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Intermodal connections at Spanish ports and their role in capturing hinterland traffic

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ABSTRACT

This article seeks to explain the dynamism of Spanish ports in capturing traffic in shared and disputed hinterlands using pool balanced dynamic models. The ability to capture this traffic is closely linked to each port's particular characteristics, including location, size and the presence of a logistics park. There is no correlation between capturing traffic and either the port having good intermodal port-rail connections or the dynamics of port traffic that does not originate in the hinterland. These empirical results are contrasted with the opinions of port managers. Both analyses are employed to discuss a number of recommendations on port management.

1. Introduction

The port system in Spain has expanded extensively over the last two decades, especially since the beginning of the port devolution process in 1992. This path of reform continued first with the 1997 change in legislation, which sought greater political decentralization for ports and the naming of port presidents by regional governments (Castillo-Manzano et al., 2010) and then the 2003 and 2011 Acts which committed to greater private initiative. The Spanish port system has thus evolved from a service port model into a landlord model, as have most European ports (see Castillo-Manzano and Asencio-Flores, 2012). Today, day-to-day management is decentralized, and port authorities enjoy a high degree of autonomy (Castillo-Manzano et al., 2008).

The dynamism of the Spanish port system is illustrated by the fact that Spain currently has two ports, Algeciras Bay and Valencia, in the list of the world's top fifty container ports although up to 2009 this figure had been 3, as the port of Barcelona was also in the list. According to Rodrigue and Notteboom (2010), this is due to the strong development of trade flows in the Latin arc (the coastline from southern Spain to northern Italy). As a result of this success, the Spanish port system has also frequently been the subject of case studies in the international literature (see, for example, Albalate et al., 2013; Castillo-Manzano et al., 2010; Castillo-Manzano et al., 2008; Garcia-Alonso and Sanchez-Soriano, 2010; González and Trujillo, 2008). Many of these studies have identified the system's specialization in international container transshipment as a major factor in its success (Castillo-Manzano et al., 2008; González and Trujillo, 2008).

This study complements earlier studies by analyzing the dynamism of inbound and outbound port hinterland traffic, i.e., all traffic that requires an intermodal connection with the rail or truck networks. This paper goes further than studies that defined hinterlands geographically (see the pioneering study by Zubieta, 1978) and, taking the Spanish port system as its reference, focuses on the factors that determine the capture of traffic in the hinterland.

This analysis is economically relevant given the need to decide choose between investment projects put forward by port authorities that are competing for increasingly limited public resources in the current context of economic restrictions, especially in a country such as Spain, which is being forced by the EU to significantly reduce its government deficit (see Bi, 2012, on Spanish debt risk, which is hampering Spanish government financing). Funding is centralized in the Spanish port system, with the central government both approving and generally co-funding port authority investments.

The economic climate and institutional scenario mean that new criteria are needed to rationalize investments in port systems like Spain's, where there are many medium-small ports in addition to

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Table 1
Main characteristics of Spanish mainland ports, 2009.

Port authority	Total traffic (thousands of tons)	Hinterland traffic by rail or truck (thousands of tons)	Rail traffic over total hinterland traffic	Extra days at sea Rotterdam-Suez-Panama	Logistics park
Algeciras Bay	69769.46	7454.45	0.62%	0.00	Under construction
Alicante	2510.40	2377.32	0.00%	0.50	Planned
Almeria-Motril	5922.22	2283.62	0.00%	0.00	No
Aviles	4000.02	3179.53	12.61%	3.60	Planned
Barcelona	42964.55	29503.76	2.47%	1.70	Yes
Bilbao	32180.13	11807.28	8.29%	5.30	Yes
Cadiz Bay	4007.63	3797.23	0.00%	0.10	No
Cartagena	20571.79	3934.36	0.33%	0.20	Planned
Castellon	11113.56	3296.32	0.00%	0.20	Planned
Corunna (La Coruña)	11917.02	4847.60	18.55%	2.30	No
Ferrol-San Cibrao	12251.14	10436.69	0.13%	2.30	Planned
Gijon	14632.97	7443.94	21.61%	3.70	Planned
Huelva	17675.59	4156.68	0.93%	0.50	No
Malaga	2151.57	1450.08	0.00%	0.10	No
Marin-Pontevedra	1683.54	1640.99	9.72%	1.90	No
Pasajes	3519.11	3247.06	9.13%	6.00	No
Santander	4486.41	4374.17	22.42%	4.90	No
Seville (Sevilla)	4501.49	4353.44	3.97%	1.10	Yes
Tarragona	31527.74	7333.27	12.61%	1.60	Planned
Valencia	57784.70	25668.63	6.32%	1.20	Under construction
Vigo	3938.79	3558.43	0.00%	1.80	Under construction
Vilagarcia	966.07	933.48	2.94%	2.00	No

the large ports. Five large Portuguese port authorities, Leixoes, Aveiro, Lisbon, Setubal and Sines, must also be considered alongside the large numbers of ports on the Spanish mainland (see Castillo-Manzano and Asencio-Flores, 2012 for an analysis of the competition between the Spanish and Portuguese port systems). The Iberian Peninsula could therefore be regarded as a system of port 'fiefdoms', where each port's more or less captive hinterland is reduced to the surrounding area, generally speaking an area the size of a province or smaller. As a result, there is fierce competition between ports because their hinterlands, or areas of economic influence, are generally non-exclusive (see Garcia-Alonso and Sanchez-Soriano, 2010), as are the *umlands* or local hinterlands in many cases (which is not the norm for European ports, see Notteboom, 2010).

In short, there is little genuinely captive traffic, and the distances between the main markets, such as the capital city, Madrid, and its surrounding towns and dry port (see Roso et al., 2009, for a complete analysis of the importance of dry ports with direct rail connections to seaports) and the mainland ports are very similar. The center of the Spanish mainland, with over six million inhabitants, can therefore be regarded as a huge hinterland shared by all mainland ports (see Notteboom, 2009, who illustrates this hypothesis graphically).

There are, nonetheless, some inland terminals, such as the Zaragoza Maritime Terminal (see Rodrigue et al., 2010; Rodrigue and Nottemboom, 2012 for an analysis of the similarities and differences between inland terminals depending on the countries where they are implemented, especially between Europe and North America, and Padilha and Ng, 2012 for inland terminals in developing countries) for which this is not true, and the shorter distances between them and certain ports, such as Barcelona in the case of Zaragoza, gives them an advantage.

This article is framed in intermodal freight transportation research. This is currently a dynamic field as, according to Bontekoning et al. (2004), intermodal freight transportation has developed into a significant sector of the transportation industry in its own right. According to Rodrigue and Notteboom (2010), international supply chains have become complex in this particular field and the pressure on gateway logistics is increasing, not only in terms of infrastructure and capacity, but also more efficient regional freight distribution strategies. Similarly, according to Van Der Horst and De Langen (2008), there has been a shift from competition between ports to competition between transport chains, as a result of which the efficiency of inland transport is now perceived as a key success factor for European ports (see Lowe, 2005, for a more universal view with multiple examples of this issue). In short, following Yu et al. (2009), efficient supply and export chains need to be established to ensure that cargoes are shipped smoothly and cost-effectively.

In this context, and based on the findings of prior studies (Ducruet et al., 2010a,b; Talley, 2009; Woxenius and Bergqvist, 2011), we will formulate a series of hypotheses regarding the factors that affect the capture of traffic in the hinterlands of Spanish ports, i.e., traffic that is closely linked to the economic fabric of the country, as it forms part of companies' logistics chains, whether for the supply of their inputs or as an outlet for their outputs. However, before doing so, a survey was conducted among Spanish National Ports System managers with the sole aim of finding out whether their opinions supported these hypotheses.

Once the hypotheses have been formulated, modeling will be used to test the evolution of port traffic to/from the mainland hinterland. Specifically, balanced dynamic pool models will be developed and estimated jointly for a cross-sectional sample comprising the 22 Spanish mainland ports with advanced features regarding the noise covariance structure. The final model will be the result of an iterative procedure that combines economic theory and empirical analysis. This will then all be used as the basis for recommendations for devising an efficient investment policy for the Spanish production system.

Among the issues that we will attempt to address are any synergies found between greater traffic dynamism and other factors, such as the existence of a logistics park or the port having good intermodal port-to-rail connections. With respect to the former, the purpose of logistics parks is to act as gateways to port hinterlands, generally by warehousing import goods for the primary commercial distribution chains and hypermarkets for further distribution on a regional scale. These parks could in

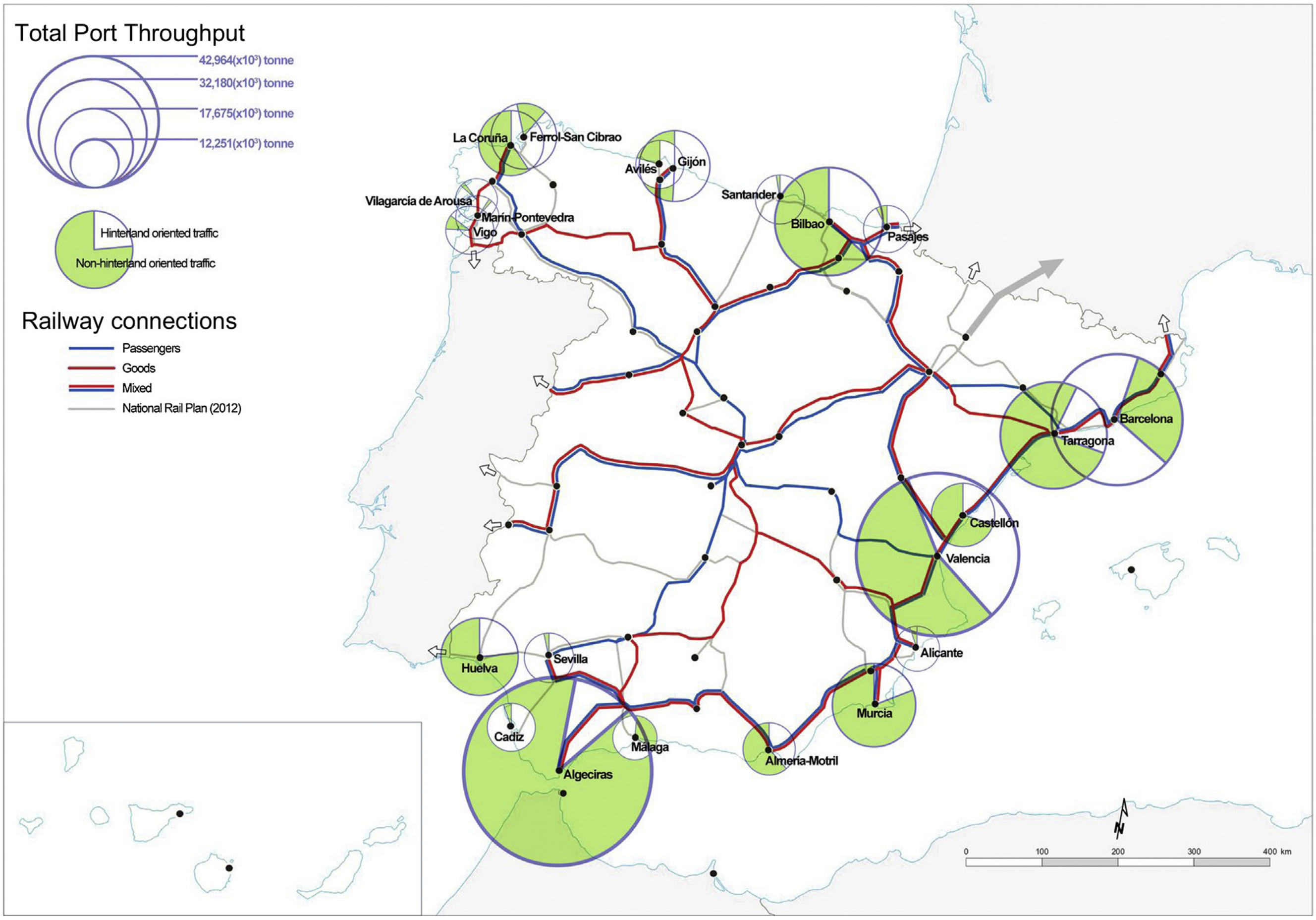

Fig. 1. Map of Spanish mainland ports.

theory be linked to the dynamic traffic in the hinterland, as ports with major consumer markets in their hinterlands are more likely to develop into logistics centers (Talley, 2009). Regarding the importance of the second aspect, there is broad agreement in the literature that a port should have good intermodal port-to-rail connections. According to Woxenius and Bergqvist (2011), the scale of hinterland transport can be increased by using rail and inland waterways rather than trucks. Roso et al. (2009) state that this can be attributed to the many advantages of rail, namely, fewer environmental spillover effects, lighter port city traffic, lower transport distance costs, more rapid throughput in ports and, in most cases, less sensitivity to delays caused by traffic congestion.

Another variable that must be taken into consideration when analyzing traffic capture is the size of the ports, as it is logical to assume that larger ports play an important role as gateways for large continental hinterlands or coastal agglomerations (Ducruet et al., 2010a). Along with size, location is considered to be a port's most significant characteristic (Malchow and Kanafani, 2004). According to Ducruet et al. (2010b), this topic has not been sufficiently addressed in the ports literature. Following Fleming and Hayuth's (1994) definitions, this location, measured by latitude and longitude, makes it possible to measure proximity to origin/destination markets (centrality) and insertion in carrier networks (intermediacy). However, when applied to Spain, this does not sufficiently explain differences between ports near the Straits of Gibraltar, which have a competitive advantage in bunker traffic, Mediterranean ports that are closer to the Far East-Europe routes, which have a competitive advantage in serving the interior of the country, and the ports on the Cantabrian coast, which are more dependent on feeder services from the North Sea ports.

We also examine synergies between economic activity in the area or any other traffic, from short sea shipping to international container transshipment, and the dynamism of traffic captured in the port's hinterland.

2. Methods

The Spanish port system currently consists of 28 Port Authorities that operate 44 general interest ports, although for most of the period analyzed, 1994–2009, there were only 27.[1] All the ports not located on the Iberian Peninsula were eliminated from this group of 27 because no good railroad connections exist in such cases and it is nonsensical to think that they should. The ports located on the Canary Islands and the Balearics have therefore been excluded, as have the port authorities of Ceuta and Melilla in northern Africa. To summarize, we used a pool of 22 port authorities. The main characteristics of these ports that are relevant for our analysis are given in Table 1, while their geographical locations are shown in Fig. 1.

[1] In October 2005, the Almeria-Motril Port Authority was split into two.

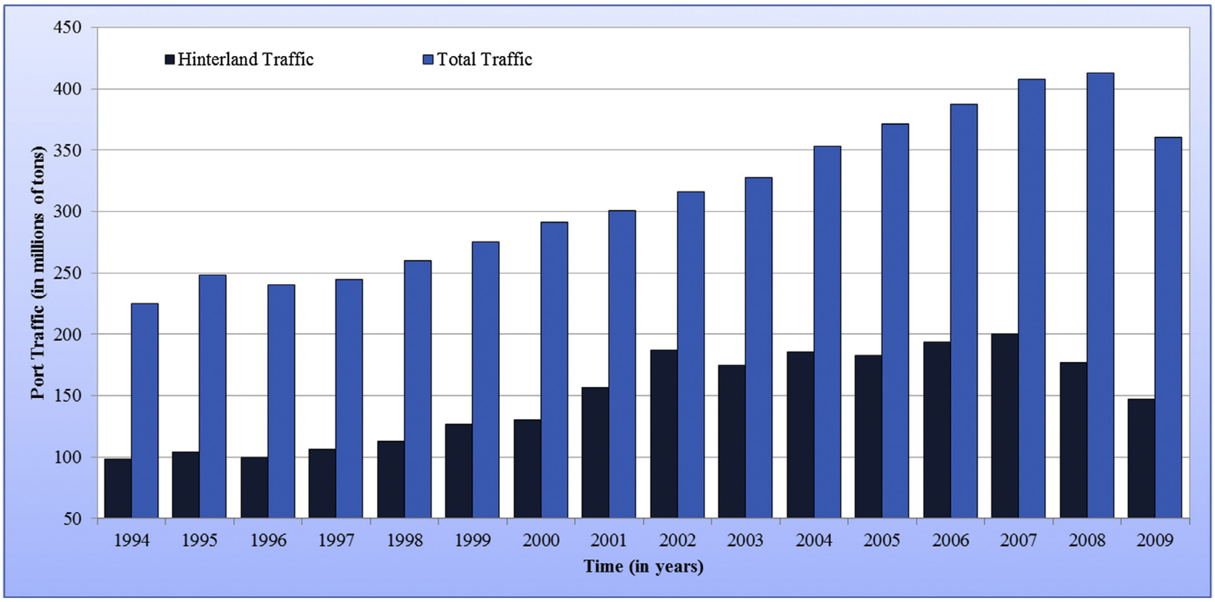

Fig. 2. Evolution of Spanish mainland port traffic (1994–2009).

Fig. 1 also provides an overview of traffic volume at each of these ports and the points of origin of the traffic, both inside and outside the ports' hinterlands. It is apparent from both Table 1 and Fig. 1 that the characteristics and size of the ports are fairly heterogeneous except for one geographical feature; the average distance to Madrid by road is 418.5 kilometers (260 miles), with a standard deviation of only 65 kilometers (40.4 miles). Hence, as stated in the introduction, the distance from any of the mainland ports to the major markets in the interior, especially Madrid, is very similar in terms both of both space and time.

Finally, Fig. 2 completes the information for the mainland port system with both hinterland and overall traffic trends.

A survey was conducted of the main managers of the ports included in our study and executives at the National Ports Agency. The questionnaire consisted of a list of determinants and their definitions and had previously been tested by colleagues at other universities specializing in port management. Appendix A includes a translation of the original questionnaire into English.

The questionnaire asked the port managers and the management of the National Ports Authority to score (0–10) a list of possible determinants that, in their opinion, would explain traffic capture in port hinterlands. A total of 20 top managers responded, including 13 port authority presidents and 7 State Port Agency executives. The response rate was therefore 57%, for the ports analyzed in this article and almost 80% for the various State Port Agency departments.

A priori, judging by the survey's mean and median scores (Table 2), the capture of traffic in a port's hinterland clearly seems to be positively linked to the determinants selected on the basis of previous studies. There only seems to be slight heterogeneity in the "Detour distance to the port on the Gibraltar-Suez route" criterion. The score is positive, but the lower absolute score and especially the fact that it presents the highest standard deviation indicate that respondents are not unanimous in their opinion that it is positive (Table 2). However, there are many criteria with scores of approximately 8 or more. Generally speaking, their standard deviations are, under 1.5 or 1, and their low scores are around 5. These criteria are almost unanimously considered by the managers and presidents to have a positive influence. They are, specifically, the quality of rail facilities near the port, direct connections with the national road network, a port's geographical location, changes in the national economy, changes in the provincial economy and changes in world maritime traffic.

Table 2
Managers' views of the determinants of Spanish mainland ports' hinterland traffic capture.

Determinant	Mean value	Median value	Standard deviation	Minimum value	Maximum value
Quality of rail facilities in the vicinity of the port	8.48	8.5	1.33	6	10
Port directly connected with national motorway network	8.78	9	0.87	7	10
Overall size of the port measured by total traffic	6.18	6	2.01	1	10
Size of the port community measured by the number of companies	6.43	7	1.92	1	9
Port marketing policy	6.95	7.5	1.76	2	10
Geographical location of the port	8.38	9	1.29	5	10
Distance to Madrid	6.75	7	1.32	5	9
Detour distance to the port on Gibraltar-Suez route	5.25	6	2.24	0	8
Availability of logistics park near the port	6.68	6.75	1.95	1	10
Changes in the national economy	8.28	8	1.09	6	10
Changes in the provincial economy	8.00	8	1.52	4	10
Changes in world maritime traffic	7.45	8	1.48	5	10
Total	7.24	8	1.98	0	10

Finally, it must be said that some of the determinants in Table 2 cannot be tested directly, including the importance of the port's commercial policy and the size of the port community. This is due to the unavailability of the information needed for these variables to be constructed for all the ports analyzed over such a long time period. Although their effects can be tested indirectly to a certain extent, these two factors have received some of the lowest scores from the managers, as a result of which they should have a less significant effect on traffic capture.

Therefore, the final hypotheses that are to be tested in the Spanish port system are as follows:

(H_{1a}) the dynamism of traffic captured in the port's hinterland is significantly influenced by the Spanish GDP and the GDP in the province where the port is located.
(H_{1b}) the dynamism of traffic captured in the port's hinterland is significantly influenced by world maritime traffic.
(H_{1c}) the dynamism of traffic captured in the port's hinterland is significantly influenced by the port having good intermodal port-to-rail connections.
(H_{1d}) the dynamism of traffic captured in the port's hinterland is significantly influenced by the existence of a logistics park near the port.
(H_{1e}) the dynamism of traffic captured in the port's hinterland is significantly influenced by other traffic at the port (bunkering, short sea shipping and international container transshipment).
(H_{1f}) the dynamism of traffic captured in the port's hinterland is significantly influenced by the size of the port.
(H_{1g}) the dynamism of traffic captured in the port's hinterland is significantly influenced by the geographical location of the port.
(H_{1h}) the dynamism of traffic captured in the port's hinterland is significantly influenced by the distance between the port and the main sea routes.

The second step was to perform an econometric analysis to test both directly and indirectly the hypotheses and criteria listed above for the set of 22 mainland ports during the 1994–2009 period. Two hundred eighty-six observations were used in the empirical analysis. All the variables in this analysis were constructed using primary data provided by a variety of organizations: the Spanish National Statistics Institute (INE, 2010), the Spanish National Ports Authority (EPPE, 2010), and the annual reports of the United Nations Conference on Trade and Development (UNCTAD, 1994–2010). All the statistical sources used and their websites are listed in the references. Table 3 gives the variables used in the econometric analysis and their primary descriptive statistics.

The time series used for maritime traffic in this study presents characteristics that could be interpreted as pure noise due to frequent statistical improvements or anecdotal situations. For example, abnormal or low rainfall could spark a major escalation in the maritime traffic of water for human consumption and reductions in all agriculture-related bulk solids traffic. For this reason, following similar studies, we have pre-filtered the time series (see Castillo-Manzano et al., 2008). First, the Hodrick–Prescott filter was applied with the Ravn and Uhlig (2002) adjustments for annual series. The Hodrick–Prescott (HP) filter is a two-sided, linear filter that computes the smoothed series HP_t of the original variable, generically y_t, by minimizing the following function in our case:

$$\mathrm{Min}\left(\sum_{t=1994}^{2009}(y_t-\mathrm{HP}_t)^2+\lambda\sum_{t=1994}^{2008}((\mathrm{HP}_{t+1}-\mathrm{HP}_t)-(\mathrm{HP}_t-\mathrm{HP}_{t-1}))^2\right)$$

where λ is the so-called smoothing constant, HP_t is the filtered series (often considered a trend cycle component in the economics literature) and $y_t - HP_t$ is the detrended output that is used subsequently. The larger the constant, the smoother the resulting filtered HP_t series. The HP filter can be understood as a low pass filter with the smoothing constant λ governing bandwidth, with a larger value of λ yielding a narrower bandwidth (Hodric and Prescott, 1997). In this paper $\lambda = 100$ (as suggested in e.g., Ravn and Uhlig, 2002, for annual time series), implying that the

Table 3
Descriptive statistics of the variables used in the empirical analysis.

Variable	Mean value	Median value	Standard deviation	Minimum value	Maximum value
HT_{it}, thousands of tons: inbound and outbound hinterland traffic by rail or truck.	6,770.26 × 10^3 tons	4,492.19 × 10^3 tons	6,841.24 × 10^3 tons	503.53 × 10^3 tons	35,185.14 × 10^3 tons
$GDPSpain_t$, annual millions of Euros. Year 2000: Spanish GDP	657,008.18 × 10^6 €	662,087.71 × 10^6 €	104,317.40 × 10^6 €	501,574.10 × 10^6 €	804,223.06 × 10^6 €
$GDPProvince_{it}$, annual millions of Euros. Year 2000: annual GDP of province where the port is located.	20,359.80 × 10^6 €	14,658.16 × 10^6 €	21,135.10 × 10^6 €	3,673.72 × 10^6 €	155,855.89 × 10^6 €
WMT_t, millions of tons: world maritime traffic.	6,277.88 × 10^6 tons	6,070 × 10^6 tons	1,238.68 × 10^6 tons	4,485 × 10^6 tons	8,210 × 10^6 tons
$Rail_{it}$: percentage of hinterland traffic using rail in preference to road transport	5.92%	1.98%	8.65%	0.00%	51.65%
$Logistics_{it}$: dummy that takes value 1 when there is a logistics park operating in the immediate area of the port authority during year t	0.06	0	0.23	0	1
OT_{it}, thousands of tons: other port traffic, such as bunkering, short sea shipping, container transshipment and liquid granules by pipeline	7,526.95 × 10^3 tons	3,771.71 × 10^3 tons	10,573.74 × 10^3 tons	0.00 × 10^3 tons	67,675.47 × 10^3 tons
$Size_{it-1}$, thousands of tons: total port traffic during preceding year	14,263.27 × 10^3 tons	8,744.41 × 10^3 tons	14,554.56 × 10^3 tons	515.44 × 10^3 tons	74,845.71 × 10^3 tons
$Latitude_i$: Latitude of the port	40.46°	41.25°	2.78°	36.13°	43.57°
$Longitude_i$: Longitude of the port	−3.81°	−4.63°	3.86°	−8.77°	4.42°
$MaritimeRoutes_i$, days at sea: number of extra days at sea on the Suez to Rotterdam and Panama routes compared to a port that minimizes said routes.	1.86 days	1.65 days	1.77 days	0.00 days	6.00 days

stationary or detrended series $y_t - \mathrm{HP}_t$ includes all cycles from 2 to 19 years.

The general model proposed in this paper belongs to the class of balanced pool models (e.g., Baltagi, 2005) and has been adapted by the authors in Eq. (1) to test the above-stated hypotheses:

$$Y_{it} = \gamma_0 + X_{it}\gamma_{it} + \delta_i + \mu_t + u_{it} \tag{1}$$

where Y_{it} is the dependent variable for each port ($i = 1, 2, \ldots, 22$) and each year ($t = 1994, 1997, \ldots, 2009$), X_{it} is a set of k regressors, and u_{it} are the error terms. The γ_0 parameter represents the overall constant in the model, while δ_i and μ_t represent cross-sectional or time specific effects. Identification requires some constraints on the γ_{it} parameters. Model (1) may be viewed as a set of regressions over time for each port that are related in some way or, alternatively, as a set of cross-sectional regressions for each year.

So, if model (1) is seen as a system of 22 stacked equations (one for each port) developing over time, the sources of the links between ports would vary. Some of these are clearly stated in Eq. (1) but others are hidden. Obviously, ports may be considered to be connected in some way if some exogenous variables affect them all or in part at the same time, or if the parameters in the model are common to all or some of the ports. By definition, γ_0 and μ_t possess this property, but so does γ_{it} provided some convenient constraints are imposed on the parameters. The hidden relationships between ports could also be introduced by means of the covariance structure of the noise terms, u_{it}. This latter possibility would result in a more complete model structure since it would allow the relationship between ports to be modeled directly, but it is not viable because the estimation exhausts the degrees of freedom. This is the reason why this option was not considered.

A number of estimation methods can be applied to system (1), most based on Generalized Least Squares. However, instrumental variable techniques with robust coefficient covariance estimation are preferred in this paper (see Baltagi, 2005; Betz and Katz, 1995; QMS, 2010) because of the dynamic behavior observed in the residuals.

A particular specification of model (1) is provided in Eq. (2) that takes into account the relevant economic theory and the constraints required to specify an identified system.

$$\begin{aligned}\mathrm{HT}_{it} = {} & \gamma_0 + \gamma_1 \mathrm{GDPSpain}_t + \gamma_2 \mathrm{GDPProvince}_{it} + \gamma_3 \mathrm{WMT}_t \\ & + \gamma_4 \mathrm{Rail}_{it} + \gamma_5 \mathrm{Logistics}_{it} + \gamma_6 \mathrm{OT}_{it} + \gamma_7 \mathrm{Size}_{it-1} \\ & + \gamma_8 \mathrm{Latitude}_i + \gamma_9 \mathrm{Longitude}_i + \gamma_{10} \mathrm{MaritimeRoutes}_i \\ & + u_{it}\end{aligned} \tag{2}$$

with $u_{it} = \rho_{i1} u_{it-1} + \rho_{i2} u_{it-2} + v_{it}$.

All the variables in model (2) are the first differences of the trend cycle components obtained by the HP filter after taking logs. Some specific assumptions of this model compared to model (1) are that: i) there are no time or cross-section specific effects, i.e., $\delta_i = 0$ and $\mu_t = 0$; ii); there is a constant common to all ports and all times; iii) some of the variables change over time but are common to all ports (such as GDP_t); iv) other variables are common to all times but specific to each port (e.g., $\mathrm{Longitude}_i$); v) some other variables are specific to each moment in time and each port (Rail_{it}); vi) all noise was empirically detected as serially dependent and estimated as a second order autoregressive structure [AR (2)] model for each of the ports unrelated to the other ports (see below).

HT_{it} is the dependent variable, in other words the first difference of the trend-cycle component of the logarithm of a port's traffic that originates from or terminates in its hinterland. Only intermodal maritime transport-truck/rail-port traffic will be included given the objectives of our analysis, irrespective of whether it is containerized or not. Roll-on/roll-off traffic is therefore included in this variable although port traffic using any other means of transport, such as oil pipelines, has been omitted.

$\mathrm{GDPSpain}_t$ and $\mathrm{GDPProvince}_{it}$ are the first differences of the trend-cycle component of the Spanish GDP logarithm and the provincial GDP logarithm for the province where port i is located. *A priori*, a strong positive correlation of these two variables with the dynamism of hinterland traffic should be expected. This assumption is borne out by the high scores awarded by Spanish port system managers, 8.28 and 8.00 for national and provincial GDP, respectively (see Table 2), and the high correlation coefficients between them, which in the case of the port of Barcelona is as high as 0.99. Different estimations will therefore be carried out alternating between the two variables to avoid multicollinearity issues.

WMT_t is the first difference of the trend-cycle component of the world maritime traffic logarithm. By including this variable, we attempt to proxy for any possible exogenous effects and processes affecting maritime transportation and port management during the period under analysis not explicitly taken into account in the other variables. On the basis of the average score of 7.45 awarded by the managers, *a priori*, there should be a positive correlation between this variable and the dependent variable. Interestingly, all the managers awarded this variable a score over 5.

The $\mathrm{Rail}_{i,t}$ variable represents the percentage of hinterland traffic that uses rail instead of road transportation. Obviously, the greater this percentage is for a given port, the greater the frequency and number of rail-port connections said port will have. A virtuous cycle is therefore created around ports as, according to Feo-Valero et al. (2011), frequency plays an essential role in the relative competitiveness of rail transportation in Spain. As such, it may be imagined *a priori* that a port with a good intermodal rail connection would be more competitive and, therefore, more dynamic. This seems to be a widely-held belief among Spanish port system managers judging by the high average score that they award it, 8.48, with a low score of 6 (see Table 2).

The $\mathrm{Logistics}_{it}$ variable takes a value of 1 if port authority i has a logistics park operating in its immediate vicinity during year t. All freight transport, logistics and distribution-related activities are located in logistics parks, also referred to as intermodal logistics platforms. As a group they provide a wide range of logistical services that generate added value for freight and satisfy the demand for increasingly complex logistics services that could be described as dynamic, competitive, digitized, global, networked and customized (see Von der Gracht and Darkow, 2010). In this case, a positive correlation would also be expected between this variable and the growth in hinterland traffic, as the presence of a logistics park would heighten the appeal of operating in the port because it reinforces the port's new role in efficient product distribution across supply chains (e.g., Tongzon et al., 2009). The results compiled here (Table 1) show that there is a widespread belief throughout the Spanish port system that it is beneficial to have a logistics park near the port, judging by the large number of ports that have built or have plans to build one. However, it is also true that it is not one of the highest scored factors (Table 2), with an average of 6.68.

The OT_{it} variable is the first difference of the trend-cycle component of the logarithm of the remaining traffic associated with port *i* in year *t* (bunkering, short sea shipping or international container transshipment).

Meanwhile, the $Size_{it-1}$ variable is the value of the trend-cycle component of the total traffic logarithm for port *i* in the preceding year. In this case, a positive correlation is also expected given that the higher the total traffic volume at the port, irrespective of whether it is associated with the hinterland or not, the greater the size of its port industry should be, i.e., the greater the number of individual freight forwarders, shipping agents and stevedores there will be. The port will therefore be subject to greater inter-port competition, which should result in a lower mean cost of the services provided by the various port industry services. Furthermore, the larger the port, the more extensive its foreland will be, i.e., the greater the number of overseas regions with which it has connections by sea. In short, the port's overall size can be considered as a proxy for both the efficiency and quality of the various companies in the port community and of the size of the foreland, i.e., the number of overseas destinations that the port offers.

Finally, a set of variables was included in an attempt to capture each separate Port Authority's particular circumstances. The first two of these are linked to the geographical location of the port, i.e., the $Latitude_i$ and $Longititude_i$ variables. Their inclusion is justified by the large number of studies that maintain that a port's location is crucial to its performance (see, for example, Ducruet et al., 2010a; Malchow and Kanafani, 2004). According to the score given by the managers -8.38- (Table 2) *a priori*, geographical location is a major factor for Spanish ports.

Another geographical factor that was taken into account was the distance between the port and the main sea routes ($MaritimeRoutes_i$). A simpler formulation of this variable was selected initially, the Detour Distance to Port *i* on the Gibraltar-Suez route. However, the low score of 5.25 given by the managers to this original formulation (Table 2) led us to opt for a broader formulation. The subsequent $MaritimeRoutes_i$ variable measures the number of extra days at sea (navigation days) required from port *i* on the Suez to Rotterdam and Suez to Panama routes over the port that minimizes sailing time on said routes.

There are some multicollinearity issues with the proposed of $Latitude_i$ and $MaritimeRoutes_i$ variables. The shape of the Iberian Peninsula and the position of the Straits of Gibraltar mean that a port's latitude is the main determinant of the duration of the Suez-Rotterdam and Suez-Panama maritime routes. The correlation coefficient between the two variables is 0.82. However, the concept of latitude is broader than that of the duration of maritime routes, as a high score in latitude also implies poor rail connections with Madrid due to the physical isolation imposed by the Cantabrian Mountains, for example. Models were estimated with each variable in turn and the one that produced the best performance was chosen.

We have also included a different error term with an AR (2) for each port authority to capture the effects of additional variables and the particular circumstances of each port not directly included in the specification. This prevents omitted variable bias and makes it possible to obtain the primary result, i.e., a series of trends or generalities valid, on average, for the entire port system. Obviously the inclusion of an AR (2) makes it much easier to extrapolate this model to the port systems of other countries even if the variables are not exactly the same. The only real difficulty for extrapolating to other countries is the availability of the information required for constructing the $Rail_{i,t}$ variable for the port system in question.

3. Results

Table 4 presents the estimated results. The estimations of the 44 parameters (22 estimations of $\hat{\rho}_{i,1}$ and 22 of $\hat{\rho}_{i,2}$) that comprise the AR (2) models for the error term for each of the port authorities, see model (2), can be found in Appendix B at the end of this article. Practically all the 44 parameters tested were statistically significant at 1% or 5% with all being significantly different in statistical terms. Hence, the way each port evolves depends on port-specific factors, such as whether there is an industrial estate or a coal mine in the area, for example. It could also depend on whether the port performs some specific role, such as organizing Balearic and Canary Island logistics and supply to/from the mainland.

There is also a group of highly significant variables, generally at the 1% confidence level, which provides us with a series of general determinants that help to explain a port's traffic capture in its hinterland. Of these, the following must be highlighted: GDPSpain, GDPProvince, LOGISTICS, SIZE, LATITUDE, LONGITUDE,

Table 4
Results of estimations of the determinants of dynamism in hinterland traffic capture in the Spanish port system. Corrected standard errors with different AR-2 disturbances for each port.

Explanatory variables	Dependent variable: HT (hinterland traffic)			
	(1)	(2)	(3)	(4)
GDPSpain	7.41 (1.70)***	–	6.77 (0.75)***	6.46 (0.28)***
GDPProvince	–	1.30 (0.43)***	–	–
WMT	−0.01 (0.01)	−0.01 (0.45)	0.42 (0.48)	–
RAIL	0.001 (0.001)	−0.001 (0.001)	0.0004 (0.001)	–
LOGISTICS	0.10 (0.03)***	0.05 (0.02)**	0.10 (0.03)***	0.10 (0.04)**
OT	0.02 (0.07)	0.006 (0.004)	−0.01 (0.004)	−0.008 (0.004)*
SIZE	0.93 (0.26)***	0.83 (0.12)***	1.28 (0.17)***	0.82 (0.18)***
LATITUDE	−0.89 (0.14)***	–	–	−0.66 (0.05)***
LONGITUDE	−0.39 (0.06)***	−0.91 (0.09)***	−0.50 (0.07)***	−0.55 (0.05)***
MARITIME ROUTES	–	−1.71 (0.29)***	−1.15 (0.11)***	–
Constant (γ_0)	2.59 (6.91)	−13.06 (3.58)***	−34.04 (2.67)***	−3.28 (3.74)
R-squared (Maximize)	0.99	0.99	0.99	0.99
Durbin-Watson	1.43	1.32	1.42	1.43
Akaike information criterion (minimize)	−0.467	−0.249	−0.476	−0.509
N	286	286	286	286

Note 1: Standard errors robust to heteroskedasticity in brackets.
Note 2: Statistical significance at 1% (***), 5% (**), 10% (*).

and MARITIME ROUTES. As seen in Table 4, the findings for this set of variables are fairly robust irrespective of the set of variables that is used. As initially expected, the estimated coefficients associated with the GDPSpain, GDPProvince, LOGISTICS, SIZE and MARITIME ROUTES variables are always positive or negative, while the last two (LATITUDE and LONGITUDE) are negative. However, the WMT, RAIL and OT variables are not significant (except for the OT variable, which is significant at the 10% confidence level in estimation no. 4).

4. Discussion

We begin by analyzing the variables that were found to be significant in our model. Firstly, there is a clear, positive relationship between the degree of traffic captured in shared hinterlands like those in Spain and the overall size of the port (SIZE variable). For this reason an optimal policy could consist of prioritizing investments in large ports over small ones in public systems similar to that in Spain and in situations characterized by a financial crisis and a lack of resources, as is currently the case (see Neal and García-Iglesias, 2013 on the current economic crisis in Spain). However, any investments in large ports should be tied to their improved economic performance in order to prevent any over-investment processes; these are especially dangerous in the port sector given the virtually unending ability of ports to consume public funds (see Castillo-Manzano and Asencio-Flores, 2012). Putting trust in large ports would raise the chance of Spanish ports succeeding in an environment -the European port system- that, according to Ducruet et al. (2010a), is organized hierarchically with a large share of overall traffic concentrated in a small number of larger ports. However, Notteboom (2010) states that this trend is not evident in Europe, as the European port system and most of its multi-port gateway regions are likely to experience a gradual cargo deconcentration process. To summarize, the current situation is far from the scenario that, according to Lathrop Cilb (1992), experts predicted at the beginning of the 1990s, that is, that eventually there would only be one central hub port in Europe, or at best three or four, and other ports would have to serve as feeder or specialized ports.

Regarding GDPSpain and GDPProvince, the logical relationship between faster growth in hinterland traffic and economic growth was confirmed. It can be seen, however, that the relationship is much closer (in terms of greater absolute coefficient value) between the dependent variable and GDPSpain. It therefore appears that what we have here is an indirect empirical test of the previously analyzed hypothesis that the Iberian Peninsula is a single, large shared hinterland. As anticipated, the coefficient value of the GDPSpain variable and its significance are much higher than they would have been if the dependent variable had been the port's total traffic (see Castillo-Manzano et al., 2008), as this would have included other traffic not directly linked to the domestic economy. Given that both the endogenous and explanatory variables are the first differences of the logarithm, the coefficient value, which is between 6.5–7.4, is interpreted as the elasticity of port traffic captured in the hinterland with respect to national GDP.

The LATITUDE and LONGITUDE variables pinpoint the location of the ports that were more effective at capturing traffic in their hinterlands during the period under analysis. As the coefficients for both variables are negative, the smaller their values (for longitude, the more negative it is), the greater their positive effect. More specifically, the first of these, LATITUDE, clearly points to the south as an optimal port location, as the smaller the value of the latitude, the closer the ports are to the Tropic of Cancer. LONGITUDE, meanwhile, points to the west as an optimal port location, i.e., the more negative the value, the further away the Greenwich meridian is. For Spanish mainland ports, latitude and longitude jointly would point to the Straits of Gibraltar, which, to be exact, are in the south-western part of the Iberian Peninsula. This is logical if the strategic location of the straits is considered in the context of the strong geographical stability of sea transportation. This is supported by Verny and Grigentin (2009), who state that the main maritime trade routes have changed very little since the beginning of the 20th century despite four decades of uninterrupted growth in container traffic.

This conclusion would also explain the clear significance and the negative result of the MARITIME ROUTES variable. The shorter the distance in days at sea from a port to the main sea routes that pass near the Iberian Peninsula (Suez-Panama and Suez-Rotterdam), the more competitive the port will be and, consequently, the more traffic it will capture in its hinterland. The lowest value for this variable is for the Straits of Gibraltar.

In other respects, there is empirical evidence that the existence of a logistics park (LOGISTICS variable) near a port provides a significant and sustained, albeit modest, boost to traffic capture in its hinterland. These results therefore seem to support the trend among Spanish ports of developing logistics parks. Apart from the three that were already up and operating during the time period analyzed (Barcelona, Bilbao and Seville), others are being developed by another 12 port authorities, including the two major authorities, Algeciras Bay and Valencia (see Table 1, last column, for further information). It should be noted that an excessive number of logistics parks in the vicinity of ports -which is what seems to be the case in the Spanish model- is usually taken as a symptom of low hinterland accessibility as, according to Notteboom and Rodrigue (2008), appears to be the case in the Pacific Asia region, especially in China. This major investment process also raises new questions for the future; will a logistics park in the near a port continue to afford the advantage that it appears to do at present once all the other ports finish constructing their own logistics parks? An obvious point that this raises is, will there be sufficient demand for so much new logistics infrastructure?

The OT variable's lack of significance in the majority of the models estimated does not allow any generalization to be made regarding the various types of port traffic. Hence, the growth rate of traffic capture in the hinterland is not related to the growth rate of other traffic, and a port can be very dynamic in capturing international container transshipment (bunkering, or short sea shipping) yet not be very capable of capturing traffic in its hinterland, and vice-versa. This has been the case of the port of Algeciras Bay, for example, where poor land transportation infrastructure by both road and rail has limited growth in capturing hinterland traffic. If we examine estimate no.4 (last column of Table 4), we can see how in some cases, the capture of traffic in the hinterland and the capture of traffic outside the hinterland could be negatively co-related. However, the low significance of this result, at 10 percent, and the fact that it only appears in one of the four models, means that we must be cautious in our interpretation. Similarly, as hinterland traffic does not seem to be related to international container transshipment as much as to economic performance in the province and in the country as a whole, our empirical model does not find any relationship between changes in international shipping (WMT variable) and the ability to capture hinterland traffic, either.

Finally, the intermodality result is complex. The hypothesis widely supported in both the literature (Woxenius and Bergqvist, 2011) and by the managers themselves (see Table 2) that a good intermodal rail-port connection (RAIL) results in a port becoming more competitive must be rejected for the Spanish port system. On the basis of our models, it could be said that this factor is more innocuous than significant. This finding must be considered in light of the characteristics of the Spanish transportation market (see Beria et al., 2012). Firstly, only a marginal amount of freight is transported by rail in Spain, only 3.6% compared to 16.6% in the EU-27, 20.9% in Germany, 15.9% in France and 9.0% in Italy (Eurostat, 2012). This is due to the limited success and volume of business of most railroad companies in Spain. To be precise, there are seven railroad companies operating in Spain: Adif (Administrador de Infraestructuras Ferroviarias), Renfe, Euskotren, Comsa Rail Transport, Continental Rail, Acciona Rail Service and, finally, Tranfesa Logistica y Transporte Ferroviario. This generally rules out major intermodal projects, such as instituting regular routes for 600–700 m long trains from ports into their hinterlands, or even becoming involved in major European railway company ventures, such as the development of the Long Intermodal Freight Train (*LIFT*) (Janic, 2008). Moreover, the radial structure of the national rail network, where the main historical function has been to link all the main cities with Madrid, must also be considered. No cross-country corridors have been developed to link the various ports either with each other or with their natural hinterlands. According to Feo-Valero et al. (2011), port-rail connections with the hinterland in Spain should be the starting-point for developing a trans-European rail network that can fully compete with road transport.

However, it is not merely a question of the quantity, but also the quality of the tracks. The gauge of Spanish railroad tracks is broader than the European standard gauge (Van den Berg and De Langen, 2011). This prevents direct rail connections with neighboring countries and consequently makes it difficult to fulfill the maxim that, according to Janic (2008), states that intermodal rail/road freight transport has always been considered a competitive alternative to its road freight counterpart in European medium- to long-distance corridors/markets. The decision to use a different gauge was made in 1844 so that larger and more powerful steam engines could be used to contend with Spain's complicated terrain. Only the port of Barcelona has European gauge railroad connections, and only since March, 2011 (Van den Berg et al., 2012).

All these problems have become more pronounced because investments in railroads have focused on the high-speed train in recent decades (see Campos and de Rus, 2009). As a result, Spain's high-speed rail network is the second largest in the world, second only to China (Bel, 2011). However, Spain's commitment to the high-speed train, with the volume of investment that this involves, has on occasion been called into question (Bel, 2011; Button, 2012). In this context, a Strategic Plan to Foster Rail Freight Transport in Spain (Ministry of Development, 2010) has been proposed to look at measures to improve the current situation, including the need to improve connections with ports. It should be noted in this respect that Art. 26 of the new Port Act 2/2011 for the first time requires Port Authorities to encourage "appropriate maritime-terrestrial intermodality by means of an efficient and safe road and rail network". Despite Port Authorities with fewer resources being able to count on support for these investments from the Port Authorities that generate most economic resources, to all appearances without it causing any serious efficiency issues (see Castillo-Manzano and Fageda, 2012), what is certain is that Art. 146 of the Act obliges them to stop their annual accounts going into the red and that, as a whole, all investments in the system should present a 2.5% profit.

Given all these weaknesses, the strong competition faced by railroads from the more agile and flexible overland transport is not surprising. The overland transport market also approximates the concept of 'perfect competition', with innumerable companies of all sizes, including many small firms (see Profillidis, 2004 for an overview of the road freight transport liberalization process in Europe and North America). This means that port operators can find more competitive prices without any long-term dependence, as it is easy to switch from one haulage company to another. In short, there is an imbalance that benefits the truck over the train, which is not unusual in Mediterranean countries (e.g., Parola and Sciomachen, 2005).

If we look outside Europe, in countries like Australia, where the railroad is better developed than in Spain, (see Bendall and Brooks, 2011) the flexibility of trucks makes them more competitive for distances of under 1500 km (932 US miles) (see Brooks et al., 2012). A separate study for North America (see Brooks and Trifts, 2008) shows that even ships find it difficult to compete with trucks for distances of under 1000 miles there.

All these reasons explain the limited success of the train compared to the truck irrespective of occasional initiatives to promote the former over the latter. These initiatives include the TECO (which stands for Express Container Train) lines, initially from the Port of Barcelona, but now also being rolled out in other ports, such as Bilbao. TECO trains can transport containers in both directions as they have locomotives at either end, one at the front and the other at the back. This cuts down on shunting and makes them more competitive than the traditional train.

Although our results provide no evidence for the prioritization of investments for ports that have, or plan to have, good rail intermodality, it is also true that they do not reject such prioritization if it is based on other reasons. Following Limbourg and Jourquin (2009), the success of road transport has resulted in increased congestion and has added to environmental problems, which is why one of the objectives of the current European Common Transport Policy is to restore the balance between different modes of transportation and to develop intermodality (although we find similar aspirations based on the same concerns in other geographical areas. See, for example, Havenga et al., 2012 on South Africa). Improved rail-port infrastructure would clearly reduce highway congestion (Parola and Sciomachen, 2005), which is one of the main causes of road accidents (Wang et al., 2013). In this regard, we should highlight that the commitment of European Union members to reducing road accidents (e.g., European Commission, 2011) requires solutions to be found that clear the highways of truck congestion. However, in Spain, the primarily maritime solutions, such as short sea shipping (see Paixao and Marlow, 2002) and seaways (see Feo et al., 2011) have only had limited success. This is due in part to the main Spanish market being located inland and the lack of river transport. Any possible advantages of mixed systems, such as combined maritime-rail systems, therefore need to be analyzed. Mixed rail-truck solutions should not be completely ruled out as, according to Woxenius and Bergqvist (2011), there are still significant opportunities and advantages to transporting semi-trailers by rail in the hinterlands of European ports. These alternatives need to be clarified, however, as in Europe combined transportation still has to demonstrate that it can compete with road transport (see Frémont and Franc, 2010). Extra services, such as additional dwell times and specific customs advantages, are of the utmost importance for encouraging the shift from road transportation to combined transportation (Frémont and Franc, 2010).

Obviously, other geographical areas outside of Europe face similar problems and, broadly-speaking, are looking at similar solutions. However, in these cases lesser political integration means that the emphasis also has to be placed on the need to minimize non-physical barriers in order to enhance the operational efficiency of the intermodal transport corridors (see Regmi and Hanaoka, 2012 on the requirements of intermodal transport in North-East and Central Asia). One major barrier is the border crossing and customs clearance process.

Before bringing this discussion of the findings to a close, mention should be made of the similarity between the results of the empirical model and the perceptions of the port managers regarding the determinants that impact on the capture of hinterland traffic (see Table 2). We should not overlook the high scores that the managers awarded variables such as the quality of rail facilities in the vicinity of the port (M 8.48) and World Maritime Traffic (M 7.45), which were not significant. Conversely, the low scores that they awarded variables such as Detour Distance to the Port on the Gibraltar-Suez Route (M 5.25), the availability of a logistics park in the vicinity of the port (M 6.48) and the overall size of the port (M 6.18) should also be borne in mind. These discrepancies show the need for empirical models to test widely-accepted opinions which might be right, albeit in general terms, but which do not necessarily hold for all port systems. These beliefs and general principles which have not been tested against reality may lead to heavy port investment which, in reality, does not reap such great success as anticipated.

5. Conclusions

The findings identify consistent factors that can be used to explain the dynamism of Spanish ports in traffic capture in shared and highly disputed hinterlands. Traffic capture is closely linked to the particular features of each port, such as its location (LATITUDE, LONGITUDE and MARITIME ROUTES) or its own particular dynamics ($\widehat{\rho}_{i,1}$ and $\widehat{\rho}_{i,2}$). It also depends on the way that the national and local economies are evolving (GDPSpain and GDPProvince).

Although there does not seem to be a relationship between the dynamics of hinterland traffic and other traffic (OT), the overall size of the port (SIZE) is relevant. This last result might justify an investment policy in public port systems like the Spanish system that incentivizes the creation of large ports (such as Algeciras Bay, Valencia and Barcelona), to the detriment of smaller ports. However, these investments must be robustly backed up by cost-benefit analyses in order to prevent any over-investment issues similar to those in the Spanish airport system where investments have been concentrated in the large airports (see Bel and Fageda, 2011).

The positive contribution that a logistics park in the vicinity of a port makes to traffic capture should also be highlighted, and it is sufficient to justify the current investment effort that Spanish ports are making in infrastructure of this type. The end result will be a significant increase in the amount of land turned over to logistics, with a rise in a few years from the current 288 hectares (711 acres) to over 2,000 (4,940 acres), of which approximately 900 hectares (2,225 acres) are already under construction (Table 1, last column). As is the case with the SIZE variable, the viability of investments in the rising number of logistics parks must be looked at closely on the basis of expected demand, and even more so given the current scenario of an economic crisis.

Although many of these conclusions were anticipated by the opinions of the managers (see Table 2), our analysis also shows significant discrepancies between their general opinions and empirical evidence. This would be the case of the high score that the managers awarded the railroad-international maritime traffic interconnection, and also their underestimation of port size, the presence of logistics parks and the distance from certain routes. Whilst the first two were not significant in our empirical model, the other three were significant at 1%, which highlights their ability to explain traffic capture.

Irrespective of whether any of these results could be skewed by managers who under-score criteria that are weaknesses of the ports that they manage, or whether there is a generally-accepted opinion regarding the main determinants that affect port traffic capture that has not been tested, these discrepancies are the best justification for studies like this article which seek to explain these determinants empirically.

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Appendix A. English translation of the survey questionnaire given to Spanish port system managers

Questionnaire on the determinants of traffic capture in the hinterlands of Spanish mainland ports

OBJECTIVE: to analyze possible general determinants that would contribute to the capture of traffic in a port's hinterland.

GRADING:

1. Score from 0.0 to 10.0 the determinants in the following table. The lowermost score of 0.0 indicates that the determinant has no importance for the capture of traffic in the hinterland whilst the topmost score of 10.0 means that the criterion is of the utmost importance.

3. If you so wish, you may add a decimal to the scores (6.3 for example).

4. As the determinants are separate from one-another, you may give the same score to different criteria.

WE ARE EXTREMELY GRATEFUL FOR YOUR COOPERATION

Hinterland traffic capture determinants

Variables	Score
Broadly-speaking, the availability of good **RAILROAD FACILITIES** in the vicinity of the port.	
Direct connections between the port and the national **DUAL-CARRIAGEWAY AND/OR MOTORWAY** network.	
Total traffic volume or **OVERALL SIZE** of the port, including all types of traffic whether related to the hinterland or not.	
The **GEOGRAPHICAL LOCATION** of the port on the mainland.	
The time that the journey takes from the port to **MADRID**, whether by rail or road.	
The **SIZE** (number of companies) of the port community.	
A **LOGISICS ACTIVITIES ZONE** in the vicinity of the port.	
The Port Authority's **MARKETING POLICY**.	
Changes in the **NATIONAL ECONOMY**.	
Changes in the **PROVINCIAL ECONOMY**.	
Changes in **INTERNATIONAL MARITIME TRANSPORT**.	
Detour distance to the port from the **GIBRALTAR-SUEZ CANAL** route.	

NB: your answer will be added together with the answers from the other experts who have been consulted in order to protect the confidentiality of your answer.
Send by mail: XXXXX Send by fax: XXXXX

Appendix B. AR (2) models for the error term for each of the Port Authorities

Explanatory variables: autoregressive term for each port authority	Dependent variable: HINTERLAND traffic			
	(1)	(2)	(3)	(4)
ALGECIRAS_AR(1)	1.859 (0.043)***	1.957 (0.050)***	1.876 (0.043)***	1.870 (0.042)***
ALGECIRAS_AR(2)	−1.057 (0.050)***	−1.123 (0.065)***	−1.069 (0.052)***	1.064 (0.050)***
ALICANTE_AR(1)	1.690 (0.110)***	1.931 (0.052)***	1.674 (0.131)***	1.727 (0.127)***
ALICANTE_AR(2)	−0.815 (0.091)***	−0.981 (0.054)***	−0.772 (0.120)***	−0.825 (0.118)***
ALMERIA-MOTRIL_AR(1)	1.820 (0.119)***	1.835 (0.180)***	1.817 (0.122)***	1.817 (0.122)***
ALMERIA_MOTRIL_AR(2)	−0.832 (0.117)***	−0.834 (0.181)***	−0.828 (0.120)***	−0.827 (0.120)***
AVILES_AR(1)	1.932 (0.050)***	1.869 (0.071)***	1.811 (0.058)***	1.791 (0.055)***
AVILES_AR(2)	−0.986 (0.047)***	−1.064 (0.079)***	−0.865 (0.053)***	−0.845 (0.049)***
BARCELONA_AR(1)	2.243 (0.063)***	1.952 (0.095)***	2.035 (0.059)***	2.254 (0.064)***
BARCELONA_AR(2)	−1.317 (0.069)***	−0.956 (0.093)***	−1.103 (0.067)***	−1.323 (0.072)***
BILBAO_AR(1)	2.124 (0.107)***	1.853 (0.101)***	2.184 (0.076)***	1.919 (0.064)***
BILBAO_AR(2)	−1.202 (0.115)***	−0.863 (0.096)***	−1.267 (0.081)***	−0.970 (0.065)***
CADIZ_AR(1)	1.755 (0.101)***	1.875 (0.106)***	1.742 (0.125)***	1.730 (0.103)***
CADIZ_AR(2)	−0.769 (0.097)***	−0.870 (0.108)***	−0.755 (0.122)***	−0.742 (0.100)***
CARTAGENA_AR(1)	1.874 (0.125)***	1.922 (0.095)***	1.892 (0.122)***	1.873 (0.122)***
CARTAGENA_AR(2)	−0.939 (0.127)***	−0.979 (0.099)***	−0.953 (0.125)***	−0.937 (0.124)***
CASTELLON_AR(1)	1.312 (0.129)***	1.842 (0.069)***	1.467 (0.171)***	1.488 (0.131)***
CASTELLON_AR(2)	−0.328 (0.128)**	−0.861 (0.064)***	−0.491 (0.165)***	−0.504 (0.126)***
CORUNNA_AR(1)	1.938 (0.077)***	2.225 (0.101)***	1.857 (0.098)***	1.864 (0.092)***
CORUNNA_AR(2)	−0.997 (0.082)***	−1.258 (0.109)***	−0.871 (0.092)***	−0.883 (0.092)***
FERROL-SAN CIBRAO_AR(1)	2.117 (0.109)***	1.606 (0.325)***	1.817 (0.079)***	1.891 (0.067)***
FERROL-SAN CIBRAO_AR(2)	−1.190 (0.139)***	−0.575 (0.350)	−0.857 (0.070)***	−0.941 (0.075)***
GIJON_AR(1)	1.953 (0.060)***	1.627 (0.219)***	1.863 (0.067)***	1.865 (0.064)***
GIJON_AR(2)	−1.011 (0.063)***	−0.622 (0.275)**	−0.901 (0.061)***	−0.905 (0.059)***
HUELVA_AR(1)	1.948 (0.123)***	2.415 (0.109)***	1.991 (0.135)***	1.993 (0.135)***
HUELVA_AR(2)	−0.951 (0.127)***	−1.465 (0.116)***	−0.996 (0.141)***	−0.998 (0.141)***
MALAGA_AR(1)	1.709 (0.085)***	1.883 (0.082)***	1.741 (0.081)***	1.717 (0.084)***
MALAGA_AR(2)	−0.767 (0.074)***	−1.100 (0.070)***	−0.815 (0.076)***	−0.790 (0.076)***
MARIN-PONTEVEDRA_AR(1)	1.864 (0.045)***	2.129 (0.072)***	1.952 (0.088)***	1.950 (0.088)***
MARIN-PONTEVEDRA_AR(2)	−1.008 (0.048)***	−1.159 (0.078)***	−0.976 (0.091)***	−0.976 (0.092)***
PASAJES_AR(1)	1.678 (0.178)***	1.850 (0.081)***	1.687 (0.202)***	1.466 (0.114)***
PASAJES_AR(2)	−0.656 (0.186)***	−0.864 (0.079)***	−0.683 (0.201)***	−0.933 (0.109)***
SANTANDER_AR(1)	1.982 (0.084)***	1.848 (0.091)***	1.978 (0.089)***	1.838 (0.082)***
SANTANDER_AR(2)	−1.050 (0.087)***	−0.874 (0.086)***	−1.052 (0.101)***	−0.868 (0.075)***
SEVILLE−AR(1)	1.878 (0.082)***	2.072 (0.172)***	1.894 (0.084)***	1.879 (0.096)***
SEVILLE−AR(2)	−0.981 (0.079)***	−1.083 (0.184)***	−0.906 (0.080)***	−0.889 (0.093)***
TARRAGONA−AR(1)	1.837 (0.056)***	1.824 (0.076)***	1.729 (0.079)***	1.797 (0.054)***
TARRAGONA−AR(2)	−0.888 (0.053)***	−1.013 (0.089)***	−0.770 (0.073)***	−0.849 (0.051)***
VALENCIA−AR(1)	1.886 (0.089)***	1.826 (0.059)***	1.594 (0.159)***	1.870 (0.101)***
VALENCIA−AR(2)	−0.981 (0.094)***	−0.854 (0.055)***	−0.682 (0.132)***	−0.876 (0.102)***
VIGO−AR(1)	1.901 (0.079)***	2.094 (0.138)***	1.854 (0.119)***	1.848 (0.102)***
VIGO−AR(2)	−0.941 (0.068)***	−1.104 (0.150)***	−0.864 (0.116)***	−0.861 (0.121)***
VILAG−AR(1)	1.899 (0.082)***	2.041 (0.088)***	1.727 (0.088)***	1.741 (0.072)***
VILAG−AR(2)	−0.907 (0.078)***	−1.083 (0.090)***	−0.892 (0.101)***	−0.916 (0.074)***

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