

Document downloaded from:

<http://hdl.handle.net/10251/160801>

This paper must be cited as:

Martí Selva, ML.; Puertas Medina, RM. (2019). Factors determining the trade costs of major European exporters. *Maritime Economics & Logistics*. 21(3):324-333.  
<https://doi.org/10.1057/s41278-017-0093-5>



The final publication is available at

<https://doi.org/10.1057/s41278-017-0093-5>

Copyright Nature Publishing Group - Macmillan Publishers

Additional Information

# FACTORS DETERMINING THE TRADE COSTS OF MAJOR EUROPEAN EXPORTERS

## Abstract

The aim of this paper is to analyze the determining factors of trade costs in the top European exporting nations (Germany, United Kingdom, Italy, France, Netherlands, Belgium, Spain and Sweden). For this purpose, we have estimated a trade costs equation to evaluate the importance of logistical performance and other variables that may be key in determining trade costs. Our results reveal the great importance of logistics, even greater than the effect of *distance* on trade costs, and they also show that in those countries where trade costs are lower, *logistics* gets more decisive in international trade. This analysis allows one to draw conclusions on the type of improvements necessary for cost reductions and, therefore, for greater international competitiveness. The research has been conducted for two years, thus facilitating the detection of possible changes that can in turn reveal the existence of a trade pattern in these countries.

JEL Classification: C5; F1; O52

Keywords: Trade Cost, Logistical Performance, European Union, International Trade.

## Introduction

The substantial growth in international trade in recent years has not been free of obstacles. On the one hand, tariff and non-tariff barriers still exist, varying according to the sectors affected, and on the other, trade costs act as impediments to trade and have been gaining in importance, exerting a significant influence on trade patterns. Within this context, logistics plays a fundamental role. Inefficient logistics clearly result in higher logistics costs, which limit global integration and deepen divergence among nations.

The literature includes studies that have modelled these costs, to examine their influence on export and import flows. Thus, Krugman (1991) emphasised their importance in economic geography models. Limao & Venables (2001) analysed trade costs, as a dependent variable, based on geographical factors and infrastructure. Subsequently, Clark *et al.* (2004) investigated the determinants of US maritime costs, finding that port efficiency is a key factor. Moreover, Wilmsmeier *et al.* (2006), analysing South American countries, demonstrated that port efficiency, infrastructure, private sector

participation, and connectivity between ports are variables that significantly affect costs. The empirical findings of Persson (2013) suggest that countries with large export transaction costs will tend to export fewer goods. Also, Marti and Puertas (2017) analysed the importance of logistical performance in international trade and its influence on costs, focusing on the study of emerging countries. They concluded that it is not possible to establish a common pattern for all developing areas, as their economic, cultural, and political characteristics are very different. The results reflect on aspects that should be strengthened to improve these countries' international positioning.

At sector level, Martínez-Zarzoso et al. (2003) investigated the factors influencing maritime transport costs, applied to the ceramics sector in Spain. In the same line, Martínez-Zarzoso et al. (2008) focused on the determinants of maritime and land transport costs, looking into four sectors (agroindustry, ceramics, automotive, and machinery), concluding that their magnitudes limits trade, especially in high value-added sectors. More recently, Chen and Novy (2011) analysed trade costs between European countries, by distinguishing among various economic sectors, thereby contributing evidence regarding important factors such as distance, non-tariff measures, and initiatives of member countries. Miroudot et al. (2012) applied the same methodology to trade in services and Egger and Pruša (2016), using a random coefficient model, assessed the sensitivity of bilateral trade volumes.

Following this line of research, the aim of this paper is to analyse the factors determining trade costs in the top European exporting nations. The equation proposed by Arvis et al. (2013) is used to determine the importance of logistical performance and other variables. This analysis allows us to derive conclusions regarding the types of improvements necessary to lead to cost reductions and, therefore, to greater international competitiveness.

The analysis has been conducted for 2005 and 2008. Considering these two years allows the detection of possible changes that can, in their turn, reveal the existence of a trade pattern in the countries considered. Limited data availability for certain variables made it impossible to study subsequent years. However, the results may serve as a guide for these countries, enabling them to verify whether efforts intended to improve logistics have been fruitful or, conversely, whether there are still areas of vital importance requiring further effort.

The paper is structured as follows. In the section ‘Methodology: cost model and sample’ includes a detailed explanation of the methodology, specifying the equation to be estimated and the sample used. The section ‘Results’, the obtained results are analysed through the application of ordinary least squares (OLS). Finally, in section ‘Conclusions’, the main conclusions are summarised.

### **Methodology: cost model and sample**

To analyse trade costs, we have included all costs related to goods trade between two countries in a broad sense (Novy, 2013). Trade costs include not only tariffs and costs related to international trade, but also certain other components that, according to Anderson and van Wincoop (2003), are relevant factors such as language, currency, or complicated export or import procedures. Based on an estimated gravity model, Novy (2013) measured trade costs as the geometric mean of bilateral and international trade costs, thereby emphasising the substantially higher costs involved in international trade relative to the national trade. Therefore, trade costs are defined as follows:

$$\tau_{ijt} \stackrel{\text{def}}{=} \left( \frac{t_{ijt} t_{jit}}{t_{iit} t_{jtt}} \right)^{\frac{1}{2}} - 1 = \left( \frac{x_{iit} x_{jtt}}{x_{ijt} x_{jit}} \right)^{\frac{1}{2(\sigma - 1)}} - 1 \quad (1)$$

where

$\tau_{ijt}$ : Geometric mean of trade costs between country  $i$  and country  $j$  at time  $t$

$t_{ij}$ : Costs of international trade from country  $i$  to country  $j$  at time  $t$

$t_{ji}$ : Costs of international trade from country  $j$  to country  $i$  at time  $t$

$t_{ii}$ : Costs of international trade from country  $i$  at time  $t$

$t_{jj}$ : Costs of international trade from country  $j$  at time  $t$

$x_{ij}$ : Flow of international trade from country  $i$  to country  $j$  at time  $t$

$x_{ji}$ : Flow of international trade from country  $j$  to country  $i$  at time  $t$

$x_{ii}$ : Flow of international trade from country  $i$  at time  $t$

$x_{jj}$ : Flow of international trade from country  $j$  at time  $t$

$\sigma$ : Specific substitution elasticity between goods from the sector. Novy (2013) considers that the substitution elasticity equals 8 in all countries and years, which represents a mean value of estimates.

The variable  $\tau_{ijt}$  includes not only the international transport costs and tariffs but also a wide range of trade costs that hinder international trade (Duval and Utoktham, 2011). This value is an approximation that is more exact than estimations traditionally used in gravity models, based on geographical distance, as it includes observable and non-observable factors. The tariff and non-tariff measures constitute one single component, as well as transport costs, behind the border barriers and costs linked to the provision of logistical services (Arvis et al. 2013).

In line with Chen and Novy (2011) and Arvis et al. (2013), we define an equation that allows us to explain the determinants of trade costs. Specifically, the expression is as follows:

$$\begin{aligned} \text{Log}(\tau_{ijt}) = & \beta_0 + \beta_1 \text{Log}(D_{ij}) + \beta_2 \text{Log}(1+T_{ijt}) + \beta_3 \text{Log}(ER_{ijt}) + \beta_4 \text{Log}(ACI_{ijt}) \\ & + \beta_5 \text{Log}(EC_{ijt}) + \beta_6 \text{LPI}_{ijt} + \beta_A W + u_{ij} \end{aligned} \quad (1)$$

where,

$\tau_{ijt}$ : Trade Cost between country  $i$  and country  $j$  at time  $t$

$D_{ij}$ : Distance between country  $i$  and country  $j$

$T_{ijt}$ : Geometric average of tariff applied to  $i$  to  $j$ 's exports and by  $j$  to  $i$ 's exports at time  $t$

$ER_{ijt}$ : Geometric average of the average official USD exchange rate of country  $i$  and country  $j$  at time  $t$   
 $ACI_{ijt}$ : Geometric average of country  $i$ 's and  $j$ 's score on the Air Connectivity Index (ACI) at time  $t$ . ACI measures integration in the global air transport network.  
 $EC_{ijt}$ : Geometric average of the cost of starting a business in country  $i$  and country  $j$  at time  $t$   
 $LPI_{ijt}$ : Geometric average of country  $i$ 's and  $j$ 's score on the Logistics Performance Index at time  $t$   
 $W$ : Dummy variables: common border (conting), has been colony (colony), and same regional trade agreement (RTA)  
 $u_{ij}$ : Stochastic term.

Trade costs are expressed as a percentage of equivalent *ad valorem*, obtained from the World Bank database (*ESCAP World Bank: International Trade Costs*). Regarding explanatory variables, distance between countries, expressed in kilometres, has been obtained from CEPII (*Centre d'Etudes Prospectives et d'Informations Internationales*), serving as a first approximation of the distance, given the complexity of determining the location of production areas, which are often distributed throughout a given territory. Tariffs and an air connectivity index, also from the World Bank, as well as the cost of starting a business, are obtained from *Doing Business*<sup>1</sup>. The exchange rate is taken from the *World Development Indicators*. Considering that trade costs are expressed as geometric mean, the rest of the independent bidirectional variables have also been transformed, taking the geometric mean for both directions. In this way, only one direction for each bilateral pair of trade relations has been maintained. The set of dummy variables that characterise countries socially and culturally has also been obtained from CEPII<sup>2</sup>.

To evaluate the importance of logistics for costs of major European exporters, we use the Logistics Performance Index (LPI), published by the World Bank, which is a

---

<sup>1</sup> <http://www.doingbusiness.org/reports/global-reports/doing-business-2005>

<sup>2</sup> Liner shipping connectivity index has not been used because it did not have information about all the countries under analyzes.

measure of the logistical performance of 150 countries (43 from Africa, 42 from Europe, 41 from Asia, 22 from Latin America, 5 from the Pacific and 2 from North America). This measure is based on surveys among logistics professionals of these countries (international freight forwarders and transport companies) to assess the predictability and reliability of specific aspects related to goods transport. Therefore, it is important to mention that the index works on qualitative characteristics of interviewees, as opposed to other indicators that are determined using real infrastructure data. The questionnaire consists of questions whose answers are qualitative and quantitative, focused on the following axes:

- Customs: Measures the agility of dispatch processes in terms of speed, simplicity, and predictability of formal issues conducted by customs control bodies.
- Infrastructure: Evaluates the quality of maritime, land, rail, and air transport infrastructure. The perception held by respondents about infrastructure is assessed in terms of modes of transport, together with storage and transportation of goods moving goods.
- Contracting: Measures the ease of negotiating competitive prices (transport costs).
- Logistics competence: Indicates the quality of logistical services, such as those of transport operators or customs agents.
- Traceability: Measures the follow-up and location of shipments. Identifying the exact location and route followed by each good is relevant up to the moment of delivery to the final client. In this component, all agents of the good's supply chain are involved; therefore, traceability is the result of global action.

- **Punctuality:** Refers to the exact time of shipment delivery. It is important to consider this factor because due to the high degree of existing competition in international trade, not meeting the agreed times is unacceptable.

None of these areas alone can ensure good logistics performance. The LPI synthesises all of this information, allowing comparisons between countries. Thus, the weighted average of these six components creates an index that reflects perceptions of logistics of a country. Its score can range from 1 (worst) to 5 points (best). This index is one of the referents for comparing the situation of logistics across countries and it is based on surveys among logistics professionals in the country (international freight forwarders and transport companies), aiming to assess the predictability and reliability of specific aspects related to goods transport.

The sample is composed of the 8 largest EU exporters in terms of volume, representing a significant share of overall European trade (80.1% of total EU exports in 2005 and 75.1% in 2008). Germany's dominant role in EU trade is clear (more than 30% of total exports for the 8 countries in both years). France occupies the second position (13.6 and 13% in 2005 and 2008, respectively), while the Netherlands climbed from fifth in 2005 to third place in 2008 (Table 1).

**Table 1.** The major European Exporters (2005 and 2008 in thousands of mil \$)

	<b>2005</b>	<b>(%)</b>		<b>2008</b>	<b>(%)</b>
Germany	977.13	30.7%	Germany	1,466.14	32.1%
France	434.35	13.6%	France	594.50	13.0%
United Kingdom	392.74	12.3%	Netherlands	545.85	12.0%
Italy	372.96	11.7%	Italy	541.79	11.9%
Netherlands	349.81	11.0%	United Kingdom	482,02	10.6%
Belgium	335.69	10.5%	Belgium	471.80	10.3%
Spain	192.80	6.1%	Spain	279.23	6.1%

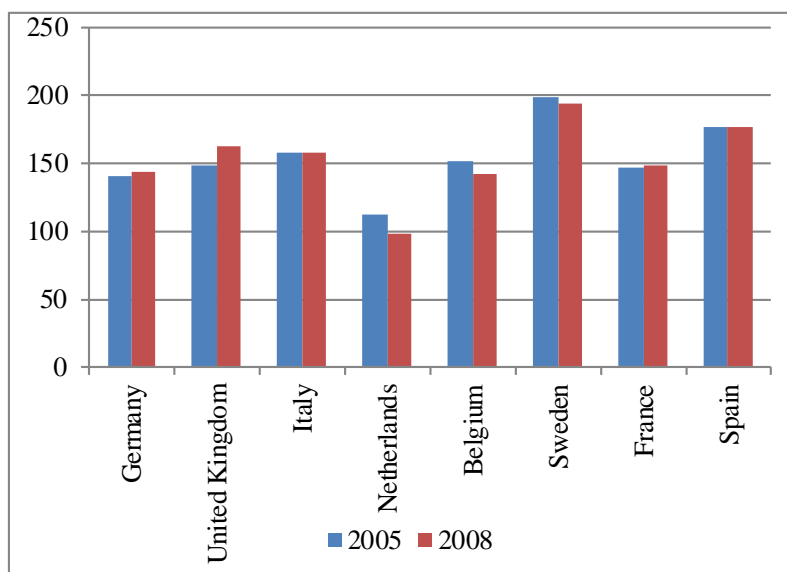


Sweden	130.26	4.1%	Sweden	183.88	4.0%
Total	<b>3,185.75</b>	<b>100.0%</b>	Total	<b>4565.21</b>	<b>100.0%</b>

Source: Own elaboration. Data from Comtrade

With regard to importing countries, the study considered approximately 126-127 of the 150 countries for which the World Bank publishes LPI, omitting those lacking an index value for the two years analysed. Figure 1 presents the mean trade costs in each of these areas for the two years analysed.

**Figure 1.** Mean trade costs (% of ad valorem equivalent)



Source: Own elaboration. Data from *ESCAP World Bank: International Trade Costs*

Sweden has the highest costs among European economies, reaching almost 200% *ad valorem* in 2005, followed by Spain. Another important observation is the decrease of costs in the Netherlands in 2008, favouring international trade relations, unlike the United Kingdom whose increased costs has resulted in a loss of significance between European exporters. Table 2 shows the classification between maximum and minimum cost for

major European exporters. We can observe the good position occupied by the Netherlands against the emerging countries, whose low development makes their trade more costly.

**Table 2.** Maximum and minimum trade cost between major European exporters

	2005		2008	
	Max	Min	Max	Min
<b>Germany</b>	Niger	Netherlands	Mauritania	Netherlands
<b>United Kingdom</b>	Lesotho	Netherlands	Buthan	Netherlands
<b>Italy</b>	Buthan	Netherlands	Buthan	Netherlands
<b>Netherlands</b>	Mauritania	Belgium	Buthan	Belgium
<b>Belgium</b>	Buthan	Netherlands	Buthan	Netherlands
<b>Sweden</b>	Burundi	Denmark	Chad	Denmark
<b>France</b>	Buthan	Netherlands	Buthan	Netherlands
<b>Spain</b>	Rwanda	Portugal	Buthan	Netherlands

Source: Own elaboration. Data from *ESCAP World Bank: International Trade Costs*

## Results

Following the methodology outlined in the previous section, the determinants of trade costs are analysed by estimating equation (1) by OLS. This allows the detection of countries that should exert greater effort to improve their international position and maximise their growth (Table 3). The coefficients of all the variables have been standardised to facilitate comparison.

The most important factors explaining trade costs concern primarily public- and export policies, aiming to minimise trade costs and improve export competitiveness. As common in the literature, a *distance* variable is included in gravity models, as an indicator (proxy) of transport costs. However, other factors, apart from distance, also condition trade costs.

First, in line with prior research (Arvis et al. 2013), distance and LPI are clearly important determinants of trade costs. The importance of trade facilitators in national development is reinforced; this, in turn, reinforces the fact that improved logistics significantly reduce trade costs. Furthermore, this result confirms that treating distance as a proxy for transport costs is an effective approach.

**Table 3.** Determinants of trade costs

	Germany		United Kingdom		Italy		Netherland		Belgium	
	2005	2008	2005	2008	2005	2008	2005	2008	2005	2008
<b>Entry Costs</b>	0,0056	-0,0001	0,0029	0,0099	0,0094	0,0036	0,0130	0,0180	-0,0026	0,0017
<b>ACI</b>	-0,0203*	-0,0318**	-0,0021	-0,0052	0,0088	-0,0127	-0,0003	0,0120	0,0056	0,0037
<b>Exchange Rate</b>	-0,0057	-0,0045	-0,0064	-0,0082	0,0141	0,0064	-0,0072	-0,0188	0,0107	-0,0133
<b>LPI</b>	-0,1256***	-0,1107***	-0,1333***	-0,1248***	-0,1093***	-0,0852***	-0,1354***	-0,1178***	-0,1242***	-0,0926***
<b>Distance</b>	0,0733***	0,0600***	0,0562***	0,0424**	0,0864***	0,0687***	0,0667***	0,0643***	0,0660***	0,0397**
<b>Tariff</b>	0,0077	0,0331*	-0,0036	0,0036	-0,0204	0,0089	-0,0192	0,0119	-0,0162	0,0072
<b>RTA</b>	-0,0398**	-0,0575***	-0,0235	-0,0471**	-0,0257	-0,0488**	-0,0341	-0,0313	-0,0314**	-0,0532***
<b>Contig</b>	-0,0275*	-0,0284*	-0,0167	-0,0116	-0,0112	-0,0136	-0,0457***	-0,0744***	-0,0476***	-0,0701***
<b>Colony</b>	-0,0075	-0,0151	-0,0403***	-0,0480***	-	-	0,0036	0,0007	-0,0123	-0,0016
<b>R<sup>2</sup></b>	0,767	0,748	0,694	0,656	0,688	0,654	0,657	0,6861	0,748	0,712
<b>N° obs</b>	127	124	127	125	127	123	127	120	126	122

	Sweden		France		Spain		All countries	
	2005	2008	2005	2008	2005	2008	2005	2008
<b>Entry Costs</b>	0,0256	0,0441***	0,0050	0,0032	0,0008	-0,0014	-0,0108**	-0,0117**
<b>ACI</b>	-0,0131	-0,0194	0,0021	-0,0056	0,0230	0,0172	-0,0171***	-0,0228***
<b>Exchange Rate</b>	-0,0080	-0,0056	-0,0066	-0,0064	0,0089	0,0066	0,0127***	0,0088
<b>LPI</b>	-0,1335***	-0,0977***	-0,1043***	-0,0876***	-0,1283***	-0,1023***	-0,1259***	-0,1095***
<b>Distance</b>	0,0667***	0,0457**	0,0108	0,0016	0,0654***	0,0552***	0,0587***	0,0504***
<b>Tariff</b>	-0,0079	0,0158	-0,0098	0,0275	-0,0276*	-0,0057	-0,0163***	0,009
<b>RTA</b>	-0,0464***	-0,0609***	-0,0751***	-0,0728***	-0,0434***	-0,0586***	-0,0459***	-0,0557***
<b>Contig</b>	-0,0096	-0,0112	-0,0471***	-0,0395***	-0,0273***	-0,0301**	-0,0307***	-0,0339***
<b>Colony</b>	-0,0190	-0,0313**	-0,0413***	-0,0453***	-0,0356***	-0,0414***	-0,0240***	-0,0231***
<b>R<sup>2</sup></b>	0,735	0,705	0,650	0,63	0,719	0,651	0,676	0,626
<b>N° obs</b>	126	121	126	124	126	123	1012	982

Note: \*, \*\* and \*\*\* denote test statistical significance at the 10% 5% and 1% levels, respectively.

Interestingly in our results, the particular case of France is notable. Here, distance loses significance in countries that participate in a RTA (EU-Algeria, EU-Tunisia, EU-Chile, EU-Egypt, EU-Mexico, among others), have a common border, or have been a French colony. Most French products are destined for neighbouring countries in the EU (Germany, Italy, the United Kingdom, Belgium, Spain and the Netherlands). The results indicate that trade costs are reduced to the extent that France has trade agreements with importing countries (Algeria, Morocco, Tunisia, Syria, Mexico, among others).

Comparing the results obtained in 2005 and 2008 reveals that, in the latter year, in aggregate for all countries studied, and in each of them, logistics, distance and colony decline in importance as determinants of trade costs while entry cost, ACI, tariff and RTA gain relevance. This highlights the need for countries to continue to adopt policies intended to further facilitate not only trade but also trade agreements.

## **Conclusions**

The process of globalization has intensified international competition, with supply chain efficiency playing a central role. EU countries have implemented major reforms to improve their logistics performance, with an emphasis mainly on the modernization of their infrastructure and regulatory systems, as well as a more open transport sector. They have managed to reduce supply chain costs, not only with regard to freight and port charges, but also costs related to predictability, reliability, and quality of logistics services.

Exporting is directly conditioned by the trade costs, which in turn depend on a country's logistics performance. Focusing on this premise we have analysed the

importance of specific explanatory variables in determining trade costs. The analysis was carried out in order to provide empirical evidence on the logistical dimensions that should be prioritised, depending on country specificities.

The results reveal that the analysed countries should continue efforts to improve their logistics, not only to boost their trade but also to improve their competitiveness. Similarly, it is found that *distance* remains a key determinant of trade costs, albeit one that is consistently less important than logistics. Finally, we also find that countries should prioritize the improvement the conditions agreed in all trade agreements because, in a period of only three years, this variable gained relevance over distance. In the period 2005-2008 no new RTA have been signed, and even do this variable has gained importance in the determination of commercial costs.

The free movement of goods and services determined by RTA signed between countries of different continents is positioning itself as one of the most determining variables of the cost of trade together with the LPI. The reduction of trade costs is essential to promote the internationalization of production. Countries that achieve an adequate development of their logistics and eliminate trade barriers between countries will be able to position themselves in international markets.

### **Acknowledged**

The authors appreciate the referees suggestions, these have made possible to improve the paper.

### **References**

Anderson, J. E. and Wincoop, E.V. (2003) Gravity with gravitas: A solution to the border puzzle. *American Economic Review* 93 (1): 70-192.

- Arvis, J.F., Duval, Y., Shepherd, B. and Utoktham, C. (2013) Trade costs in the developing world 1995-2010, working paper, The World Bank. Poverty Reduction and Economic Management Network. International Trade Department No. 6309.
- Chen, N. and Novy, D. (2011) Gravity, trade integration, and heterogeneity across industries. *Journal of International Economics* 85 (2): 206-221.
- Clark, X., David, D. and Micco, A. (2004) Port efficiency, maritime transport cost, and bilateral trade. *Journal of Development Economics* 75(2): 417-450.
- Egger, P. and Pruša, J. (2016) The determinants of trade costs: a random coefficient approach. *Empirical Economics* 50(1): 51-58.
- Henderson, V., J., Shalizi, Z. and Venables, A.J. (2001) Geography and development. *Journal of Economic Geography* 1(1): 81-106.
- Krugman, P. (1991) Increasing returns and economic geography. *Journal of Political Economy* 99(3): 483-499.
- Limao, N. and Venables, A.J. (2001) Infrastructure, geographical disadvantage, transport costs and trade. *The World Bank Economic Review* 15(3): 451-479.
- Marti, L. and Puertas, R. (2017) The importance of export logistics and trade costs in emerging economies. *Maritime Economics & Logistics* 19 (2): 315-333.
- Martinez-Zarzoso, I., García-Menendez, L. and Suarez-Burguet, C. (2003) Impact of transport costs on international trade: The case of Spanish ceramic exports. *Maritime Economics & Logistics* 5(2): 179-198.
- Martinez-Zarzoso, I., Perez-García, E. and Suarez-Burguet, C. (2008) Do transport cost have a differential effect on trade and the sectoral level?. *Applied Economics* 40(24): 3145-3157.

Miroudot, S., Saurage, J. and Shepherd, B. (2012) Measuring the cost of international trade in services, WIOD Conference, 26-28 May Vienna.

Novy, D. (2013) Gravity redux: Measuring international trade cost with panel data. *Economic Inquiry* 51(1): 101-121.

Persson, M. (2013) Trade facilitation and the extensive margin. *The Journal of International Trade & Economic Development* 22(5): 658-693.

Wilmsmeier, G., Hoffmann, J. and Sanchez, R.J. (2006) The impact of port characteristics on international maritime transport cost. *Research in transportation economics* 16(1): 117-140.