



BULLETIN

FACILITATION OF TRANSPORT AND TRADE IN LATIN AMERICA AND THE CARIBBEAN

Investment and port traffic: an analysis of the situation in Spain

Introduction

Investment in infrastructure is sometimes used as a competitive strategy because as international trade relations become stronger, the volume of maritime traffic rises. These trade links also take advantage of economies of scale and the fact that the number and frequency of maritime routes are more stable. As a result, port facilities must be large enough to prevent the congestion that could send traffic elsewhere.

For this reason, port managers have been investing in infrastructure in order to ensure optimum levels of service quality and cost.

Based on these assumptions, this study sets out to analyse whether the outcome of competition for traffic is directly linked to the expansion of port facilities in Spain.

I. Infrastructure services and sustainable development: the theoretical discussion

Maritime transport is considered as one of the pillars of globalization and economic development at the country level. The principal stakeholders in this market are users, shipping companies and ports. Each stakeholder has redefined its own strategies, and the academic literature has become specialized as the research focus turns not only to users and shipping companies but also to ports.

The world's major industrial production hubs are so dispersed geographically that most trade (approximately 80%) involves maritime transport at some stage of the process. The role of ports is therefore crucial as they are becoming the main interface between sea and land.

The principal objective of this issue of the *FAL Bulletin* is to look at investments made in the Spanish port system between 1993 and 2010 in order to determine whether there is a direct link between expansion of port facilities and the outcome of competition for traffic. The conclusion is that the response of traffic to facilities improvements is not an entirely direct one, as can be seen in changes in and specialization of Spanish port traffic.

The author of this bulletin is Fernando González Laxe, Professor of Applied Economics and Director of the Institute of Maritime Studies at the University of A Coruña in Spain. For more information please contact: trans@cepal.org.

The opinions expressed in this document are those of the author and do not necessarily reflect the views of the organization.



Introduction



I. Infrastructure services and sustainable development: the theoretical discussion



II. Port investment in Spain



III. Is the investment effort consistent with the patterns in activity?



IV. Final reflections



V. Bibliography



UNITED NATIONS

ECLAC

In the 1990s, many countries amended their port legislation with three objectives in mind: (a) attract private investment in port operations; (b) increase domestic and international competition between ports; and (c) achieve economies of scale and scope in port operations (Tavares and Guimarães, 2011).

Ports have become specialized in terms of traffic and services. They are seeking to become more efficient and productive and boost their operational capability system-wide by developing complex cargo handling and warehousing systems.

Ports have been optimizing their operations by vertically integrating interactions between users, shipping companies and ports. The only instruments available for this were port pricing and the range of port facilities. In other words, transport services were supply-based. The demand for transport, however, was driven by tariffs and quality of service, based on indicators of service frequency and total transport time. The market was therefore in the hands of the companies, whose goal was to maximize their profits in the short term.

The market is a vertical one, so it can be broken down into a series of interactions between stakeholders. This is why some port managers believe that investment policies are what make the difference in attracting traffic.

Economic constraints at the country level can eventually turn port operations into a natural monopoly. Only when there is a reasonable number of ports will competition between them require measures to regulate the behaviour of port operators.

Ports compete, primarily, for origin-destination routes, hinterlands, cargo in transit and potential market segments. In some cases, greater competition between ports drives investment in and development of areas outside the port (arrière-pays or inland), which is becoming increasingly common. By the same token, another good option for port development are railway-port networks given that they help to improve the port's position in the international arena.

The port industry is unique in that it is part of a network. Obviously, a networked industry is made up of complementary links in a production chain that, for technological reasons, are interdependent to differing degrees –much more so than the segments of the industry itself. This is why port operations are considered a link in global supply chains.

Studies of ports (Malchow and Kanafani, 2001) share a focus on infrastructure and physical constraints of port areas. For instance, many ports are located in urban areas and have no room for expanding, putting them

in a position of suppressed demand. This gives the port operator greater power to choose between clients, or it can even favour the creation of monopolies or oligopolies in cases of low demand, access difficulties or a long distance from maritime routes.

Limitations of this kind can restrict competition between ports. The lack of land, low demand and a limited number of operators can mean that the port sector poses significant entry barriers for trade or service activities.

This situation may give rise to price wars to win over the major players and stakeholders in the market (Haralambides, 2002) and may lead ports to use a wide range of marketing strategies (González Laxe, 2010).

Ports undoubtedly seek efficiency. Several indexes are used to measure port efficiency, including (a) average berth waiting time (which measures the operating performance of the port upon arrival of the vessel); (b) berth occupancy rate (which evaluates superstructure quality and quantity, i.e., availability); and (c) average productivity per terminal (number of moves) (De Weille and Ray, 1974; Blonigen and Wilson, 2006).

Installed port capacity shapes the institutional framework, as the need for economic regulation depends on the extent to which tariffs and cargo movements are defined by port authorities themselves and the regulator.

II. Port investment in Spain

Port investment in Spain since the 1990s, following enactment of the 1993 state-owned ports and merchant marine law, has outpaced port activity itself. Between 1993 and 2010, total investment grew by around 400% and amounted to 11.097 billion euros during that period. Investments doubled during the first eight years (1994-2001). And they doubled again, but this time in only six years, between 2001 and 2007. This growth was the result of the push by government agencies at all levels to invest in infrastructure.

According to García and others (2010) port authorities might have reacted to fresh interport competition by investing heavily in port facilities. However, they also highlight that this would require a heavy outlay, which may not ultimately be justified by the improvement in traffic capture. This possibility should be analysed and compared with Ronnevik's (2008) theory that port infrastructure can contribute positively to the economic development of a country with direct access to the sea.

Spain is adapting to the strong growth of maritime transport and the selective investments made in some ports which are trying to improve their ranking in order to achieve four objectives: become logistic hubs in an

increasingly globalized market; position themselves in international maritime networks; be able to respond to maritime stakeholders, including shippers and terminal or logistics operators, to create joint strategies; and operate as the focal point for the companies which will fuel hinterland growth and economic development. After all, a port aims to increase its opportunities and capacities in order to attract activity and traffic to its facilities.

The growth in investments took place at a remarkable rate, between 1993 and 2008, with the exception of small setbacks in 2000 and 2007. Growth was especially vibrant in 2003, 2006 and 2008 (Castillo and others, 2009).

According to García and others (2010), a port bases its competitive strategy on variables it can act on, the most important of which are investment policies. They hold that port tariffs have practically no effect on a port's ability to attract traffic. For example, up until 2003, ports were subject to legislation barring them from using tariff discounts as incentives to meet their strategies. However, since then (and more specifically since implementation of Port Law 33/2010) port authorities have been able to focus more on designing and implementing their own distinct port policies and less on infrastructure investment policies.

This has helped slow the pace of public investment in port infrastructure, but at a number of ports other factors were involved. First, investment policies adopted by individual port authorities were not entirely successful in attracting traffic. Another factor was rising debt, which in some cases exceeded the ability of port turnover to service. Lastly, growth in investment far outpaced growth in traffic, and investment in infrastructure rose faster than total investment, thereby hindering ports' strategies as interport competition grew.

The following two observations may be made regarding the outcomes of overall action taken by Spanish ports:

- (a) The main ports used similar strategies, which means that there were no alternative options available and a copycat effect tended to prevail. There was also a misconception regarding the principle "supply creates its own demand" in that it was widely thought that if traffic could not be increased in the short term it would always grow in the long term. However, that horizon was never defined or quantified.
- (b) In very few cases, ports followed other policies, such as investing in logistics and special equipment.

It can therefore be concluded that investing in infrastructure does not guarantee that a port will successfully attract traffic, given that most ports adopted the same strategy and the results did not bear them out.

This shows that Spanish ports responded to changes in maritime transport and burgeoning containerization by spending heavily on infrastructure. Investment was aimed above all at expanding ports and increasing capacity. Investment in infrastructure represented slightly over 50% of total investment in 1995 but by 2008 had risen to almost 90%. A more detailed breakdown shows that investment in infrastructure and port capacity went up from 63% in 1998 to 75% in 2009. Logistics and intermodal operations, along with equipment and facilities, were next, making up 17% of total investment in 1998, 11% in 2008 and 13% in 2009. Together, these items accounted for 88% of total investment, while others received less. For example, investment in port-city links and the environment combined was only 3% in 1998 and had fallen to 1.2% by 2009.

Table 1
PERCENTAGE DISTRIBUTION OF EXPENDITURE ON INFRASTRUCTURE IN RELATION TO TOTAL PORT INVESTMENT

Item	1998	2008	2009
Infrastructure and port capacity	63%	78%	75%
Logistics, equipment and facilities	17%	11%	13%
Port-city links and the environment	3%	2%	2%
Fishing facilities	3%	1%	0.5%
Passenger facilities	5%	1%	2.5%
Others	9%	7%	7%
TOTAL	100%	100%	100%

Source: The author, on the basis of data from State Ports of Spain annual reports.

The criteria for selecting which ports will receive public investment in seafronts reflect the various strategies adopted by ports themselves in line with the potential of their hinterlands and forelands, as discussed by Bobrovith (1982). Of the total investments made by port authorities in Spain between 1993 and 2010, 57.36% went to ports located on the Mediterranean coastline. The largest and most significant investment (18.49%) was in the Catalan ports of Barcelona and Tarragona, followed by the ports in Andalusia (18.13%) and Valencia (15.95%). Ports located on the Atlantic coast and the Bay of Biscay accounted for the remaining 42.64%, in particular the Galician (11.51%), Asturian (10.16%) and Canarian (9.54%) ports.

A look at investments made in individual ports over the past 17 years shows that the cities which received the largest share were Barcelona in first place and Valencia in second. They were followed by the ports in Gijón, Bilbao, Algeciras, Las Palmas and A Coruña. These ports also made investments in their own facilities to build new docks and storage areas (Barcelona, Valencia, Algeciras, Las Palmas) or new outer ports (Bilbao, Gijón and A Coruña). In total, 60% of total investment went to these seven ports.



Investments in smaller ports were lower, particularly in the ports of Vilagarcía and Marín in Galicia, Avilés in Asturias, Pasajes in the Basque Country and Almería, Motril and Cádiz in Andalusia. Meanwhile, major investments, as will be seen in the discussion of levels of specialization and growth of traffic, were made in specific ports such as Ferrol, Tarragona, Castellón, Cartagena, Málaga, Cádiz and Huelva.

Table 2
**MATERIAL INVESTMENT IN PORT INFRASTRUCTURE, BY
 AUTONOMOUS COMMUNITY AND PORT (1993-2010,
 THOUSANDS OF EUROS)**

Autonomous community	Port	Investment	Total investment per autonomous community
Catalonia	Barcelona	1 591 601	2 052 089
	Tarragona	460 488	
Community of Valencia	Castellón	276 559	1 770 023
	Valencia	1 338 676	
	Alicante	154 788	
Murcia (Region of) Andalusia	Cartagena	294 696	2 011 580
	Almería	155 756	
	Motril	69 119	
	Málaga	205 979	
	Algeciras	856 130	
	Cádiz	167 442	
	Seville	275 897	
	Huelva	281 257	
Basque Country	Pasajes	70 767	770 358
	Bilbao	699 591	
Cantabria	Santander	176 526	176 526
Asturias (Principality of)	Gijón	979 197	1 112 772
	Avilés	133 575	
Galicia	Ferrol	240 325	1 277 732
	A Coruña	598 059	
	Vilagarcía	74 167	
	Marín	84 782	
	Vigo	279 299	
Canary Islands	Las Palmas	652 435	1 058 431
	Santa Cruz de Tenerife	405 996	
Autonomous cities	Ceuta	87 651	
	Melilla	148 853	
TOTAL		11 097 632	

Source: The author, on the basis of data from State Ports of Spain annual reports.

III Is the investment effort consistent with the patterns in activity?

There are several different answers to this question, which can be found by comparing investment in port infrastructure with the change in traffic reported by port authorities. On the one hand, some ports with similar growth in traffic have spent widely different amounts on infrastructure. On the other hand, ports that have made very similar investment efforts have attracted very different levels of traffic.

Table 3 presents a number of useful conclusions:

- (a) In terms of traffic, the data highlight changes in ranking and specialization. The ports which improved their national ranking were Valencia (up from ninth to second place), Cartagena (up from tenth to seventh place), Las Palmas (up from eleventh to sixth place), Vigo (up from twenty-second to seventeenth place) and Santander (up from nineteenth to sixteenth place). The ports which went down in ranking were A Coruña (down from seventh to twelfth place), Gijón (down from fifth to ninth place); Málaga (down from twelfth to twenty-first place) and Tenerife (down from sixth to tenth place).

The leading port also changed. Bilbao took the top spot in 1993 but dropped to fourth place some years later. Algeciras moved up from second place in 1993 to take the leading position in 2008. Barcelona also went up (from fourth to third place), and the port of Valencia shot up from ninth to second place. The ports fall into four groups on the basis of their rate of growth in traffic, as the table below shows.

- (b) The rate of growth differed along with levels of specialization. Considerable investments were made in ports that are highly specialized in solid bulk cargo because of the need for specialized facilities and equipment. There was a positive correlation between investments and traffic (see table 5).

Large investments were also made in ports with high levels of specialization in liquid bulk cargo. However, they were private investments stemming from concessions granted to oil terminals and regasification plants. Growth of traffic in those ports has been determined, above all, by the performance of their specialized terminals and the throughput capacity of plants (see table 6).

Ports with a high level of specialization in general cargo —i.e. those that handle a wider variety of cargo— have a much lower level of investment than ports which specialize in solid or liquid bulk cargo. The results for the growth of maritime traffic were also very different (see table 7).

Table 3
RELATIONSHIP BETWEEN PORT INFRASTRUCTURE INVESTMENT AND TRAFFIC IN SPANISH PORTS

Port	Infrastructure investment 1993-2010 (thousands of euros)	Growth of investment 1993-2010 (percentage)	Average annual investment (thousands of euros)	Traffic 1993 (thousands of tons)	Traffic 2010 (thousands of tons)	Total growth of traffic 1993-2010 (percentage)
A Coruña	598 059	2 918	35 180	11 759	12 265	4
Alicante	154 788	36	9 105	2 114	2 203	4
Almería ^a	155 756	551	9 162	8 353	3 863	-45
Avilés	133 575	7	7 857	3 446	4 590	33
Algeciras	856 130	112	50 361	30 002	70 276	134
Cádiz	167 442	12	9 850	3 747	4 006	7
Balearic Islands	337 920	1 021	19 878	5 736	11 722	104
Barcelona	1 591 601	205	93 624	18 119	43 679	141
Bilbao	699 591	76	41 152	30 006	34 666	16
Cartagena	294 696	109	17 335	10 410	19 230	85
Castellón	276 559	2 092	16 268	6 934	12 484	80
Ceuta	87 651	383	5 156	4 532	2 625	-42
Ferrol	240 325	555	14 137	4 834	10 709	122
Gijón	979 197	2 711	57 600	12 681	15 719	24
Huelva	281 257	367	16 545	11 316	22 431	101
Las Palmas	652 435	52	38 379	9 390	22 615	141
Málaga	205 979	156	12 116	8 506	2 354	-72
Marín	84 782	116	4 987	0 896	1 979	121
Melilla	148 853	607	8 756	0 773	835	11
Motril ^a	69 119	275	4 066		1 941	49
Pasajes	70 767	180	4 163	4 293	3 898	-9
Santa Cruz de Tenerife	405 996	92	23 882	12 269	15 968	30
Santander	176 526	17	10 384	3 792	5 014	32
Seville	275 897	229	16 229	2 678	4 366	63
Tarragona	460 488	50	27 088	23 814	32 773	38
Valencia	1 338 676	264	78 746	10 521	64 029	509
Vigo	279 399	405	16 435	3 337	4 352	30
Vilagarcía	74 167	1 578	4 363	592	738	25

Source: The author, on the basis of data from State Ports of Spain annual reports.

^a The port of Motril was separated from the port of Almería in 2005.

Table 4
RANKING OF SPANISH PORTS BASED ON THEIR GROWTH OF MARITIME TRAFFIC, 1993-2010

Ports which more than doubled their traffic	Ports which showed considerable growth (>15% and <100%)	Ports which showed moderate growth (<15%)	Ports which showed a decline in growth
Algeciras, Balearic Islands, Barcelona, Ferrol, Huelva, Las Palmas, Marín, Valencia	Avilés, Bilbao, Cartagena, Castellón, Gijón, Motril, Santa Cruz de Tenerife, Santander, Seville, Tarragona, Vigo, Vilagarcía	A Coruña, Alicante, Cádiz, Melilla	Almería, Ceuta, Málaga

Source: Compiled on the basis of data from State Ports of Spain annual reports.

Table 5
MAIN PORTS WITH A HIGH PROPORTION OF SOLID BULK CARGO TRAFFIC, 2010

	Proportion of solid bulk cargo to total traffic (percentage)	Growth in port traffic 1993-2010 (percentage)	Growth of investment (percentage)
Gijón	85	24	2 711
Almería	83	-45	551
Ferrol-San Cibrao	69	122	555
Avilés	60	33	7
Santander	57	32	17
Vilagarcía	55	25	1 578
Seville	49	63	229
Marín	49	121	116

Source: Compiled on the basis of data from State Ports of Spain annual reports.

Table 6
MAIN PORTS WITH A HIGH PROPORTION
OF LIQUID BULK CARGO TRAFFIC, 2010

	Proportion of liquid bulk cargo to total traffic (percentage)	Growth in traffic 1993-2010 (percentage)	Growth of investment 1993-2010 (percentage)
Cartagena	79	85	109
Huelva	74	101	367
Motril	66	49	275
A Coruña	62	4	2 918
Castellón	61	80	2 092
Tarragona	59	38	50
Bilbao	57	16	76
Santa Cruz de Tenerife	51	30	92
Ceuta	36	-42	383

Source: Compiled on the basis of data from State Ports of Spain annual reports.

Table 7
MAIN PORTS WITH A HIGH PROPORTION
OF GENERAL CARGO TRAFFIC, 2010

	Proportion of general cargo to total traffic (percentage)	Growth in traffic 1993-2010 (percentage)	Growth of investment 1993-2010 (percentage)
Valencia	87	509	264
Melilla	84	11	607
Vigo	79	30	405
Balearic Islands	68	104	1 021
Las Palmas	67	141	52
Barcelona	63	141	205
Málaga	61	-72	156
Alicante	61	4	36
Algeciras	57	134	112
Pasajes	56	-9	180
Cádiz	51	7	12

Source: Compiled on the basis of data from State Ports of Spain annual reports.

(c) The table below shows the relationship between investment in infrastructure and port traffic. Between 1993 and 2010, investment in port infrastructure rose by 292% and traffic increased by 76%, on average. The substantial investments did not attract new traffic. The ports of Gijón and A Coruña are good examples of this.

Similarly, although the ports of Málaga and Pasajes invested heavily in infrastructure, the results obtained did not meet expectations. However, when efforts were well-planned, like those in the ports of Barcelona, Algeciras, Valencia and Marín, the results obtained were more balanced and in fact very promising (see table 8).

Table 8
RELATIONSHIP BETWEEN THE RATE OF GROWTH IN INVESTMENTS AND TRAFFIC

	Decline in traffic	Growth of traffic 0%-25%	Growth of traffic 25% -100%	Growth of traffic over 100%
Growth in investment 0%-100%		Alicante Avilés, Cádiz, Bilbao	Santa Cruz de Tenerife, Santander Tarragona	Las Palmas
Growth in investment 100%-400%	Málaga Pasajes		Cartagena, Motril, Seville	Algeciras, Barcelona Marín, Valencia
Growth in investment 400%-1 000%	Almería Ceuta	Melilla	Vigo	Huelva
Growth in investment over 1 000%		A Coruña Gijón	Castellón Vilagarcía	Balearic Islands, Ferrol

Source: Compiled on the basis of data from State Ports of Spain annual reports.

(d) A number of very clear conclusions can be drawn from the relationship between investment effort and new cargo traffic. The ports of Melilla, Vilagarcía, Vigo and Seville, in particular, show that a greater investment effort led to a rise in cargo traffic. These ports started off with poorly equipped facilities but great potential because of their proximity to industrial plants and distribution networks. As these areas became industrial and logistics hubs, traffic grew at a faster pace. Meanwhile, the ports of Barcelona, Valencia, Las Palmas and Málaga consolidated their established traffic patterns, enhanced their draw and established new links to international networks that made them even more attractive. The ports of A Coruña, Alicante,

Almería, Avilés, Balearic Islands, Bilbao, Castellón, Ceuta, Ferrol, Gijón, Marín, Motril and Santa Cruz de Tenerife posted a higher-than-average ratio of euros invested per ton captured, but for widely different reasons because of individual specialization and infrastructure. Only five ports were below the average: the ports of Cádiz, Cartagena, Huelva, Pasajes and Tarragona. The results, like those in the previous section, do not provide much information on their growth because they were already highly specialized at the start of the period studied, so their impact on throughput at specialized terminals in the area had already been felt. Some examples include chemical and gas plants, oil refineries and car plants in the five ports.

Table 9
RELATIONSHIP BETWEEN INVESTMENT IN PORT
INFRASTRUCTURE AND TRAFFIC CAPTURED

	Material investment in infrastructure compared with system total 1993-2010 (percentage)	Total traffic compared with system total 1993-2010 (percentage)	Investment effort (material investment in euros/tons) 1993-2008
A Coruña	5.4	3.44	2.7
Alicante	1.4	0.78	3.0
Almería	1.4	1.81	1.4
Avilés	1.2	1.2	1.7
Algeciras	7.7	14.98	0.9
Cádiz	1.5	1.29	0.1
Balearic Islands	3	3.12	1.7
Barcelona	14.3	9.45	2.6
Bilbao	6.3	8.41	1.3
Cartagena	2.7	4.9	0.9
Castellón	2.5	2.84	1.5
Ceuta	0.8	0.9	1.5
Ferrol	2.2	2.46	1.5
Gijón	8.8	4.76	3.1
Huelva	2.5	4.84	0.9
Las Palmas	5.9	5.05	2.0
Málaga	1.9	1.57	2.0
Marín	0.8	0.45	2.9
Melilla	1.3	0.22	10.5
Motril	0.6	0.44	1.9
Pasajes	0.6	1.27	0.9
Santa Cruz de Tenerife	3.7	4.56	1.4
Santander	1.6	1.43	1.9
Seville	2.5	1.18	3.6
Tarragona	4.1	8.08	0.9
Valencia	12.1	9.21	2.2
Vigo	2.5	1.13	3.8
Vilagarcía	0.7	0.25	4.6
Spain	100	100	1.1

Source: Compiled on the basis of data from State Ports of Spain annual reports.

(e) Private investment and the borrowing capacity of port authorities have both increased considerably over the past few years. Data from State Ports of Spain, the government agency, also confirm this. Over the years, political initiatives led to legislative action. Spain has opted for an advanced landlord model, which involves welcoming private capital in port areas. The granting of concessions to operate specialized terminals, expanding ports and liberalizing technical nautical services (tugs, wharfage and pilotage) are evidence of increasing involvement of private capital in port operations and business development.

IV. Final reflections

The considerations set out herein are at odds with the assumptions made by Lirn and others (2004), who concluded that the factors determining the attractiveness of a given facility can be grouped into four categories: (a) physical and technical facilities; (b) cost; (c) management; and (d) location. It goes without saying that port managers have no influence over port location and not much power over port tariffs (Martinez Budría, 1996; Rus, Román and Trujillo, 1994; Díaz Hernández and Martínez Budría, 2008). The key therefore lies in improving and expanding infrastructure as a competitive strategy.

The response of traffic to improvements in facilities is not a direct one, as seen in the changing pattern of specialization in Spanish port traffic. There are several good examples of this.

All Spanish ports invested heavily in infrastructure between 1993 and 2010, but not all of them saw increased traffic. The ratio of improvements to outcomes was not similar, either, and the results varied considerably. Ports can therefore be categorized as follows: (a) winners, that is, ports that saw the most growth in traffic and moved up in rank; and losers, those ports that saw their levels of traffic decline and moved down in rank. Among the first are the ports of Valencia, Barcelona, Las Palmas, Ferrol, Algeciras, Cartagena and the Balearic Islands, because their traffic increased and their national ranking improved. The second group includes the ports of Málaga, Pasajes, Almería and Ceuta, which moved down in ranking. There are also ports that saw more modest growth, such as Alicante, Avilés, Cádiz and A Coruña. Spanish ports which made considerable investments can be sorted into two groups: those which did so gradually over the past 10 years (Bilbao, Barcelona and Valencia) and those which made a single, sizeable investment in recent years (Tarragona, Castellón, Gijón and A Coruña).

Previous research (García and Sánchez, 2006) reveals two interesting conclusions: (a) investment effort does not really drive traffic; and (b) logistics and equipment are the only relevant components of expense. For these authors, then, the most useful approach would be to analyse and study container traffic, with logistics as the best explanatory variable for any changes.

It can therefore be concluded, first, that ports which experienced the highest growth in traffic are those which specialize in handling cargo (particularly, containerized cargo). It is in such ports where the investment-to-traffic ratio is the most sensitive to investment spending (including spending on improving port infrastructure).

Other studies, such as Verhoeff (1981), cast doubt on this strategy, noting that port traffic did not seem to respond to infrastructure investment. This reasoning could be valid in the case of Spain, with its heavy outlays in specialized plants and terminals and a high concentration of businesses specializing in liquid or solid bulk cargo located there. The port of Cartagena is a good example: the entry of private initiative drove companies to make hefty investments, which enabled them to maintain their level of constrained or captive traffic along with stable or growing traffic overall.

Lastly, the analysis set out herein reveals that the Spanish ports with the best results in terms of growth in traffic are located on the Mediterranean coast and that it is not easy for bottom-ranking ports (those which are the farthest below national averages) to compete with top-ranking ports. As a result, two observations can be made. First, the Mediterranean area is an emerging link in international maritime and port networks. This makes sense, because the areas with the fastest-growing economies on the Iberian Peninsula during the period were Catalonia and Valencia, and because of the boom in transshipment or in-transit zones, as was the case in the port of Algeciras. Second, ports on the Bay of Biscay and the Atlantic coast found it harder to be part of larger routes and act as engines of the regional economy where they are located. This explains why they experienced lower levels of growth despite investments in port infrastructure.

V. Bibliography

Blonigen, B. and W. Wilson (2006), *New measures of Port Efficiency Using International Trade Data*, NBER Working Paper No. 1052.

Bobrovith, D. (1982), "Decentralized planning and competition in a National Multiport System", *Journal of Transport Economics and Policy*, XVI.

Castillo, J.I. and others (2009), "Low-cost port competitiveness index: Implementation in the Spanish Port System". *Marine Policy*, 33.

De Weille, J. and A. Ray (1974), "The optimum port capacity", *Journal of Transport Economics and Policy*, Vol. VIII. 244-259.

Díaz Hernández, J.J. and E. Martínez Budría, (2008), "La inversión pública en los puertos españoles", *Papeles de Economía Española*, No 118, 148-156.

García Alonso, L. and others (2010), *Distribución interportuaria del contenedores: análisis del caso español*, XVI Panam, July 15-18, 2010, Lisbon.

García Alonso, L.; J. Sánchez Soriano, (2006), *Evolución de la inversión vs. evolución de la actividad en el sector portuario*, XXXII Reunión de Estudios Regionales, Ourense, 16-18 November.

González-Laxe, F. (2010), "Port Marketing Strategies and the Challenges of Maritime Globalization", in Coto, P., M. A. Pesquera, and J. Castanedo (eds), *Essays on Port Economics*, Physica-Verlag Springer, 5-18.

Haralambides, H. (2002), "Competition, excess capacity, and pricing of port infrastructure", *International Journal of Transport Economics*, 4, 4.

Lirn, T.C. and others (2004), "An application of AHP on transshipment port selection: a global perspective", *Maritime Economics and Logistics*, 6, 1.

Malchow, M. and A. Kanafani (2001), "A disaggregate analysis of factors influencing port selection", *Maritime Policy and Management*, 28, 3.

Martínez Budría, E. (1996), "Un estudio econométrico de los costes del sistema portuario español", *Revista Asturiana de Economía*, 5.

Puertos del Estado (several issues), *Anuarios Estadísticos del Sistema Portuario de Titularidad Estatal*, Ministerio de Fomento.

Ronnevik, J. (2008), "Investment in transport infrastructure are not enough: lessons from the port of Tema, Ghana", *XV Congreso Panamericano de Ingeniería de Tránsito y Transporte*, Barranquilla.

Rus, G.; Román, C.; Trujillo L. (1994), *Actividad económica y estructura de costes del puerto de la Luz de Las Palmas*, Ed.Civitas, Madrid.

Tavares de Araujo, J.; Guimarães, E.A. (2011), "Concorrência e desempenho dos portos brasileiros", *Breves Cíndes*, No. 46. February.

Verhoeff, J.M. (1981), "Seaport competition: some fundamental and political aspect", *Maritime Policy and Management*, 8, 1.