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I. Introduction

Since the beginning of modern economics, the literature concerning the determination of standards of living has also been interested in trade.[2] Despite some initial controversy, empirical studies show a positive relationship between trade and growth. Frankel and Romer (1999) claim "…trade has a quantitatively large, significant, and robust positive effect on income."[3]

The lack of initial consensus among researchers on the relationship between trade and growth has been mirrored by differences in the actual trade strategies of developing countries. During the 1960s and into the 1970s, many countries adopted import substitution policies to protect their infant industries, though a few economies in East Asia took a different approach. By the 1990s many developing countries, including most of the large ones, had shifted to an outward-oriented strategy and had seen accelerations in their growth rates[4].

These recent liberalizations have reduced tariff and, in some cases, non-tariff barriers too. For instance, Latin America reduced its average tariff rate from almost 26% at the beginning of the 1980s to 10% by the end of the 1990s and Asia reduced its average tariff rate from 30% to 14%.[5] These reductions in artificial trade barriers have implied that the relative importance of transport costs as a determinant of trade has increased.[6] As shown in Figure 1, total import freight costs represented 5.25 percent of world imports (fob) in 1997. This percentage -which may seem low- is mainly driven by developed countries, which represent more than 70 percent of world imports and whose proximity to each other is reflected in a relatively low freight cost (4.2%). When desaggregating these costs per region, they turn out to be substantially higher. Although Latin America appears to have low freight costs relative to the other developing regions

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[2] Adams Smith (*The Wealth of Nations*, 1776), in his discussion of specialization and the extent of the market stresses the relationship between wealth and trade between nations.

[3] Similarly, Ades and Glaeser (1999) find that openness accelerates growth of backward economies. For a skeptical view of the cross-national evidence, see Rodriguez and Rodrik (1999).

[4] See Dollar and Kraay (2001).

[5] Central America and the Caribbean reduced its average tariff rate from 21% to 9% between these periods, and African countries from 30% to 20%. These average tariff rates correspond to simple averages across countries of their unweighted tariff. If we consider weighted tariffs, the resulting average tariff rates by the end of the 90s should be smaller. (Source: World Bank)

(7% compared to 8% of Asia and 11.5% of Africa), the Latin American figure is weighted by Mexico's proximity to its main trading partner, the United States, and consequently low freight costs. When Mexico is excluded, Latin American average freight costs rise to 8.3 percent, more similar to the rest of the developing countries.

As liberalization continues to reduce artificial barriers, the effective rate of protection provided by transport costs is now in many cases higher than the one provided by tariffs. Figure 2 presents a comparison of average tariffs and a measure of transport costs for various countries around the world, and Figure 3 presents an alternative comparison of transport costs to the US and average tariffs faced in the US market by a group of Latin American countries. From Figure 3, it is striking to realize that for some countries, like Chile and Ecuador, transport costs exceed by more than twenty times the average tariffs they face in the US market. Consequently, any additional effort to integrate a country into the trading system should consider and analyze the effect of transport costs and its determinants.

As a result, some immediate questions arise. How much do these transport costs affect trade and growth? How much of these costs can be affected by government policies? The broad literature that applies the gravity approach to the study of international bilateral trade shows that geographical distance, which is used as proxy for transport costs, is negatively related with trade.[7] In a recent paper, Limao and Venables (2000, henceforth LV) show that raising transport costs by 10 percent reduces trade volumes by more than 20 percent. They also show that poor infrastructure accounts for more than 40% of predicted transport costs. In a different analysis, Radelet and Sachs (1998) show that shipping costs reduce the rate of growth of both manufactured exports and GDP per capita. These authors claim that "... doubling the shipping cost (e.g. from an 8% to 16% CIF band) is associated with slower annual growth of slightly more than-half of one percent point."

In spite of the relevance of transport costs on trade and growth, shown by these studies, there are not many other studies on transport costs. Moreover, these few studies

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[6] See Amjadi and Yeats (1995) and Radelet and Sachs (1998).
[7] An example of this literature is Bergstrand (1985).

rely on macro level data, which is certainly useful but misses the advantages that a microdata can have. An exception is a recent study of Fink, Mattoo and Neagu (2000, henceforth FMN), which analyzes the determinants of maritime transport costs in 1998, focusing on the effect of non-competitive public and private policies. They find the latter having a significant effect on transport costs. But, what about other factors influencing transport costs, such as port efficiency? There is a wide consensus on the crucial importance of port activities for the transport services. However, there are no measures of how important are inefficiencies at port level for transport costs. This is one of the objectives of this study. We analyze the effect of port efficiency on transport costs (in addition to other standard variables), and then we explore the factors that lie behind port efficiency.

Our analysis departs from FMN (2000) by incorporating port efficiency variables and by redefining some variables. In addition, we address the problems of endogeneity and omitted variable bias their estimations present, and we also extend backward the period of analysis to 1995. We find that a 100 percent increase in distance raises maritime transport costs by around 20 percent, a result that is quite consistent with the existent literature. With respect to port efficiency, we find that improving port efficiency from the 25^{th} to 75^{th} percentiles reduces shipping costs by more than 12%. This result is robust to different definitions of port efficiency as well as to different years.

In turn, when looking at the determinants of port efficiency, we find that the level of infrastructure and organized crime exert a significant positive and negative influence respectively. In addition, policy variables reflecting regulations at seaports affect port efficiency in a non-linear way. This result suggests that having *some* level of regulation increases port efficiency, but an *excess* of regulation could start to reverse these gains.

The remainder of this paper is structured as follows. Section II presents a description of factors that may be behind transport costs. Section III describes the econometric model used to quantify the relative importance of these factors affecting transport costs. It also contains a description of the data used as well as the results of our analyses. In Section IV, we analyze how important are infrastructure, regulation and organized crime in explaining port efficiency. Section V concludes.

II. What Factors Explain Maritime Transport Costs?

As shown, transport costs may be an important barrier to trade and could have an important effect on income. But why do some countries have higher transport costs than others? What are the main determinants of these transport costs? Can government policies affect these costs? Following some previous studies,[8] this section addresses these questions, based on a qualitative and quantitative description of transport cost determinants. Given its relative importance (and also the availability of data), the main focus in this paper is on international maritime transport cost.

The nature of services provided by shipping companies forces them to be transnational companies serving more than one country. In general, these companies have access to international capital markets and they are able to hire workers from all over the world[9], although under some restrictions sometimes. In any case, we should not expect differences in capital or labor costs to be the main factors in explaining differences of transport costs across countries. There are many other important specific factors affecting transport costs across countries, which we present next.

The obvious and most studied determinant of transport cost is geography, particularly distance[10]. The greater the distance between two markets, the higher the expected transport cost for their trade. Using shipping company quotes for the cost of transporting a standard container from Baltimore (USA) to selected worldwide destinations, LV(2000) find that an extra 1,000 km raises transport costs by $380 (or 8% for a median shipment). Moreover, breaking the journey into an overland and a sea component, an extra 1,000 km by sea raises costs by only $190 while the same distance by land raises costs by $1,380—4 and 30 percent of a median shipment, respectively. In addition, if a country is landlocked, transport costs rise by $2,170, almost a 50 percent

[8] This section follows McConville (1999) Fuchsluger (1999), Limao and Venables (2000), and Fink, Mattoo and Neagu (2000).

[9] Shipping companies prefer to sail their ships under open-registry flags. In fact, Panama, Liberia, Cyprus or Bahamas account for more than 40 percents of world fleet (measured in dead weight tons -dwt-) – UNCTAD (1998)-.

[10] It has long been recognizes that bilateral trade patterns are well described empirically by the so-called gravity equation, which relates bilateral trade positively to both countries GDP and negatively to the distance between them (which is used as proxy for transport cost). See Bergstrand (1985).

increase in the average cost.[11] In other words, being landlocked is equivalent to being located 10,000 km farther away from markets.

Trade composition additionally helps to explain transport costs differences across countries. First of all, due to the insurance component of transport costs, products with higher unit value have higher charges per unit of weight. On average, insurance fees are around 2 percent of the traded value and they represent around 15 percent of total maritime charges. Therefore, high value added exporting countries should have higher charges per unit weight due to this insurance component. On the other hand, some products require special transport features and therefore have different freight rates. [12]

Directional imbalance in trade between countries implies that many carriers are forced to haul empty containers back. As a result, either imports or exports become more expensive. Fuchsluger (2000) shows that this phenomenon is observed in the bilateral trade between the US and the Caribbean. In 1998, for instance, 72 percent of containers sent from the Caribbean to the US were empty. This excess of supply in the northbound route implied that a US exporter paid 83 percent more than a US importer for the same type of merchandise between Miami and Port of Spain (Trinidad and Tobago).[13] Similar phenomenon occurs in the Asian-US and the Asian-European trade routes, where westbound excess of supply means that Asian exporters end up paying more than 50% of extra charge in transport costs than their eastbound counterparts (the US and Europe)[14].

Maritime transport is a classic example of example of an industry that faces increasing return to scale. Alfred Marshall put it clearly long ago: *"… a ship's carrying power varies as the cube of her dimensions, while the resistance offered by the water*

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[11] This result controls by the extra overland distance that must be overcome by landlocked countries to reach the sea.

[12] LSU-National Ports and Waterways Institute (1998) shows that the average freight rates between Central America and Miami for cooled load merchandise is about twice the transport cost for textiles.

[13] The actual freight rate for a 20-foot dry container between Port of Spain and Miami were $1,400 and $750 for the southbound and northbound route, respectively.

[14] Ships going from Asia to the US utilize more than 75 percent of their capacity, while when going back to Asia the utilization does not even attain a 50 percent rate. The rates from Asia to the US and in the opposite direction are $1561/TEU and $999/TEU respectively. The capacity utilization of ships from Asia to Europe is 75% and 58% in the opposite direction, while the rates charged by shipping companies are $1353/TEU and $873/TEU respectively.

increase only a little faster than the square of her dimensions"[15]. Besides increasing returns at the vessel level, there are economies of scale at the seaport level. For instance, at the port of Buenos Aires (Argentina) the cost of using the access channel is $70 per container for a 200 TEU[16] vessel but only $14 per container for a 1000 TEU vessel. [17] In general, even though most of these economies of scale are at the vessel level, in practice they are related to the total volume of trade between two regions. Maritime routes with low trade volume are covered by small vessel and *vice versa*. [18]

In addition, the development of containerized transport has been an important technological change in the transport sector during the last decades. Containers have allowed large cost reductions in cargo handling, increasing cargo transshipment and therefore national and international cabotage.[19] In turn, this increase in cabotage has induced the creation of hub ports that allow countries or regions to take advantage of increasing return to scale.[20]

Commercial routes more liable to competition and less subject to monopoly power will tend to have lower markups. Monopoly powers can be sustained either by government restrictive trade policies or by private anti-competitive practices (cartels). The former includes a variety of cargo reservation schemes, for example the UN Liner Code.[21] Private anti-competitive practices include, among others, the practice of fixing rates of maritime conferences.[22] Some authors have claimed that maritime conferences have reduced their power in recent years,[23] which has forced shipping companies to merge as a way to hold their monopoly power.[24]

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[15] Quoted by McConville (1999). Additional economies of scale come from both material to build the vessel and labor to operate it (especially that of navigation).

[16] TEU is a standard container measure and it refers to Twenty Feet Equivalent Unit.

[17] See Fuchsluger (2000).

[18] See PIERS, *On Board Review*, Spring 1997.

[19] Cabotage refers to transshipment of the merchandise before it arrives to its final destination.

[20] See Hoffman (2000).

[21] This agreement stipulates that conference trade between two economies can allocate cargo according to the 40:40:20 principle. Forty per cent of tonnage is reserved for the national flag lines of each exporting and importing economy and the remaining 20 per cent is to be allocated to liner ships from a third economy.

[22] Maritime conferences enjoy an exemption from competition rules in major trading countries, like the US and the European Union.

[23] In the last years there have been some reforms in the regulation affecting international shipping. For instance, the United States' Ocean Shipping Reform Act of 1998 eroded the power of conferences, creating greater scope for price competition.

[24] See Fink, Mattoo and Neagu (2000) and Hoffman (2000).

Similar restrictions and anti-competitive practices can induce inefficiencies and/or monopoly power in ports. For example, in many countries workers are required to have special license to be able to provide stevedoring services, and in general these restrictions imply high fees and low productivity.[25]

Finally, the quality of onshore infrastructure is an important determinant of transport costs. LV(2000) find that it accounts for 40 percent of predicted transport costs for coastal countries, and up to 60% for landlocked ones[26]. If a country with a relatively poor infrastructure, say at the 75th percentile in an international ranking, is able to upgrade to the 25th percentile, it will be able to reduce transport costs by between 30 and 50 percent.[27]

III. Maritime Transport Costs Estimation

Focusing on the factors affecting transport costs already described, this section attempts to quantify the importance of most[28] of them on maritime transport charges paid by U.S. imports carried by liner companies[29] from countries all over the world. This analysis closely follows FMN (2000) study. However, we add additional variables – notably a measure of port efficiency – to the analysis, we redefine some of the other relevant variables (including the dependent variable), and we also extend backward the

[25] In 1981 the supply of seaport service were de-regulated in Chile, and the change in legislation induced a significant fall in seaport cost. See Trujillo and Nombela (1999) and Camara Chilena Maritima (1999) for a discussion of this case.

[26] Their infrastructure index is measured as a simple weighted average of kilometers of road, paved road, rail and telephone main line (per square Km of country area and population, respectively). In their regression, the authors use this index to the power of -.3.

[27] LV(2000) use two alternative measures of transport costs: CIF/FOB ratios reported for bilateral trade between countries by the IMF and quotes from a shipping company. According to them, an improvement in own infrastructure from the 75th to the 25th percentiles reduces transport costs by 30% based on shipping data (from \$6,604 to \$4,638) and by more than 50% based on the CIF/FOB ratio (from 1.40 to 1.11). In addition, an improvement in own *and* transit countries' infrastructures from the 75th to the 25th percentiles reduces by more than half the disadvantage associated with being landlocked.

[28] We do not analyze the impact of trade imbalance in transport charges because of data unavailability.

[29] For most countries, US imports account for a significant share of their exports. For instance, US imports accounted for 56 percent of Latin American exports in 1999, and they accounted for 31 percent of Japan's exports this year.

period of analysis to 1995. In addition, we address the problems of endogeneity and omitted variable bias we believe their estimations present, which we explain in the rest of this section.

The Model

To estimate the importance of each factor in maritime transport costs we use a standard reduced form approach, also presented in FMN (2000). Maritime charges are assumed to be equal to the marginal cost multiplied by shipping companies' markup. Expressed in logarithm, we have:

$$p_{ijk} = mc(i,j,k) + \phi(I, J, k) \quad [1]$$

Where:

p_{ijk}: charges per unit of weight, in logarithm, for the product *k* transported between locations *i* and *j*.

i: corresponds to foreign port, located in country I

j: corresponds to US port, located in district J

k: product, aggregated at the 6 digit of the Harmonized System (HS) Classification

mc: marginal cost, in logarithm.

ϕ: markup, in logarithm.

As expressed in equation [1], both the marginal cost and the markup should be a function of factors depending on the port or country of origin (*i,I*), the port or district of destiny in the US (*j,J*) and the type of product (*k*). In particular, we assume that the marginal cost has the following form:

$$mc_{ijk} = \alpha_J + \lambda_k + \psi\, wv_{ijk} + \gamma T_{ijk} + \partial\, d_{iJ} + \eta\, q_{IJ} + \omega PE_I \quad [2]$$

Where:

α_J: dummy variable referring to US district J.

λ_k: dummy variable referring to product k.

wv_{ijk}: value per weight for product k, transported from foreign port i to US port j, in logarithm. We also refer to this variable as the weight value.

T_{ijk}: fraction of k goods shipped (from i to j) in containers.

d_{iJ}: distance between foreign port j and US custom district J, in logarithm.

q_{IJ}: volume of imports carried by liner companies between country I and US coasts, in logarithm.

PE_I: ports' efficiency of foreign country I.

The first term (α_J) in equation [2] takes into account potential differences in port efficiencies across US custom districts. The second term (λ_k) accounts for different marginal costs across products. The third term – weight value, (wv_{ijk}) – is used as a proxy for the insurance component of the maritime transport cost (p_{ijk}). The fourth term (T_{ijk}) represent a technological effect, and it captures reductions in costs induced by the utilization of containers. The fifth term (d_{iJ}) refers to the maritime distance between trade partners. The next variable (q_{IJ}) accounts for potential economies of scale, and the last term (PE_I) accounts for port efficiency in the foreign country. Thus, we expect a positive sign for ψ and ∂, and a negative sign for γ, η, and ω.

In this stage, we present three differences with respect to FMN (2000). The first two refer to the construction of the dependent variable and the variable measuring economies of scale. For the first, we use charges per weight (instead of charges per value, as they do), because – despite the level of desaggregation of the data – it still presents important differences inside product categories. This heterogeneity inside product categories is better captured when using our definition. With respect to the economy of scale variable, we define it as the volume of imports departing from a particular foreign country and arriving to a particular coast in the US.[30] A third and more important difference lies in the inclusion of the weight value variable. As already stated, this variable accounts for the effect of the insurance component on the transport cost and, as we show next, it turns out to be highly significant. FMN (2000) do not include a variable of this type, probably because of the inclusion of dummies per product. However,

[30] FMN (2000) define this variable as the total *value* of imports departing from a particular foreign port and arriving to a particular US district.

because of the insufficient level of desaggregation of the data, product dummies are not enough and the exclusion of this variable can cause important omitted variable bias[31].

Finally, and here we follow more closely FMN (2000) formulation, we assume that shipping companies' markups have the following form:

$$\phi(I, J, k) = \mu_k + \psi^{PA} A_{IJ}^{PA} + \psi^{CA} A_{IJ}^{CA} \quad [3]$$

Where

A_{IJ}^{PA}: existence of price-fixing agreements between country I and US district J.

A_{IJ}^{CA}: existence of cooperative working agreement between country I and US district J.

The first term (μ_k) in the above equation reflects a product-specific effect that captures differences in transport demand elasticity across goods (this is a derived demand from the final demand of good k in the US). The last two terms account for potential collusive agreements between shipping companies covering a same route. Two types of agreements are distinguished: price-fixing agreements (which include most maritime conferences), and cooperative working agreements that do not have binding rate setting authority. Substituting the second and third equations on the first one, we obtain the econometric model to be estimated:

$$p_{ijk} = \alpha_J + \beta_k + \psi\, wv_{ijk} + \gamma T_{ijk} + \partial\, d_{iJ} + \eta q_{IJ} + \omega PE_I + \psi^{PA} A_{IJ}^{PA} + \psi^{CA} A_{IJ}^{CA} + \varepsilon_{ijk} \quad [4]$$

Where:

$\beta_k \equiv \lambda_k + \mu_k$

ε_{ijk}: error term.

[31] We replicated FMN (2000) estimations with and without the unit value variable (which is the relevant variable to add in their specification, based on their construction of the dependent variable). The variable turned out to be highly significant (even after using product dummies), but their results for the rest of the variables changed dramatically.

Data[32] and Results

Data on maritime transport costs, value and volume of imports, and shipping characteristics – like the percentage of the goods transported through containers – come from the U.S. Import Waterborne Databank (U.S. Department of Transportation). Our dependent variable – transport costs – is constructed using *imports charges*, defined by the U.S. Census Bureau as: "...the aggregate cost of all freight, insurance, and other charges (excluding U.S. import duties) incurred in bringing the merchandise from alongside the carrier at the port of exportation -in the country of exportation- and placing it alongside the carrier at the first port of entry in the United States."

The U.S. Import Waterborne Databank covers the period 1995-1998. Even though this database includes all U.S. imports carried by sea, classified by type of vessel service (liner, tanker and tramp), we focus only on liner services to be able to estimate the effect of conferences and agreements in maritime charges.[33] Liner imports account for around 50 percent of total US imports and 65 percent of US maritime imports.[34] Given that our objective is to focus only on maritime transport costs, we also drop all the observations for which the origin of the import is different from the port of shipment[35].

The distance variable and the data on maritime conferences and working agreement between liners were kindly provided by FMN(2000). The first correspond to the distance between foreign ports and US custom districts, it is expressed in nautical miles, and comes from a private service. The data on carrier agreements - used by FMN to construct their indices- comes from the Federal Maritime Commission, it covers 59 countries and is available only for 1998. Therefore, when estimating for the other years (1995-97), we have no choice but to use the same 1998 values for all the years.

Unfortunately, there is not much comparable information about port efficiency –at port level- to be used in a cross-country analysis.[36] So, we use an aggregated measure -

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[32] Appendix A gives a complete description of the data used.

[33] This also allow us to compare our results with FMN (2000) ones. Liner services are scheduled carriers that advertise in publications advance of sailing. They generally have a fix itinerary and tend to carry mixed types of containerized, non-bulk cargo. Tramp and tanker services, in turn, are (dry, liquid) bulk carriers and have no regular scheduled itineraries, but are more depending on momentary demand.

[34] The remaining US imports by sea are carried by tramp services.

[35] That is, in transit merchandise is not included.

[36] The World Bank is launching a program (*Global Facilitation Partnership for Transportation and Trade*) to focus on significant improvements in the invisible infrastructure of transport and trade in different

per country- of port efficiency, consisting of a one-to-seven index (with 7 being the best score) from the Global Competitiveness Report (GCR). This data covers the period 1995-1999.[37] As an alternative measure, we also use GDP per capita as a proxy for port efficiency. Countries' GDP per capita are correlated with their level of infrastructure. For our particular problem – explaining the cost of shipping the same product from different ports in the world to the U.S. – it is hard to see why the per capita GDP of the sending country would matter except to the extent that it is proxying for the quality of infrastructure. As noted, we will use both this indirect measure and a direct measure of port efficiency in different specifications.

In addition to the per capita GDP, we construct a second measure of infrastructure – this time an index à la LV (2000) – for 1998, based on information at country level on paved road, paved airports, railways and telephone lines[38]. We incorporate this variable based on the assumption that the infrastructure level in a country is likely highly correlated with the infrastructure level at their ports, and also because it allow us to compare our results with LV (2000) ones. We should note that, despite having a somewhat similar infrastructure index, our formulation differs from that of LV (2000) in many respects. First, one of their measures of transport costs is the CIF/FOB ratio, which has the disadvantage of being an aggregate measure for all products, while we use transport cost information at product level. Also, this measure is well known for having measurement deficiencies (although they try to control for that). Their second measure of transport cost – shipping rates (for a homogeneous product) from Baltimore to a group of different countries – try to address these problems. However, as the same authors point out, the shipping rates from Baltimore are not necessarily representative -not even for the rest of the US ports-. Our database, on the other hand, has information from many ports around the world to different ports in the US.[39] An advantage of their second measure,

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member countries. However, the project is in its first stage and it does not cover all the countries of our sample yet.

[37] The report, however, is based on microdata from annual surveys at firm level, made to a representative group of enterprises in every country. The particular question for port efficiency is: "*Port facilities and inland waterways are extensive and efficient. (1 = strongly disagree, 7 = strongly agree)*". The number of countries covered has been growing over time (from 44 in the 1996 report to 56 in the 2000 one).

[38] See the Appendix for a description of its construction.

[39] In addition, we believe their sample is biased in favor of African countries. The bad infrastructure and port quality of African countries may be biasing upward the coefficient estimates they obtain.

however, is that it allow them to construct an estimate of inland transport cost, which is not our purpose in this paper.

Table 1 reports our estimations for equation [4]. We start by presenting the results only for 1998 because the variables on maritime conferences and working agreement between liners refer to this particular year. The first three columns show the coefficients using OLS, while the rest of the estimations use an Instrumental Variable (IV) technique[40]. Columns I and IV report the results using GDP per capita as a proxy for port efficiency, columns II and V use the variable port efficiency from the GCR, and columns III and VI use the index of infrastructure we constructed. As it can be seen, in both type of estimations most of the variables are highly significant and with the expected sign.

Distance has a significant (at 1%) positive effect on transport costs. A doubling in distance, for instance, roughly generates a 20 percent increase in transport costs. This distance elasticity close to .2 is consistent with the existent literature on transport costs. The value per weight variable is also positive and highly significant, with a t-statistic around 50. As already stated, these regressions include dummy variables for products at the six-digit HS level. One might think that unit values would be quite similar across countries at that level of disaggregation; not so. Feenstra (1996) shows that there is a large variation in unit values even at the 10-digit HS level. He cites the examples of men's cotton shirts, which the U.S. imports from fully half of its 162 trading partners. The unit values range from $56 (Japan) to $1 (Senegal). These differences in unit values lead to large differences in insurance costs per kilogram, even for "homogeneous" products. So, it is not surprising that we find that the more expensive the product, per unit of weight, the higher the insurance and hence the overall transport cost.[41]

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[40] In all the estimations (OLS, IV), we allow the observations to be independent across exporting countries, but not necessarily independent within countries. At the same time, the standard errors presented in the Table correspond to the consistent Huber/White ones.

[41] In addition, there is the possibility that the unit weight variable could be capturing some measurement errors. The argument is as follows. One should expect that the variables *charges* and (total) *import value* were very carefully measured, because the US custom constructs the *dutiable value of imports* by excluding the former to the latter (and it should have a special interest in calculating it correctly). However, this could not be case for the measurement of weight. If so, measurement errors in the weight variable would induce a positive correlation between *charges per weight* (our dependent variable) and *value per weight.*

With respect to the two variables referring to agreements between liner companies, only the first of them (price fixing binding agreements) turns out to be positive -as expected- but only significant in one specification (at 10%).[42] This result seems to suggest that maritime conferences have been exerting some mild monopoly power – adding an estimated 6.7% to transport costs in 1998, ceteris paribus. However, as we will see later, this estimated effect of the price-fixing agreements is not significant for other years.

The next variable, the level of containerization, presents a significant negative effect on transport costs. As explained before, this variable represents technological change at both vessels and seaport level. The idea behind this result is that containerization reduces services cost, such as cargo handling, and therefore total maritime charges.

The variable capturing economies of scale is the level of trade that goes through a particular maritime route.[43] This variable, calculated in terms of volume, has a significant negative coefficient (as expected).[44] However, the direct incorporation of this variable in the estimations presents a problem of endogeneity (also presented in FMN (2000)). On one hand, one should expect the bigger the trade the lower the transport costs. But, at the same time, lower transport costs induce more trade. We address this problem in columns IV to VI.

Finally, the coefficient related on port efficiency is negative and significant (at 1% in two cases and 5% in the other): the greater the efficiency at port level, the lower the transport costs. This result is robust to the three alternative measures of port efficiency (columns I, II and III). In particular, the coefficient for the measure from the Global Competitiveness Report (column II), along with the distribution of the port

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[42] FMN (2000) find the price-fixing agreement dummy variable to be significant and much larger in magnitude: between .4 and .51; that is, the maritime agreements add at least 40% to transport costs. They also use policy variables referring to cargo reservation policies (not significant), cargo handling services (significant in one estimation but with wrong sign, and not significant in another), and mandatory port services (significant, correct sign).

[43] Each couple foreign country and US coast is defined as a maritime route. We define three coast in the US: East, West and Golf coast.

[44] We must note that this variable differs from the one presented by Fink, Mattoo and Neagu (2000) in two aspects. First, they use the value of imports while we use the volume of imports (in tons). Second, the definitions of maritime route through which economies of scale arise are different: they use the trade (in

efficiency index among countries, indicates that an improvement in port efficiency from the 25th to the 75th percentile reduces transport charges a little more than 12%.[45] Similar results are obtained for the other measures[46].

To solve the endogeneity problem mentioned above, we use countries' GDP as instrument. We make the identifying assumption that if country size affects transport costs, it does so through the volume of trade and economies of scale in shipping. Columns IV to VI in Table 1 present the results for the instrumental variable (IV) estimations. Most coefficients remain stable -with the expected signs- and they continue to be significant, except for the price fixing agreement policy variable, which losses its significance. Using the instrumental variables, the economy of scale variable remains negative and significant, but the magnitude of the coefficient increases in absolute value when we use the GCR measure of port efficiency (-0.042 v/s -0.025). Thus, we estimate that doubling the volume of trade between a particular port and the U.S. reduces transport costs by 3-4%. As we already mentioned, the coefficients for the rest of the variables -in particular, for the three port efficiency measures- are quite stable.

We performed similar estimations for the rest of the years for which we have data. For brevity of space, Table 2 presents the estimated coefficients only for the IV regressions using GDP per capita as a proxy for port efficiency.[47]

For each year, the coefficients on distance and weight value are quite stable and significant (at 1%). Price-fixing rate agreement has the right sign in each year but it is only significant in two years. Cooperative agreement, instead, is never significant. In addition, when we use the port efficiency index from the GCR (not shown here) the

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value) between foreign ports and US districts (31), while we use the trade (in volume) between foreign countries and US coasts (3).

[45] That is, when port efficiency is measured with the GCR index, an improvement in port efficiency from 25th to 75th percentile (i.e., from a score of 3.4 to 5.6 respectively) generates a maritime transport costs decline of around 12%.

[46] When proxying port efficiency with the per capita GDP, an increase from the 25th to the 75th percentile reduces maritime transport charges in almost 15%. When using the infrastructure index, the reduction in transport cost is of 7%. This last variable could be showing a smaller effect because in fact it is measuring the existence of infrastructure, but not necessarily its quality, while the other measures should capture also quality.

[47] The results with port efficiency from the GCR are similar. We do not report them because the number of countries for which we have data changes (sometimes considerably) over time.

price-fixing variable is only significant in 1997 (at 10%). From these results it is difficult to conclude whether conferences have been exerting some monopoly power or not.

From Table 2 we can see that the coefficient on containerization is not stable over time. It is significant only in 1998 and 1995. In the case of Total Liner Volumes, the coefficient is only significant in the last two year (1997 and 1998). Finally, the estimated coefficient for port efficiency is stable and significant from both an economic and statistical point of view. When we used the port efficiency index from the GCR (not shown here) we obtain similar results. These results allow us to conclude that port efficiency is an important determinant of maritime transport costs. For example, if countries like Ecuador, India or Brazil improved their port efficiency from their current level to the 75th percentile -that is, to a level attained by France or Sweden- they would reduce their maritime transport costs in more than 15% each.

A final caveat about these results. Our model assumes that, if inefficiency in a port raises shipping costs by 10% for a shipment of shirts, it will increase the shipping costs for a shipment of cars by the same 10%. Suppose, instead, that the "tax equivalent" of port inefficiency varies by product. Then, products for which the tax is excessively high will not be exported and we will not observe them in the data. In other words, we have estimated the effect of port inefficiency for *products that are actually shipped.* The effect may be higher for some products, which are then not exported. In this sense our estimate of the cost of port inefficiency may be conservative.

IV. Determinants of Port Efficiency

The previous subsection stresses the importance of port efficiency on maritime transport cost, but what are the factors behind port efficiency? The activities required at port level are sometimes crucial for international trade transactions. These include not only activities that depend on port infrastructure, like pilotage, towing and tug assistance, or cargo handling (among others), but also activities related to customs requirements. It is often claimed that "...the (in)efficiency, even timing, of many of port operations is strongly influenced (if not dictated) by customs".[48,49]

Some legal restrictions can negatively affect port performance. For example, in many countries workers are required to have special license to be able to provide stevedoring services, artificially increasing seaport costs. Other deficiencies, associated with port management itself, are also harmful to country competitiveness. For instance, some ports still receive cargo without specifying the presentation of a Standard Shipping Note, which is inconceivable in modern port practice. In many ports, it is quite impossible to obtain a written and accurate account of the main port procedures, and sometimes port regulations are not clear about the acceptance of responsibilities (for cargo in shed or on the quay, for instance). All of this generates unreasonably long delays, increases the risks of damage and pilferage of the products (in turn raising the insurance premiums), and as a consequence considerably increases costs associated with port activities.

Port efficiency varies widely from country to country and, specially, from region to region. It is well know that some Asian countries (Singapore, Hong Kong) have the most efficient ports in the world, while some of the most inefficient are located in Africa (Ethiopia, Nigeria, Malawi) or South America (Colombia, Venezuela, Ecuador). Table 3 presents some estimates of port efficiency, per geographic region[50].

The first column is a subjective index based on surveys reported by the World Economic Forum's 1999 *Global Competitiveness Report*. North America and Europe have the best rankings, followed by the Middle East, and East Asia & the Pacific. Latin America and South Asia, in turn, are the regions perceived as having the least efficient ports. The second column indicates the time, in median days, to clear customs (taken from business surveys performed by the Inter-American Development Bank and World

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[48] Thus, any unexpected delay at ports due to extra custom requirements or cargo inspections, for instance, may increase considerably the associated port costs (due to moving containers and storage of frozen products, for example) and hence reduce exporters competitiveness.

[49] See John Raven (2000), for a description of relevant issues concerning trade and transport facilitation.

[50] We must note that these efficiency variables -per regions- are not directly comparable to each other, because the availability of countries is not the same for each of the variables. Thus, we should think of these as complement rather than substitute measures.

Bank[51]). The striking results are the ones for Africa -East and South Africa, and West Africa- for which the median number of days to clear customs is 12. Among East and South African countries, Ethiopia (30 days), Kenya, Tanzania and Uganda (14 days each) are the countries with bigger delays in clearing customs; while Cameroon (20 days), Nigeria (18 days) and Malawi (17 days) are the West African countries with the biggest delays.[52] The second region presenting big problems at custom levels is Latin America, with a median delay in clearing customs of 7 days. In this group, Ecuador (15 days) and Venezuela (11 days) appear as the worst performers.

Finally, the third column of Table 3 presents some estimates of the costs of handling containers inside the ports (in US$/TEU). This variable was constructed based on information provided by the Transport Division of the World Bank and information from additional papers.[53] Despite the fact that the sample of countries for this variable is a lot more restricted than for the previous ones, the estimates are quite consistent with the previous variables. While the efficient ports in East Asia present lower charges, the Latin American ports have the most expensive handling services. This relationship is even clearer when we take into account wage differential across countries. Table 4 presents the regression of handling costs -adjusted by wage- on port efficiency and an index of infrastructure (same as used in table 1). This index -at country level- is included under the assumption that infrastructure at country level is highly correlated with infrastructure at port level. In Column I handling costs are adjusted by manufacturing wages,[54] in Column II and III we adjust by per capita GDP (as proxy for wages), and in Column IV handling cost is adjusted by PPP GDP per capita.

Port efficiency is an important determinant of handling cost. Countries with inefficient seaports having higher handling costs. The negative and significant coefficient on GDP per capita implies that countries with good infrastructure have lower seaport costs. Figure 4 presents the relationship between handling costs and port efficiency, controlling for PPP GDP per capita (Column IV specification of Table 4). Countries

[51] The specific question is: "If you import, how long does it typically take from the time your goods arrive at their port of entry until the time you can claim them from customs?"

[52] The African countries' results from this survey are totally consistent with the results presented by the African Competitiveness Report 2000/2001 (World Economic Forum), which performed the same custom clearance question (though the average time presented by the latter are slightly higher).

[53] Camara Maritima y Portuaria de Chile (1999) and LSU (1998).

where ports are considered the most efficient (e.g. Singapore and Belgium) are at the same time the ones whose ports charge the least for their services (in comparable units). As already noted, some Latin American countries (Brazil, Ecuador) are among the worst ranked in term of their efficiency and also present the highest charges per services (after controlling by the level of infrastructure).[55]

Finally, we try to explain which are the factors behind port efficiency. As we already mentioned in the case of transport costs, it is reasonable to think that the determinants of port efficiency will not only consist of infrastructure variables, but also of management and/or policy variables. Therefore, besides a proxy for port infrastructure[56], we include among the explanatory variables two policy variables, one referring to *Cargo Handling Restrictions* and the other to *Mandatory Port Services*. Both variables are zero-to-one indices from FMN (2000). The first captures restrictions and special requirements imposed on foreign suppliers of cargo handling services, where foreign suppliers refer to local companies with foreign participation.[57] The second captures the extent to which port services are mandatory for incoming ships.[58] Both indices represent restrictions at port level that could limit competition, so we can expect a negative relationship between them and port efficiency. However, due to some quality and security considerations, we also have to consider that it may be beneficial to have a certain level of regulation at the seaports. Thus, we also explore the possibilities of non-linearities of the effect of each of these indices on port efficiency.

As we already mentioned, we consider the overall level of infrastructure, which we assume to be positively correlated with a country's level of seaport infrastructure. We expect the better the infrastructure the higher the probability of an efficient port; that is, a

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[54] Manufacturing wages are taken from UNIDO Industrial Statistics Database.

[55] A similar result is obtained when manufacturing wages (from the UNIDO Industrial Statistics Database) are used -instead of GDP per capita- to adjust handling costs. Appendix B presents the values used to construct these series.

[56] We use the index of country infrastructure we constructed as proxy for port infrastructure.

[57] The index takes a value of 0 if no restriction exists, 0.25 for minor restrictions, 0.5 if a joint venture condition is imposed, 0.75 if a very high national participation in the company is required, and 1 if foreign companies are simply forbidden to provide cargo handling services.

[58] This variable is constructed adding .125 for each of the following services if they are mandatory: pilotage, towing, tug assistance, navigation aids, berthing, waste disposal, anchorage and others mandatory services.

positive coefficient for this variable. Finally, we also include a *Crime Index*, taken from the Global Competitiveness Report, and consisting of a one-to seven index ranking how severe is organized crime in a particular country (with 7 meaning "not a problem"). The idea behind the inclusion of this variable is that organized crime constitutes a direct threat to port operations and merchandise in transit. With all of this in mind, we present in Table 5 some estimations of the effects of these variables on port efficiency, calculated for 1998.

As it can be seen, the coefficient on infrastructure is always positive and significant. The results for the policy variables are somehow mixed, but make some sense. Cargo handling restrictions are not significant, no matter the specification. The variable for mandatory port services, on the other hand, is significant both in level and square level, presenting a positive and negative sign, respectively. This result **suggests** that having *some* level of regulations increases port efficiency, however, an *excess* of it can start to reverse these gains. In terms of the countries in our sample, this result **suggests** that Argentina is taking advantage of a moderate level of regulation in its seaports, but instead Brazil is reducing its seaport efficiency because of excess regulation.

Finally, the crime variable also turns out to be highly significant and with the expected positive sign (remember that the variable is defined as crime "not being a problem"). In terms of this sample, an increase in organize crime from the 25^{th} to 75^{th} percentile implies a reduction in port efficiency from the 50^{th} to the 25^{th} percentile.

V. Conclusion

By the 1990s many countries had adopted a development strategy emphasizing integration with the global economy and therefore had reduced their tariff and non-tariff barriers to trade. This reduction in artificial trade barriers has raised the importance of transport costs as a remaining barrier to trade. Therefore, any strategy aimed at integrating a country into the trading system has to take transport costs seriously.

Besides distance and other variables that no government can change, an important determinant of maritime transport costs is seaport efficiency. An improvement in port efficiency from 25th to 75th percentiles reduces shipping costs by more than 12%, or the equivalent of 5,000 miles in distance. This result is robust to different definition of port efficiency as well as to different years. Inefficient ports also increase handling costs.

Seaport efficiency, though, is not just a matter of physical infrastructure. Organized crime has an important negative effect on port services, increasing transport costs. In terms of our sample, an increase in *organized crime* from the 25th to 75th percentile implies a reduction in port efficiency from 50th to 25th percentile. In addition our results suggest that some level of regulation increases port efficiency, but excessive regulation can be damaging.

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Appendix A. Data Description

Transport Costs Estimation (Tables 1 and 2)
Maritime Transport costs: calculated as import charges divided by weight. Source: calculated from data of the US Import Waterborne Databank (US Department of Transportation).

Distance: Correspond to the distance between the foreign port i and the US custom district J. Data provided by Fink, Mattoo and Neagu (2000).

Unit Weight: Value of total US imports divided by its total weight, and calculated per maritime route (where we define routes as "from foreign ports to US custom districts"). Calculated from data of the US Import Waterborne Databank (US Department of Transportation).

Price-Fixing agreement: Dummy variable signaling the presence of carrier agreements on maritime routes: conferences and other price-fixing agreements. Source: Fink, Mattoo and Neagu (2000).

Cooperative agreement: Dummy variable signaling the presence of carrier agreements on maritime routes: cooperative working agreements that do not have a binding rate authority. Source: Fink, Mattoo and Neagu (2000).

Containerization: Percentage of cargo transported by containers. Source: US Import Waterborne Databank (US Department of Transportation).

Total Liner Volume: Total volume of imports transported per maritime route (where we define routes as "from foreign country to US coast"). Source: constructed from data of US Import Waterborne Databank (US Department of Transportation).

Foreign GDP per capita: GDP per capita of the exporting countries to the US. Source: World Development Indicators 2000 (The World Bank).

Port Efficiency: one-to-seven index ranking port efficiency, based on surveys performed to representative firms of each country. The specific question is "Port facilities and inland waterways are extensive and efficient (1=strongly disagree, 7=stronlgy agree)". Source: The Global Competitiveness Report, various years (1996-2000)

Port Efficiency Variables (Tables 3 and 4)

Container Handling Charges: Correspond to containers handling charges in port (US$/TEU). For nineteen countries we have information from the Transport Division of the World Bank. For twelve countries, from which eight are in the World Bank sample, we have information (as an index) from the Cámara Marítima y Portuaria de Chile A.G. Finally, for four Central American countries from which only Panama is in the previous samples, we have information from the LSU- National Ports and Waterways Institute. Using ratios, we put all samples in the same unit used by the data from the World Bank.

Port Efficiency: same as above.

Custom Clearance: Correspond to time (days, median) to clear customs, based on surveys performed (by the World Bank) to importers in each country. The specific question is "If you import, how long does it typically take from the time your goods arrive at their port of entry until the time you can claim them from customs?" Source: The World Bank.

Container Handling Charges in Port: Correspond to the cost of handling containers inside the ports, expressed in US$ per TEU (Twenty Feet Equivalent Unit). This variable was constructed based on information provided by the Transport Division of the World Bank and information from particular additional papers (see text).

Manufactures wages: Source: UNIDO Industrial Statistics Database.

Infrastructure Index: Correspond to the simple average of four indices: main telephone lines per capita, kilometers of paved road, kilometers of railroad, and the number of paved airport, the last three variable per country surface area. To homogenize these four indices we divide each of them by their standard deviation.[59] Source: World Development Indicators 2000 (The World Bank) and The World Factbook 2000 (Central Intelligence Agency).

Port Efficiency Estimation (Table 5)
GDP per capita: Source: World Development Indicators 2000 (The World Bank).

Cargo Handling Restrictions: zero-to-one index that captures restrictions and special requirements imposed to foreign suppliers of cargo handling services. The index takes a value of 0 if no restriction exists, 0.25 for minor restrictions, 0.5 if a joint venture condition is imposed, 0.75 if a very high national participation in the company is required, and 1 if foreign companies are simply forbidden to provide cargo handling services. Source: Fink, Mattoo and Neagu (2000).

Mandatory Port Services: zero-to-one index that captures the extent to which port services are mandatory for incoming ships. This variable is constructed adding 0.125 for each of the following services if they are mandatory: pilotage, towing, tug assistance, navigation aids, berthing, waste disposal, anchorage and others mandatory services. Source: Fink, Mattoo and Neagu (2000).

Organized Crime: one-to-seven index ranking "organized crime as not been a problem", based on surveys performed to representative firms of each country. The specific question is "Organized crime does not impose significant costs on business and is not a burden (1=strongly disagree, 7=stronlgy agree)". Source: The Global Competitiveness Report, various years (1996-2000)

[59] We follow LV (2000) to construct this index......

Appendix B. Data Used

Country	Cargo Hand. Restriction Index	Mandatory Services Index	Price Fixed Agreements Index	Cooperative Agreements Index	Median Clearance time Days	Port Efficiency Index (1-7)	Crime Index (1-7)	Container Handling Charges Worl Bank US$/TEU	CMPCH Index	LSU Index
Argentina	0.00	0.13	0.00	1.00	7.0	3.81	4.52	na	139	na
Armenia	na	na	na	na	4.0	na	Na	na	na	na
Australia	0.00	0.13	1.00	1.00	na	4.79	6.19	199	na	na
Azerbija	na	na	na	na	5.0	na	na	na	na	na
Belarus	na	na	na	na	4.0	na	na	na	na	na
Belgium	0.00	0.06	1.00	0.00	na	6.17	5.73	120	na	na
Belize	na	na	na	na	5.0	na	na	na	na	na
Benin	1.00	0.00	0.00	0.00	na	na	na	na	na	na
Bolivia	na	na	na	na	9.5	1.61	4.38	na	na	na
Botswana	na	na	na	na	4.0	na	na	na	na	na
Brazil	0.50	0.75	0.00	1.00	10.0	2.92	4.45	328	292	na
Brunei	0.00	0.00	0.00	0.00	na	na	na	na	na	na
Bulgaria	na	na	na	na	2.0	3.68	3.23	na	na	na
Cambodia	na	na	na	na	7.0	na	na	na	na	na
Cameroon	na	na	na	na	20.0	na	na	na	na	na
Canada	0.00	0.13	0.00	0.00	2.0	6.42	6.27	190	na	na
CDI	na	na	na	na	8.5	na	na	na	na	na
Chile	0.00	0.25	0.43	1.00	3.0	3.76	6.05	202	100	na
China	0.50	0.00	0.00	0.00	7.0	3.49	4.44	110	na	na
Colombia	0.50	0.13	0.50	1.00	7.0	2.26	1.88	na	na	na
Costa Rica	0.00	0.00	0.00	1.00	4.0	2.46	3.28	na	na	68
Croatia	na	na	na	na	2.0	na	na	na	na	na
Cyprus	1.00	0.31	0.00	0.00	na	na	na	na	na	na
CzechRep	na	na	na	na	2.0	3.27	4.41	na	na	na
Trinidad and T.	na	na	na	na	7.0	na	na	na	na	na
Denmark	0.00	0.06	1.00	0.00	na	6.16	6.71	na	na	na
Dominican R.	0.25	0.25	0.50	1.00	7.0	na	na	na	na	na
Ecuador	0.00	0.00	0.43	1.00	15.0	2.63	3.65	na	139	na
Egypt	0.75	0.75	0.00	0.00	5.5	3.72	6.37	na	na	na
El Salvador	0.00	0.00	0.00	1.00	4.0	2.95	2.30	na	na	61
Estonia	na	na	na	na	1.0	na	na	na	na	na
Ethiopia	na	na	na	na	30.0	na	na	na	na	na
Finland	0.00	0.25	0.00	0.00	na	6.26	6.63	na	na	na
France	0.00	0.38	1.00	0.00	3.0	5.39	6.58	201	na	na
Georgia	na	na	na	na	2.0	na	na	na	na	na
Germany	0.00	0.38	1.00	0.00	5.0	6.38	6.02	163	117	na
Ghana	1.00	0.50	0.00	1.00	5.0	na	na	na	na	na
Greece	1.00	0.19	0.00	0.00	na	4.28	5.60	na	na	na
Guatemala	na	na	na	na	7.0	na	na	na	na	55
Haiti	na	na	na	na	15.0	na	na	na	na	na

(continued)

Country	Cargo Hand. Restriction Index	Mandatory Services Index	Price Fixed Agreements Index	Cooperative Agreements Index	Median Clearance time Days	Port Efficiency Index (1-7)	Crime Index (1-7)	Container Handling Charges World Bank US$/TEU	CMPCH Index	LSU Index
Honduras	na	na	na	na	4.0	na	na	na	na	na
Hong Kong	0.00	0.25	0.00	0.00	na	6.38	5.46	na	na	na
Hungary	na	na	na	na	3.0	2.59	4.14	na	na	na
Iceland	0.00	0.13	0.00	0.00	na	5.78	6.64	na	na	na
India	0.00	0.00	0.00	1.00	na	2.79	4.28	na	na	na
Indonesia	1.00	0.06	0.00	0.38	5.0	3.41	4.06	na	na	na
Ireland	0.00	0.13	1.00	0.00	na	4.28	5.12	na	na	na
Italy	0.25	0.50	0.38	0.00	2.0	4.11	3.29	228	na	na
Ivory Coast	0.00	0.25	0.00	1.00	na	na	na	na	na	na
Jamaica	0.50	0.00	0.00	0.60	na	na	na	na	na	na
Japan	0.75	0.13	0.89	1.00	na	5.16	5.16	250	202	na
Kazakhst	na	na	na	na	9.0	na	na	na	na	na
Kenya	na	na	na	na	14.0	na	na	na	na	na
Korea	0.00	0.38	0.00	0.00	na	4.12	5.22	na	na	na
Kyrghizs	na	na	na	na	10.0	na	na	na	na	na
Lithuani	na	na	na	na	1.0	na	na	na	na	na
Madagascar	na	na	na	na	10.0	na	na	na	na	na
Malawi	na	na	na	na	17.0	na	na	na	na	na
Malaysia	0.00	0.25	0.00	0.38	7.0	4.95	5.76	75	na	na
Mauritius	1.00	0.38	0.00	0.00	na	5.35	5.53	na	na	na
Mexico	0.50	0.38	0.00	1.00	4.0	3.34	2.61	na	na	na
Moldova	na	na	na	na	5.0	na	na	na	na	na
Morocco	0.50	0.13	0.00	0.00	na	na	na	na	na	na
Namibia	na	na	na	na	4.0	na	na	na	na	na
Netherlands	0.00	0.50	1.00	0.00	na	6.64	5.42	156	84	na
New Zealand	0.00	0.38	1.00	1.00	na	5.82	6.14	na	na	na
Nicaragua	0.00	0.00	0.00	1.00	5.0	na	na	na	na	na
Nigeria	0.00	0.50	0.00	1.00	18.0	na	na	na	na	na
Panama	na	na	na	na	5.0	na	na	na	234	100
Papa N.Guinea	0.50	0.00	0.00	0.00	na	na	na	na	na	na
Peru	0.50	0.00	0.50	1.00	7.0	2.88	3.32	na	142	na
Philippines	0.50	0.00	0.00	0.38	7.0	2.79	3.51	118	na	na
Poland	0.25	0.00	0.00	0.00	3.0	3.34	3.41	na	na	na
Portugal	0.00	0.13	1.00	0.00	8.0	3.81	6.50	na	na	na
Romania	0.00	0.63	0.00	0.00	3.0	na	na	na	na	na
Russia	na	na	na	na	7.0	3.33	2.23	na	na	na
Senegal	0.00	0.00	0.00	1.00	7.0	na	na	na	na	na
Singapore	1.00	0.38	0.00	0.33	2.0	6.76	6.72	117	na	na
Slovakia	na	na	na	na	2.0	3.50	4.35	na	na	na
Slovenia	na	na	na	na	2.0	na	na	na	na	na

(continued)

Country	Cargo Hand. Restriction Index	Mandatory Services Index	Price Fixed Agreements Index	Cooperative Agreements Index	Median Clearence time Days	Port Efficiency Index (1-7)	Crime Index (1-7)	Container Handling Charges Worl Bank US$/TEU	CMPCH Index	LSU Index
South Africa	na	na	na	na	5.0	5.24	2.08	na	na	na
Spain	0.00	0.06	1.00	0.00	4.0	4.88	6.08	200	105	na
Sweden	0.00	0.06	1.00	0.00	2.0	5.73	6.46	na	na	na
Taiwan	0.50	0.00	0.00	0.00	na	5.18	4.49	140	163	na
Tanzania	na	na	na	na	14.0	na	na	na	na	na
Thailand	0.50	0.63	0.00	0.38	4.0	3.98	5.12	93	na	na
Togo	0.00	0.00	0.00	0.00	na	na	na	na	na	na
Tunisia	0.50	0.13	0.00	0.00	5.5	na	na	na	na	na
Turkey	0.00	0.00	0.43	0.00	na	3.81	5.00	na	na	na
Uganda	na	na	na	na	14.0	na	na	na	na	na
Ukraine	na	na	na	na	10.0	3.41	3.28	na	na	na
United Kingdom	0.00	0.31	1.00	0.00	4.0	5.37	6.17	173	na	na
United States	na	na	na	na	5.0	6.27	5.40	259	336	na
Uruguay	0.00	0.00	0.00	1.00	5.0	na	na	na	na	na
Uzbekist	na	na	na	na	7.0	na	na	na	na	na
Venezuela	0.00	0.00	1.00	1.00	11.0	3.28	3.63	na	na	na
Vietnam	0.00	0.00	0.00	0.50	na	3.81	5.02	na	na	na
Zambia	na	na	na	na	10.0	na	na	na	na	na
Zimbabwe	na	na	na	na	10.0	3.29	5.15	na	na	na

na: not available

Figure 1
Estimates of Total Imports Freight Costs Relative to Imports (fob)
1997

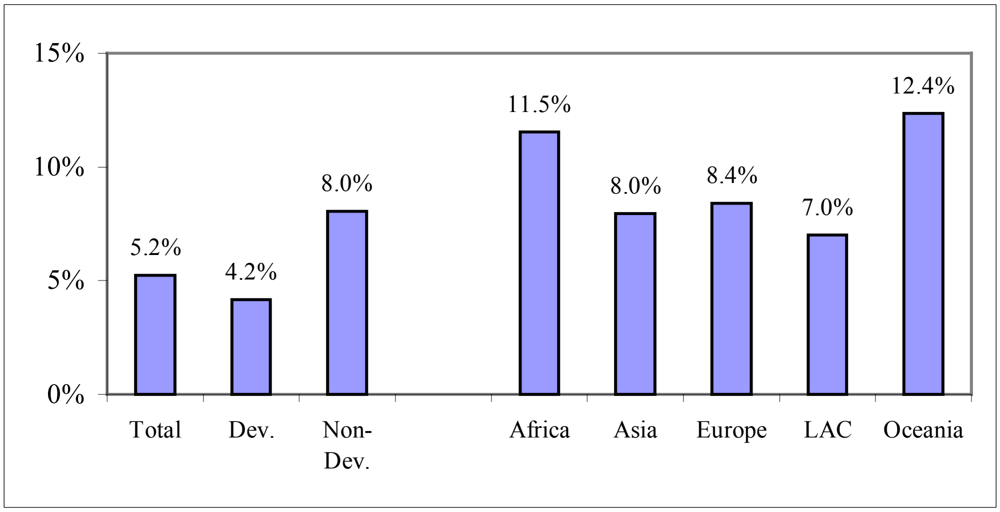


Figure 2
Imports Freight Costs (CIF/FOB ratio) and Import Tariffs relative to Import value (1996-97)

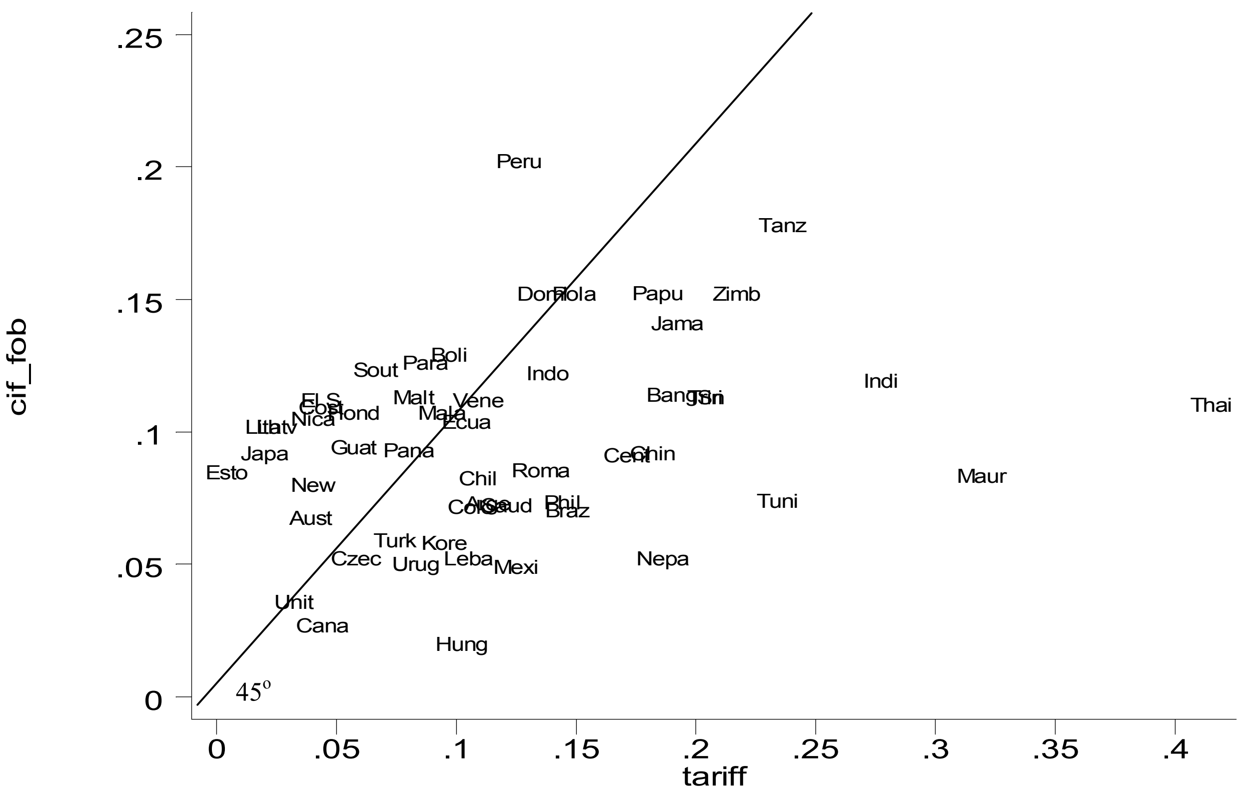
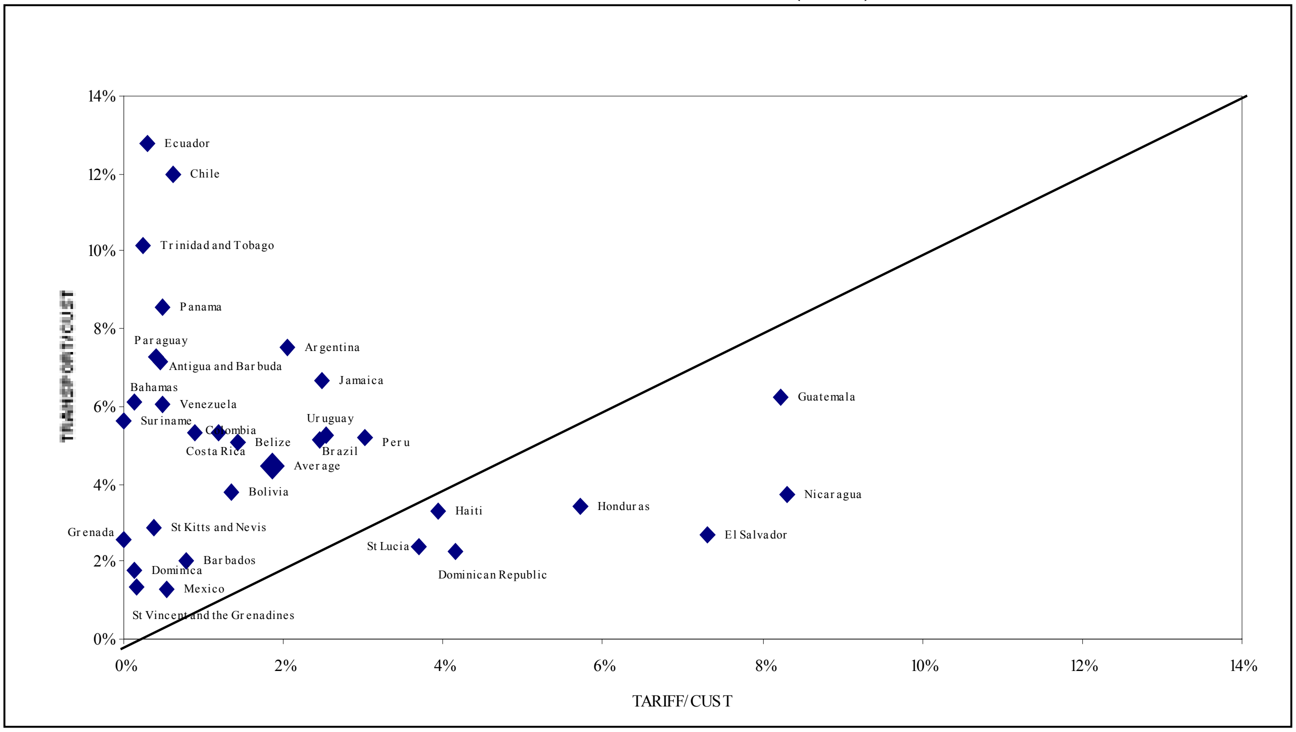


Figure 3
Export Freight Costs and US Tariff
Latin American Countries (1998)



Sources: U.S. Census Bureau, Department of Commerce.[60]

[60] The high calculated duty presented by Central American countries are due to textile products (code 6 in HTSUSA).

Table 1: Determinants of Maritime Transport Costs, 1998
Independent Variable: TC= (Charges / Weight)

Variables	OLS estimations			IV Estimations		
	(I)	(II)	(III)	(IV)	(V)	(VI)
Distance (km)	0.181	0.185	0.177	0.18	0.173	0.175
	(0.019)***	(0.019)***	(0.017)***	0.022)***	0.021)***	0.020)***
Unit Weight	0.554	0.548	0.545	0.554	0.548	0.545
	0.011)***	(0.011)***	(0.011)***	(0.010)***	(.011)***	(0.012)***
Policy variables						
Price-fixing rate agreement	0.067	0.026	0.009	0.067	0.024	0.011
	(0.037)*	(0.038)	(0.044)	(0.041)	(0.042)	(0.049)
Cooperative agreement	-0.015	-0.033	-0.007	-0.015	-0.031	-0.008
	(0.017)	(0.024)	(0.030)	(0.018)	(0.024)	(0.033)
Containerization	-0.042	-0.039	-0.044	-0.042	-0.037	-0.043
	(0.013)***	(0.014)***	(0.013)***	(0.012)***	(0.013)***	(0.012)***
Total Liner Volume	-0.023	-0.025	-0.033	--	--	--
(Foreign country to US coast)	(0.006)***	(0.008)***	(0.010)***	--	--	--
Total Liner Volume (Instr.)	--	--	--	-0.027	-0.042	-0.036
(Foreign GDP)	--	--	--	(0.013)**	(0.016)***	(0.020)*
Foreign Port Efficiency						
Foreign GDP per capita	-0.058	--	--	-0.058	--	--
(proxy for infrastructure)	0.011)***	--	--	0.012)***	--	--
Port Efficiency	--	-0.056	--	--	-0.053	--
(Global Competit. Report)	--	(0.014)***	--	--	0.015)***	--
Infrastructure Index	--	--	-0.058	--	--	-0.059
(proxy for port infrast.)	--	--	(0.029)**	--	--	(0.029)**
Nr. Observ.	314,034	308,549	314,034	314,034	308,549	314,034
R sq. (adj)	0.465	0.465	0.463	0.465	0.465	0.463

Notes: First row indicates the coefficient value and the second the Huber/White standard error. All estimations include fix effects for products (4828 products) and for US district (31 districts). Regressions allow the observations to be independent across exporting countries, and interdependent within each country. ***, **, *: significant at 1%, 5% and 10% respectively.

Table 2: Determinants of Transport Costs, 1995-1998, IV Estimations
Independent Variable: TC= (Charges / Weight)

Variables	1998	1997	1996	1995
Distance (km)	0.180	0.175	0.176	0.187
	(0.022)***	(0.026)***	(0.024)***	(0.026)***
Unit Weight	0.554	0.558	0.553	0.553
	(0.010)***	(0.010)***	(0.013)***	(0.009)***
Policy variables				
Price-fixing rate agreement	0.067	0.111	0.092	0.071
	(0.041)	(.048)**	(0.047)**	(0.046)
Cooperative agreement	-0.015	0.003	-0.012	-0.017
	(0.018)	(0.025)	(0.026)	(0.025)
Containerization	-0.042	-0.017	0.015	-0.036
	(0.012)***	(0.016)	(0.016)	(0.021)*
Total Liner Volume (Instr)	-0.027	-0.029	-0.022	-0.018
(Foreign GDP)	(.013)**	(0.015)*	(0.014)	(0.016)
Foreign Port Efficiency				
Foreign GDP per capita	-0.058	-0.062	-0.069	-0.074
(proxy for infrastructure)	(0.012)***	(0.014)***	(0.015)***	(0.012)***
Nr. Observ.	314,034	296,725	272,981	272,830
R sq. (adj)	0.465	0.487	0.490	0.521

Notes: First row indicates the coefficient value and the second the Huber/White standard error. All estimations include fix effects for products (4828 products) and for US district (31 districts). Regressions allow the observations to be independent across exporting countries, and interdependent within each country. ***, **, *: significant at 1%, 5%, and 10% respectively.

Table 3: Port Efficiency Variables

	Port Efficiency (7=best, 1=worst)	Custom Clearance (days)	Container Handling Charges in Ports (US$/TEU)
North America	6.35	3.50	261.7
Europe (excl. East)	5.29	4.00	166.7
Middle East	4.93	na	na
East Asia & the Pacific	4.66	5.57	150.5
East & South Africa	4.63	12.00	na
North Africa	3.72	5.50	na
Former Soviet Union	3.37	5.42	na
East Europe	3.28	2.38	na
Latin Am. & the Caribbean	2.90	7.08	251.4
South Asia	2.79	--	na
West Africa	na	11.70	na

Sources: Global Competitiveness Report (1999), World Bank Surveys, Camara Maritima y Portuaria de Chile. A.G. (1999), and LSU (1998). (na: not available)

Table 4: Handling Costs and Port Efficiency, 1998

Independent Variable: Container Handling Charges divided by Wage (in logarithm)

Variable	(I) (Manf. Wages)	(II) (GDP 98)	(III) [a] (GDP 98)	(IV) (PPP GDP 98)
Port Efficiency	-0.448	-.0268	-0.279	-0.333
(Global Competit. Report)	(5.926)***	(3.685)***	(3.110)***	(4.665)***
Infrastructure Index [b]	-0.182	-0.731	-0.748	-0.239
(proxy for port infrastructure)	(1.368)	(6.850)***	(5.794)***	(2.502)**
Constant	-1.596	-0.221	-0.078	-1.927
	(5.901)***	(1.024)***	(0.233)	(9.172)***
Nr. Observ.	13	24	19	24
R sq.	0.943	0.947	0.940	0.883

Notes: (a): This regression only uses handling cost data coming from the World Bank. (b): The Infrastructure Index is in logarithm. First row indicates the coefficient value and the second the t statistic, using Huber/White standard error. ***, **, *: significant at 1%, 5% and 10% respectively.

Figure 4
Handling Costs and Port Efficiency
(Handling Costs Divided by PPP GDPpc 1998)

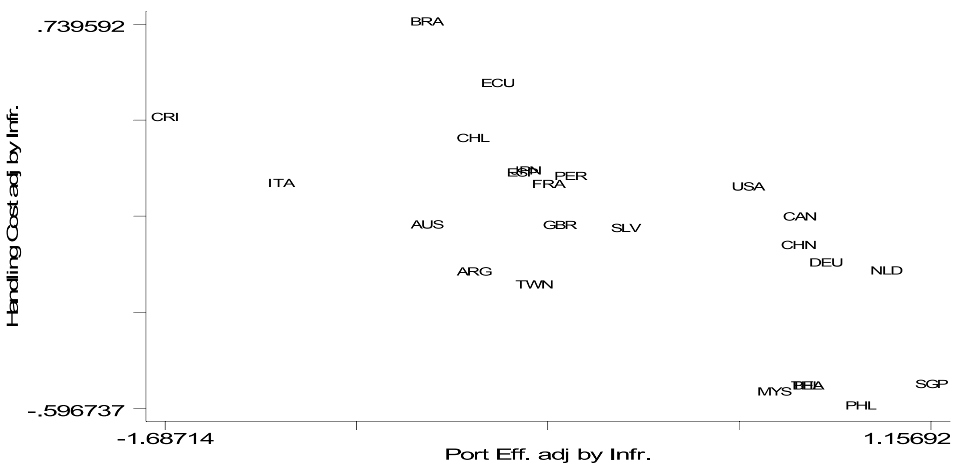


Table 5: Determinants of Port Efficiency, 1998

Dependent variable: Port Efficiency (from the Global Competitiveness Report)

Variables	(I)	(II)	(III)
Infrastructure	0.332	0.350	0.301
	(0.155)**	(0.153)**	(0.125)**
Cargo Handling Restrictions	1.457	0.344	--
	(1.273)	(0.463)	--
Cargo Handling Rest. (sqr.)	-1.234	--	--
	(1.395)	--	--
Mandatory Port Services	4.309	3.904	4.213
	(1.867)**	(1.910)**	(1.810)**
Mandatory Port Services (sqr.)	-6.840	-5.962	-6.198
	(2.671)**	(2.608)**	(2.571)**
Organized Crime	0.628	0.573	0.566
(Org crime is not a problem)	(0.119)***	(0.084)***	(0.086)***
Constant	0.973	1.323	1.380
	0.646	(0.464)***	(0.497)***
Nr Observations	42	42	42
R sq.	0.716	0.712	0.706

Notes: First row indicates de coefficient value and the second row the standard error. ***, **: significant at 1%, and 5% respectively.