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Infrastructure, Competition Regimes and Air Transport Costs: Cross Country Evidence

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First Version: March 2004

Abstract:

The relevance of transport costs has increased as liberalization continues to reduce artificial barriers to trade. Countries need to adopt policies to "get closer" to global markets. Can improvements in infrastructure and regulation reduce transport costs? Is it worthwhile to implement policies designed to increase competition in transport markets? Focusing on air transport, which has increased its share in US imports from 24% in 1990 to 35% in 2000, this paper quantifies the effects of infrastructure, regulatory quality and liberalization of air cargo markets on transport costs. During the 1990s, the US implemented a series of Open Skies Agreements, providing a unique opportunity to assess the effect that a change in the competition regime has on prices. We find that infrastructure, quality of regulation and competition matter. In our sample, an improvement in airport infrastructure from the 25th to 75th percentiles reduces air transport costs 15 percent. A similar improvement in the quality of regulation reduces air transport costs 14 percent. Besides, Open Skies Agreements further reduces air transport costs 8 percent.

Keywords: Infrastructure, Transport costs, air transport liberalization, regulatory quality.

JEL Classification: [F4], [L4], [L9]

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2 We thank Danielken Molina for valuable research assistance.

I. Introduction

There is a close relationship between trade costs and the capacity of a country to increase its exports and to integrate in the world economy. The relevance of transport costs, as a component of trade costs, has been increasing as liberalization continues to reduce artificial barriers to trade. In many cases, the effective rate of protection provided by transport costs is higher than the one provided by tariffs (Clark et al., 2002; Hummels, 1999).

One of the most important and evident components of transport costs is distance. In its simplest formulation, the successful gravity model for trade, introduced by Linnemmann (1966), states that bilateral trade flows depend positively on the product of the GDPs of both economies and negatively on the distance between them, which stands for bilateral transport costs. The impact of distance on countries' volume of trade is significant: recent estimates of the elasticity of trade volumes with respect to distance indicate that when distance increases by 10 percent, the volume of trade is reduced between 9 and 15 percent (Overman et al., 2003).[3]

However, in addition to distance, many other elements influence transport costs. As explained by Limão and Venables (2001), transport costs and trade volumes depend on many complex details of geography, infrastructure, administrative barriers and the state of competition in the transport industry. Provided that distance and infrastructure related costs are major determinants of the success of a country's export sector, immediate questions arise: what can governments do to "get closer" to markets with high import demand? Can improvements in infrastructure and regulation reduce transport costs? Is it worthwhile to implement policies designed to increase competition in transport markets? Do these policies have a quantifiable impact on transport costs?

Not many papers have tried to estimate the impact on transport costs of policies that improve the quality of regulation and infrastructure or implement new competition regimes. Focusing on infrastructure and using data from maritime shipping companies, Limão and Venables (2001) show that poor infrastructure accounts for more than 40% of predicted transport costs. In a study specific to the port sector, Clark et al. (2002) show that an improvement in port efficiency from the 25^{th} to the 75^{th} percentile reduces shipping costs by more than 12 percent.[4] Fink et al. (2002) argue that both public policies, like restrictions on the provision of port services, and private practices—collusive carrier arrangements—exercise a significant influence on maritime transport costs. A policy implication derived from their estimation is the need to pursue attempts to break up international cartels in this market.[5] Because their data do not include a change in the intensity of competition in the market (i.e., from cartel to non-collusive behavior) they cannot estimate the effects on transport costs of a change in the competition regime.

The aim of this paper is to close this gap in the literature. In particular, we estimate the effects of infrastructure, quality of regulation and changes in the competition regime on air transport costs. We focus exclusively on air transport costs due to its increasing importance as a transport mode, the availability of detailed micro data for US imports and the recent change in competition regimes introduced by open skies agreements.

The advent of wide-body aircrafts in the 1970s made available large volumes of belly space available. Being able to accept palletized or containerized freight, airlines began addressing the air cargo market more aggressively. As the evolution and design of aircrafts made it possible to carry more cargo in an efficient manner, dedicated cargo airlines entered this market.[6]

The size of the airfreight and express market worldwide is approximately USD 75 billion, and during the 1990s this market grew at an average rate of 6% per year.[7] The geographic distribution of the revenue generated in the air cargo and air passenger markets are similar, explaining in the US almost 40 % of total revenue. In the United States, as indicated by Figure 1, the value of air shipments relative to the aggregate value of air and vessel shipments increased from 24% in 1990 to 35% in 2000. The drastic drop

3 Deardorff (1984) surveys the early work on this subject.

4 Clark et al (2004) show that reductions in country inefficiencies associated to transport costs from the 25th to 75th percentiles imply an increase in bilateral trade of around 25 percent.

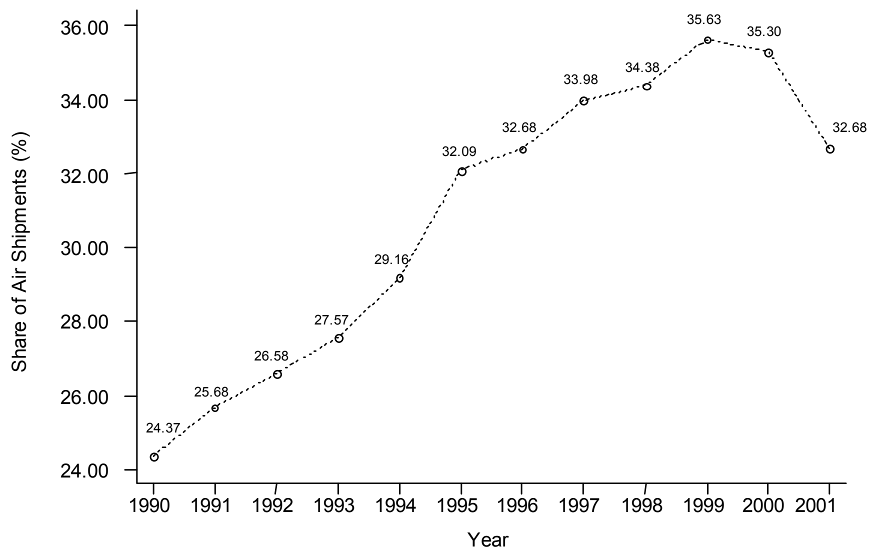
5 Clark et al. (2002) show that their results are not robust to the inclusion of additional control variables (e.g., unit value of the shipped merchandise).

6 As Walker (1999) explains, until recently, the majority of airlines considered cargo a by-product of their passenger activities. The consequence was a pricing strategy that regarded cargo as a low additional cost product. In recent times, airlines significantly improved the way common costs are allocated and implemented a yield management strategy, which involves the creation of a stand-alone company with full profit responsibility.

7 Data obtained from Air Cargo Management Group (www.cargofacts.com).

in air shipments in 2001 is due to the drastic restrictions that the US applied to air traffic after September 11th 2001.[8]

Figure 1. Share of Air Shipments in US Imports



Share: Value of Air Shipments / (Value of Air Shipments and Vessel Shipments)
SOURCE: U.S. Imports of Merchandise 1990 - 2001 – U.S. Department of Commerce.

In 1992 the United States signed the first open skies agreement with the Netherlands. Since then, the United States has signed more than fifty-five open skies agreements with developed and developing countries in all continents. These agreements give us a unique opportunity to estimate the effect that a liberalized air cargo market has on transport costs. Given that there is no estimation in the literature of the effects of open skies agreements on cargo rates, this paper adds a new dimension to the literature that estimates the determinants of transport costs.

8 According to data provided by the Air Transport Association, the recent evolution of international cargo transport for US airlines (measured in million of ton miles) is as follows: 1999: 23,501; 2000: 25,121; 2001: 22,421; 2002:23,627; 2003: 24198 (estimated data).

	Bilateral Open-Skies Agreements. United States.				
Year	Country	Year	Country	Year	Country
2002	Jamaica	1999	Dominican Republic	1997	El Salvador
2002	Cape Verde	1999	Tanzania	1997	Guatemala
2002	Uganda	1999	Qatar	1997	Panama
2001	Sri Lanka	1999	Argentina	1997	Taiwan
2001	France	1999	Bahrain	1997	Brunei
2001	Oman	1999	United Arab Emirates	1997	Singapore
2001	Poland	1999	Pakistan	1996	Jordan
2000	Senegal	1998	Italy	1996	Germany
2000	Benin	1998	Peru	1995	Czech Republic
2000	Malta	1998	Korea	1995	Austria
2000	Rwanda	1998	Uzbekistan	1995	Belgium
2000	Morocco	1997	Netherlands Antilles	1995	Denmark
2000	Nigeria	1997	Romania	1995	Finland
2000	The Gambia	1997	Chile	1995	Iceland
2000	Turkey	1997	Aruba	1995	Luxembourg
2000	Ghana	1997	Malaysia	1995	Norway
2000	Burkina Faso	1997	New Zealand	1995	Sweden
2000	Namibia	1997	Nicaragua	1995	Switzerland
2000	Slovak Republic	1997	Costa Rica	1992	Netherlands
1999	Portugal	1997	Honduras		

Source: Aviation and International Affairs of the U.S Department of Transportation. http://ostpxweb.dot.gov/aviation/

The results obtained have important policy implications. We find strong evidence that investments in airport infrastructure and improvements in the quality of regulation reduce air transport costs. In our sample, improvements in both variables from the 25th percentile to the 75th percentile reduce transport costs by more than 20 percent. In addition, we find that a more competitive air transport market—through open skies agreements— reduces air transport costs by around 8 percent.[9]

The paper is organized as follows. Section II briefly summarizes the economics of air cargo. Section III presents the empirical framework while Section IV shows the results for the cross section and panel data estimation. Finally, Section V concludes.

II. The Determinants of Air Transport Costs, the Economics of Air Cargo and Open Skies Agreements

This section addresses, based on a qualitative and quantitative description, the

9 This result depends on the econometric specification used.

main determinants of air transport costs, emphasizing recent developments in the economics of air cargo.

The nature of the services provided by air cargo airlines forces them to be both extremely capital intensive and transnational companies serving more than one country. In general, these companies have access to international capital markets and they are able to hire an important fraction of their workers from all over the world.[10] We should not expect differences in capital or labor costs to be the main factors explaining differences in transport costs across countries. There are other important specific factors affecting transport costs across countries, which we present next.

The most studied determinant of transport cost is geography, particularly distance. The greater the distance between two markets, the higher the expected transport costs. For air carriers, the cost variable most affected by distance is fuel cost, which during most of the 1990s represented between 12 and 15 percent of airlines' total operating costs (Doganis, 2001).

Dedicated freight airlines pay special attention to airport use-related fees. They have more flexibility than passenger airlines, as they do not have to operate from airports with the best location for business passengers and they can avoid slot-constrained airports or operate during off-peak hours. Consequently, dedicated freight airlines usually have a broader selection of competing airports to choose from. The available airport infrastructure and the quality of regulation—, which have a direct impact on airport use fees, are important variables for cargo airlines when deciding which airports they serve, and thus are relevant variables in the determination of air transport cost.

There is not a unique model for tariff regulation in airports. However, in the majority of airports, tariffs for "aeronautical services" (runway and taxiway, air control, aircraft parking, security) are regulated by a government agency or sector-specific regulator (Serebrisky et al., 2002). The quality of regulation, i.e., the level and structure of tariffs for aeronautical services, how they are set and the regulatory process to modify them, are a key factor that directly impacts airlines' operating costs and transport costs.

The creation of cargo dedicated airline and the implementation of yield

10 Doganis (2001) shows that for passenger airlines labor costs explain only between 25 to 35 percent of total operating costs. Undoubtedly, for dedicated freight carriers, this percentage is much lower because they do not need to employ flight attendants and

management strategies in passenger-cargo airlines allowed these companies to adopt a flexible approach to the selling of cargo space. As a consequence, there are not only directional differences in rates, mainly because of relative demand sizes,[11] but there are also wide variations in the rates offered to bulk contract shippers as opposed to one-off clients.[12]

Trade composition additionally helps to explain other differences in transport costs. 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 1.75 percent of the traded value and represent around 15 percent of total air charges. Therefore, high value added exporting countries should have higher charges per unit of weight due to this insurance component.[13] Besides, some products require special transport features and therefore have different freight rates.[14]

Since 1992, the United States has signed more than fifty bilateral open skies agreements. The main objective sought by these agreements is the promotion of an international aviation system based on competition among airlines with minimum government regulation. As stated in the introduction of these agreements,[15] the motivation governments have to support them is the desire to facilitate the expansion of air transport opportunities, making it possible for airlines to offer the traveling and shipping public a variety of service options at the lowest possible prices.

Although the substance of all open skies agreements signed by the United States is alike, some include provisions that allow for variations in the degree of openness of air transport markets. Most of these provisions are temporary, and their purpose is to allow more time to one party's airlines and air transport institutions to adjust and prepare to a more competitive environment. However, other provisions are introduced to increase competition in some segments of the air transport market. The inclusion of seventh

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other personnel that work in passenger related services (VIP lounges, ckeck-in counters, customer service personnel in airports, etc.).

11 Directional imbalance in trade between countries implies that many air-carriers are forced to haul empty space back. As a result, either imports or exports become more expensive.

12 Transport is a classic example of example of an industry that faces increasing return to scale.

13 Clark et al. (2002) show that the insurance component is an important determinant for maritime transport costs as well.

14 For example, in the case of maritime transport costs, 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.

15 The text of open skies agreements can be found at http://ostpxweb.dot.gov/aviation/

freedom rights[16] for cargo is an example of a provision designed to achieve greater liberalization and more competition in air transport markets.

The inclusion of specific provisions for air cargo in the open skies agreements signed by the United States suggests that, irrespective of the size of the air cargo market, the American government is concerned about entry barriers, competition and ultimately prices of air cargo services.

Most of the empirical literature in this area focuses on the effects that open skies agreements have on passengers. A recent and comprehensive study (Brattle Group, 2002) estimates the effects on passengers of open skies agreements between the United States and countries in the European Union. Button (2002) describes the potential effects that the liberalization of U.S-European air transport market could have on airlines, passengers and labor, but he does not provide any quantitative evidence. The U.S. Department of Transportation (2000) published a report that argues that between 1996 and 1999 average passenger airfares in transatlantic markets declined 10.3% in non-open skies countries and 20.1% in open skies countries. Citing confidentiality restrictions, this report does not show the data or explains the methodology used to estimate the reduction in airfares.

Despite some work on the effects of open skies on passenger fares, a survey of the empirical literature shows that there is no estimation of the effects of open skies agreements on cargo rates, a task we pursue in this paper.

III. Empirical Framework

To estimate the importance of each of the factors that explain air transport costs, we use a standard reduced form approach. Air transport freight prices are assumed to be equal to the marginal cost multiplied by the air shipping companies' markup. Expressed in logarithms, the reduced form equation takes the following form:

$$p_{ijkt} = mc(I, J, K, T) + \mu(I, J, K, T) \qquad [1]$$

16 If an open skies agreement includes seventh freedom rights for cargo, a carrier from one country can offer stand-alone cargo services between two foreign countries, neither of which is its home country.

Where:

i : Corresponds to a foreign airport located in foreign country I.

j : Corresponds to a US airport located in district or region J.

k: Corresponds to the product, aggregated at four digits of the HS classification code.

p_{ijkt} : Air transport cost (or charges).

mc : Is the marginal cost expressed in logarithm.

μ : Is the markup expressed in logarithm.

Therefore, p_{ijkt} represents air transport costs[17] (freight charges), and it is measured by the logarithm of the freight charges per unit of weight for each of the k products transported between foreign airport i located in country I to any of the US districts[18] or regions[19] j in period t.

We assume that both marginal cost and markup are functions of factors that depend on the airport or country of origin (*i,I*), and the airport or district of destiny in the US (*j,J*) for each of the *k* product types. Specifically, we assume that the marginal cost has the following functional form:

$$mc(I, J, K, T) = \alpha_j + \lambda_k + \psi\, wv_{ijkt} + \partial\, d_{iJ} + \eta\, q_{ijt} + kunb_{ijt} + wAPE_I \qquad [2]$$

Where:

α_j : dummy variable referring to US district J

λ_k : dummy variable referring to product k.

wv_{ijkt} : represents the logarithm of the value per unit of weight of product *k*.

d_{iJ} : logarithm of the distance between country I and the US.

q_{ijt} : logarithm of the value of imports carried by air from country I to the US.

unb_{ijt} : unbalance between country I and the US.

APE_I : state of infrastructure in airports of foreign country I.

17 We do not take into account the observations that have zero trade with the US.

18 We consider 36 US districts.

19 We divide the districts in three regions.

The first dummy takes into account potential differences in airport efficiencies across US custom regions or districts, and the second one accounts for different marginal transport costs across products. wv_{ijkt} represents the value per unit of weight of product $k$and is used as a proxy for the insurance component of air transport cost (p_{ijkt})[20]. Unbalance between country I and the US corresponds to the ratio between US exports minus US imports and the level of bilateral trade between the two countries. The variable APE_I is a proxy for the state of infrastructure in foreign airports and corresponds to the ratio between the squared number of airports in the foreign country that have runways over 1,500m long and the product of the country area and total population. In addition, in some specifications we include variables that capture the quality of regulation across countries.

With respect to the second term of the reduced form equation, we assume that air shipping companies' markups have the following functional form:

$$\mu(I, J, K, T) = \rho_k + \varphi A_{IJt} \qquad [3]$$

Where:

ρ_k : dummy variable per product

A_{IJt} : dummy variable for open skies agreements.

ρ_k is a dummy variable that reflects a product-specific effect that captures differences in transport demand elasticity across goods (which is derived from the final demand of good k in the US). A_{IJt} is a variable that specifies if a pair of countries have an open skies agreement.

Substituting the second and third equations into the first one, we obtain the econometric model to be estimated:

$$p_{ijkt} = \alpha_j + \beta_k + \psi wv_{ijkt} + \partial d_{ij} + \eta q_{Ijt} + kunb_{ijt} + \omega APE_I + \varphi A_{IJt} + \varepsilon_{ijk} \qquad [4]$$

20 We assume that insurance costs increase unit price of transported goods.

where $\beta_{\kappa} \equiv \lambda_{\kappa} + \rho_{\kappa}$

ε_{ijk} : error term.[21]

In the estimation, we should expect a positive sign for the coefficients of the proxy for insurance costs, ψ , and distance, ∂ , and a negative sign for the coefficients of the volume of trade, η , trade unbalance, k , and the state of airport infrastructure, ω .

We divide our empirical results into two sets. First, we run cross-sectional regressions to identify the effects of the variables that rarely or never vary over time on transport costs. These variables are: distance, foreign airport infrastructure and total imports volume. Using cross-sectional regressions we are able to identify whether countries that implemented an open skies agreement face lower or higher transport costs than others that did not. Although this information by itself is valuable, it is not precisely the most relevant question for a policymaker. A policymaker would like to know what is the impact of signing open skies agreements; that is, if by implementing this type of agreements, transport costs are reduced over time.

To answer this question, our second set of results relies on panel data and includes country fixed effects in order to isolate the time series dimension of open skies agreements and their impact on air transport costs, leaving out the cross-sectional variation. Thus, time-invariant country specific variables such as distance between a foreign country and the US will be subsumed in these country fixed effects. In addition, to some extent, the inclusion of country dummies addresses potential endogeneity problems that would arise if countries following a cost-benefit analysis tend to invest in an open skies agreement only with partners with which they have high air transport costs, since the potential benefits for these countries derived from more competition will be higher. If this is the case, a cross-sectional analysis would underestimate the effect of open skies agreements on transport costs. Indeed, as will be shown below, a comparison of our panel results with those obtained when we use cross section regressions suggests that the latter in fact understate the impact of open skies agreements on air transport

21 We allow the error term to be correlated among the country clusters.

costs.[22]

It is important to clarify that the use of country dummies does not fully eliminate the endogeneity bias. It is possible that countries decide to sign an open skies agreement following a substantial increase in their air transport costs. The shorter the period used to estimate the effect since the implementation of open skies agreements, the less severe are the remaining concerns about endogeneity.[23] In any case, if endogeneity were a problem, one would expect our estimates to underestimate the effect of open skies agreement on transport costs.

The relation between transport costs and imported volume causes an additional endogeneity problem. To control for this endogeneity problem, in the empirical section, following the gravity literature on trade, we use the foreign country's GDP as an instrument for the volume of imports.

IV. Empirical Results

Data on air-transport costs comes from the U.S. Imports of Merchandise Database put together by the U.S. Department of Commerce. The level of aggregation of the data is HS 4 - digit, and the period covered is 1990 – 2001. Our dependent variable, air-transport costs, is the variable *imports charges*, which is defined by the U.S. Bureau of Census 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."[24]

Our explanatory variables are HS 4-digit aggregated, and they were obtained from different sources. In the case of value of imports, volume of imports and directional unbalance,[25] the source is the U.S. Imports of Merchandise Database gathered by the U.S.

22 Glick and Rose (2001) and Micco, Stein and Ordoñez (2003) use this same technique to identify the effect of currency union and EMU on trade, respectively.

23 For this reason, our short period of time is perfect to estimate the effect of open skies.

24 To avoid a measurement error, in our empirical exercises we only use countries that have 50 or more observations in our sample. Our results are robust to the inclusion of those countries with less than 50 observations.

25 This variable was only available for the year 2000.

Department of Commerce, 1990 - 2001. Population and GDP data were obtained from the World Bank's World Development Indicators (2002). Most of the country-specific variables (coordinates for the calculation of distances, number of airports, etc.) were taken from the CIA's World Factbook.[26] Finally, the information for regulatory quality and government efficiency were taken from Kaufmann et al. (2003). Details on the definition of the variables are provided in Appendix A.

Cross Sectional Results

Cross Sectional results are reported in Table 1 and Table 2. The main difference between these tables is that in Table 2 we control for country development level using a dummy variable for developed countries.[27] Both tables report the results for the year 2000. We chose the year 2000 because it was the only year for which we had information to construct the variable directional trade imbalance.

Table 1 reports our estimations for equation [4]. In all the specifications we control for distance, volume (US imports measured in US dollars), product unit value, directional trade unbalance, type of product and district of cargo entry in the US and airport infrastructure in the exporter country. In all the specifications we allow the error term to be correlated among country clusters to avoid misspecifications of the var-cov matrix.[28] As we already mentioned, when we introduce imports volume, an endogeneity problem arises. It is expected that the bigger the trade volume, the lower transport costs are going to be (due to economies of scale) but, on the other way around, lower transport costs may increase trade. To solve this problem in all specifications shown in Table 1, we instrumentalize imports volume using countries' GDP.[29]

Column (1) reports the results obtained for the benchmark regression specified in equation [4] using the square number of large airports in the foreign country normalized by area and population as our measure of airport infrastructure. As shown, distance has a

26 We obtained the number of airports from the CIA World Fact Book, 1990 – 2001.

27 To control for this country specific characteristic, we constructed a dummy variable that has the value of 1 if the country is classified by the World Bank Income Classification (2002) as a high income country, and zero in all other cases.

28 Clusters control for the fact that, even though we use thousands of air-shipping observations, most of our variables of interest only vary across countries.

29 Following the gravity model, trade between two countries is proportional to the product of countries' GDP divided by the distance

significant (at 1%) and positive effect on air transport costs. For instance, doubling the distance between a country I and the US generates a 20 percent increase in air transport costs. The variable capturing economies of scale is the level of trade that goes through a particular route.[30] This variable, calculated in terms of monetary volume, has the expected significant and negative coefficient. This result could be explained by the fact that the more transited routes are served by the biggest airplanes, which have more cargo space available, or have more competition due to the presence of more cargo companies covering the same route.[31] In our sample, an increase in import volume from the level of Zimbabwe (p25) to the level of Denmark (p75) reduces air transport costs by around 11 percent.[32]

The value per weight variable is also positive and highly significant. As already mentioned, these regressions include dummy variables for products aggregated at the four-digit HS level. One might think that unit values would be quite similar across countries at that level of disaggregation, but not so. Clark et al. (2001) found the same results for maritime transport costs. Additionally, Feenstra (1996) shows that there is a large variation in unit values even at the 10-digit HS level. He cites the example of cotton shirts for men, which the U.S. imports from almost 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. Thus, 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.

Directional imbalance in trade between the US and the source country has the expected negative sign and is significant at one percent. If we move from a favorable unbalance (from the point of view of the exporters to US[33]) of 50 percent to a negative one of the same amount, air transport costs increase around 16 percent.

Finally, the coefficient associated to airport infrastructure is negative and

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between them.

30 Each "foreign country and US region" pair is defined as an air route. We define three regions in the US: East, West and Gulf Coast (see Appendix B, Table A3.).

31 [to be completed] correlation between liners and route volume and correlation between liners and costs.

32 In term of countries (not of observations), XX and X are in the 15th and 85th percentiles,respectively.

33 For foreign exporters, the larger is the unbalance of US bilateral trade (exports – imports divided by bilateral trade) the lower should be the transport costs, they face because of the low capacity utilization of the airplanes coming back to the US.

significant (at 1%): the greater the investment in infrastructure, the lower transport costs are. In our sample, an improvement in airport infrastructure from the level of Colombia (p25) to the level of Great Britain (p75) reduces air transport costs in 15 percent. This result may be due to the following reverse causality. Airport infrastructure reduces air transport costs, but at the same time, low air transports costs increases trade and may induce to invest in airport infrastructure. To control for this reverse causality in column (2) we instrumentalize the level of foreign airport infrastructure of column (1) with indexes of telephones per capita and paved roads. In addition, as a robustness test, in column (3) we use a five-year lag of our infrastructure variable. In both cases we obtain very significant effects, similar to the results obtained in column (1).

In columns (4), (5) and (6), besides the level of airport infrastructure, we include institutional variables to observe their effect on air transport costs. We should expect a better institutional framework -measured by regulatory quality and/or government efficiency- to reduce air transport costs.[34] In columns (4) to (6) we present our results using regulatory quality and/or government efficiency obtained from Kaufmann et al. (2003).[35] As shown, separately, both dimensions have the expected sign and both are statistically significant at conventional levels (Column 4 and 5). But, when we include both institutional variables at the same time, only regulatory quality has the expected sign and is significant at standard levels.[36] Not surprisingly, this last result suggests that regulatory quality, which should directly affect airport efficiency, has a significant effect on air transport costs. In our sample, a country that increases its level of regulatory quality from the level of Ecuador (p25) to the level of France (p75) can experience a reduction in its air transport costs of 14 percent.

The last two columns of Table 1 report the results when we include our open skies agreement dummy variable[37] with and without regulatory quality. In both cases, open

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34 See Kaufmann,Kraay, and Mastruzzi (2003) for a general discussion of the role of the institutional environment in country performance.

35 To check the robustness of these results, we estimated the benchmark equation with Rule of Law and Control of Corruption and we found that the results obtained where very similar in magnitude of coefficients and in level of significance.

36 The lack of significance of government efficiency may come from the fact that both institutional variables are highly correlated in our sample.

37 The dummy variable that accounts for the existence of an Open Skies Agreement between partner countries was obtained from the U.S. Department of Transport. The introduction of this paper presents a table with all Open Skies Agreements and the years they were

skies agreement has the expected negative sign, but it is not statistically different from zero at conventional levels. It is possible that this result is biased to zero due to the endogeneity problem described at the beginning of this section (countries with initial high transport cost are willing to sign open skies agreements).

To see if our results are robust to the addition of country-income controls, in Table 2 we include, in all specifications, a dummy variable that takes the value of one if the foreign country is a developed country (high income country), and zero otherwise. We found that all our previous results are robust to the inclusion of this dummy, except for the total volume variable, which keeps its negative sign in all specifications but is not statistically different from zero. The variables of airport infrastructure and regulatory quality keep their negative signs but their effects on air transport costs are slightly smaller. These results are not surprising if we take into account that most of the observed variance experienced by airport infrastructure and regulatory quality occurs between developing and developed countries, which is now captured by our developed country dummy. Controlling by infrastructure and regulatory quality, on average, developed countries have 14 percent lower air transport cost than the other countries in our sample.

Panel Data Results

In the cross section estimations we mentioned the possibility that the estimated coefficients of open skies agreements might be biased to zero. To solve this problem, Table 3 presents the results of a country-product fixed effect estimation for the period 1990–2001. The inclusion of country-product dummies allows us to focus on the time series effect of open skies agreements. The country-product fixed effect captures the initial level of transport costs as well as those variables that do not change over time (for instance distance).[38] As we did in the cross section estimation, we still allow the error term to be correlated within countries in a given year, and we control for US region or district fixed effects.

In column (1) we report the results obtained when we allow the average air

signed.

38 We do not include our institutional variables because they are only available since 1996 and they almost do not change over time.

transport costs to follow a linear trend. As we found in the cross section regressions, volume has a negative sign but is not significant at standard levels. Unit weight values remain highly significant with a similar coefficient. More interestingly, in our panel setup, open skies agreement remains negative and becomes significant at standard levels. This result is robust even when we control with a quadratic trend (column 2), dummies per years (column 3) and US district fixed instead of US region dummies (column 4). The result also holds when we include our measure of airport infrastructure, which has an estimated value of zero and has no statistical power. This low power may be explained by the low time variability of our airport infrastructure measure.[39]

The results in columns (1) to (5) suggest that, even though statistically significant, open skies agreements imply only a small decline in air transport costs of around 2.3%. This is the average effect of open skies agreement on freight rates independent of the number of years the agreement has been standing. Open skies agreements may reduce freight rates over time, in which case the total effect of these agreements would be larger than 2.3%. We want to test the hypothesis that air carriers take time to adapt to the new rules in the market and need to go through an underlying "learning by doing" process. A similar hypothesis, which cannot be tested separately with the available data, would be that those firms that survive after opens skies agreements are signed, are more efficient and, given the existence of more contestable markets, they set lower tariffs. The process of fighting to survive is not a one-period game and that would explain why freight rates decrease over time. To test the first hypothesis, columns (6) to (8) compute the previous regressions using only the years 1990 and 2001.[40] Using this "type of" first difference regressions,[41] the dummy for Open Sky Agreements captures the fall in freight rates for the whole period since the agreement was signed in each country. For example, Spain signed an open skies agreement with the US in 1995, therefore, in the year 2001 the agreement has been standing for 6 years. In column (6) the agreement dummy implies a large drop in freight rates of around 9 percent. When we include our infrastructure

In most specifications we do not include our measure of airport infrastructure because it barely changes over time.

39 Most improvements in airport infrastructure over time are within the same airport (e.g., equipment), and therefore are not captured in our measure.

40 We drop countries that are not in the whole sample to avoid any composition effect (2 countries). Results hold with the whole sample.

measure in column (7), the fall in freight rates increases to 13 percent. In this specification our infrastructure variable is significant at 10 percent levels and it has a magnitude similar to that obtained in column 2 of Table 1. Finally, to confirm that the effect of agreements increases over time, in columns (8) and (9), besides our Open Sky dummy, we include the number of years since the agreement was signed. Reassuring our previous results, the interaction term is negative and significant at conventional levels. These results suggest that after 6 years, an Open Sky Agreement induces a fall in air transport costs of around 2 percent. These results, even though they are significant at conventional levels, are estimated imprecisely.

To check the results of the previous paragraph, Table 4 presents the results of country-product fixed effect regressions for the whole sample period but allowing the effect of open skies agreements to differ over time. The dummy "Year of Signature" captures the change in freight rates the same year the agreement was signed. The dummy "One Year After" captures the change the first year after the agreement was signed. Finally, the dummies "Four or More Years After" captures the average fall in freight rates after four or more years since the agreement was signed. Columns (1) to (4) show the same results. In the year the agreement is signed there is a 1 percent fall in freight rates. This fall increases 1 percent per year after the agreement is signed.[42] Three years after the agreement was signed we observe a 3-4 percent fall in rates, which is significant at conventional levels in all the specifications. Focusing on columns (2) and (4), the long run effect of Open Sky Agreement is a fall in air transport costs of around 8 percent. It is important to highlight that this result does not allow us to identify the source of the reduction in air transport costs associated with open skies agreements. It could be the case that costs are lower because a more intense competition induced a lower mark-up. An alternative explanation consistent with the reduction in transport costs would be that airlines became more efficient, and keeping mark-ups constant, were able to reduce freight rates.

V. Conclusion

41 These would be first difference regressions if there were only one district of entry in the US.

42 In all specifications, the sum of the first three dummies ("year of Signature," "One Year after" and "Two Years After") is

During the 1980s and 1990s many countries engaged in a process of reduction of tariff and non-tariff barriers to trade. As a consequence, the relevance of transport costs as a determinant of the ability of a country to integrate into the global economy increased significantly. At first glance, it could be argued that governments cannot reduce transport costs because they are, to a great extent, determined by exogenous factors, mainly distance. Even though it is true that distance is an important explanatory variable of transport costs, this paper shows that governments can implement different policies to reduce transport costs and effectively help their countries "get closer" to high demand markets.

This paper concentrates on air transport, the fastest-growing cargo transport mode. Relying on detailed micro data and the opportunity that open skies agreements provide to evaluate the impact of changes in the competition regime, our estimations show that improvements in infrastructure and the quality of regulation and a more liberal air cargo market significantly reduce transport costs. In our sample, an improvement in airport infrastructure from the 25^{th} to 75^{th} percentiles reduces air transport costs 15 percent. A similar improvement in the quality of regulation reduces air transport costs 14 percent. Besides, deregulating the air cargo market—through what are usually called open skies agreements—further reduces air transport costs around 8 percent.

These results have important policy implications. Efforts aimed at improving the quality of regulation and the state of infrastructure (airports) have definite effects on the ability of local producers to compete in the global economy. Signing open skies agreements has been difficult and strongly resisted, especially by airlines. This paper provides sound evidence that many economic sectors could benefit from a deregulated air cargo market.

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significant at conventional levels.

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Appendix A. Data Description

Air Transport Costs: Corresponds to the import charge per unit of weight by type of commodity and by foreign country. The variable was constructed with the information of import charges and weight reported by the U.S. Imports of Merchandise Database, of the U.S. Department of Commerce and U.S. Census Bureau , 1990 - 2001. Air transport costs per commodity is calculated at a 4 digit aggregated HS level.

Control of Corruption: Measures perceptions of corruption, conventionally defined as the exercise of public power for private gain. Despite this straightforward focus, the particular aspect of corruption measured by the various sources differs somewhat, ranging from the frequency of "additional payments to get things done," to the effects of corruption on the business environment, to measuring "grand corruption" in the political arena or in the tendency of elite forms to engage in "state capture". The presence of corruption is often a manifestation of a lack of respect of both the corrupter (typically a private citizen or firm) and the corrupted (typically a public official or politician) for the rules which govern their interactions, and hence represents a failure of governance according to our definition. This measure is obtained from Kaufmann, Kraay and Mastruzzi (2003).

Developed Country Dummy: This dummy variable takes the value of one if the country is classified by the World Bank (2002) as a High Income Country, otherwise zero.

Distance: Corresponds to the distance between the foreign airport I and the U.S. customs district J. The geographic coordinates used to calculate the distance between US custom district and the foreign airport were obtained from CIA Factbook 2001.

Directional Trade Unbalance: Corresponds to the ratio between the difference of U.S. exports and imports, and bilateral trade. The variable was constructed with information on imports and exports reported by the U.S. Imports of Merchandise Database, of the U.S. Department of Commerce and U.S. Census Bureau for year 2000.

Foreign Airport Infrastructure Index: Corresponds to the logarithm of the ratio between the number of airports (square) with runaways of at least 1500m long (a_c) per country, and the product between country surface $(surf_c)$ and country population (pop_{ct}) .

$$Number\,of\,airports = \ln\left(\frac{a_c^2}{surf_c * pop_{ct}}\right) \qquad where\ t\ is\ year$$

The Number of runaways per country was obtained from CIA World Fact Book, 1990 – 2001.

Government Efficiency: Measures the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies.

The main focus of this index is on "inputs" required for the government to be able to produce and implement good policies and deliver public goods. This variable was obtained from Kaufmann, Kraay and Mastruzzi (2003).

Number of Pavimented Roads: This variable was obtained from World Bank World Development Indicators, 2002.

Open Sky Agreement Dummy Variable: This dummy variable takes the value of one if there is an Open Skies Agreement between U.S and the foreign country in that specific year. The information was obtained from the U.S. Department of Transportation, 1990 - 2001.

Population: This variable was obtained from World Bank World Development Indicators, 2002.

Product Unit Value: Corresponds to the total value per unit of weight of U.S. imports calculated from foreign airport to each of the U.S. customs districts. The variable was constructed with the information of import value and weight reported by the U.S. Imports of Merchandise Database, of the U.S. Department of Commerce and U.S. Census Bureau, 1990 - 2001. Product Unit Value is calculated at a 4 digit aggregated HS level.

Product Unit Weight: Corresponds to the weight of U.S. imports from foreign airport to each of U.S. customs districts. The variable was obtained from U.S. Imports of Merchandise Database, of the U.S. Department of Commerce and U.S. Census Bureau , 1990 - 2001. It is aggregated at a 4 HS level.

Real GDP: This variable was obtained from World Bank World Development Indicators, 2002.

Real GDP per capita: This variable was obtained from World Bank World Development Indicators, 2002.

Region: Corresponds to the U.S. customs districts classification done by the authors. In Table A3 of appendix B, there is a detailed description of the regions associated to each custom district.

Regulatory Quality: Measures the incidence of market-unfriendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development. This measure is obtained from Kaufmann, Kraay and Mastruzzi (2003).

Rule of Law: This variable was obtained from Kaufmann, D., Kraay, A., and Mastruzzi, M. 2003. "Governance Matters III: Governance Indicators for 1996-2002". World Bank Research Working Papers Series, 3106.

Surface: This variable was obtained from World Bank World Development Indicators, 2002.

Telephones: This variable was obtained from World Bank World Development Indicators, 2002.

Total Liner Volume: Corresponds to the total value of imports transported between each foreign country and each U.S. customs district. The variable was obtained from U.S. Imports of Merchandise Database, of the U.S. Department of Commerce and U.S. Census Bureau, 1990 - 2001. It is aggregated at a 4 HS level.

Appendix B. Data Used

Country	Infrastructure	Phones	Roads	Control of Corruption	Government Efficiency	Rule of Law	Regulatory Quality
Andorra	1.442	n.a.	n.a.	n.a.	1.358	1.294	1.548
Afghanistan	-25.513	0.182	-10.578	-1.469	-1.344	-1.544	-2.699
Angola	-1.483	n.a.	n.a.	n.a.	-1.354	-1.119	-1.435
Albania	-22.488	3.842	-5.665	-0.587	-0.534	-0.726	-0.232
United Arab Emirates	-21.086	6.845	-12.232	0.702	0.584	1.096	0.690
Argentina	-25.139	5.931	-7.688	-0.356	0.136	-0.011	0.284
Armenia	-24.012	5.053	-6.048	-0.699	-0.525	-0.432	-0.357
Antigua and Barbuda	-17.214	6.667	-6.171	0.838	0.558	1.017	0.704
Australia	-26.442	6.879	-5.410	1.973	1.771	1.906	1.390
Austria	-23.648	7.113	-2.820	1.837	1.660	1.998	1.411
Azerbaijan	-23.111	5.070	-7.018	-1.030	-0.876	-0.847	-0.833
Burundi	-25.887	1.675	-6.726	-1.057	-1.131	-0.867	-1.121
Belgium	-21.264	6.931	-2.729	1.303	1.490	1.484	1.079
Benin	-27.265	2.862	-9.620	-0.527	-0.245	-0.320	-0.097
Burkina Faso	-26.560	1.874	-9.890	-0.389	-0.403	-0.582	-0.191
Bangladesh	-27.695	1.608	-5.982	-0.649	-0.473	-0.705	-0.419
Bulgaria	-21.537	6.087	-6.476	-0.360	-0.400	-0.093	0.296
Bahrain, Kingdom of	-18.596	6.310	-3.803	0.448	0.563	0.860	0.863
Bahamas, The	-19.060	6.173	-6.036	0.815	0.950	1.048	0.997
Bosnia & Herzegovina	-23.263	4.887	-6.052	-0.486	-0.764	-0.734	-1.207
Belarus	-21.770	5.612	-5.927	-0.577	-0.977	-1.036	-1.830
Belize	-22.423	5.388	-6.497	-0.129	-0.344	0.284	0.047
Bermuda	1.442	n.a.	n.a.	n.a.	1.092	1.294	1.282
Bolivia	-25.227	4.868	-8.046	-0.689	-0.366	-0.515	0.528
Brazil	-28.466	5.762	-6.183	-0.006	-0.189	-0.195	0.261
Barbados	-18.559	6.081	-3.575	1.294	1.358	0.767	0.688
Brunei Darussalam	-21.301	6.281	-7.206	0.144	0.788	0.793	0.866
Bhutan	-0.282	2.976	-7.930	n.a.	0.585	0.898	-0.417
Botswana	0.746	n.a.	n.a.	n.a.	0.672	0.674	0.744
Central African Rep.	-27.084	1.380	-8.315	-0.852	-1.040	-0.638	-0.572

Canada	-26.285	6.868	-5.854	2.208	1.890	1.888	1.322
Switzerland	-22.480	7.223	-4.031	2.234	2.230	2.166	1.374
Chile	-24.397	6.095	-7.489	1.364	1.223	1.271	1.337
China,P.R.: Mainland	-28.167	5.180	-8.697	-0.240	0.179	-0.297	-0.196
Côte d'Ivoire	-27.061	3.876	-7.603	-0.367	-0.508	-0.728	-0.136
Cameroon	-25.982	2.284	-8.680	-1.082	-0.655	-1.100	-0.417
Congo, Republic of	-27.661	3.440	-8.747	-0.904	-1.232	-1.196	-0.917
Colombia	-26.444	5.405	-8.144	-0.471	-0.148	-0.625	0.242
Comoros	-20.942	2.303	-7.382	-0.711	-0.916	-0.944	-0.796
Cape Verde	-21.298	5.145	-7.292	0.068	0.045	0.378	-0.309
Costa Rica	-24.608	5.708	-5.018	0.841	0.408	0.738	0.797
Cuba	-22.292	3.788	-5.804	-0.186	-0.330	-0.691	-1.117

(Continued)

Country	Infrastructure	Phones	Roads	Control of Corruption	Government Efficiency	Rule of Law	Regulatory Quality
Cayman Islands	1.442	n.a.	n.a.	n.a.	1.892	1.294	1.548
Cyprus	-18.777	6.875	-4.032	1.206	1.118	0.825	1.013
Czech Republic	-22.430	6.687	-5.555	0.415	0.681	0.641	0.885
Germany	1.358	n.a.	n.a.	n.a.	1.753	1.846	1.836
Djibouti	-22.021	2.745	-7.470	-0.840	-0.985	-0.443	-0.500
Dominica	-0.042	n.a.	n.a.	n.a.	-0.534	0.002	0.008
Denmark	-21.751	7.208	-3.788	2.320	1.909	1.964	1.473
Dominican Republic	0.161	n.a.	n.a.	n.a.	-0.398	-0.387	-0.290
Algeria	-24.746	4.091	-8.809	-0.590	-0.746	-0.677	-0.799
Ecuador	-24.992	4.928	-7.537	-0.867	-0.854	-0.573	-0.175
Egypt	-23.961	4.680	-9.652	-0.154	-0.081	0.178	-0.092
Eritrea	-22.857	2.067	-10.156	0.150	-0.125	-0.214	-0.447
Spain	1.223	n.a.	n.a.	n.a.	1.665	1.357	1.260
Estonia	-23.395	6.620	-3.086	0.488	0.670	0.601	1.222
Ethiopia	-26.014	1.356	-11.075	-0.401	-0.554	-0.347	-0.670
Finland	1.618	n.a.	n.a.	n.a.	1.870	2.390	2.038
Fiji	-23.420	5.157	-7.134	0.279	-0.070	-0.345	-0.501
France	-23.541	6.978	-3.702	1.490	1.541	1.457	0.991
Micronesia, Fed. Sts.	-0.728	n.a.	n.a.	n.a.	-0.391	-0.319	-0.547
Gabon	-25.096	4.864	-8.395	-0.830	-0.661	-0.397	-0.182
United Kingdom	-22.775	7.182	-4.645	2.060	2.056	1.906	1.635
Georgia	-21.977	5.150	-6.739	-0.846	-0.545	-0.815	-0.735
Ghana	-29.111	2.898	-7.948	-0.424	-0.050	-0.120	-0.035
Guinea	-26.845	2.575	-7.580	-0.367	-0.527	-0.870	-0.177
Gambia, The	-23.291	3.394	-7.489	-0.271	-0.205	-0.200	-0.536
Guinea-Bissau	-24.241	2.219	-7.463	-0.625	-1.005	-1.276	-0.852
Equatorial Guinea	-23.274	2.595	-7.343	-1.482	-1.565	-1.383	-1.496
Greece	-21.757	6.993	-4.600	0.642	0.731	0.737	0.876
Grenada	-17.322	5.934	-3.428	0.279	-0.084	0.328	0.178

Guatemala	-25.069	4.772	-8.731	-0.744	-0.447	-0.728	0.294
Guyana	0.008	4.834	-7.766	n.a.	-0.212	-0.361	-0.120
China,P.R.:Hong Kong	1.662	n.a.	n.a.	n.a.	1.445	1.506	1.576
Honduras	-25.103	4.248	-8.264	-0.767	-0.589	-0.776	0.056
Croatia	-22.065	5.442	-5.736	-0.132	0.105	-0.071	0.179
Haiti	-26.114	2.186	-9.447	-1.123	-1.352	-1.352	-1.050
Hungary	-22.424	6.513	-3.263	0.658	0.708	0.790	0.981
Indonesia	-0.206	n.a.	n.a.	n.a.	-0.390	-0.920	-0.753
India	-0.178	n.a.	n.a.	n.a.	-0.117	-0.229	0.126
Ireland	-24.903	6.982	-3.419	1.772	1.714	1.766	1.542
Iran, I.R. of	-1.394	n.a.	n.a.	n.a.	-0.310	-0.599	-0.558

(Continued)

Country	Infrastructure	Phones	Roads	Control of Corruption	Government Efficiency	Rule of Law	Regulatory Quality
Iceland	-24.062	7.148	-5.122	2.159	1.813	1.898	1.039
Israel	-20.974	7.076	-6.184	1.278	1.009	1.062	0.930
Italy	-23.187	7.099	-4.301	0.779	0.863	0.919	0.855
Jamaica	-22.687	5.832	-4.401	-0.307	-0.323	-0.240	0.441
Jordan	-21.668	5.019	-9.022	0.059	0.375	0.422	0.340
Japan	0.756	n.a.	n.a.	n.a.	1.099	1.261	1.617
Kazakhstan	-27.432	4.830	-8.711	-0.894	-0.700	-0.788	-0.461
Kenya	-26.888	2.678	-8.340	-1.007	-0.737	-0.953	-0.317
Kyrgyz Republic	-24.799	4.367	-7.921	-0.781	-0.562	-0.766	-0.455
Cambodia	-26.997	2.507	-9.545	-0.903	-0.642	-0.797	-0.227
Kiribati	-0.841	3.808	-4.994	n.a.	-0.194	-0.531	-0.426
St. Kitts and Nevis	0.177	6.397	-4.971	n.a.	-0.052	0.175	0.134
Korea	-23.180	6.938	-6.425	0.368	0.606	0.779	0.542
Kuwait	-21.516	6.200	-7.488	0.901	0.142	0.943	0.048
Lao People’s Dem.Rep	-1.168	n.a.	n.a.	n.a.	-0.482	-0.933	-1.108
Lebanon	0.117	n.a.	n.a.	n.a.	-0.132	-0.339	-0.114
Liberia	-26.432	0.742	-7.895	-1.301	-1.655	-1.692	-2.010
St. Lucia	-18.371	5.797	-4.174	0.303	0.074	0.134	0.177
Liechtenstein	1.688	n.a.	n.a.	n.a.	1.625	1.294	1.548
Sri Lanka	0.386	n.a.	n.a.	n.a.	-0.273	-0.159	0.057
Lesotho	-0.319	n.a.	n.a.	n.a.	-0.058	-0.029	-0.129
Lithuania	-22.618	6.137	-3.745	0.118	0.303	0.199	0.493
Luxembourg	1.552	n.a.	n.a.	n.a.	2.067	1.973	1.923
Latvia	-21.556	6.150	-3.313	-0.131	0.297	0.244	0.628
Macao, China	0.704	n.a.	n.a.	n.a.	0.825	-0.074	0.752
Morocco	-24.636	4.889	-8.255	0.108	0.083	0.289	0.156
Moldova	-0.409	n.a.	n.a.	n.a.	-0.673	-0.615	-0.335
Madagascar	-0.232	n.a.	n.a.	n.a.	-0.469	-0.278	-0.662
Maldives	0.325	n.a.	n.a.	n.a.	0.538	-0.371	-0.293

Mexico	0.600	n.a.	n.a.	n.a.	0.146	-0.340	-0.267
Marshall Islands	-0.637	n.a.	n.a.	n.a.	-0.507	-0.133	-0.438
Macedonia, FYR	-23.281	5.743	-6.529	-0.607	-0.375	-0.395	-0.082
Mali	-26.994	1.465	-10.968	-0.437	-0.680	-0.633	-0.043
Malta	-18.642	6.702	-3.201	0.497	0.984	0.640	0.558
Myanmar	-1.377	1.755	-10.584	n.a.	-1.287	-1.252	-1.268
Mongolia	-23.538	4.614	-7.345	-0.121	-0.079	0.265	-0.085
Mozambique	-27.042	1.931	-9.616	-0.671	-0.362	-0.892	-0.493
Mauritania	-25.417	2.282	-10.749	-0.254	-0.188	-0.466	-0.315
Martinique	0.950	n.a.	n.a.	n.a.	0.825	0.838	1.282
Mauritius	-21.602	5.956	-6.476	0.426	0.561	0.846	0.420
Malawi	-0.167	n.a.	n.a.	n.a.	-0.648	-0.639	-0.386
Malaysia	0.547	n.a.	n.a.	n.a.	0.794	0.447	0.686

(Continued)

Country	Infrastructure	Phones	Roads	Control of Corruption	Government Efficiency	Rule of Law	Regulatory Quality
Namibia	-24.417	4.695	-5.791	0.582	0.334	0.784	0.340
Niger	-28.864	0.689	-11.809	-0.796	-0.877	-0.874	-0.548
Nigeria	-26.715	1.518	-8.026	-1.149	-1.162	-1.213	-0.743
Nicaragua	-25.760	3.892	-7.438	-0.546	-0.662	-0.750	0.027
Netherlands	1.688	n.a.	n.a.	n.a.	2.165	2.242	1.916
Norway	-22.822	7.157	-5.104	2.082	1.814	2.042	1.248
Nepal	-0.345	n.a.	n.a.	n.a.	-0.621	-0.392	-0.350
New Zealand	-25.460	6.969	-4.797	2.313	1.820	2.011	1.594
Oman	-21.826	5.034	-6.159	0.689	0.877	1.104	0.578
Pakistan	-0.470	n.a.	n.a.	n.a.	-0.514	-0.773	-0.611
Panama	0.801	n.a.	n.a.	n.a.	-0.185	-0.338	0.051
Peru	-24.531	4.713	-8.729	-0.145	-0.179	-0.434	0.554
Philippines	-26.352	4.823	-6.314	-0.433	0.086	-0.287	0.373
Papua New Guinea	-28.474	2.595	-8.707	-0.738	-0.633	-0.446	-0.558
Poland	-23.044	6.123	-4.483	0.433	0.581	0.574	0.612
Korea, Dem. Rep.	-22.528	3.822	-7.921	-0.743	-1.041	-1.068	-1.874
Portugal	-22.413	6.999	-5.267	1.360	1.117	1.261	1.230
Paraguay	-25.639	5.006	-7.828	-0.914	-1.063	-0.800	-0.288
Qatar	-21.199	6.152	-8.355	0.598	0.721	1.060	0.307
Romania	-24.144	5.658	-4.875	-0.342	-0.519	-0.211	-0.091
Russia	-23.864	5.482	-9.068	-0.831	-0.517	-0.804	-0.657
Rwanda	-0.840	n.a.	n.a.	n.a.	-0.720	-0.340	-0.807
Saudi Arabia	-0.039	n.a.	n.a.	n.a.	-0.106	0.174	0.670
Sudan	-27.539	2.576	-13.165	-0.994	-1.385	-1.295	-1.148
Senegal	-28.238	3.869	-9.064	-0.344	-0.042	-0.227	-0.267
Singapore	-19.423	7.063	-5.563	2.340	2.341	2.030	1.939
Solomon Islands	-1.101	3.002	-8.819	n.a.	-0.965	-0.543	-0.772
Sierra Leone	-26.610	1.850	-7.940	-0.962	-0.966	-0.926	-1.060
El Salvador	-25.591	5.385	-7.165	-0.436	-0.263	-0.390	0.794

Somalia	-25.178	0.405	-9.330	-1.450	-2.138	-1.791	-2.377
São Tomé & Principe	-0.514	3.431	-7.235	n.a.	-0.754	-0.293	-0.696
Suriname	-24.898	5.591	-8.078	0.036	-0.126	-0.611	-0.772
Slovak Republic	-23.064	6.253	-4.958	0.206	0.235	0.240	0.397
Slovenia	-23.026	6.906	-4.588	0.942	0.679	0.844	0.645
Sweden	-23.648	7.244	-4.393	2.328	1.789	1.943	1.357
Swaziland	-0.062	n.a.	n.a.	n.a.	-0.418	-0.222	-0.143
Seychelles	-0.960	n.a.	n.a.	n.a.	-0.606	0.131	-0.041
Syrian Arab Republic	-0.955	n.a.	n.a.	n.a.	-0.796	-0.568	-0.371
Chad	-27.129	-0.330	-9.069	-0.820	-0.495	-0.725	-0.527
Togo	-24.843	2.996	-8.379	-0.677	-0.954	-0.863	-0.427
Thailand	-25.399	4.960	-8.914	-0.227	0.228	0.398	0.417

(Continued)

Country	Infrastructure	Phones	Roads	Control of Corruption	Government Efficiency	Rule of Law	Regulatory Quality
Tajikistan	-24.270	3.578	-7.026	-1.214	-1.310	-1.319	-1.555
Turkmenistan	-2.234	n.a.	n.a.	n.a.	-1.384	-1.205	-1.152
Tonga	-18.094	4.591	-5.050	-0.319	-0.493	-0.653	-0.689
Trinidad and Tobago	-21.235	5.811	-4.569	0.188	0.415	0.385	0.650
Tunisia	0.282	n.a.	n.a.	n.a.	0.803	0.279	0.314
Turkey	-24.026	6.264	-5.821	-0.154	-0.162	0.070	0.391
Taiwan Prov.of China	1.019	n.a.	n.a.	n.a.	1.222	0.783	0.989
Tanzania	-28.252	2.306	-8.250	-0.980	-0.567	-0.416	-0.194
Uganda	-26.335	2.415	-8.700	-0.731	-0.239	-0.602	0.156
Ukraine	-22.149	2.786	-6.906	-0.881	-0.778	-0.725	-0.819
Uruguay	-27.093	6.017	-8.887	0.589	0.594	0.553	0.830
Uzbekistan	-27.761	4.238	-7.339	-0.928	-1.029	-1.020	-1.547
St. Vincent & Grens.	0.129	5.482	-3.725	n.a.	-0.095	0.175	0.243
Venezuela, Rep. Bol.	-25.275	5.785	-7.743	-0.745	-0.886	-0.776	-0.267
Vietnam	-26.076	3.730	-7.985	-0.662	-0.236	-0.602	-0.606
Vanuatu	-21.599	3.571	-7.649	-0.319	-0.451	-0.426	-0.379
West Bank and Gaza	-0.178	n.a.	n.a.	n.a.	-0.183	0.089	0.472
Samoa	-19.992	n.a.	3.857	n.a.	-6.648	n.a.	n.a.
Yemen, Republic of	-0.525	n.a.	n.a.	n.a.	-0.632	-0.549	-0.946
Serbia and Montenegro	-24.739	5.854	-6.999	-0.924	-0.829	-0.993	-1.108
South Africa	-26.457	5.716	-5.988	0.466	0.315	0.259	0.313
Congo, Dem. Rep. of	-28.488	-0.527	-8.452	-1.563	-1.772	-1.820	-2.387
Zambia	-26.427	2.856	-7.428	-0.825	-0.729	-0.414	0.083
Zimbabwe	-25.998	3.721	-9.584	-0.586	-0.833	-0.570	-1.148

Source: Infrastructure, Telephones and Phones are the indexes calculated by the authors. Control of Corruption, Government Efficiency, Rule of Law and Regulatory Quality were obtained from Kauffmann, D.(2003). The information used to construct the airport infrastructure index was obtained from CIA World Fact Book, 1990 - 2001, and the World Bank World Development Indicators (2002). The indexes of Roads and Telephones were contructed using the information of phones, roads, surface and population available in the World Development Indicators (2002), World Bank.

The first three variables are in logarithms. All the indexes reported are only for year 2000.

Table A1 and A2 present the summary statistics for the variables used for year 2000 and for the whole sample, respectively.

Table A1. Summary Statistics Year 2000

Variable:	Obs.	Mean	SD	Pct.5	Pct. 95
Log Value of Air Transport Costs per Unit of Weight	116620	0.864	1.298	-1.296	2.736
Total Volume (ln)	116620	21.857	1.865	17.939	23.787
Product Unit Value (ln)	116620	3.765	1.602	1.396	6.604
Unbalance	116620	-0.048	0.350	-0.727	0.548
Distance (ln)	116620	8.916	0.552	7.951	9.578
Open Sky Agreement	116620	0.560	0.496	0.000	1.000
Airport Inf.	116620	-23.937	2.091	-28.167	-20.974
Regulatory Quality	116620	0.896	0.624	-0.196	1.635
Gov. Effectiveness	116620	1.084	0.880	-0.473	2.230
Developed Countries	116620	0.634	0.482	0.000	1.000

Table A2. Summary Statistics Whole Sample (1990 - 2001)

Variable:	Obs.	Mean	SD	Pct.5	Pct. 95
Log Value of Air transport costs per unit of weight	1830170	0.980	1.226	-0.997	2.788
Total Volume (ln)	1830170	17.418	1.660	14.179	19.296
Product Unit Value (ln)	1830170	3.739	1.557	1.426	6.470
Unbalance	1829563	-0.078	0.331	-0.727	0.509
Distance (ln)	1830170	8.945	0.545	7.879	9.579
Open Sky Agreement	1830170	0.292	0.455	0.000	1.000
Airport Inf.	1605448	-23.926	2.032	-28.060	-21.239
Regulatory Quality	1826134	0.936	0.622	-0.196	1.662
Gov. Effectiveness	1826134	1.133	0.855	-0.447	2.230
Developed Countries	1828762	0.659	0.474	0.000	1.000

Table A3. specifies the regions associated with each U.S. custom district.

Table A3. U.S. Regions

District of Entry	Region	District Code
Baltimore M.D.	1	13
Boston Mass.	1	4
Buffalo N.Y.	1	9
Chicago ILL.	1	39
Cleveland Ohio	1	41
Detroit Mich.	1	38
New York City N.Y.	1	10
Norfolk Va.	1	14
Ogdensburg N.Y.	1	7
Philadelphia Pa.	1	11
Portland Maine	1	1
Providence R.I.	1	5
St. Albans Vt.	1	2
St. Louis Mo.	1	45
Washington D.C.	1	54
Charleston S.C.	2	16
El Paso	2	24
Houston Tex.	2	53
Laredo Tex.	2	23
Miami Fla.	2	52
Milwaukee Wis.	2	37
Mobile Ala.	2	19
New Orleans La.	2	20
Port Arthur Tex.	2	21
Savannah Ga.	2	17
Tampa Fla.	2	18
Wilmington N.C.	2	15
Worth, Texas	2	55
Columbia-Snake	3	29
Duluth Minn.	3	36
Great Falls	3	33
Los Angeles	3	27
Minneapolis Minn.	3	35
Nogales Ariz.	3	26
Pembina N. Dak.	3	34
San Diego Calif.	3	25
San Francisco Calif.	3	28
Seattle Wash.	3	30

Source: U.S. Imports of Merchandise Database. U.S. Department of Commerce.

Table 1: Determinants of Air Transport Costs
Depedant Variable: Log Value of Air Transpor Costs per Unit of Weight

Variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Distance (ln)	0.197	0.208	0.196	0.191	0.184	0.182	0.199	0.185
	(0.035)***	(0.033)***	(0.038)***	(0.037)***	(0.034)***	(0.032)***	(0.033)***	(0.035)***
Total Volume (ln)	-0.031	-0.032	-0.032	-0.016	-0.018	-0.025	-0.029	-0.017
	(0.011)***	(0.012)***	(0.011)***	(0.015)	(0.013)	(0.014)*	(0.011)***	(0.012)
Product Unit Value	0.485	0.491	0.483	0.488	0.489	0.488	0.485	0.489
	(0.013)***	(0.013)***	(0.014)***	(0.013)***	(0.013)***	(0.013)***	(0.013)***	(0.013)***
Unbalance	-0.156	-0.138	-0.160	-0.108	-0.098	-0.110	-0.164	-0.102
	(0.059)***	(0.053)***	(0.064)**	(0.056)*	(0.042)**	(0.043)**	(0.057)***	(0.045)**
Airport Inf.	-0.041	-0.066		-0.030	-0.025	-0.025	-0.037	-0.024
	(0.011)***	(0.014)***		(0.012)**	(0.009)***	(0.009)***	(0.011)***	(0.009)***
Airport Inf. (Lagged 5 years)			-0.037					
			(0.012)***					
Gov. Effectiveness				-0.066		0.065		
				(0.029)**		(0.061)		
Regulatory Quality					-0.121	-0.193		-0.118
					(0.034)***	(0.075)**		(0.037)***
Open Sky Agr.							-0.048	-0.017
							(0.042)	(0.038)
Observations	116620	116620	116620	116620	116620	116620	116620	116620
R-squared	0.339	0.340	0.338	0.340	0.341	0.341	0.339	0.341
IV		Tel & Road						
F Test, Reg. Qual. & Gov. Eff. = 0						7.078		
Prob > F						0.001		

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

Table 2: Determinants of Air Transport Costs

Depedant Variable: Log Value of Air Transpor Costs per Unit of Weight

Variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Distance (ln)	0.181	0.191	0.179	0.179	0.181	0.179	0.177
	(0.034)***	(0.036)***	(0.035)***	(0.034)***	(0.034)***	(0.035)***	(0.036)***
Total Volume (ln)	-0.008	-0.014	-0.007	-0.009	-0.008	-0.009	-0.007
	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)
Product Unit Value	0.490	0.491	0.489	0.490	0.490	0.490	0.490
	(0.013)***	(0.013)***	(0.013)***	(0.013)***	(0.013)***	(0.013)***	(0.013)***
Umbalance	-0.095	-0.102	-0.092	-0.082	-0.097	-0.083	-0.079
	(0.049)*	(0.053)*	(0.051)*	(0.044)*	(0.052)*	(0.048)*	(0.045)*
Airport Inf.	-0.024	-0.042		-0.020	-0.024	-0.020	
	(0.010)**	(0.016)***		(0.009)**	(0.010)**	(0.009)**	
Airport Inf. (Lagged 5 years)			-0.020				-0.016
			(0.010)**				(0.009)*
Regulatory Quality				-0.076		-0.076	-0.080
				(0.043)*		(0.043)*	(0.044)*
Open Sky Agr.					-0.005	-0.001	
					(0.036)	(0.034)	
Dummy Developed Ctry.	-0.176	-0.128	-0.191	-0.109	-0.175	-0.109	-0.120
	(0.035)***	(0.046)***	(0.034)***	(0.051)**	(0.036)***	(0.051)**	(0.051)**
Observations	116620	116620	116620	116620	116620	116620	116620
R-squared	0.341	0.341	0.341	0.342	0.341	0.342	0.341
IV		Tel & Road					

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

Table 3: Determinants of Air Transport Costs

Dependant Variable: Log Value of Air transport costs per unit of weight

Variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total Volume(ln)	-0.014	-0.023	-0.005	-0.010	-0.062	0.068	-0.076	0.043	-0.097
	(0.045)	(0.042)	(0.044)	(0.044)	(0.034)*	(0.073)	(0.048)	(0.065)	(0.052)*
Product Unit Value	0.501	0.501	0.501	0.503	0.505	0.502	0.512	0.502	0.512
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.009)***	(0.010)***	(0.009)***	(0.010)***
Open Sky Agreement	-0.027	-0.024	-0.019	-0.018	-0.027	-0.085	-0.132	-0.022	-0.070
	(0.013)**	(0.012)**	(0.010)*	(0.010)*	(0.011)**	(0.037)**	(0.042)***	(0.044)	(0.048)
Open Sky Agreement								-0.016	-0.018
*Years since signed[1]								(0.009)*	(0.007)**
Airport Inf.					0.003		-0.067		-0.073
					(0.011)		(0.037)*		(0.037)*
Year	-0.022	0.335				-0.022	-0.004	-0.020	-0.002
	(0.006)***	(0.064)***				(0.009)***	(0.007)	(0.008)**	(0.008)
year (square)		-0.002							
		(0.000)***							
Observations	1747483	1747483	1747483	1747483	1601247	276858	221903	276858	221903
R-squared	0.422	0.423	0.423	0.433	0.430	0.465	0.487	0.465	0.487
Sample			1990 - 2001				1990 & 2001[2]		
Region Fixed Effect	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
District of entry Fixed Effect				Yes					
Year Fixed Effect			Yes	Yes	Yes				

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

1: Open Shy Dummy interacted with the number of years since the agreement was signed

2: Columns 6 to 9 include data, only for 1990 and 2001 for countries that are in the whole period.

Table 4: Determinants of Air Transport Costs

Dependant Variable: Log Value of Air transport costs per unit of weight

Variables:	(1)	(2)	(3)	(4)
Total Volume(ln)	-0.056	-0.057	-0.084	-0.090
	(0.037)	(0.037)	(0.033)**	(0.033)***
Product Unit Value	0.500	0.500	0.505	0.505
	(0.003)***	(0.003)***	(0.003)***	(0.003)***
Airport Inf.			0.003	0.002
			(0.011)	(0.011)
Open Sky Agreement	-0.009	-0.009	-0.016	-0.017
*Year signed[2]	(0.009)	(0.009)	(0.010)	(0.010)*
One Year After	-0.018	-0.019	-0.028	-0.029
	(0.013)	(0.013)	(0.015)*	(0.015)*
Two Years After	-0.029	-0.031	-0.040	-0.042
	(0.019)	(0.019)	(0.023)*	(0.023)*
Three Years After	-0.043	-0.044	-0.053	-0.055
	(0.019)**	(0.019)**	(0.022)**	(0.022)**
Four Years After		-0.058		-0.037
		(0.023)**		(0.018)**
Four of More Years After	-0.074		-0.061	
	(0.020)***		(0.017)***	
Five or More Years After		-0.088		-0.081
		(0.025)***		(0.019)***
Observations	1695944	1695944	1554189	1554189
R-squared	0.420	0.420	0.427	0.427
Sample	1990 - 2001			
Fixed Effect	Region & Year	Region & Year	Region & Year	Region & Year

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