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Bilateral Transport Cost, Infrastructure, Common Bilateral Ties and Political Stability

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Abstract. Transport Costs are one of the most important sources of barriers to trade. Inspired by this concern, we use an ad-hoc empirical model to examine the possible determinants of transport costs.

Using a country aggregate bilateral transport costs database for 1990, we replicate Limao and Venables (2001) and we find that the effect of their infrastructure index on transport costs is not robust. Following Micco (2004) and Micco and Serebrinzky (2005) we calculate two alternative indexes of infrastructure. Using these new indexes we find that not only distance but infrastructure, political stability, common bilateral ties and open sky agreements as well are other important channels through which transport costs can be reduced.

Keywords: transport costs, infrastructure.

JEL classification: pending.

Resumen. Los costos de transporte son una de las más importantes fuentes de barreras al comercio. Inspirados por este aspecto, utilizamos un modelo empírico ad-hoc con el fin de examinar los posibles determinantes de los costos de transporte.

Utilizando una base de datos de costos de transporte bilaterales para el año 1990, replicamos el trabajo de Limao y Venables (2001) y encontramos que el efecto de su índice de infraestructura sobre los costos de transporte no es robusto. Siguiendo a Micco (2004) y Micco y Serebrinzky (2005) calculamos dos índices alternativos de infraestructura. Utilizando estos índices encontramos que aparte de la distancia, la infraestructura, la estabilidad política, las relaciones bilaterales comunes y los acuerdos de cielos abiertos son otros importantes canales mediante los cuales los costos de transporte pueden reducirse.

Palabras clave: costos de transporte, infraestructura.

Clasificación JEL: pendiente.

[*]All errors are my own.

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1. Introduction

Transport Costs are one of the most important sources of barriers to trade. As Obstfeld and Rogoff (2001) explain, several puzzles can be explained by their existence. But as Hummels (2006) points out, the literature has not yet devoted enough attention to try to model the determinants of transport costs. Previous approaches have modeled them, but the approaches are completely ad-hoc and they are characterized by heuristic functional specifications. Therefore, we believe that future work can be developed in this area.

Given this concern, we use an ad-hoc empirical model to examine the possible determinants of transport costs, inspired specially by the fact that they have been decreasing since the early 1980's.[1] In particular, we estimate the effect of infrastructure and distance on bilateral transport costs. Using a country aggregate bilateral transport costs database for 1990, Limao and Venables (2001) (henceforth LV) estimate that the deterioration of the infrastructure index of a country from the median level to the 75th percentile raises transport costs by 12 percentage points. This effect implies a reduction in trade volume by around 28 percent.[2]

Following the same approach, we replicate LV results, and we find that the effect of his infrastructure index on transport costs is not robust. Adopting Micco (2004) and Micco and Serebrinzky (2005) we calculate two alternative measures of infrastructure which we consider are a better proxy of the port infrastructure of a country. In addition, we estimate the effect of common bilateral ties, country political stability and open sky agreements on transport costs.

We found that in addition to distance, infrastructure, political stability, common bilateral ties and open sky agreements are other important channels through which transport costs can be reduced.

The structure of this paper is as follows: Section II sets up the model and the empirical estimation strategy that LV used. Section III performs a detailed description of the required data. In particular, the section describes how we calculate the infrastructure measures. Section IV describe the results obtained. First, we replicate the results obtained by LV in tables 2, 3, 5, 6, 7 and 8. Second we expand the data, and we perform panel data estimates of the effects with the LV infrastructure index, and our new infrastructure variables and the new sets of controls. Section V concludes.

[1] See figure 1 in appendix A.
[2] Limao, N. and Venables, J. (2001), p. 451.

2. The Model

Following LV, we know that the unit costs of shipping a good (T_{ij}) from country i to country j in period t is given by the following equation:[3]

$$T_{ij} = T\left(x_{ij}, X_i, X_j, \mu_{ij}\right) \tag{1}$$

Where x_{ij} is a vector of characteristics related to the journey between country i and country j. X_i is a vector of characteristics related to country i. X_j is a vector of characteristics related to country j, and μ_{ij} is a vector of nonobservables.

Following the trade literature,[4] LV used the bilateral distance between country i and county j and a border dummy variable as the journey specific variables defined in x_{ij}. As expected, the higher the distance between the two destinations the higher the transport cost are, and second, when two countries share a common border, we would expect that other factors besides distance might reduce transport costs.

First, neighboring countries might have more integrated transport networks that reduce transport costs. Second, neighboring countries might have similar customs agreements or transit rules that decrease the amount of time expended in transporting goods between destinations. This implies a reduction in the shipping and insurance costs charged per good. Third, the higher the trade volume among neighboring countries, the lower the fixed costs are.[5] The reason is due to the fact that the high volume of trade between two locations reduces the fixed costs shared by the senders within the two destination points because of cargo backhauling.[6]

As for the country specific characteristics defined in X_i or X_j, LV only focus their attention on geographical and infrastructure measures. For geographical characteristics, LV controls if either the country is an island or not, and they also control whether the country is landlocked or not.[7]

The motivation to focus on these two measures is given by the fact that landlocked countries might have higher transport costs since they do not have ports; therefore, cargo must first pass through neighboring countries first, which increases the time of transportation and in consequence increases transport costs. In relation to islands, they expect that islands may have better ports infrastructure which implies a reduction in transport costs.

[3] For simplification, we suppress sub index t.

[4] Anderson and Wincoop (2004) performed a detailed survey of the approaches followed by trade literature.

[5] Limao and Venables (2001), pp. 453-454.

[6] For further reference see Micco et al. (2004).

[7] In particular, the landlocked variable is a dichotomic variable that takes the value of one if the country is landlocked, zero otherwise. The island variable is also a dichotomic variable that takes the value of one if the country is an island, zero otherwise.

Since LV use information at country level[8] obtained from the Directional Trade Data ($DOTS$), the ad valorem transport cost factor between country i and country j is defined as the ratio between C.I.F and F.O.B trade values.[9] Then, our measure of transport costs is determine by the following equation:

$$t_{ij} = \frac{cif_{ij}}{fob_{ij}} = \frac{p_{ij} + T_{ij}}{p_{ij}} = t\left(x_{ij}, X_i, X_j, \tilde{\mu}_{ij}\right) \tag{2}$$

Under the assumption that t_{ij} can be approximated by a log linear function, we can proxy transport cost factors between country i and country j by the following equation:[10]

$$\ln t_{ij} = \tilde{\alpha} + \tilde{\beta} x_{ij} + \tilde{\gamma}' \ln X_i + \tilde{\delta}' \ln X_j + \omega_j \tag{3}$$

Where we assume that ω_j is uncorrelated with the explanatory variables previously defined in x_{ij}, X_i and X_j. As we discuss in the following section, there are a couple of factors that should be taken into account before advancing to estimate equation (3). First, the results obtained by LV are based on the strong assumption that transport costs are a linear function of the variables defined. This can be tested by introducing some non linear relationships with the infrastructure variable per country. Since we are following LV, we do not test for the non linear relationship of the infrastructure indexes. Second, Yeats (1978) and Hummels (2006) point out transport cost data proxy by the matched partner technique[11] has an important portion of its own variance explained by noise. Third, since $DOTS$ data is obtained from three different sources, it is subject to data differences that are not related to trade costs. Certain statistical offices may value goods differently, i.e. fluctuation of the exchange rate within the time that it takes to transport the good between location may determine different valuation methods for products in C.I.F and FOB values respectively. Fourth, discrepancy in levels of C.I.F and FOB among matched country data can induce to high ad valorem transport costs. Fifth, $DOTS$ data for a single year for a given country might change within different publications. Although the change is small in levels, it's implication on the ad valorem transport cost rate (as defined in equation 2) could be important.

[8]The data section provides a complete description of the variables used to replicate LV results. In addition, we provide a detailed description of the additional variables to perform the extensions to LV results.

[9]C.I.F. represents the value of imports at the first port of entry of the importer country (i). The measure is based on the purchase price and includes all freight, insurance, and other charges excluding import duties incurred in bringing the merchandise from the country of exportation (j).

F.O.B represents the value of the good at the port of exportation in country (j). The export value excludes any import duties at country (i), and it also excludes any other charge associated to transportation and insurance from country (j) to country (i).

[10]LV, p. 457.

[11] $\frac{cif_{ij}}{fob_{ij}}$ ratio obtained from $DOTS$ data.

3. Data

Since this paper replicates tables 2, 3, 5, 6, 7 and 8 from LV, the variables that we need to replicate the results obtained by the authors are: ad valorem transport costs, bilateral distance between countries i and j, common border dummy, island dummy for countries i and j, GDP and GDP per capita for countries i and j, infrastructure index for countries i and j, landlocked dummy, African country dummy for countries i and j and rule of law and control of corruption of countries i and j.

Ad valorem transport costs (t_{ij}) defined by equation (2) were directly calculated from $DOTS$ trade data for year 2005. As explained by Hummels (2006), this data has the advantage that it has a very good coverage, it has information of bilateral imports and exports at C.I.F and F.O.B trade values for almost all the countries of the world from 1948 up to the present (with a lag of two years). But as we mentioned before, it has some problems as well. The IMF builds up this data from several sources, which implies that the data has variations that are not due to transport costs. So when we proxy t_{ij} by equation (2), part of the variation in t_{ij} is not due to transport costs per se.

Differences across countries can be due to different valuations of trade; i.e. at F.O.B a country can report value of good in the ship, and another can report the value of the good before entering the ship, the U.S. values imports at the exchange rate due the same day the product enters the first port, but other countries use the average exchange rate within the period that it took the good to arrive from country i to country j. Other differences can be explained by the country quality of the data. This bias is particularly important for developing countries where the quality of data is usually lower than in developed countries.

Another source of differences are the re-adjustments made by the IMF to clarify errors and mistakes from previous years. So even though we access the raw data to calculate t_{ij}, our measure by definition is different from the measure used by LV because IMF has corrected the numbers.

In addition, IMF has a rule of imputing values for imports and exports. If data is available for F.O.B exports but not for C.I.F. imports, for countries i and j, then it replaces the C.I.F missing values by a factor of 1.1 respect to F.O.B, and if there is data on C.I.F but not on F.O.B, then it replaces the missing F.O.B discounting 9% on C.I.F data.

Finally, the data reports values for imports and exports near zero, which could lead to over estimation of the transport cost. According to the summary statistics reported by LV, t_{ij} ad valorem transport costs are around 87% and 400% which is a very good example of the noise of the data used by LV.

To address this problem, first, we do not take into account the bilateral import and export data that has the imputation rule previously described. Second, the ad valorem transport costs used are between 4% and 248% [Hummels (2006) suggests a reasonable value of 200%]. So all the results reported through tables 1-6 of this paper have a bilateral sample size of 3,077 observations. Comparing to LV, our sample is lower since he uses 4,516 observations

to estimate the same tables.

The variables of bilateral distance, common border, landlocked and island dummy variables were calculated using the information reported by the CIA World Factbook,[12] which is the same source used by LV. In particular, bilateral distance was calculated using the world great distance formula.

GDP, GDP per capita and the infrastructure index were also obtained from the same source, World Development Indicators, but we used the 2007 version. This would imply some small distortions caused by the data revision that the World Bank performed to correct for previous editions mistakes.[13] However, special attention has to be applied to the way the authors define the infrastructure index. This variable is not a variable directly calculated by the World Bank; this variable is defined by the following equation:

$$\inf ra_i = \left[\frac{tel_i + roads_i + paved_i + rail_i}{4}\right]^{-j}$$

where $j = 1, 1/3$ and

tel_i: telephone mainlines per capita in country i,

$roads_i$: total road network in country i, (4)

$paved_i$: percentage of paved roads in country i,

$rail_i$: total rail lines routes in country i.

As explained by LV, the better the infrastructure level of the ports the lower transport costs are since insurance and time of transportation are reduced. Given that they do not have access to this data, they calculate an infrastructure index (equation (4)). LV emphasize that roads, rails, and telephone infrastructures are highly correlated to port infrastructures. But instead, I found this measure not as good as they claim, since this average is on the variables that reflect the interconnection within the country and this may not reflect the real infrastructure level of the ports of the country. As an example, Paraguay is a landlocked country, so the infrastructure index should reflect only the infrastructure of the airports, but, instead, the index is classifying this country as having a similar level as a country that has a similar size and is not landlocked; i.e. Costa Rica (both countries are in their sample). In addition, they are not controlling by country size, neither by population density.

Taking this into account, in our extensions (tables 7-10), we performed a robustness check on the LV infrastructure index. As it is shown the index is not statistically different from zero. Following Micco et al. (2004) and Micco and Serebrinzky (2005), we use two infrastructure indexes that measure the infrastructure level of sea ports and the airports per country. Both of our indexes control for country size and population density. As explained in Micco et al. (2004) the infrastructure index of airports controls for two characteristics.

[12] https://www.cia.gov/library/publications/the-world-factbook/index.html

[13] As shown in our summary statistics, island, landlocked and bilateral distance variables are very similar to the summary statistics reported by LV.

It controls for the quality of the airports per country, and by the population density and the size of the country. By quality we mean that we are able to determine how many airports are located within 50, 75 and 100 km radius distance from the most important cities of each country. This controls for the amount of population that the airport serves. Highly populated airports may have higher transport costs since it implies higher congestions; increasing transport costs. Second, we can control for the length of the airport airways. In our case, we use two measures, airways with at least 2000 or 2500 meter long. This means that the longer the airways, the bigger the type of plane that can land in the airport. Therefore, the bigger the cargo that can be transported and the lower the transport costs are per unit of good transported.

As for maritime ports and following Micco (2005), we constructed a port index per country that controls for the quality of the ports in several dimensions. To construct this index we used the information of the port at the port level within the country. The data used enables us to determine how many ports each country of the world has, and in addition we can determine the size, the exact location, the type of water access to the port (river or ocean), the size of the channel of the port, the cargo pier length, the types of communications that the port has, the types of cranes, the maximum capacity of the lifts that it has to move the cargo, and we can also determine if a port can perform services to the incoming ships. All this information was taken into account to build the index. So our indexes truly reflect the infrastructure level of airport and maritime port within a country. Therefore, our country indexes are just the average of the infrastructure index of each maritime port and airport within the country.[14]

Finally, we include two variables that measure the political and enforcement of the law within a country. We believe that the lower the security is in a port, the higher the insurance per good is; increasing transport costs. In particular, we use two Kauffman political indexes;[15] Rule of Law and Control of Corruption.[16]

[14]To be able to construct the airport infrastructure index, we used the information per city and airports that is obtained from www.tageo.com. In particular the website offers the latitude, longitude and population of each of the most important sixty cities within the country. As for the airports, the webpage offers the location coordinates as well as the information about the width, and the length of the airports within a country. This is why we can calculate the number of airports that on average a city of country i has access to within a radius of 50, 75 and 100 km, controlling for the size of the runaways.

For the case of ports, we use the data available at www.portualia.com.

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[16]For further reference see Kaufmann, D. and Kraay, A., and Massimo Mastruzzi, M. (2006).

The following section presents the results obtained for the replications (tables 1-6), and for the extensions (tables 7-10).

4. Estimation Results

As we mentioned in the previous section, our results are divided in two sets: Replication and Extensions. In particular, first, we replicate the results obtained by LV for tables 2, 3, 5, 6, 7 and 8. Then, we expand the data as a robustness check for LV infrastructure index. We include new measures of country infrastructure indexes and we control for other country variables that might affect transport costs. Therefore, we proceed to estimate a panel for the years comprehended between 1990-2003, controlling for country and year fixed effects.

4.1. Cross Section Results, 1990.

Following LV and our previous data description, we acknowledge that the ad valorem transport costs data is censored, therefore, we proceed to estimate equation (3) with a lower limit Tobit for year 1990.

Table 1 exhibits the results obtained when we estimate ad valorem transport costs as a function of bilateral distance, GDP per capita of countries i and j, border dummy, island dummy for countries i and j, GDP per capita for countries i and j, infrastructure index for countries i and j and landlocked infrastructure indexes for countries i and j. The first three columns are obtained using lower limit Tobit estimation, and the fourth column includes partner country fixed effects. In general, our results are very similar to the results obtained by LV, they have the correct sign and similar coefficients. The only differences in the results are given by the sign of the island dummy effect for i country and the landlocked infrastructure level. In LV, the island dummy is negative and is only statistically different from zero in one specification. On the contrary, in our results the sign is positive. As for landlocked infrastructure index, in our case it is not statistically different from zero.

It is important to acknowledge the infrastructure index is always significant and has the correct sign. By definition from equation (4), the infrastructure index coefficient should be positive because the LV index is really the inverse of the infrastructure level and we know an increase in the infrastructure of a country reduces the index determine by equation (4) and reduces the level of transport costs as well.

Column 1 reports the effect of bilateral distance on transport alone. Its coefficient across the different specifications is very similar to the values obtained by LV. In addition, the decrease of a country's ad valorem transport cost from the top 25 percentile to the 50th percentile is equivalent to a reduction in the bilateral distance of 1273 km.[17] Furthermore, if we ask the question of how

[17] This result is obtained using the following formula: $1273.01 = 7288 - 7288 * \left(\frac{0.574}{0.942}\right)^{\frac{0.174}{0.449}}$.

much closer must two otherwise identical countries be if they do not share a border and are to have the same transport costs?[18] We find that the countries should be 964 km closer.[19] This suggests that, besides distance, the intercommunication of neighboring countries explains a very important component of the structure of transport costs. A final interesting remark is given by the results of our R^2. As LV show, R^2 increases as we include other variables besides distance. The later only explains around 8% of the variation of the transport costs. In contrast when we add the other variables we explain an additional 38% of the variance of the transport cost.

Instead of looking directly at the ad valorem transport costs, we proceed to estimate the following Gravity equation:

$$M_{ij} = \psi \, GDP_i^{\psi_1} \, GDP_j^{\psi_2} \, t_{ij}^{\tau} \, \varepsilon_{ij} \tag{5}$$

Where bilateral imports (M_{ij}) depends on the income of the two countries, and on the level of transport costs. Taking logs, and replacing transport costs as defined by equation (3) we obtain the following expression:[20]

$$\tilde{M}_{ij} = \psi_0 + \psi_1 \, \tilde{GDP}_i + \psi_2 \, \tilde{GDP}_j + \tau \left[\tilde{\beta} x_{ij} + \tilde{\gamma}' \ln X_i + \tilde{\delta}' \ln X_j \right] + \eta_{ij} \tag{6}$$

Where τ is the transport cost elasticity. Since we know that vectors x_{ij}, X_i, and X_j are compose by bilateral and country specific variables, then equation that we want to estimate is given by the following specification:

$$\begin{aligned} \tilde{M}_{ij} = {} & \psi_0 + \psi_1 \, \tilde{GDP}_i + \psi_1 \, \tilde{GDP}_2 + \psi_3 \, \tilde{Dist}_{ij} + \psi_4 \, border_{ij} \\ & + \psi_5 \, isl_i + \psi_6 \, isl_j + \psi_7 \inf \tilde{a}_i + \psi_8 \inf \tilde{a}_j + \psi_9 \, \tilde{llock} \inf{}_i \\ & + \psi_{10} \, \tilde{llock} \inf{}_j + \psi_{11} \, \tilde{GDPperk}_i + \psi_{12} \, \tilde{GDPperk}_j + \eta_{ij} \end{aligned} \tag{7}$$

Where *border*, $isl, \inf$, $\tilde{llock}$, and *GDPperk* are the border dummy, the island dummy, LV infrastructure index, landlocked infrastructure index and GDP per capita, respectively. Table 2, shows the results obtained when we estimate equation (7) with the same data set used for transport costs. Again, all of our estimated coefficients have the correct sign, are statistically different from zero at 1%, and have similar values as the reported by LV. One difference has to be taken into account. The LV infrastructure index in our results is not as robust as the results presented by LV. In sum we obtain that an increase in the infrastructure index from the median to the 25th percentile increases imports in

The numbers are obtained from fourth column table 1, and from summary statistics of distance, and infrastructure level.

[18] Following LV, p. 460.

[19] Following LV, $964 = 1000 \left[1 - \exp\left(\frac{-1.492}{0.449} \right) \right]$. Coefficients where obtained from column four, table 1.

[20] In our notation ˜ means logarithm.

40%.[21] In terms of distance, the countries should need to be 655 km[22] closer to experience this level of imports. This implies that the effects of infrastructure on trade are very important.

In addition, we previously defined τ as the transport cost elasticity. As determined by equations (6) and (7), we have overidentifying restrictions to estimate the transport costs elasticity. Therefore, our estimates for τ can be given by two different procedures. First we can estimate τ with the ratio of corresponding estimates of the Gravity equation and the transport cost specifications (columns 1, 2), or we can estimate it using the predicted transport costs estimates obtained by equations (6) and (7).

Table 3 reports the results obtained with the first approach. As it is shown in column 3, the transport costs elasticity varies from -3.64 to -0.22. As explained by LV, the reason for this dispersion is given by the fact that "...some variables influence trade volumes by other channels different to transport costs; i.e. distance and border effects might be expected to influence trade volumes through information flows, language and cultural ties"[23] which are not taken into account in any of our specifications. That is the reason for our estimated parameter to tend to zero.[24]

On the other hand, table 4 reports the results obtained when following the second approach. Under this approach, instead of replacing the observed value of transport costs, we use their predicted values. This alternate approach enables us to directly estimate the transport cost elasticity under the specification established by equation (6). As shown, our transport cost elasticity varies from -0.20 up to -1.066. There are three important differences in our results with respect to LV. First, they are significant at 1%. Second, our results suggest that when controlling for GDP, developed countries trade more than non developed. We believe that this result is more realistic than the result obtained by LV (completely the opposite) since the most important share of trade is commercialized within developed economies. Third, the change observed in the coefficient of transport costs between columns one and two reinforce the hypothesis that transport costs affect trade by other channels different from transport costs. Summing up, we can state that transport cost elasticity ranges between -0.2 and -1.06. Therefore, an increase in the transport costs from the median to the third upper quartile, implies a decrease in trade volume of around 42%.[25]

As we have shown, infrastructure has an important role in increasing trade

[21] $40\% = \left(\frac{1.5162}{2.4937}\right)^{-0.2}$. As before, the ratio was obtained from the summary statistics of the infrastructure index, and the exponent is equal to the coefficient of the infrastructure index; column four, table 2.

[22] $655 = \exp(8.89431) * \left[1 - \left(\frac{1.5163}{2.4938}\right)^{\frac{-0.201}{-1.062}}\right]$

[23] LV, p. 464.

[24] Typical effect of an omitted variable bias.

[25] See summary statistics and results obtained in tables 3 and 4. $0.42 = \exp(0.11) * \left[1 - \left(\frac{0.11}{1.33625}\right)^{\frac{-0.2}{-1.066}}\right]$

and decreasing transport costs. In particular, there is a common belief that non developed trade level is lower than the trade achieved by developed economies. Following this approach, and subject to the results presented by LV, tables 5 and 6 show the results obtained when we include a set of three type of African dummy variables. We control for the case when one of the countries is an African country, and we control for when the two countries involved in trade are African countries.

Focusing on transport costs (table 5), we find that transport costs in African countries are 220%[26] higher than the rate experienced by the other countries in the sample. In addition, trade is initially 83% higher,[27] because intra trade within African countries is very high. But when we control for infrastructure, we find that transport costs in African countries are only 130%.[28] In terms of distance, once we have controlled for infrastructure, we find that transport costs of trade among African countries located within 1000 km of distance are 54%[29] higher than the costs of trade of other countries, and they increase up to 149% for trade among African countries within 3000 km of bilateral distance. In terms of trade, we find that controlling for infrastructure, trade within African countries is 87% higher.[30] Epitomizing, we estimate that transport costs for African countries are higher when the bilateral distance among them is higher than 371 km.[31] Additionally, trade among African countries is only higher when they share a common border, given that the critical distance has to be lower than 26 km.[32]

As previously mentioned, we proceeded to test the results obtained by LV using a panel for the period between 1990 and 2003. The results are discussed in the following section.

4.2. Extension, 1990-2003.

As shown, the central argument of LV is that the infrastructure level of countries help to decrease transport costs and increase trade. But, on several occasions the sign of the infrastructure variable is not the correct one (i.e. tables 2 and 5). We strongly believe the LV index is capturing the level of infrastructure within the country and is not capturing the infrastructure level that is supposed to. Therefore, we proceed to expand LV results in two ways. First, we expand the years contained in the data and we form a panel of bilateral imports for the period comprehended between 1990 and 2003. Then, following Micco (2004), and Micco and Serebrinzky (2005), we proceed to create two new infrastructure indexes that we believe are a best approximation of the level of infrastructure of ports per country. Finally, we introduce three new controls

[26] Is obtained by adding up the coefficients of African dummies in column 1 table 5.
[27] Is obtained by adding up the coefficients of African dummies in column 1 table 6.
[28] Is obtained by adding up the coefficients of African dummies in column 3 table 5.
[29] See table 5, column four. African 1000 result.
[30] See table 6, column four. African 1000 result.
[31] See table 5, column four. Critical distance result.
[32] See table 6, column four. Critical distance result.

in our specifications: common language, level of corruption, and rule of law. Taking advantage of the panel structure of the data, we control for year fixed effects, country i fixed effects and country j fixed effects.

So how robust is the LV infrastructure index? As table 7 shows, this variable is not a very good proxy for port infrastructure. In all the specifications, the variable is not statistically different from zero and, in addition, the sign associated with this variable is not the correct one; i.e. it should be positive.[33]

On the other hand, we find that common bilateral ties and political stabilities of countries have an important effect on transport costs. As shown in columns 2 through 6, common language and common border dummies always have the right sign, and they are significant at 1%. In addition, once they are introduced, they reduce the effect initially associated to bilateral distance. Columns 4 through 6 control for the political stability per country. As shown, countries with high level of corruption, or low level of law enforcement experience higher transport costs. This result is robust even when we control for both of them at same time.

Since LV index is not a good proxy, we proceed to test our two sets of new infrastructure indexes. As table 8A shows, our airport infrastructure index always has the correct sign, and is always significantly different from zero at 5%. In addition, we found that the closer the airport and the better the quality, the higher the reduction on transport costs are.

In addition, when we control for the country maritime port infrastructure, our results may prove to be more interesting. As table 8B shows, we found that countries with higher infrastructure levels of airports and maritime ports experience the highest transport cost reductions.

Following our results in table 7, we proceed to test the robustness of the new indexes even with the inclusion of the political stability channel. As table 9A and table 9B show, the results of both indexes are robust to the political stability indexes, and more important, the importance of the political stability variables remains unchanged; i.e. they have the right sign and are statistically significant.[34]

As Micco and Serebrinzky (2005) explained, transport costs for air shipments have been decreasing since the late 70's. The importance of this effect is very important as almost 35%[35] of cargo is moved by air. As they point out, one of the factors that influences the decrease in air transport costs is the establishment of bilateral open sky agreements (OSA). Following this approach, we performed a final robustness check of our previous results. As table 10 shows, our previous results are even robust to the inclusion of the OSA effect. As shown, the effects of the infrastructure indexes, political stability and common ties remain statistically significant and they all have the correct sign.

Following Micco and Serebrinzky (2005), we estimate that OSA reduce

[33] See equation (4).

[34] As a robustness exercise, in un-reported regressions we run the same specifications of tables 9A and 9B with all the other infrastructure indexes used in tables 8A and 8B. We found that our results are robust in any of this specifications.

[35] Micco and Serebrinzky (2005).

transport costs by 0.85%. However, we find that this effect is only achieved when both the importing and the exporting countries have signed an OSA between each other (columns 6-9).

5. Conclusions

Following Limao and Venables (2001) we use an ad-hoc empirical model to examine the possible determinants of transport costs. We replicate the results obtained by LV (tables 2, 3, 5, 6, 7 and 8), and we further submit their infrastructure variable to some robustness checks. We found that their index is not robust to additional specifications. Therefore, we proceed to use two additional measures of port infrastructures. One for airports, and one for ports. Controlling for quality, density, and population, we found that our measures are better proxies than the infrastructure index used by LV.

In addition, we proceed to estimate the effect of common bilateral ties, country political stability and open sky agreements on transport costs. We found that apart from distance; infrastructure, political stability, common bilateral ties and open sky agreements are other important channels through which transport costs can be reduced.

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Appendix A

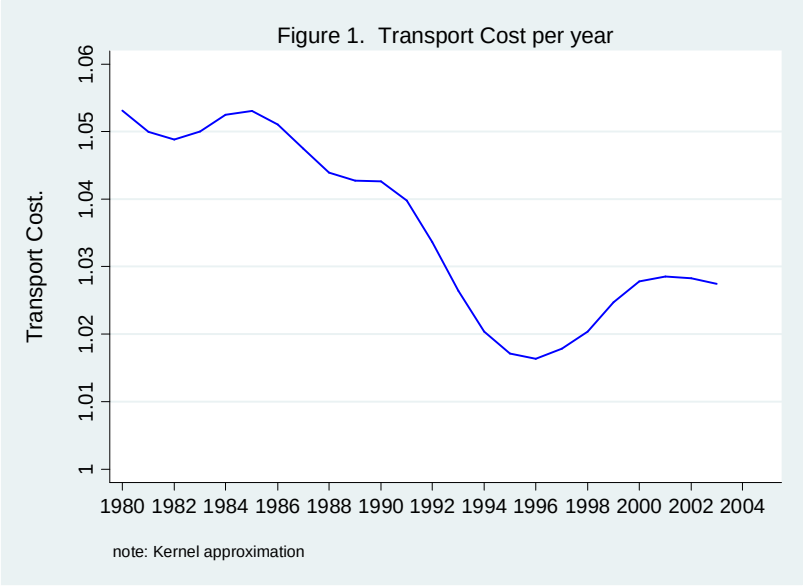
Figure 1. Transport Cost per year
Transport Cost.
1
1.01
1.02
1.03
1.04
1.05
1.06
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004
note: Kernel approximation

Appendix B

Table B1. Summary Statistics, 1990. Replica Limao and Venables (2001).

Variable	Mean	Std. Deviations	Percentile 25	Percentile 50	Percentile75
Imports*	2.3317	3.3268	0.2890	2.5919	4.6138
Transport Costs*	1.8055	1.7579	0.5322	1.2328	2.5460
Infrastructure*	1.1977	0.9709	0.4034	0.9044	1.7740
Infrastructure of Landlock*	0.2057	0.6645	0.0000	0.0000	0.0000
Bilateral Distance*	8.6851	0.8035	8.2895	8.8953	9.2518
Border Dummy	0.0358	0.1858	0.0000	0.0000	0.0000
Island Dummy	0.1635	0.3699	0.0000	0.0000	0.0000
Landlocked Dummy	0.1273	0.3333	0.0000	0.0000	0.0000
Africa dummy	0.2555	0.4362	0.0000	0.0000	1.0000
Bilateral Africa dummy	0.0876	0.2827	0.0000	0.0000	0.0000
Distance between African Countries*	0.6753	2.1929	0.0000	0.0000	0.0000
GDP	24.5410	2.0929	22.8067	24.5145	26.1863
GDP per Capita*	7.9419	1.6266	6.5864	7.8052	9.5215

Note: * In Logarithm.
Source:Own Authors Estimates.

Table B2. Summary Statistics, 1990 - 2003. Extension (2001).

Variable	Mean	Std. Deviations	Percentile 25	Percentile 50	Percentile75
Transport Costs*	2.0184	1.8675	0.6285	1.4633	2.8655
Infrastructure*	1.2816	1.0504	0.4672	0.9092	1.8606
Infrastructure of Landlock*	0.1524	0.5975	0.0000	0.0000	0.0000
Bilateral Distance*	8.5611	0.8574	8.0806	8.7643	9.1819
Border Dummy	0.0309	0.1729	0.0000	0.0000	0.0000
Island Dummy	0.2084	0.4062	0.0000	0.0000	0.0000
Landlocked Dummy	0.1547	0.3616	0.0000	0.0000	0.0000
Africa dummy	0.2524	0.4344	0.0000	0.0000	1.0000
Bilateral Africa dummy	0.0638	0.2444	0.0000	0.0000	0.0000
Distance between African Countries*	0.4935	1.8993	0.0000	0.0000	0.0000
GDP	23.8604	2.3211	22.2359	23.6311	25.5104
GDP per Capita*	7.8968	1.6023	6.5723	7.8761	9.3508

Note: * In Logarithm.
Source:Own Authors Estimates.

Appendix C

Table 1. The Bilateral Transport Cost Factor, 1990.
Dependent Variable: Transport Costs (ln.)

Variable	(1)	(2)	(3)	(4)
Bilateral Distance (ln.)	0.247	0.256	0.245	0.174
	(0.051)***	(0.055)***	(0.055)***	(0.060)***
Border Dummy		-0.934	-1.111	-1.492
		(0.232)***	(0.232)***	(0.235)***
Island Dummy, Import Cty.		0.106	0.268	0.362
		(0.104)	(0.107)**	(0.107)***
Island Dummy, Export Cty.		-0.193	-0.071	
		(0.107)*	(0.109)	
GDP per Capita, Import Cty. (ln.)		-0.489	-0.331	-0.374
		(0.024)***	(0.036)***	(0.036)***
GDP per Capita, Export Cty. (ln.)		-0.192	-0.093	
		(0.024)***	(0.037)**	
Infr. Index LV, Import Cty.			0.386	0.449
			(0.063)***	(0.064)***
Infr. Index LV, Export Cty.			0.245	
			(0.067)***	
Infr. Index Landlocked LV, Import Cty.			0.146	
			(0.131)	
Infr. Index Landlocked LV, Export Cty.			-0.177	-0.079
			(0.125)	(0.061)
Pseudo R-squared	0.0879	0.3673	0.3879	0.4682
Sigma	1.4927	1.4424	1.4359	1.4374
	Tobit	Tobit	Tobit	Tobit Parent Fixed Effects

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Note: The dependent variable of transport costs is defined as the ratio between the imports and the exports at CIF and FOB value.

Border Dummy is a dichotomic variable that takes the value of one if the countries share a common border, zero otherwise. Island Dummy, Import Cty. and Island Dummy, Export Cty. are dichotomic variables that take the value of one if the Importer or the Exporter countries are Islands, zero otherwise. Infr. Index LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables (2001). Infr.Index Landlocked LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables for countries that are landlocked. Sigma stands for the standard errors obtained in the Tobit estimates. Column four is estimated including Partner Fixed Effects. The Pseudo R-squared is given by the correlation between the actual endogenous variable and the predicted one.

Source: Replica Table 2, Limao Venables (2001).

Table 2. The Gravity model of Bilateral Imports, 1990.
Dependent Variable: Bilateral Imports (ln.)

Variable	(1)	(2)	(3)	(4)
GDP, Import Cty. (ln.)	0.718	0.690	0.674	0.703
	(0.010)***	(0.013)***	(0.013)***	(0.012)***
GDP, Export Cty. (ln.)	0.743	0.683	0.681	
	(0.010)***	(0.013)***	(0.014)***	
Bilateral Distance (ln.)	-0.911	-0.895	-0.893	-1.062
	(0.023)***	(0.027)***	(0.027)***	(0.026)***
Border Dummy		0.570	0.610	0.320
		(0.106)***	(0.107)***	(0.100)***
Island Dummy, Import Cty.		0.424	0.368	0.400
		(0.051)***	(0.053)***	(0.049)***
Island Dummy, Export Cty.		0.406	0.418	
		(0.053)***	(0.055)***	
GDP per Capita, Import Cty. (ln.)		0.060	0.035	0.027
		(0.016)***	(0.020)*	(0.019)
GDP per Capita, Export Cty. (ln.)		0.115	0.146	
		(0.016)***	(0.021)***	
Infr. Index LV, Import Cty.			-0.217	-0.201
			(0.119)*	(0.109)*
Infr. Index LV, Export Cty.			0.055	
			(0.023)**	
Infr. Index Landlocked LV, Import Cty.			-0.281	-0.302
			(0.069)***	(0.063)***
Infr. Index Landlocked LV, Export Cty.			-0.256	
			(0.071)***	
Pseudo R-squared	0.817	0.8271	0.8288	0.8615
Sigma	1.1290	1.1147	1.1122	1.0594
	Tobit	Tobit	Tobit	Tobit Parent Fixed Effects

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Note: The dependent variable is bilateral Imports.

Border Dummy is a dichotomic variable that takes the value of one if the countries share a common border, zero otherwise. Island Dummy, Import Cty. and Island Dummy, Export Cty. are dichotomic variables that take the value of one if the Importer or the Exporter countries are Islands, zero otherwise. Infr. Index LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables (2001). Infr.Index Landlocked LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables for countries that are landlocked. Sigma stands for the standard errors obtained in the Tobit estimates. Column four is estimated including Partner Fixed Effects. The Pseudo R-squared is given by the correlation between the actual endogenous variable and the predicted one.

Source: Replica Table 3, Limao Venables (2001).

Table 3. Estimates of Import Elasticity with Respect to the Transport Cost Factor, 1990.

		Elasticity	
Variable	Gravity	CIF / FOB	Trade
Bilateral Distance (ln.)	-0.8928	0.2449	-3.6451
Infrastructure of partner's transit country	-0.2555	0.1462	-1.7474
Transit Country Infrastructure	-0.2813	-0.1770	-1.5894
Import Country Infrastructure (ln)	-0.2173	0.3864	-0.5623
Common Border	0.6104	-1.1109	-0.5495
Partner Country Infrastructure (ln)	0.0550	0.2447	-0.2248

Gravity elasticities correspond to the estimates in column 3 Table 2.
CIF/FOB elasticities correspond to the estimates in column 3 Table 1.
Trade elasticities corresond to the ratio of Gravity and CIF/FOB estimates.
Source: Replica Table 5, Limao and Venables (2001)

Table 4. Trade Volumes and Predicted Import Costs, 1990.
Dependent Variable: Bilateral Imports (ln.)

Variable	Based on Full Model	Based on Fixed Effect Model
Transport Cost Factor (estimated)	-0.020	-1.066
	(0.070)	(0.096)***
GDP, Import Cty. (ln.)	0.679	-0.016
	(0.013)***	(0.066)
GDP, Export Cty. (ln.)	0.675	
	(0.013)***	
GDP per Capita, Import Cty. (ln.)	0.073	-0.013
	(0.036)**	(0.017)
GDP per Capita, Export Cty. (ln.)	0.128	
	(0.021)***	
Distance (ln.)	-0.831	-0.109
	(0.033)***	(0.087)
Border Dummy	0.560	-0.329
	(0.125)***	(0.113)***
Pseudo R-squared	0.8216	0.8615
Sigma	1.2598	1.1222
	Tobit	Tobit

Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Endogenous variable is bilateral Imports. Transport Cost Factor, is an estimate of transport costs obtained from column 2 and column 4 of table 2.

Model. The Pseudo R-squared is given by the correlation between the actual endogenous variable and the predicted one.

Source: Replica, Table 6. Limao and Venables (2001)

Table 5. Transport costs of Sub-Saharan African Countries, 1990.
Dependent Variable: Bilateral Transport Costs (ln.)

Variable	(1)	(2)	(3)	(4)
Bilateral Distance (ln.)	0.325	0.306	0.292	0.270
	(0.059)***	(0.059)***	(0.059)***	(0.060)***
Border Dummy	-1.077	-0.912	-1.180	-1.010
	(0.235)***	(0.248)***	(0.238)***	(0.249)***
Island Dummy, Import Cty.	0.216	0.215	0.276	0.279
	(0.106)**	(0.106)**	(0.110)**	(0.110)**
Island Dummy, Export Cty.	-0.131	-0.122	-0.039	-0.027
	(0.110)	(0.110)	(0.112)	(0.112)
GDP per Capita, Import Cty. (ln.)	-0.406	-0.410	-0.352	-0.353
	(0.028)***	(0.028)***	(0.037)***	(0.037)***
GDP per Capita, Export Cty. (ln.)	-0.159	-0.162	-0.079	-0.080
	(0.028)***	(0.028)***	(0.037)**	(0.037)**
Infr. Index LV, Import Cty.			0.195	0.201
			(0.072)***	(0.072)***
Infr. Index LV, Export Cty.			0.246	0.255
			(0.077)***	(0.077)***
Infr. Index Landlocked LV, Import Cty.			-0.279	-0.264
			(0.128)**	(0.128)**
Infr. Index Landlocked LV, Export Cty.			0.167	0.167
			(0.136)	(0.136)
African Import Cty., Dummy. (a)	0.787	0.788	0.704	0.700
	(0.111)***	(0.110)***	(0.121)***	(0.121)***
African Export Cty., Dummy. (b)	0.273	0.276	0.053	0.049
	(0.124)**	(0.124)**	(0.139)	(0.139)
Pairwise African Cty., Dummy. (c)	0.110	-3.036	0.073	-3.337
	(0.215)	(1.510)**	(0.215)	(1.511)**
Inter. Pairwise African Cty. And Bilateral Distance (ln.) (d)		0.404		0.437
		(0.192)**		(0.192)**
Pseudo R-squared	0.404	0.4057	0.4119	0.4138
Sigma	1.4624	1.4618	1.4597	1.4591
Africa Factor	3.2206		2.2916	
Africa 1000 km		2.2643		1.5420
Africa 3000 km		3.5286		2.4933
Critical Distance		132.1482		371.4836
	Tobit	Tobit	Tobit	Tobit

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Dependent Variable: Bilateral Transport Costs. Border Dummy is a dichotomic variable that takes the value of one if the countries share a common border, zero otherwise. Island Dummy, Import Cty. and Island Dummy, Export Cty. are dichotomic variables that take the value of one if the Importer or the Exporter countries are Islands, zero otherwise. Infr. Index LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables (2001). Infr.Index Landlocked LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables for countries that are landlocked. Sigma stands for the standard errors obtained in the Tobit estimates. The Pseudo R-squared is given by the correlation between the actual endogenous variable and the predicted one.

African Factor is given by: exp(a + b + c).
African 1000 km is given by: exp(a + b + c + d*ln(1000)).
African 3000 km is given by: exp(a + b + c + d*ln(3000)).
Critical Distance is given by solving the following formula: 1 - exp(a + b + c + d*ln(x))=0.
Source: Replica Table 7, Limao and Venables (2001).

Table 6. The Gravity Models for Sub-Saharan African Countries, 1990.
Dependent Variable: Bilateral Imports (ln.)

Variable	(1)	(2)	(3)	(4)
GDP, Import Cty. (ln.)	0.692	0.692	0.682	0.682
	(0.014)***	(0.014)***	(0.014)***	(0.014)***
GDP, Export Cty. (ln.)	0.691	0.691	0.690	0.690
	(0.013)***	(0.013)***	(0.014)***	(0.014)***
Bilateral Distance (ln.)	-0.852	-0.853	-0.852	-0.852
	(0.027)***	(0.027)***	(0.027)***	(0.027)***
Border Dummy	0.440	0.445	0.472	0.470
	(0.106)***	(0.110)***	(0.107)***	(0.111)***
Island Dummy, Import Cty.	0.401	0.401	0.360	0.360
	(0.051)***	(0.051)***	(0.052)***	(0.052)***
Island Dummy, Export Cty.	0.391	0.392	0.402	0.402
	(0.052)***	(0.052)***	(0.053)***	(0.053)***
GDP per Capita, Import Cty. (ln.)	0.064	0.064	0.047	0.047
	(0.017)***	(0.017)***	(0.020)**	(0.020)**
GDP per Capita, Export Cty. (ln.)	0.121	0.121	0.156	0.156
	(0.017)***	(0.017)***	(0.020)***	(0.020)***
Infr. Index LV, Import Cty.			-0.054	-0.055
			(0.037)	(0.037)
Infr. Index LV, Export Cty.			0.120	0.120
			(0.038)***	(0.038)***
Infr. Index Landlocked LV, Import Cty.			-0.283	-0.284
			(0.069)***	(0.069)***
Infr. Index Landlocked LV, Export Cty.			-0.264	-0.264
			(0.072)***	(0.072)***
African Import Cty., Dummy. (a)	-0.230	-0.230	-0.148	-0.148
	(0.059)***	(0.059)***	(0.064)**	(0.064)**
African Export Cty., Dummy. (b)	-0.167	-0.167	-0.213	-0.213
	(0.059)***	(0.059)***	(0.065)***	(0.065)***
Pairwise African Cty., Dummy. (c)	1.000	0.847	0.985	1.058
	(0.116)***	(0.859)	(0.116)***	(0.858)
Inter. Pairwise African Cty. And Bilateral Distance (ln.) (d)		0.020		-0.010
		(0.112)		(0.112)
Pseudo R-squared	0.8301	0.8301	0.8319	0.8319
Sigma	1.2322	1.2322	1.2264	1.2264
Africa Factor	1.8259		1.8664	
Africa 1000 km		1.8020		1.8784
Africa 3000 km		1.8424		1.8588
Critical Distance		14.6759		26.0234
	Tobit	Tobit	Tobit	Tobit

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Dependent Variable: Bilateral Imports. Border Dummy is a dichotomic variable that takes the value of one if the countries share a common border, zero otherwise. Island Dummy, Import Cty. and Island Dummy, Export Cty. are dichotomic variables that take the value of one if the Importer or the Exporter countries are Islands, zero otherwise. Infr. Index LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables (2001). Infr.Index Landlocked LV for Import and Export Cty. are the Infrastructure indexes developed by Limao and Venables for countries that are landlocked. Sigma stands for the standard errors obtained in the Tobit estimates. The Pseudo R-squared is given by the correlation between the actual endogenous variable and the predicted one.

African Factor is given by: exp(a + b + c).

African 1000 km is given by: exp(a + b + c + d*ln(1000)).

African 3000 km is given by: exp(a + b + c + d*ln(3000)).

Critical Distance is given by solving the following formula: 1 - exp(a + b + c + d*ln(x))=0.

Source: Replica Table 8, Limao and Venables (2001).

Table 7. Transport Costs and Infrastructure Index, 1990 - 2003.
Endogenous Variable: Bilateral Transport Costs (ln.).

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Bilateral Distance (ln.)	0.528	0.443	0.444	0.449	0.450	0.450
	(0.009)***	(0.011)***	(0.011)***	(0.011)***	(0.011)***	(0.011)***
GDP, Import Cty. (ln.)		-0.875	-0.885	-0.938	-0.959	-0.967
		(0.149)***	(0.149)***	(0.150)***	(0.150)***	(0.150)***
GDP, Export Cty. (ln.)		-0.642	-0.647	-0.691	-0.657	-0.675
		(0.160)***	(0.160)***	(0.160)***	(0.161)***	(0.161)***
GDP per Capita, Import Cty. (ln.)		0.880	0.891	0.937	0.961	0.968
		(0.148)***	(0.148)***	(0.149)***	(0.149)***	(0.149)***
GDP per Capita, Export Cty. (ln.)		0.347	0.352	0.416	0.364	0.401
		(0.161)**	(0.161)**	(0.162)**	(0.162)**	(0.163)**
Commun Language, Dummy		-0.519	-0.519	-0.522	-0.513	-0.513
		(0.026)***	(0.026)***	(0.026)***	(0.027)***	(0.027)***
Commun Border, Dummy		-0.328	-0.328	-0.321	-0.322	-0.322
		(0.042)***	(0.042)***	(0.042)***	(0.042)***	(0.042)***
Infr. Index LV, Import Cty.			0.149	0.136	0.144	0.145
			(0.108)	(0.109)	(0.111)	(0.111)
Infr. Index LV, Export Cty.			-0.052	-0.082	-0.135	-0.122
			(0.111)	(0.112)	(0.114)	(0.114)
Rule of Law, Import Cty.				-0.023		0.001
				(0.057)		(0.068)
Rule of Law, Export Cty.				-0.178		-0.145
				(0.060)***		(0.069)**
Control of Corruption, Import Cty.					-0.012	-0.012
					(0.049)	(0.054)
Control of Corruption, Export Cty.					-0.158	-0.106
					(0.051)***	(0.056)*
Observations	94387	94387	94387	91930	90777	90777
R-squared	0.2718	0.2763	0.2763	0.2806	0.2802	0.2803
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Import Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Export Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%
Source: Student own estimates.

Table 8A. Transport Cost, Infrastructure Index 1990 - 2003.
Endogenous Variable: Bilateral Transport Cost

Variable	(1)	(2)	(3)	(4)	(5)
Bilateral Distance (ln.)	0.444	0.450	0.450	0.450	0.450
	(0.011)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
GDP, Import Cty. (ln.)	-0.885	-0.901	-0.909	-0.905	-0.914
	(0.149)***	(0.159)***	(0.159)***	(0.159)***	(0.159)***
GDP, Export Cty. (ln.)	-0.647	-0.614	-0.616	-0.609	-0.613
	(0.160)***	(0.167)***	(0.166)***	(0.167)***	(0.166)***
GDP per Capita, Import Cty. (ln.)	0.891	0.917	0.924	0.921	0.929
	(0.148)***	(0.157)***	(0.157)***	(0.157)***	(0.157)***
GDP per Capita, Export Cty. (ln.)	0.352	0.314	0.315	0.309	0.313
	(0.161)**	(0.168)*	(0.168)*	(0.168)*	(0.168)*
Commun Language, Dummy	-0.519	-0.530	-0.529	-0.529	-0.529
	(0.026)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***
Commun Border, Dummy	-0.328	-0.326	-0.326	-0.326	-0.326
	(0.042)***	(0.043)***	(0.043)***	(0.043)***	(0.043)***
Infr. Index LV, Import Cty.	0.149				
	(0.108)				
Infr. Index LV, Export Cty.	-0.052				
	(0.111)				
Infr. Index Airp. 50 - 20, Import Cty. (ln.)		-0.488			
		(0.173)***			
Infr. Index Airp. 50 - 20, Export Cty. (ln.)		-0.333			
		(0.206)			
Infr. Index Airp. 75 - 20, Import Cty. (ln.)			-0.306		
			(0.153)**		
Infr. Index Airp. 75 - 20, Export Cty. (ln.)			-0.296		
			(0.176)*		
Infr. Index Airp. 50 - 25, Import Cty. (ln.)				-0.404	
				(0.204)**	
Infr. Index Airp. 50 - 25, Export Cty. (ln.)				-0.426	
				(0.241)*	
Infr. Index Airp. 75 - 25, Import Cty. (ln.)					-0.236
					(0.180)
Infr. Index Airp. 75 - 25, Export Cty. (ln.)					-0.352
					(0.205)*
Observations	94387	86458	86458	86458	86458
R-squared	0.2763	0.2738	0.2737	0.2738	0.2737
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Import Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes
Export Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Infr. Index LV stands for Limao Venables (2001) infrastructure Index.

Infr. Index Airp. 50 - 20, Infr. Index Airp. 75 - 20, Infr. Index Airp. 50 - 25, Infr. Index Airp. 75 - 25 meassures the airport infrastructure per country, Importer and Exporter. See Appendix C for further explanation.

Source: Student own estimates.

Table 8B. Transport Cost, Infrastructure Index 1990 - 2003.
Endogenous Variable: Bilateral Transport Cost

Variable	(1)	(2)	(3)	(4)	(5)
Bilateral Distance (ln.)	0.444	0.450	0.450	0.450	0.450
	(0.011)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
GDP, Import Cty. (ln.)	-0.885	-0.919	-0.927	-0.923	-0.932
	(0.149)***	(0.159)***	(0.159)***	(0.159)***	(0.159)***
GDP, Export Cty. (ln.)	-0.647	-0.615	-0.615	-0.611	-0.616
	(0.160)***	(0.169)***	(0.169)***	(0.169)***	(0.169)***
GDP per Capita, Import Cty. (ln.)	0.891	0.934	0.940	0.936	0.943
	(0.148)***	(0.158)***	(0.158)***	(0.158)***	(0.158)***
GDP per Capita, Export Cty. (ln.)	0.352	0.313	0.313	0.309	0.314
	(0.161)**	(0.171)*	(0.170)*	(0.171)*	(0.170)*
Commun Language, Dummy	-0.519	-0.529	-0.529	-0.529	-0.529
	(0.026)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***
Commun Border, Dummy	-0.328	-0.327	-0.327	-0.327	-0.327
	(0.042)***	(0.043)***	(0.043)***	(0.043)***	(0.043)***
Infr. Index LV, Import Cty.	0.149				
	(0.108)				
Infr. Index LV, Export Cty.	-0.052				
	(0.111)				
Infr. Index Airp. 50 - 20, Import Cty. (ln.)		-1.581			
		(0.505)***			
Infr. Index Airp. 50 - 20, Export Cty. (ln.)		-0.553			
		(0.542)			
Infr. Index Airp. & Port 50 - 20, Import Cty. (ln.)		-0.042			
		(0.019)**			
Infr. Index Airp. & Port 50 - 20, Export Cty. (ln.)		-0.008			
		(0.020)			
Infr. Index Airp. 75 - 20, Import Cty. (ln.)			-1.064		
			(0.401)***		
Infr. Index Airp. 75 - 20, Export Cty. (ln.)			-0.389		
			(0.406)		
Infr. Index Airp. & Port 75 - 20, Import Cty. (ln.)			-0.030		
			(0.015)**		
Infr. Index Airp. & Port 75 - 20, Export Cty. (ln.)			-0.004		
			(0.015)		
Infr. Index Airp. 50 - 25, Import Cty. (ln.)				-1.354	
				(0.524)***	
Infr. Index Airp. 50 - 25, Export Cty. (ln.)				-0.602	
				(0.562)	
Infr. Index Airp. & Port 50 - 25, Import Cty. (ln.)				-0.043	
				(0.021)**	
Infr. Index Airp. & Port 50 - 25, Export Cty. (ln.)				-0.008	
				(0.023)	
Infr. Index Airp. 75 - 25, Import Cty. (ln.)					-0.969
					(0.414)**
Infr. Index Airp. 75 - 25, Export Cty. (ln.)					-0.452
					(0.418)
Infr. Index Airp. & Port 75 - 25, Import Cty. (ln.)					-0.034
					(0.017)**
Infr. Index Airp. & Port 75 - 25, Export Cty. (ln.)					-0.004
					(0.018)
Observations	94387	86458	86458	86458	86458
R-squared	0.2763	0.2738	0.2738	0.2738	0.2738
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Import Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes
Export Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Infr. Index LV stands for Limao Venables (2001) infrastructure Index.

Infr. Index Airp. 50 - 20, Infr. Index Airp. 75 - 20, Infr. Index Airp. 50 - 25, Infr. Index Airp. 75 - 25 meassures the airport infrastructure per country, Importer and Exporter.

Infr. Index Airp. & Port 50 - 20, Infr. Index Airp. & Port 75 - 20, Infr. Index Airp. & Port 50 - 25, Infr. Index Airp. & Port 75 - 25 accounts for the airport and port country infrastructure index, importer and exporter.

See Appendix C for further explanation.

Source: Student own estimates.

Table 9A. Transport Cost, Infrastructure Index and Corruption 1990 - 2003.
Endogenous Variable: Bilateral Transport Cost

Variable	(1)	(2)	(3)	(4)
Bilateral Distance (ln.)	0.450	0.449	0.450	0.450
	(0.012)***	(0.012)***	(0.012)***	(0.012)***
GDP, Import Cty. (ln.)	-0.901	-0.928	-0.946	-0.953
	(0.159)***	(0.159)***	(0.160)***	(0.160)***
GDP, Export Cty. (ln.)	-0.614	-0.643	-0.593	-0.617
	(0.167)***	(0.167)***	(0.167)***	(0.168)***
GDP per Capita, Import Cty. (ln.)	0.917	0.940	0.964	0.968
	(0.157)***	(0.158)***	(0.158)***	(0.159)***
GDP per Capita, Export Cty. (ln.)	0.314	0.364	0.295	0.341
	(0.168)*	(0.169)**	(0.169)*	(0.170)**
Commun Language, Dummy	-0.530	-0.538	-0.528	-0.528
	(0.028)***	(0.028)***	(0.028)***	(0.028)***
Commun Border, Dummy	-0.326	-0.328	-0.330	-0.330
	(0.043)***	(0.043)***	(0.043)***	(0.043)***
Infr. Index Airp. 50 - 20, Import Cty. (ln.)	-0.488	-0.590	-0.553	-0.560
	(0.173)***	(0.176)***	(0.179)***	(0.180)***
Infr. Index Airp. 50 - 20, Export Cty. (ln.)	-0.333	-0.266	-0.352	-0.316
	(0.206)	(0.209)	(0.211)*	(0.211)
Rule of Law, Import Cty.		-0.000		0.018
		(0.059)		(0.071)
Rule of Law, Export Cty.		-0.199		-0.167
		(0.062)***		(0.072)**
Control of Corruption, Import Cty.			-0.007	-0.012
			(0.051)	(0.056)
Control of Corruption, Export Cty.			-0.167	-0.109
			(0.052)***	(0.057)*
Observations	86458	85683	84580	84580
R-squared	0.2738	0.2753	0.2751	0.2751
Year Fixed Effects	Yes	Yes	Yes	Yes
Import Cty. Fixed Effects	Yes	Yes	Yes	Yes
Export Cty. Fixed Effects	Yes	Yes	Yes	Yes

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Note: Infr. Index Airp. 50 - 20 meassures the airport infrastructure per country, Importer and Exporter. See appendix C for futher explanation.
Source: Own Student estimations.

Table 9B. Transport Cost, Infrastructure Index and Corruption 1990 - 2003.
Endogenous Variable: Bilateral Transport Cost

Variable	(1)	(2)	(3)	(4)
Bilateral Distance (ln.)	0.450	0.448	0.450	0.449
	(0.012)***	(0.012)***	(0.012)***	(0.012)***
GDP, Import Cty. (ln.)	-0.919	-0.942	-0.965	-0.971
	(0.159)***	(0.160)***	(0.161)***	(0.161)***
GDP, Export Cty. (ln.)	-0.615	-0.650	-0.599	-0.624
	(0.169)***	(0.170)***	(0.170)***	(0.171)***
GDP per Capita, Import Cty. (ln.)	0.934	0.953	0.982	0.985
	(0.158)***	(0.159)***	(0.159)***	(0.160)***
GDP per Capita, Export Cty. (ln.)	0.313	0.369	0.299	0.345
	(0.171)*	(0.172)**	(0.171)*	(0.173)**
Commun Language, Dummy	-0.529	-0.538	-0.528	-0.528
	(0.028)***	(0.028)***	(0.028)***	(0.028)***
Commun Border, Dummy	-0.327	-0.328	-0.330	-0.330
	(0.043)***	(0.043)***	(0.043)***	(0.043)***
Infr. Index Airp. 50 - 20, Import Cty. (ln.)	-1.581	-1.475	-1.450	-1.449
	(0.505)***	(0.506)***	(0.509)***	(0.510)***
Infr. Index Airp. 50 - 20, Export Cty. (ln.)	-0.553	-0.538	-0.579	-0.565
	(0.542)	(0.544)	(0.546)	(0.546)
Infr. Index Airp. & Port 50 - 20, Import Cty. (ln.)	-0.042	-0.035	-0.035	-0.035
	(0.019)**	(0.019)*	(0.019)*	(0.019)*
Infr. Index Airp. & Port 50 - 20, Export Cty. (ln.)	-0.008	-0.011	-0.009	-0.010
	(0.020)	(0.020)	(0.020)	(0.020)
Rule of Law, Import Cty.		-0.002		0.021
		(0.059)		(0.071)
Rule of Law, Export Cty.		-0.199		-0.166
		(0.062)***		(0.072)**
Control of Corruption, Import Cty.			-0.008	-0.015
			(0.051)	(0.056)
Control of Corruption, Export Cty.			-0.168	-0.110
			(0.052)***	(0.057)*
Observations	86458	85683	84580	84580
R-squared	0.2738	0.2753	0.2751	0.2751
Year Fixed Effects	Yes	Yes	Yes	Yes
Import Cty. Fixed Effects	Yes	Yes	Yes	Yes
Export Cty. Fixed Effects	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Infr. Index Airp. 50 - 20 meassures the airport infrastructure index per country, Importer and Exporter.
Infr. Index Airp. & Port meassures the airport and port infrastructure index poer country, Importer and Exporter.
See appendix C for futher explanation.

Source: Own Student estimations.

Table 10. Transport Cost, Infrastructure Index, Corruption and Open Sky Agreements, Infrastructure Index 1990 - 2003.
Endogenous Variable: Bilateral Transport Cost.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bilateral Distance (ln.)	0.450	0.449	0.448	0.450	0.449	0.448	0.447	0.448	0.448
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
GDP, Import Cty. (ln.)	-0.919	-0.917	-0.941	-0.967	-0.973	-0.899	-0.924	-0.949	-0.956
	(0.159)***	(0.159)***	(0.160)***	(0.161)***	(0.161)***	(0.160)***	(0.160)***	(0.161)***	(0.161)***
GDP, Export Cty. (ln.)	-0.615	-0.613	-0.650	-0.593	-0.621	-0.641	-0.679	-0.625	-0.653
	(0.169)***	(0.170)***	(0.171)***	(0.171)***	(0.172)***	(0.170)***	(0.170)***	(0.171)***	(0.171)***
GDP per Capita, Import Cty. (ln.)	0.934	0.930	0.951	0.982	0.986	0.912	0.935	0.964	0.970
	(0.158)***	(0.158)***	(0.159)***	(0.159)***	(0.160)***	(0.158)***	(0.159)***	(0.159)***	(0.160)***
GDP per Capita, Export Cty. (ln.)	0.313	0.309	0.369	0.293	0.342	0.332	0.394	0.319	0.370
	(0.171)*	(0.171)*	(0.172)**	(0.172)*	(0.173)**	(0.171)*	(0.172)**	(0.172)*	(0.173)**
Commun Language, Dummy	-0.529	-0.529	-0.538	-0.529	-0.528	-0.529	-0.538	-0.528	-0.528
	(0.028)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***
Commun Border, Dummy	-0.327	-0.327	-0.328	-0.330	-0.330	-0.322	-0.324	-0.326	-0.325
	(0.043)***	(0.043)***	(0.043)***	(0.043)***	(0.043)***	(0.043)***	(0.043)***	(0.043)***	(0.043)***
Infr. Index Airp. 50 - 20, Import Cty. (ln.)	-1.581	-1.520	-1.421	-1.391	-1.389	-1.502	-1.403	-1.377	-1.371
	(0.505)***	(0.506)***	(0.507)***	(0.510)***	(0.511)***	(0.507)***	(0.508)***	(0.510)***	(0.511)***
Infr. Index Airp. 50 - 20, Export Cty. (ln.)	-0.553	-0.537	-0.521	-0.577	-0.555	-0.473	-0.460	-0.504	-0.487
	(0.542)	(0.543)	(0.546)	(0.548)	(0.548)	(0.542)	(0.545)	(0.546)	(0.546)
Infr. Index Airp. & Port 50 - 20, Import Cty. (ln.)	-0.042	-0.041	-0.034	-0.034	-0.034	-0.041	-0.034	-0.035	-0.034
	(0.019)**	(0.019)**	(0.019)*	(0.019)*	(0.019)*	(0.019)**	(0.019)*	(0.019)*	(0.019)*
Infr. Index Airp. & Port 50 - 20, Export Cty. (ln.)	-0.008	-0.008	-0.010	-0.009	-0.010	-0.008	-0.010	-0.009	-0.009
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Dummy OSA., Import Cty		-0.043	-0.037	-0.040	-0.040	0.020	0.026	0.019	0.021
		(0.028)	(0.028)	(0.028)	(0.028)	(0.031)	(0.031)	(0.031)	(0.031)
Dummy OSA., Export Cty		-0.014	-0.015	-0.004	-0.010				
		(0.027)	(0.027)	(0.027)	(0.027)				
Marginal OSA.						-0.173	-0.173	-0.164	-0.168
						(0.037)***	(0.037)***	(0.037)***	(0.037)***

Rule of Law, Import Cty.			-0.007		0.014		-0.011		0.008
			(0.060)		(0.071)		(0.060)		(0.071)
Rule of Law, Export Cty.			-0.201		-0.168		-0.209		-0.180
			(0.062)***		(0.072)**		(0.062)***		(0.072)**
Control of Corruption, Import Cty.				-0.007	-0.011			-0.005	-0.007
				(0.051)	(0.056)			(0.051)	(0.056)
Control of Corruption, Export Cty.				-0.168	-0.109			-0.165	-0.102
				(0.052)***	(0.057)*			(0.052)***	(0.057)*
OSA Effect	86458	86458	85683	84580	84580	86458	85683	84580	84580
Observations	0.2738	0.2739	0.2753	0.2751	0.2752	0.2740	0.2755	0.2753	0.2753
R-squared	0.2701	0.2701	0.2714	0.2713	0.2714	0.2703	0.2716	0.2715	0.2716
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Import Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Export Cty. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Infr. Index Airp. 50 - 20 meassures the airport infrastructure index per country, Importer and Exporter.

Infr. Index Airp. & Port meassures the airport and port infrastructure index poer country, Importer and Exporter. Dummy OSA is a dichotomic variables that takes value of one if country sign an open sky agreement. See appendix C for futher explanation.

Source: Own Student estimations.