</i>	-1.517 (0.009)***	-1.523 (0.009)***	-0.442 (0.006)***
<i>Landlocked</i>	-0.302 (0.021)***	-0.304 (0.021)***	-0.103 (0.011)***
<i>comlang_ethno</i>	0.723 (0.019)***	0.725 (0.019)***	0.118 (0.011)***
<i>colony</i>	0.752 (0.055)***	0.749 (0.055)***	-0.428 (0.048)***
<i>p_INF1</i>	0.18 (0.008)***	0.182 (0.008)***	0.133 (0.004)***
<i>p_INS1</i>	0.235 (0.010)***	0.236 (0.010)***	0.063 (0.006)***
<i>p_INF2</i>	0.163 (0.012)***	0.166 (0.012)***	0.198 (0.007)***
<i>p_INS2</i>	0.179 (0.008)***	0.181 (0.008)***	0.116 (0.004)***
<i>Tariffs</i>	-1.188 (0.100)***	-1.184 (0.100)***	0.16 (0.055)***
<i>Constant</i>	-56.516 (2.028)***	-53.468 (1.217)***	3.681 (0.446)***
<i>n-observations</i>	138613	209528	209528
<i>R-squared</i>	0.76		

Source: own calculations. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5
N-S Sample OLS and Heckman estimates

	OLS	Heckman	
	imports, value	imports, value	Probit Pr(import)
<i>lnppcGDP</i>	1.148 (0.013)***	1.15 (0.013)***	0.214 (0.009)***
<i>lnppOP</i>	1.142 (0.009)***	1.145 (0.009)***	0.37 (0.007)***
<i>lnrpcGDP</i>	0.959 (0.141)***	0.959 (0.141)***	-0.167 (0.067)**
<i>lnrpOP</i>	0.915 (0.284)***	0.934 (0.284)***	-1.432 (0.177)***
<i>lnDist</i>	-1.404 (0.018)***	-1.407 (0.018)***	-0.345 (0.013)***
<i>Landlocked</i>	-0.5 (0.035)***	-0.501 (0.035)***	-0.133 (0.022)***
<i>comlang_ethno</i>	0.606 (0.035)***	0.608 (0.035)***	0.218 (0.022)***
<i>colony</i>	0.916 (0.093)***	0.914 (0.093)***	-0.531 (0.099)***
<i>p_INF1</i>	0.157 (0.013)***	0.159 (0.013)***	0.155 (0.009)***
<i>p_INS1</i>	0.069 (0.019)***	0.068 (0.019)***	-0.042 (0.013)***
<i>p_INF2</i>	0.371 (0.021)***	0.371 (0.021)***	0.025 -0.015
<i>p_INS2</i>	0.237 (0.014)***	0.24 (0.014)***	0.274 (0.010)***
<i>Tariffs</i>	-1.353 (0.240)***	-1.355 (0.239)***	0.199 -0.136
<i>Constant</i>	-20.37 (3.617)***	-22.481 (3.671)***	4.912 (0.930)***
<i>n-observations</i>	36578	50266	50266
<i>R-squared</i>	0.72		

Source: own calculations. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table6
N-LLDC Sample OLS and Heckman estimates

	OLS	Heckman	
	imports, value	imports, value	Probit Pr(import)
<i>lnppcGDP</i>	0.49 (0.076)***	0.495 (0.076)***	0.128 (0.048)***
<i>lnppOP</i>	1.442 (0.032)***	1.471 (0.034)***	0.642 (0.022)***
<i>lnrpcGDP</i>	0.651 (0.348)*	0.651 (0.346)*	-0.371 (0.141)***
<i>lnrpcOP</i>	1.504 (0.694)**	1.684 (0.693)**	-1.263 (0.344)***
<i>lnDist</i>	-0.609 (0.082)***	-0.62 (0.081)***	-0.327 (0.051)***
<i>Landlocked</i>	-0.666 (0.062)***	-0.682 (0.062)***	-0.31 (0.039)***
<i>comlang_ethno</i>	0.923 (0.092)***	0.956 (0.092)***	0.658 (0.052)***
<i>colony</i>	1.143 (0.214)***	1.124 (0.213)***	0.861 (0.389)**
<i>p_INF1</i>	0.127 (0.039)***	0.133 (0.039)***	0.109 (0.025)***
<i>p_INS1</i>	0.319 (0.052)***	0.325 (0.051)***	0.103 (0.032)***
<i>p_INF2</i>	0.176 (0.069)**	0.186 (0.068)***	0.185 (0.045)***
<i>p_INS2</i>	-0.412 (0.058)***	-0.411 (0.057)***	-0.01 -0.035
<i>Tariffs</i>	-2.679 (0.527)***	-2.635 (0.524)***	0.66 (0.271)**
<i>Constant</i>	-28.325 (5.017)***	-29.968 (5.018)***	2.191 -1.88
<i>n-observations</i>	8326	13674	13674
<i>R-squared</i>	0.64		

Source: own calculations. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7
S-S Sample OLS and Heckman estimates

	OLS	Heckman	
	imports, value	imports, value	Probit Pr(import)
<i>lnp_pcGDP</i>	1.231 (0.009)***	1.273 (0.010)***	0.403 (0.005)***
<i>lnp_pOP</i>	1.194 (0.007)***	1.237 (0.008)***	0.427 (0.004)***
<i>lnr_pcGDP</i>	3.368 (0.094)***	3.307 (0.095)***	-0.169 (0.035)***
<i>lnr_pOP</i>	4.9 (0.235)***	4.846 (0.235)***	-1.334 (0.101)***
<i>lnDist</i>	-1.815 (0.013)***	-1.859 (0.014)***	-0.497 (0.007)***
<i>Landlocked</i>	-0.199 (0.031)***	-0.215 (0.031)***	-0.13 (0.013)***
<i>comlang_ethno</i>	0.715 (0.029)***	0.744 (0.029)***	0.309 (0.014)***
<i>colony</i>	1.017 (0.143)***	0.938 (0.143)***	-0.965 (0.071)***
<i>p_INF1</i>	0.176 (0.012)***	0.19 (0.012)***	0.137 (0.005)***
<i>p_INS1</i>	0.222 (0.016)***	0.239 (0.016)***	0.142 (0.007)***
<i>p_INF2</i>	0.242 (0.019)***	0.261 (0.019)***	0.193 (0.009)***
<i>p_INS2</i>	0.056 (0.012)***	0.071 (0.012)***	0.147 (0.005)***
<i>Tariffs</i>	-1.317 (0.130)***	-1.291 (0.130)***	0.136 (0.061)**
<i>Constant</i>	-79.707 (2.636)***	-54.898 (1.460)***	18.722 (1.427)***
<i>n-observations</i>	69245	127697	127697
<i>R-squared</i>	0.69		

Source: own calculations. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

or not. A greater involvement of the state in the economy has a positive impact on exports.⁶ On the other hand, basic economic institutions matter both for the value of exports and the probability of exporting. Indeed, for the LLDC sample, we have a broad four-part complementarity linking the greater involvement of the state in the economy (*INS2*), better quality of basic institutions (*INS1*) and both the communications and transport infrastructures (*INF1*) and *INF2*) to exports. It is also clear that past colonial relationships still guide the trade of the least developed countries. There is a significantly greater probability that we will see trade given a past colonial relationship, while trade is also substantially higher if this is the case. Finally, we turn to South-South trade. Here, we find similar results than for the full sample, a smaller involvement of the state in the economy has a positive impact both on the value of exports and the probability of exporting. We again get an unambiguous message about infrastructure though. It is a significant determinant of trade both for the probit results, and also for the trade volumes given that trade occurs.

4 Robustness checks

In order to test the robustness of our results we run the same regressions using other institutional variables from alternative sources. Instead of using principal component analysis we include these institutional variables separately in the regressions. Since these variables are also correlated with income of the country we follow the previously used methodology and regress the institutional variables on per-capita income and population, specified as a quadratic relationship, and take the residuals as representative of deviations from income-conditional expected values for each of the four indexes.

⁶This may be because better governed South economies are better able to take advantage of export opportunities with the North.

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 for the period 1996-2003. The Index ranks countries in terms of the degree to which corruption is perceived to exist among public officials and politicians and focuses on corruption in the public sector and defines corruption 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. Data for the year 1997, 1999, 2001 and 2003 were interpolated. The variables were used to check the robustness of our previous results: 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 about -2.5 to 2.5, with higher values corresponding to better governance outcomes.

The results using the variables measuring different aspects of institutional quality and the index proxying the importance of corruption in the public sector confirm the previous findings. All the alternative institutional variables have important positive impact on both the value of exports and the probability of exporting.

Table 8
Robustness checks

	government effectiveness		corruption		regulatory quality		rule of law		voice and accountability	
	imports, value	Pr(import)	imports, value	Pr(import)	imports, value	Pr(import)	imports, value	Pr(import)	imports, value	Pr(import)
<i>lnPpCGDP</i>	1.232 (0.005)***	0.515 (0.004)***	1.249 (0.006)***	0.546 (0.005)***	1.237 (0.005)***	0.511 (0.004)***	1.226 (0.005)***	0.505 (0.004)***	1.229 (0.005)***	0.536 (0.004)***
<i>lnppOP</i>	1.187 (0.005)***	0.444 (0.003)***	1.2 (0.006)***	0.465 (0.005)***	1.191 (0.005)***	0.437 (0.003)***	1.182 (0.005)***	0.438 (0.003)***	1.168 (0.005)***	0.451 (0.003)***
<i>lnrPcGDP</i>	1.497 (0.116)***	-0.048 (0.119)***	1.671 (0.119)***	-0.056 (0.116)***	1.488 (0.116)***	-0.045 (0.116)***	1.501 (0.116)***	-0.043 (0.116)***	1.495 (0.116)***	-0.051 (0.116)***
<i>lnrPOP</i>	1.319 (0.304)***	-1.815 (0.184)***	0.972 (0.320)***	-2.15 (0.224)***	1.336 (0.303)***	-1.849 (0.184)***	1.329 (0.304)***	-1.774 (0.183)***	1.344 (0.304)***	-1.83 (0.185)***
<i>lnDist</i>	-1.506 (0.010)***	-0.563 (0.008)***	-1.493 (0.010)***	-0.565 (0.010)***	-1.516 (0.010)***	-0.587 (0.008)***	-1.501 (0.010)***	-0.555 (0.008)***	-1.51 (0.010)***	-0.609 (0.008)***
<i>Landlocked</i>	-0.45 (0.020)***	-0.317 (0.011)***	-0.363 (0.021)***	-0.287 (0.014)***	-0.467 (0.020)***	-0.336 (0.011)***	-0.481 (0.020)***	-0.347 (0.011)***	-0.467 (0.020)***	-0.323 (0.011)***
<i>comlang_ethno</i>	0.941 (0.022)***	0.282 (0.016)***	0.961 (0.024)***	0.25 (0.020)***	0.925 (0.022)***	0.269 (0.016)***	0.935 (0.022)***	0.264 (0.016)***	0.949 (0.022)***	0.281 (0.016)***
<i>colony</i>	0.838 (0.063)***	-0.444 (0.088)***	0.657 (0.066)***	-0.569 (0.096)***	0.852 (0.063)***	-0.425 (0.088)***	0.858 (0.063)***	-0.429 (0.088)***	0.833 (0.063)***	-0.505 (0.089)***
<i>p-INST</i>	0.286 (0.014)***	0.331 (0.009)***	0.096 (0.007)***	0.08 (0.005)***	0.297 (0.012)***	0.316 (0.007)***	0.254 (0.014)***	0.253 (0.009)***	0.244 (0.011)***	0.371 (0.007)***
<i>p-INF1</i>	0.137 (0.008)***	0.062 (0.005)***	0.139 (0.010)***	0.071 (0.006)***	0.135 (0.008)***	0.071 (0.005)***	0.136 (0.008)***	0.06 (0.005)***	0.11 (0.008)***	0.035 (0.005)***
<i>p-INF2</i>	0.184 (0.014)***	0.126 (0.009)***	0.108 (0.016)***	0.106 (0.011)***	0.185 (0.014)***	0.126 (0.009)***	0.181 (0.015)***	0.119 (0.009)***	0.176 (0.014)***	0.105 (0.009)***
<i>Tariffs</i>	-1.222 (0.117)***	-0.008 (0.131)***	-1.009 (0.131)***	0.009 (0.131)***	-1.237 (0.117)***	0.005 (0.117)***	-1.228 (0.117)***	0.009 (0.117)***	-1.102 (0.117)***	0.084 (0.117)***
<i>Constant</i>	-30.437 (4.358)***	3.419 (0.947)***	-28.772 (1.836)***	26.363 (3.039)***	-30.546 (4.354)***	3.812 (0.948)***	-30.563 (4.359)***	4.142 (0.968)***	-31.322 (4.391)***	3.69 (0.956)***
<i>n-observations</i>	156317	156317	113836	113836	156317	156317	156317	156317	156317	156317

Source: own calculations. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

5 Summary

Recent empirical research supports the characterization of developing countries as those that are globalizers, and those that are not. The globalizers (like China and India) have seen rapid growth in trade, and this growth has been linked to an accelerating of growth rates, pushing incomes on a catch-up path with the OECD and driving poverty rates down in the process. At the same time, there is another cohort of developing countries (many in Africa) with a very different story to tell. For a raft of reasons, they are being left behind. While trade and growth are wrapped up in a positive cycle for the globalizers, those left behind have not experienced rapid trade growth, or the related mechanisms that signal deeper integration into the global economy.

In this paper we have explored the evolution of trade across a panel spanning bilateral trade flows from 1988 to 2002. We have examined not just trade volumes where trade is observed, but also the determinants of zero trade flows. This has involved a two-stage "Heckit" estimation procedure, where we combine a probit analysis of the probability of a given bilateral trade occurring with a least-squares analysis of the volume of trade. We work with a gravity model in this context, where the standard right hand side variables have been expanded to include indexes of both physical infrastructure and institutional development. Our results indicate that while the evidence on institutions is somewhat mixed. At the same time, variation in infrastructure relative to the expected values for a given income cohort is strongly linked to exports. Domestic infrastructure (communications and transportation) matters for exports. In addition, on the basis of split sample regressions, we conclude that for the least developed countries, we have found evidence of a broad three-part complementarity between greater involvement of the government in the economy and both the domestic communications and domestic transport infrastructures on the one hand, and export performance

on the other.

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Annex Table A.1: Sample countries

reporter & partner		
Albania	Guyana	Nepal
Argentina	Hong Kong, China	New Zealand
Australia	Honduras	Oman
Austria	Croatia	Pakistan
Belgium	Hungary	Panama
Benin	Indonesia	Peru
Bangladesh	India	Philippines
Bulgaria	Ireland	Papua New Guinea
Bahamas, The	Iran, Islamic Rep.	Poland
Bolivia	Iceland	Portugal
Brazil	Israel	Paraguay
Barbados	Italy	Romania
Botswana	Jamaica	Russian Federation
Central African Republic	Jordan	Rwanda
Chile	Japan	Senegal
Cote d'Ivoire	Kenya	Singapore
Cameroon	Korea, Rep.	El Salvador
Congo, Rep.	Kuwait	Slovak Republic
Colombia	Sri Lanka	Slovenia
Costa Rica	Lithuania	South Africa
Cyprus	Latvia	Sweden
Czech Republic	Luxembourg	Syrian Arab Republic
Germany	Morocco	Chad
Dominican Republic	Madagascar	Togo
Algeria	Mexico	Thailand
Ecuador	Mali	Trinidad and Tobago
Egypt, Arab Rep.	Malta	Tunisia
Spain	Mauritius	Turkey
Estonia	Malawi	Tanzania
Finland	Malaysia	Uganda
Gabon	Namibia	Ukraine
Ghana	Nicaragua	Venezuela
Guatemala	Norway	Zambia
		Zimbabwe
	partner only	
Fiji	Sierra Leone	United Arab Emirates
Haiti		