EFFECTS OF TRADE FACILITATION ON LATIN-AMERICAN SECTORAL TRADE

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ABSTRACT

This paper focuses on the analysis of the relationship between trade facilitation, transport costs and maritime trade in Latin America. A gravity model is estimated using sectoral exports from 181 countries to 9 Latin American countries, namely, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Paraguay and Uruguay, by transport mode over the period 2000-2006. The model is augmented with maritime transport infrastructure and trade facilitation variables. In particular, port container throughput and time delays and number of bureaucratic procedures are used to proxy for maritime transport infrastructure and trade facilitation variables, respectively. The main findings show that time delays significantly increase freight rates and that natural trade barriers (transport costs) are more important than institutional trade barriers (trade facilitation factors) for Latin American trade.

KEYWORDS: Trade facilitation; Maritime trade; Latin America

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1. INTRODUCTION

Latin America has experienced continued economic growth over the last decade which has also been reflected in the significant increase in international trade in terms of volume, value and also diversification of traded products. Maritime transport has been the principal carrier and facilitator of this growth. While significant advances have been made in port infrastructure development to satisfy this continued increase in transportation demand, a growing mismatch between infrastructure provision and transportation demand growth can still be observed. Additionally, recent institutional trade conflicts among Latin American partners, such as excessive time delays and bureaucratic requirements for different goods traded, indicate the need of empirical research to provide some insights on the effect that trade facilitation could play in fostering trade in Latin America.[1]

Consequently, the question that arises is how these trade facilitation factors have evolved over time and in how far repercussions from maritime transport infrastructure development and trade facilitation might be reflected in the structure of maritime transport costs, and hence, in bilateral trade.

Whereas a number of studies have analysed the effects of transport infrastructure on transport costs and trade in developed and developing countries (Limao and Venables, 2001; Márquez-Ramos et al, 2010), only a few studies have focused on trade facilitation issues (Persson, 2007; Martínez-Zarzoso and Márquez-Ramos, 2008) and, to our knowledge, none of them has analysed the effect of trade facilitation on both transport cost and bilateral trade in Latin American countries. Therefore, this paper aims to cover this gap by analysing the relationship between trade facilitation, transport costs and maritime imports in Latin America.

[1] See for example the case "Brasil informará hoy si acepta las condiciones argentinas para negociar" ("Brazil will announce today whether it accepts Argentina's conditions for negotiations" in English), Page 12, 16th May 2011. http://www.pagina12.com.ar/diario/economia/2-168230-2011-05-16.html

Our methodology is based on the estimation of a transport costs model and a gravity equation of trade using recent panel data techniques that allow controlling for country and sectoral unobserved heterogeneity.

Our findings show that trade facilitation variables, namely time to trade and number of documents needed to trade have a direct influence on transport costs. Furthermore, natural trade barriers (transport costs) are of higher importance than institutional trade barriers established by Latin American countries (trade facilitation variables) when trading with this region.

The paper is organized as follows. A review of the literature on trade facilitation is provided in Section 2. Section 3 presents the data and variables used. Section 4 outlines the model specification and the empirical approach. Section 5 details the main results. Finally, Section 6 offers some concluding remarks.

2. LITERATURE REVIEW

In relation to the definition of trade facilitation, Wilson, Mann and Otsuki (2003, 2005) considered a broad definition of trade facilitation, and quantified the impact of four different measures (port efficiency, customs environment, regulatory environment and e-business usage). As an alternative, Engman (2005) used the WTO definition of trade facilitation (the simplification and harmonisation of international trade procedures) by paying attention only to what happens around the border. Other authors[2] focused, instead, on the effects of single measures of trade facilitation (information technology, port efficiency, institutions' quality).

Concerning the empirics, two main modelling approaches have been used. First, several investigations use the gravity model of trade augmented with "trade facilitation" variables. In this line, Wilson, Mann and Otsuki (2003, 2005) estimated a gravity model of trade augmented with the above-mentioned trade-facilitation variables for a group of countries in the Asia-Pacific

[2] See Wilson, Mann and Otsuki (2003, 2005) for a more detailed review of earlier work on single measures of trade facilitation.

region and for a sample of 75 countries. In addition, Soloaga, Wilson and Mejía (2006) used a similar methodology and data, but focused on Mexican competitiveness. In a more general setting, Djankov, Freund and Pham (2006) used the World Bank's Doing Business Database, as we do in this paper, but focused only on the effects of time delays in the exporting country whereas Nordas, Pinali and Grosso (2006) centred on how time delays affect the probability to export and the export volumes for imports from Japan, Australia and the United Kingdom. Persson (2007) studied the effect of time delays and transaction costs on trade flows using a sample selection approach and focussing on the specific effects for each of the six groups of ACP countries negotiating Economic Partnership agreements with the EU. Finally, Martínez-Zarzoso and Márquez-Ramos (2008) analyse the effect of trade facilitation on trade volumes at a disaggregated level. They focus on the simplification of "at the border procedures", which includes the number of documents and amount of time involved in border crossings, as well as the transaction costs incurred. Their results support multilateral initiatives that encourage countries to assess and improve their trade facilitation needs and priorities.

Second, several institutions and authors (UNCTAD, 2001; OECD, 2003; Dennis, 2006; Decreux and Fontagne, 2006) used a computable general equilibrium model to estimate the effect of a composite index of trade facilitation on trade flows. In general, the results obtained from both approaches reveal significant and positive effects on trade flows.

To our knowledge, only recently Márquez-Ramos, Martínez-Zarzoso and Suárez-Burguet (2011) compare different types of trade barriers in both developed and developing countries, thus being trade facilitation variables and policy trade barriers, as tariff peaks and tariff escalation remain important issues for developing countries, and a "tariff bias" exists against developing countries (Márquez-Ramos et al, 2011). These authors show that trade facilitation variables are, in relative terms, more important than tariffs. Therefore, increasing trade facilitation would lead to an increase in world trade, although this increase would not be the same in all countries as, by running simulations, Márquez-Ramos et al (2011) show that the magnitude of the effect of improving trade facilitation depends on country size. However, Márquez-Ramos et al (2011) focus on exports and their single-exporter regressions indicate that their model and data perform better for developed than for developing exporters. Additionally, they do not focus on specific developing regions and do not consider an accurate bilateral freight rate measure, and then they do not analyse the role that trade facilitation procedures might play on transport costs. The present paper mainly differs from existing trade-facilitation literature in that it focus on imports and analyses the effect of trade facilitation on both transport costs and bilateral trade with Latin America.

3. DATA

This section describes the variables used in this paper and discusses their expected signs in the transport costs and trade equations. The original database includes 2,601,644 observations for disaggregated maritime exports from 181 countries to 9 Latin American countries, thus being Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Paraguay and Uruguay. Each observation corresponds to a given product, k. Hence abovementioned number of observations refers to the variables tc_{ijkt}, uv_{ijkt} and q_{ijkt}.[3] Transport costs data are obtained from the BTI transport database.[4]

The dependent variable in the transport cost model is the ad-valorem freight rate between the country of origin and the country of destination. This variable expresses the amount in dollars that the importer has to pay for the shipment to be transported by sea from on-board the vessel moored at the port of origin to the port of destination (on-board the vessel). Transport insurance

[3] Descriptive statistics are available in Table 1.

[4] For detailed description of the BTI see: G. Wilmsmeier , J. Hoffmann, G. Pérez (2002): International Trade and Transport Profiles of Latin American Countries, year 2000. CEPAL – Serie Manuales No. 19, Santiago, Chile

is included but terminal handling costs and inland transport costs are excluded. The variables incorporated into the transport cost equation and their a priori expected signs are:

Product value ($/Kg): Ratio of value to weight (in dollars/kilograms) calculated for each specific product shipment. This variable is expected to be negative as the dependent variable is expressed in ad-valorem terms. Goods with a higher value/weight ratio tend to be associated with lower ad-valorem transport costs, as the freight rate represents a lower share of the final valued of the product.

Volume exported: Total weight in tonnes of the trade flows shipped to each specific country of destination. The expected effect on maritime transport costs is negative, since a larger volume would generate further economies of scale at the importer level, producing an expected decrease in freight rate.

Port container throughput: In recent studies container port traffic (container throughput) has been considered as an appropriate variable to measure economies of scale and port production (Wang et al, 2005). Economies of scale are presented at country level. Larger volumes of containerised cargo loaded and unloaded in a country enables the shipping lines to use larger containerships, as well as permitting the terminal operators to optimise the use of terminal equipment, infrastructure and stevedoring shifts. More effective terminals can be expected to induce lower unit transport costs. This variable is used as a proxy for maritime transport infrastructure and then, the expected sign of this variable is negative.

Distance: The actual shipping distance between major ports in each country is calculated in nautical miles as the maritime distance from the most important ports in the exporter and importer countries. The expected sign of this variable is positive.

Number of days (documents) to import and export: These variables are from the World Bank's Doing Business (2006) database (see Márquez-Ramos et al 2011, for a detailed description). The expected sign for this variable is positive, since more days (documents) needed could be associated with higher transport costs.

The dependent variable in the gravity model is imports between the country of origin and the country of destination. This variable expresses the amount in current dollars that importers have to pay for the products at free on board (fob) prices.

The variables incorporated into the gravity equation and their a priori expected signs are:

Gross domestic product (GDP) of the importer and exporter countries and gross domestic product per capita in both countries: For the former the expected sign is positive since GDPs are a proxy for supply capacity and market size. The estimated coefficients for GDP per capita could take a positive or a negative sign depending on the type of products traded. For capital intensive products (labour intensive) the expected sign of the GDP per capita of the exporter country is expected to be positive (negative), whereas for normal products (inferior products) the expected sign of the GDP per capita of the importer country is expected to be positive (negative).

Transport costs and *distance* are also added as explanatory variables in the gravity equation and were defined above, since these two variables also enter into the transport cost equation.

A number of dummies that represent factors fostering or deterring trade are usually added as explanatory variables in the gravity model of trade: We include common language and common border. The expected sign for both variables is positive.

Table 1 shows the summary statistics for the variables in natural logarithms.

4. MODEL SPECIFICATION

Different specifications for transport costs and bilateral trade are estimated with data from 2000 to 2006. First, we investigate what accounts for the variation in ad-valorem transport cost across importing countries in Latin America. Second, we investigate to what extent transport costs and trade facilitation procedures affect the volume of imports in Latin America.

The transport costs equation is specified as:

$$\ln TC_{ijkt} = \delta_k + \chi_t + \alpha_1 \ln uv_{ijkt} + \alpha_2 \ln q_{ijkt} + \alpha_3 \ln iportv_{jt} + \alpha_4 \ln eportv_{it} + \alpha_5 \ln dist_{ij} + \alpha_6 \ln ET_{jt} + \alpha_7 \ln ET_{it} + \gamma_{ij} + \varepsilon_{ijkt} \quad (1)$$

where ln indicate natural logarithms, uv_{ijkt} denotes the value per weight ratio (US dollars per ton) of product *k* in year *t*, q_{ijkt} is the volume of transaction between countries *i* (exporter) and *j* (importer) of product *k* in year *t*, $iportv_{jt}$ and $eportv_{it}$ denote total port throughput or maritime transport infrastructure in the importing and exporting countries in year *t*, $dist_{ij}$ denotes the maritime distance between main ports in country *i* and *j*, and ET_{jt} and ET_{it} denote easy to trade or trade facilitation variables considered in this research, namely the average number of days and documents needed in the importer and the exporter country to trade a product. γ_{ij} are bilateral dummy variables, χ_t is a dummy variable referring to year t and δ_k is a dummy variable referring to product k. We make the assumption that ε_{ijkt} is a classic time-varying idiosyncratic error assumed to be serially uncorrelated and uncorrelated with the independent variables in the model.

Since we have multiple observations for each country pair in each year, specific assumptions regarding the unobserved heterogeneity are needed. In a three-dimensional dataset we have unobserved heterogeneity coming from three sources; country-pair dummies, product dummies and year dummies.

Given the abovementioned considerations, in the baseline specification we include time invariant bilateral country dummies (γ_{ij}), time dummies (χ_t) and sectoral dummies at one digit SITC classification (δ_k=SITC2-SITC8) to control for unobserved country-pair heterogeneity, unobserved product heterogeneity and unobserved time heterogeneity. The unobserved heterogeneity could be treated as fixed or as random. If the unobserved heterogeneity is correlated with our regressors a fixed-effects panel data model rather than a random effects specification would be the correct choice. We used a Hausman test to infer whether the exporter country effects are correlated with the explanatory variables and in most specifications we could not reject the null hypothesis of independence between the unobserved effects and the regressors. Hence the preferred specification includes three sets of fixed effects: importer dummies, year dummies and sectoral dummies and exporter random effects.

Next, to link trade costs to trade a simple gravity equation for imports for disaggregated trade is given by:

$$\begin{aligned}\ln M_{ijkt} &= \beta_k + \phi_t + \beta_1 \ln(igdp_{jt} \times egdp_{it}) + \beta_2 \ln(igdph_{jt} \times egdph_{it}) + \beta_3 \ln tc_{ijkt} + \\ &+ \beta_4 \ln dist_{ij} + \beta_5 border_{ij} + \beta_6 lang_{ij} + \beta_7 \ln ET_{jt} + \beta_8 \ln ET_{it} + \gamma_{ij} + \varepsilon_{ijkt}\end{aligned} \quad (2)$$

where $\ln M_{ijkt}$ is the log of the value of imports of product *k* into country *j* from country *i* in period *t*. GDP_{jt} is the value of gross domestic product for importer *j* in period *t* and GDP_{it} that of exporter *i* in the same period, $dist_{ij}$ is the distance between each pair of trading partners and ET denote trade facilitation variables. ε_{ijkt} is a composite error term of unobservable effects. A similar set of country-pair, time and sectoral dummies as in equation (1) is added.

The gravity equation is typically augmented by other variables that serve as proxies for a variety of trade costs and other barriers to trade – for example, geographical variables, cultural variables and free trade agreements. We include a common language dummy equal to one if the country pairs share a common official language (*lang*) and whether the countries share a common border (*border*).

In the empirical literature on bilateral trade determinants, the distance measure is commonly used as a proxy for the transport cost component of trade; however it could also capture other potential barriers (e.g. lack of familiarity, cultural differences). The BTI database allows us to model the empirical relationship between trade costs and the value of imports more accurately by extracting the transport cost effect of distance. By explicitly allowing freight charges to directly impact trade, we are able to measure the size of the transport cost barrier while distance can now capture some of the remaining components of trade costs such as cultural distance. The structure of the database would allow us to investigate the relationship between transport costs and trade over time while the highly disaggregated nature of the data would give us the possibility to examine the variation in ad-valorem transport costs across commodities as well as their impact on the volume of imports of that commodity. Nonetheless, due to data restrictions in Latin America, we estimate equation (2) only for aggregated trade data. The estimating equation now takes the following form:

$$\begin{aligned} \ln M_{ijt} &= \tau_0 + \tau_1 \ln(igdp_{jt} \times egdp_{it}) + \tau_2 \ln(igdph_{jt} \times egdph_{it}) + \tau_3 \ln dist_{ij} + \\ &\tau_4 \ln tc_{ijt} + \tau_5 border_{ij} + \tau_6\, lang_{ij} + \tau_7 \ln ET_{jt} + \beta_8 \ln ET_{it} + \alpha_{ij} + \mu_t + \varepsilon_{ijt} \end{aligned} \tag{3}$$

An observation in our aggregate dataset consists of the nominal value of imports transported by sea from exporter *i* to importer *j* in period *t* measured in current US dollars. α_{ij} denotes time invariant unobserved heterogeneity related to each country pair, the rest of variables was already described above. Transport costs in our model are in ad-valorem equivalent entering our model in logs (*lntc*) and are obtained from the BTI transport database described above.

Having defined the basic structure of the estimating equations, we now turn to the main results.

5. MAIN RESULTS

Table 2 and Table 3 show the obtained results for transport cost and bilateral trade equations, respectively. Columns (1) and (2) in Table 2 present results of estimating equation (1) with disaggregated data, whereas Columns (3) and (4) in Table 2 present results of estimating equation (1) with aggregated data. In the transport cost equation (Table 2) the ratio of value to weight (product value) is found to be significant and negative signed, as expected, using both aggregated and disaggregated data, hence goods with a higher value/weight ratio tend to be associated with lower ad-valorem transport costs. Total volume traded with Latin American countries presents a negative effect on transport costs, thus pointing towards the importance of economies of scale at the importer level, and showing that higher volumes traded are associated to lower freight rates. Container port traffic (container throughput) is found to be not significant; therefore, our data fails to provide evidence that larger volume of containerised cargo to Latin America enables the shipping lines to use larger containerships, probably due to maritime transport infrastructure restrictions. Distance is positive signed, as expected, although it is not statistically significant.

In relation to the target variables, both the number of days and documents required to trade with Latin American countries are in general positively correlated to transport costs. In particular, an increase in the number of days as well as an increase in the number of documents needed to import, both are associated to higher freight rates. However, only the number of days required to import is statistically significant when using disaggregated data, whereas both the number of days needed to import and export are statistically significant when using aggregated data. These results show that whereas time delays directly affect transport costs, the number of documents needed to trade do not present a statistically significant correlation with the dependent variable.

Table 3 shows the results for the trade equation. The aggregated income variable, which is used as a proxy for supply capacity and market, has a positive and significant effect on trade, as expected. The estimated coefficient for GDP per capita is found to be non-significant, whereas common border and common language variables increase trade. The other two variables that enter the transport cost equation, distance and transport cost, are negative signed. Nonetheless, only transport cost is statistically significant. Geographical distance is usually used as a proxy for transport costs in gravity studies of trade, but in reality it also represents similar political, cultural and social backgrounds, factors already controlled for in the import equation (with common language and border variables).

As far as trade facilitation variables is concern, the number of days and documents required to export to Latin America are found to be negative and significant, whereas a non expected positive sign is found for time required to import and the number of documents needed to import is not statistically significant. On the other hand, the coefficient for transport cost is highly significant and also shows a higher elasticity in comparison to the trade facilitation variables. These results indicate that natural trade barriers (transport costs) are more important than institutional trade barriers in Latin American countries (trade facilitation procedures).

6. CONCLUSIONS

This paper focuses on the analysis of the relationship between trade facilitation, transport costs and maritime trade in Latin America. In particular, both maritime transport infrastructure (port container throughput) and trade facilitation procedures (time and documents required to trade) are considered as determinants of transport costs. While significant advances have been made in port infrastructure development to satisfy the continued increase in transportation demand, a growing mismatch between infrastructure provision and transportation demand growth can still be observed. Additionally, recent institutional trade conflicts among Latin American partners indicate the need of empirical research to investigate the effect of institutional trade barriers, or trade facilitation procedures on Latin American trade.

Using trade data on Latin America trade routes over the period 2000-2006 this paper evaluates the effect of maritime transport infrastructure and trade facilitation on the expansion of Latin American imports. Our data fails to provide evidence that larger volume of containerised cargo to Latin America enables the shipping lines to use larger containerships, probably due to maritime transport infrastructure restrictions in the region. Our results also show that time needed to trade is a more important trade barrier for Latin American countries than bureaucratic procedures and that natural trade barriers, namely transport costs, are in turn more important than institutional trade barriers, trade facilitation factors, in Latin American countries. Further research could focus on estimations for different types of products, in order to provide a better understanding of the role played by trade facilitation factors in Latin American countries.

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TABLES

TABLE 1. SUMMARY STATISTICS

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Log of imported value at free on board prices	2881510	9.51608	1.91590	0	20.22671
Log of importer's GDP	2881510	26.64319	1.16326	22.34177	27.70066
Log of exporter's GDP	2782053	27.40537	1.60056	18.71006	30.20614
Log of importer's GDP per capita	2881510	8.33260	0.35958	6.80942	9.09506
Log of exporter's GDP per capita	2781933	9.70571	1.07970	4.79257	11.40600
Log of distance	2881504	9.25872	0.55727	5.09793	9.89249
Log of transport costs (ad-valorem)	2881267	-3.02131	1.20569	-14.20230	9.05951
Log of days to import	1131083	3.16620	0.13466	2.99573	3.87120
Log of days to export	1122829	2.36420	0.50434	1.60943	4.48863
Log of documents to import	1131083	1.97854	0.10547	1.94591	2.39789
Log of documents to export	1122829	1.62831	0.28020	1.09861	2.63905

Note: Log denotes natural logarithms.

TABLE 2: MAIN RESULTS TRANSPORT COSTS

	(1)	(2)	(3)	(4)
Product value	-0.693***	-0.693***	-1.419***	-1.433***
	-32.093	-32.065	-21.548	-22.34
Volume imported	-0.110***	-0.110***	-0.785***	-0.802***
	-9.437	-9.433	-44.201	-46.139
Importer's port container throughput	0.516	0.327		
	1.174	0.734		
Exporter's port container throughput	-0.324	-0.419		
	-1.188	-1.577		
Distance			0.156	0.14
			1.512	1.392
Days to import	0.012***		0.026**	
	4.002		2.43	
Days to export	0.011		0.010**	
	1.586		2.276	
Documents to import				-0.083
				-1.48
Documents to export		0.039		0.014
		1.57		0.981
Constant Term	-3.92	0.834	3.216***	5.084***
	-0.503	0.112	2.907	5.133
R-squared	0.359	0.317	0.872	0.869
Number of observations	1077504	1077504	745	745
RMSE	0.750	0.750	0.586	0.589

Notes: ***, **, * indicate significance at 1%, 5% and 10%, respectively. The corresponding t-statistic is reported below each coefficient. Columns (1) and (2) present results of estimating equation (1) with fixed effects (disaggregated data) and Columns (3) and (4) present results of equation (1) with random effects (aggregated data).

TABLE 3. MAIN RESULTS BILATERAL TRADE. AGGREGATED DATA

	(5)	(6)
Income	0.359***	0.321***
	6.387	4.827
Income per capita	-0.107	-0.037
	-1.455	-0.525
Distance	-0.075	-0.063
	-0.445	-0.365
Transport costs	-0.677***	-0.699***
	-12.823	-13.041
Border	1.561***	1.412***
	3.822	3.538
Language	0.655**	0.754**
	2.119	2.304
Days to import	0.036***	
	2.709	
Days to export	-0.030***	
	-3.617	
Documents to import		-0.016
		-0.136
Documents to export		-0.068***
		-3.242
Constant Term	-5.561*	-4.137
	-1.815	-1.183
R-squared	0.808	0.804
Number of observations	727	727
RMSE	0.633	0.641

Notes: ***, **, * indicate significance at 1%, 5% and 10%, respectively. The corresponding t-statistic is reported below each coefficient. Columns (5) and (6) present results of equation (2) wit random effects (aggregated data).