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# How are Investments Allocated in a Publicly Owned Port System? Political Factors versus Economic Criteria

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CASTILLO-MANZANO J. I. and FAGEDA X. How are investments allocated in a publicly owned port system? Political factors versus economic criteria, *Regional Studies*. This paper estimates the determinants of investments in port infrastructure in the Spanish regions made by the central administration. It is found that the use of the infrastructure in relation to capacity has some influence on the amount of investment received by a region. Furthermore, specialization in containers is also relevant for receiving more resources. However, it is found that when greater political decentralization does not go hand in hand with greater financial decentralization, the importance of tactical political aspects increases. Overall, efficiency plays a more relevant role in the regional allocation of investments in ports than in other transport infrastructures.

Ports Investment Efficiency Solidarity Political factors Container transshipment

CASTILLO-MANZANO J. I. and FAGEDA X. 公有港口系统如何配置投资？政治因素相对于经济准则，区域研究。本文评价由西班牙中央政府决策的区域港口基础建设投资之决定因素。研究发现，基础建设的使用之于港口吞吐量，对于一个区域所接受的投资数量具有某种程度的影响。此外，仓储的专殊化亦关乎获得更多的资源。但研究也发现，当更多的政治分权无法配合更进一步的财政分权时，政治手段方面的重要性便会增加。总体来说，相较于其他交通基础设施建设而言，效率在港口投资的区域配置方面有着更为关键的角色。

港口 投资 效率 团结 政治因素 仓储转运

CASTILLO-MANZANO J. I. et FAGEDA X. Comment les investissements sont-ils alloués dans un système portuaire à caractère public? Les facteurs politiques par rapport aux critères économiques, *Regional Studies*. Cet article cherche à évaluer les déterminants des investissements dans l'infrastructure portuaire aux régions espagnoles réalisés par l'administration centrale. Il s'avère que l'utilisation de l'infrastructure en matière de capacité influe jusqu'à un certain point sur le montant de l'investissement qu'une région a attiré. Qui plus est, la spécialisation en conteneurs se révèle important pour attirer des ressources. Cependant, il s'avère que l'importance des aspects politiques tactiques augmente au moment où la décentralisation politique accrue ne va pas de pair avec la décentralisation financière. Globalement, l'efficacité joue un rôle plus important dans l'octroi régional des aides à l'investissement dans les ports plutôt que dans d'autres moyens de transport.

Ports Investissement Efficacité Solidarité Facteurs politiques Transbordement de conteneurs

CASTILLO-MANZANO J. I. und FAGEDA X. Wie werden Investitionen in einem öffentlichen Hafensystem verteilt? Politische Faktoren im Vergleich zu wirtschaftlichen Kriterien, *Regional Studies*. In diesem Beitrag werden die Determinanten für die Investitionen der Zentralregierung in die Hafen-Infrastruktur von spanischen Regionen untersucht. Wir stellen fest, dass die Auslastung der Infrastruktur im Vergleich zur Kapazität einen gewissen Einfluss auf den Umfang der von einer Region erhaltenen Investitionen ausübt. Darüber hinaus ist eine Spezialisierung auf Container ebenfalls für den Erhalt von zusätzlichen Ressourcen relevant. Allerdings stellen wir fest, dass die Bedeutung von taktischen politischen Aspekten zunimmt, wenn eine stärkere politische Dezentralisierung nicht mit einer stärkeren finanziellen Dezentralisierung einhergeht. Insgesamt spielt die Effizienz für die regionale Verteilung von Investitionen bei Häfen eine größere Rolle als bei anderen Verkehrsinfrastrukturen.

Häfen Investitionen Effizienz Solidarität Politische Faktoren Containerumschlag

CASTILLO-MANZANO J. I. y FAGEDA X. ¿Cómo se distribuyen las inversiones en un sistema portuario público?: Factores políticos frente a criterios económicos, *Regional Studies*. En este artículo se estiman los factores que determinan la distribución de las inversiones del gobierno central en el sistema portuario español. Se concluye que en este reparto se prima a aquellos puertos que más tráfico gestionan en relación a sus activos y a los que presentan una mayor especialización en el tráfico de contenedores. Sin embargo, los criterios políticos ganan importancia cuando la descentralización política no va acompañada de una descentralización financiera. En resumen, la eficiencia juega un papel más relevante en la distribución de las inversiones portuarias de lo que influye en el reparto de otras infraestructuras.

Puertos Inversión Eficiencia Solidaridad Factores políticos Transbordo de contenedores

JEL classifications: H54, L91, R42

## INTRODUCTION

Investments in transportation infrastructure can have a notable impact on regional economic growth. This is especially true when these investments are directed at territories, where citizens and firms make a greater use of them, whether to meet some unmet demand, to alleviate congestion problems or to correct bottlenecks in a given network.

A number of empirical studies (for example, ALBALATE *et al.*, 2012; CADOT *et al.*, 2006; CASTELLS and SOLÉ-OLLÉ, 2005; KEMMERLING and STEPHAN, 2002, 2010; SOLÉ-OLLÉ, 2010, 2012) have analysed the determinants for central governments' regional allocations of investments in transportation infrastructure in a variety of European countries. Although there is a consensus regarding the economic importance of transport infrastructures, a common result in studies such as these is that the importance of considerations of efficiency or performance is modest for the decision about which territories are allocated a larger or a smaller proportion of the available resources for investment in infrastructure. As a result, issues of political tactics, pressure from certain interest groups or a preference for satisfying redistribution criteria play a role that is even more important than that played by the concern for greater economic efficiency.

In the case of Spain, CASTELLS and SOLÉ-OLLÉ (2005) estimated an equation for the determinants of investment in general transportation infrastructure for a sample of regions in the country during the period 1987–1996. This study finds evidence of the existence of political factors that divert government attention to the efficiency–equity dilemma in investment decisions. Among these political factors, statistical significance is found for aspects such as the support given by regional political parties to the party that is governing in a minority in the central administration, the number of votes that the party in government needs in the region to gain a representative in parliament, and the fact that the same political party is in power in both the central and regional governments.<sup>1</sup>

CADOT *et al.* (2006) simultaneously estimated an aggregated production function and an equation for the determinants in investment in infrastructure for a

sample of regions in France during the period 1985–1992. They concluded that the regions where the investment's marginal productivity is higher do not necessarily receive greater investment, whilst the influence of certain interest groups (measured by the number of large companies based in the region) or political factors, such as the difference in votes between the two main political parties, do impact greatly on this decision. Meanwhile, KEMMERLING and STEPHAN (2002) also simultaneously estimated production and investment allocation functions for a sample of German towns and cities for 1980, 1986 and 1988. They found that redistribution considerations have a greater importance for decisions on infrastructure than any related to efficiency or performance, and those political factors, such as the fact that the same party is in power in local and regional governments, also play a significant role. KEMMERLING and STEPHAN (2010) emphasized the importance of country-specific political institutions in order to explain the regional distribution of investment.

These studies use an aggregated focus, where the considerations of efficiency and solidarity are mainly related through the relationship between investments and levels of activity in the region. In particular, efficiency is generally measured as the ratio between gross domestic product (GDP) in relation to the capital stock and solidarity is measured through the GDP per capita. This implies that the use of the infrastructure, which should be measured by the levels of traffic it bears, is habitually included indirectly. Investments in the various modes of transportation are taken into account, but the analysis focuses especially on network infrastructure (road and rail) given the size of the investment made in both these modes. Note that the transportation literature usually considers efficiency in infrastructure transportation by relating traffic intensity to existent capacity.

There are some specific studies for airports relative to the cases of Spain (BEL and FAGEDA, 2009) and the United States (BILOTKACH, 2010). As they examine a specific mode of transportation, their analyses of efficiency can include variables directly related to traffic. These studies find that tactical political factors seem to

be more important than economic factors. As far as the authors are aware, there is no study that has analysed the determinants for investment in ports. The main contribution of this article is the empirical analysis of the relative role that economic and political considerations play in investments in port infrastructure.<sup>2</sup>

It is not clear whether in the sphere of ports political considerations are as important as for other modes of transportation. In fact, it might be anticipated a priori that performance could play a more important role. Only a limited number of regions have ports in most countries. This means that they are less attractive for policies such as territorial solidarity than other more omnipresent types of transport infrastructure such as airports and roads. They have, however, traditionally played a major role as regional development policy instruments.

Regardless of the ownership structure, the management of many major world ports has been transferred from national or state governments to local governments, or even to the level of an individual entity. In this way, it has become more common for port authorities to have a high degree of financial independence for deciding on investments and the way that these are financed, especially over the last two decades. Most of empirical studies consider that the higher degree of autonomy in the management of ports has brought about gains in efficiency and performance. The higher degree of autonomy may be due to decentralization (BARROS, 2003; GONZÁLEZ and TRUJILLO, 2008), a higher involvement of private capital (CULLINANE *et al.*, 2002; TONGZON and HENG, 2005) or both these reasons (ESTACHE *et al.*, 2002). This could be taken as an indication that efficiency and port performance considerations have played a relevant role in the allocation of investments.

Finally, port activity mainly focuses on the movement of freight, as a result of which investment in this type of infrastructure is less productive for securing votes compared with other infrastructure, such as roads, airports and railways where there are great movements of people (JACOBS, 2007). Furthermore, it should be noted that many port facilities have been set further away from city centres in recent decades to avoid congestion (BICHOU and GREY, 2005). This process has taken place in many old port cities that have had to renew facilities. Hence, the citizen-voter is less aware of port activities.

This study focuses on an analysis of the determinants of investment in ports in Spain. The institutional framework is characterized by financial centralization and growing political decentralization within a port devolution process that is similar to that found in other Mediterranean countries. There are also financial instruments that redistribute resources among ports in the country.

The purpose of this study is to test whether the existence of a financially centralized and politically decentralized institutional framework might also lead to other

considerations apart from port performance playing an important role in the regional allocation of resources, as the previous literature states is the case for other transportation infrastructure.

In particular, the authors want to test whether the central government favours more efficient ports (that is, those ports where the use of the infrastructure is more intensive), or whether the regional allocation of investment in ports is guided by other economic criteria, like inter-regional solidarity. Furthermore, the authors want to test whether some variables related to political tactics or the pressure of interest groups explain why a region receives more resources for its ports. In this regard, the central research question aims to examine whether economic criteria or political factors (or both) play a major role in explaining the regional allocation of investments in port facilities.

In order to address this, multivariate regressions are performed to account of the quantitative impact of all the potential relevant factors that may determine public investments in ports.<sup>3</sup>

In particular, the following questions are addressed:

- Does the use of the infrastructure have any influence on future investments?
- Is specialization by the Spanish port system in certain specific emerging traffic, such as container transport, being favoured?
- Do mechanisms, such as the inter-port compensation fund, really allow funds to be redistributed from large to small ports?
- Is investment being favoured by the inclusion of regional governments in the management of ports of the same political colour as the central government?
- Has the relative weight in the regional economy of manufacturing and construction firms influence on the allocation of investments?

The paper is organized as follows. The second section sets out the main features of the Spanish port system and focuses on the various factors that impact on the way investment is shared out among the country's ports. The third section describes the empirical model used, including the origin of the data, and justifies the use of the variables. The fourth section explains the econometric issues that need to be considered in the regression analysis. The fifth section presents the results of the estimates. Finally, the sixth section discusses the findings and presents the conclusions that are drawn.

## INVESTMENT IN THE SPANISH PORT SYSTEM

Spain has one of the most studied port devolution processes of the last decade (CASTILLO-MANZANO and ASECIO-FLORES, 2012; CASTILLO-MANZANO *et al.*, 2008; GONZÁLEZ and TRUJILLO, 2008).<sup>4</sup> This process has developed with four changes in legislation from

the beginning of the 1990s to the present day, specifically Laws 27/1992, 62/1997, 48/2003 and 33/2010.

These reforms broke with the traditional public model of ports in the hands of the central government which had been common to Mediterranean port systems in the preceding decades (SUYKENS and VAN DE VOORDE, 1998). Public ownership and centralized decision-making for investment were continued under the new model. However, privately owned terminals with a high degree of independence from the port authorities were permitted on port premises. Also, broadly speaking, a kind of decentralization akin to the landlord management model can be talked of regarding both economic management and political supervision.<sup>5</sup>

The first reform essentially resulted in great managerial autonomy for the various port authorities after Law 27/92, although under the supervision of the central government's State Port Authority which had to approve their respective business plans on a yearly basis (COTO-MILLÁN, 1996).

The second reform entailed political decentralization in Law 62/97. This law established that regional governments should assume competence for naming the presidents of the port authorities. Since then, the vast majority of the presidents have been members of the parties in power in the regional governments where the port authorities are found (CASTILLO-MANZANO *et al.*, 2010).

Moreover, coinciding with the port devolution process, a process of over-investment in the Spanish port system similar to that seen in other European countries in the previous decade was also in place (for examples of this, see GOSS, 1995). In this way, the vast majority of the port authorities used their autonomy to make major improvements to their infrastructure or port superstructure.<sup>6</sup> In some cases, such as A Coruña, Ferrol and Gijón, they constructed a new port and moved out of their old facilities, and in others, such as Seville, they constructed a new lock and a new logistics activities zone with its associated quays.

In short, investment in the Spanish port system has multiplied by three with this process once inflation has been deducted. To be specific, the €322 million invested in 1991, a year before the port devolution process began, rose to €998 million in 2008 (with both amounts expressed as constant year 2000 euros). It is also easy to see that there is a correlation between the increase in investment expenditure and political decentralization, as up to 1997 investment remained below €400 million constant euros.

In this context, many regional governments considered that ports could be turned into major drivers of regional development, with this hypothesis being upheld by a number of studies on port economic impact that were commissioned ad hoc (for a survey of these, see CASTILLO-MANZANO *et al.*, 2004). This led a number of regional governments to take on competences without any legal basis, such as the

coordination of the policies and strategies of all the port authorities in their regions. For this, public companies were created in regions such as Andalusia, Catalonia and Galicia that have not been able to undertake this coordination in practice since, as previously stated, it is the central government which has to approve their respective business plans on a yearly basis through the State Ports Authority.

In comparison with these new formal organizations, others of a more informal nature have also appeared with the sole objective of lobbying central government in order to attract a greater volume of investment to certain port authorities. To be more precise, these are rather heterogeneous platforms organized within the port authority environments which have gradually incorporated such widely differing organizations as the local councils in the port hinterlands, trade unions, businessmen's associations and even residents' associations. It has not been uncommon to see representatives of these platforms meeting with representatives of regional or national governments and even from the European Investment Bank.

Cooperation between town councils and port authorities has meant additional funds have been secured thanks to the property (real estate) bubble that the Spanish economy has experienced. Specifically, local councils have paved the way for the land where former port facilities were located, which in historical ports was generally in the city centre, to be reclassified, while the port authorities planned their new facilities far from the normally congested urban centres. This reclassification has allowed the port authorities to gain some major extra income by promoting the construction of new facilities (BICHOU and GREY, 2005). The new constructions are used both for company use (offices and conferences) and for leisure activities, in keeping with the Barcelona Port Authority's successful Port Vell 'shopping mall and leisure center' model. Port Vell was in turn influenced by successful large-scale international projects such as the major rebuilding project linked to the old docks in London (UK) (regarding this last process, see CARMONA, 2009). Unlike major investment in port infrastructure, there are usually abundant private funds for projects to redevelop old port facilities for tertiary use (malls, offices and even aquariums).

Even so, the massive influx of economic resources into ports over the last decade from both the system's own resources and public resources not linked to the system have not been sufficient to cover these funding needs.<sup>7</sup> This has meant that port authorities have been accruing debt with financial institutions at a double-digit annual growth rate. In 2008 the accumulated debt stood at over 150% of the total annual revenue for the whole port system.

What is striking is the ease with which many port authorities, especially those with little traffic, were able to have access to loans from financial institutions, even



more so when it is considered that after Law 27/1992 they had to respond to present and future loans with their own resources. The only explanation is the belief on the part of financial institutions that any debt would be borne by the central government should the port authority become insolvent. This belief has been confirmed by the Ministry of Public Works' intervention to deal with Gijón Port Authority's poor debt situation by taking on all its debts in exchange for greater control over its future management.

Despite the decentralization described above, the majority of the economic resources needed to fund these investments are still in the hands of the central government in this investment process. This includes public resources not linked to the port system that come from the Ministry of Public Works and from the European Regional Development Fund (ERDF). And the resources of the system itself are also included, specifically both 4% of the income for all ports (except the island ports and Ceuta and Melilla, which only give 2%) as well as resources from an inter-port solidarity fund, known as the Fondo de Compensación Interportuario (Inter-Port Compensation Fund) since 2003. This fund comprises contributions from ports with a surplus to finance investments and other expenditure at ports with a shortfall. These two amounts together come to some €40 million per year, of which €20–25 million are used to finance ports that have special economic difficulties or are located outside the Iberian Peninsula. These amounts are necessary for the economic viability of several of the twenty-eight port authorities in the Spanish port system given their little ability to generate resources, including Ceuta, Marín, Melilla, Motril and Vilagarcía.

As such, the issue of how public investment funds are to be distributed is economically relevant both because of the amount in question, €1300 million current year euros in the last decade, which represents an annual average of €46.5 million per year for each of the port authorities, and because of the complicated political interests that are in play. To summarize, it is the central government which authorizes investments and provides a large part of the funding that is required, whereas it is the regional government that can make political capital of them through the president of the port authority, and it is the local councils in the hinterlands of the ports that most benefit from them. For this reason, many mayors of port towns and cities try to front port investment through these platforms, especially in small or medium-sized towns and cities where the port authority is not just one of the leading investors, but the main investor, which means that these towns and cities therefore have great economic dependence on port investment.

In this context, this article seeks to analyse the criteria used to split the investments among Spanish ports. The aim is to quantify the influence that transportation economics criteria have on the way investments are

shared out and, within this sphere, whether inter-port or inter-regional solidarity criteria prevail or, conversely, it is electioneering criteria to favour cities or regions that are allied with the central government that dominate.

The following section estimates an empirical model that accounts for different political and economic factors that may influence the allocation by the central administration of regional investments in ports in the Spanish provinces (NUTS-3) where there are facilities of this type.<sup>8</sup>

### THE EMPIRICAL MODEL

During the period of study covered, the Spanish port system was composed of twenty-seven port authorities which included forty-four ports of general interest. Currently, there are twenty-eight port authorities, after the segregation of the Port of Motril from the Port of Almería. There are other territorial bodies managed by the respective regional administrations, but their size is always quite small compared with the so-called general interest ports.

Information on the majority of the variables used in the empirical analysis is only available at the provincial level (NUTS-3), as a result of which the geographical unit of analysis is the province. This means that no distinction can be made between different port authorities in the same province and data for these have been aggregated on the provincial scale. In particular, the sample is based on twenty-two provinces.<sup>9</sup> The time period analysed was also determined by data availability and covers the period 1982–2005. A total of 528 observations were made for the empirical analysis.

The empirical analysis is based on the estimation of an equation of the determinants of investments in port infrastructure in province  $i$  during year  $t$ . An equation is estimated where the endogenous variable (*INVESTMENT*) is the amount of investment in port infrastructure in province  $i$  during year  $t$  expressed in constant year 2000 euros. Port authorities are in charge of investments in port infrastructure such as berths, while specialized private firms are generally in charge of investments in port superstructure such as cranes. The focus is on the public investment. Data on investment in port infrastructure were taken from historical public capital series that the BBVA-IVIE Foundation publishes periodically.<sup>10</sup>

Investments in ports of general interest are proposed by the Spanish Ports Authority (Puertos del Estado), which is an entity dependent on the Ministry of Transport (central government). Proposed investments must be approved in accompanying laws included in the Central Government's General Budget Law. Thus, regarding the political timing of investments, what is relevant is who is governing at the time at which the

budget is approved and not when the investment is effectively made.

In this regard, information of the explanatory variables was used referring to province  $i$  during year  $t-1$ . Indeed, the levels of investment in year  $t$  will be determined by decisions taken in year  $t-1$ , whereby the influence of the various explanatory variables is expected to relate to year  $t-1$ .

The following explanatory variables were considered for the provincial allocation of investments in port infrastructure:

- (1) The endogenous variable with a lag of 1. Most large-scale port investment projects, from a new terminal to the development of an area for logistics activities, are multi-annual, which means that the investment for period  $t$  is probably closely linked with investment during period  $t-1$ .
  - (2) The capital stock in port infrastructures in province  $i$  in year  $t-1$  (*STOCK CAPITAL*). Capital stock is expressed in constant year 2000 euros and information comes from BBVA-IVIE Foundation.
- This variable is related to the equity objective of the central government (KEMMERLING and STEPHAN, 2010). If the central government has the objective of equal infrastructure endowment across regions, it should invest more resources in regions with a lower stock of capital.
- (3) The ratio between the amount of traffic and capital stock for the port authorities in province  $i$  in year  $t-2$  (*TRAFFIC/CAPITAL*). Traffic data are expressed in terms of tonnes of goods moved.<sup>11</sup> The information on traffic was obtained from the Spanish National Ports Authority, Puertos del Estado.<sup>12</sup>

With the data available, this is the best approximation of an indicator of efficiency that the authors have been able to construct for analysing its influence on investments. It should be remembered that previous studies on the regional allocation of investments in transport infrastructure (CASTELLS and SOLÉ-OLLÉ, 2005; SOLÉ-OLLÉ, 2010, 2012; KEMMERLING and STEPHAN, 2002, 2010) used as an indicator of efficiency the ratio of GDP to capital stock.<sup>13</sup> However, the use of infrastructure in relation to capacity is the most accurate indicator of efficiency in the case of transportation. Bearing this in mind, the authors still recognize that their variable has some limitations because it is the ratio between one measure in physical units and another in monetary units.

If efficiency considerations are relevant in the regional allocation of investments, the volume of investment received by a port authority can be expected to be dependent upon the volume of traffic in relation to its capacity. The higher the level of traffic in relation to the available capacity, the greater the need for investment in improvements and the greater will be the expansion of port facilities.

Hence, port authorities that make a more intense use of assets will receive more resources.

However, the existence of the Inter-Port Compensation Fund could result in the relationship between the levels of traffic and the levels of investment being less closely related than might be anticipated in a system where the financial autonomy of the port authorities is higher than in the case of Spain.<sup>14</sup> It should be noted that port legislation in Spain explicitly states that redistribution based on solidarity depends on the level of traffic that the port generates and is not related to the relative wealth of the province in which the port is located.

- (4) Gross domestic product per capita of province  $i$  during year  $t-1$  (*GDP PER CAPITA*). Information for this variable was obtained from Spain's Institute of Statistics, the Instituto Nacional de Estadística (INE). Data are expressed in constant year 2000 euros. This variable captures economic wealth so that it measures whether the central government invests more in poorer regions. In such a case, one of the goals of the port policy in Spain would be solidarity based on the levels of income.
- (5) Port authorities' specialization in containers in province  $i$  during year  $t-1$  (*WEIGHT CONTAINERS*). The information for this variable was obtained from the Spanish National Ports Authority, Puertos del Estado.

This variable is constructed as the quotient between tonnes moved in containers by port authorities in province  $i$  and total tonnes moved by all port authorities in the Spanish system. Note that several observations do not have container traffic at all. Given that all continuous variables are in logs, the lowest non-zero value in the sample (0.01%) to those observations that do not have container traffic at all is computed.

It should be borne in mind that there is generally a more diverse range of commodities in larger ports (DUCRUET *et al.*, 2010a). Controlling for the volume of traffic, this variable is used to examine whether ports that are more highly specialized in container traffic have been favoured with greater amounts of investment. In this way, indications will be obtained as to whether there is a deliberate policy on the part of the central government to favour the development of hub ports. This policy could be one of the reasons that explain why Spain is the European country with most ports on the list of the world's busiest container seaports, three to be precise.

Container traffic is not on average the traffic with the greatest added value (HAEZENDONCK, 2001), but it requires more costly port facilities with a higher degree of technical complexity compared with other types of freight. Furthermore, given the importance of this type of traffic for international trade, it would be plausible to

expect the central government to bias public investments with a view to favouring the creation of one or more hubs on national territory, which would thus make Spain less dependent on other countries for organizing its supply and distribution chains. Finally, and this is probably not just the case in Spain, it should be expected that the greater the value of this variable for a port authority, the greater the presence of private terminals there will be at the port authority (although, generally, with public investment in infrastructure).

- (6) The percentage represented by added value in manufacturing and construction activities (it was impossible to separate the two activities) compared with the added value that the whole province generates (*WEIGHT INDUSTRIAL ACTIVITY*). Information for this variable was obtained from Cambridge Econometrics (European Regional Database publication). Manufacturing companies might be anticipated to have a great interest in investments being made in ports where their activities are located as their import and export activities depend on these facilities. Construction companies, meanwhile, could benefit from the construction work that comes from improving and expanding port capacity. Hence, this variable may work as a proxy for lobbying forces.
- (7) Percentage of votes of the incumbent party in the central government in the elections to the central parliament across regions (*VOTES*). Information for this variable was obtained from the Ministry of Domestic Affairs website. The party in power in central government might have greater incentives for investing in regions where its popularity is greater as the political capital these regions have for the party will be greater.
- (8) A dummy variable which takes a value of 1 when the party that is in power in the central government and the party in power in the regional government (*NUTS-2*) in the province where the respective port authority is located coincide from 1998 (*D<sup>REGIONAL\_CORRESPONDENCE</sup>*). Information for this variable was obtained from the Ministry of Domestic Affairs website. This variable is used to measure any political bias there might be in the way that the central government has distributed investments after Law 62/1997 came into force in January 1998. The specific aim is to test the hypothesis that port authorities located in regions governed by the same political party as the central government have been systematically favoured. These include both majority governments and those in coalition. In these regions, the presidents of both the port authorities and of the State Ports Authority would belong to the same political party.
- (9) A dummy variable which takes a value of 1 when the party that is in power in the central government

and the party in power in the largest town or city in the province where the respective port authority is located coincide (*D<sup>LOCAL\_CORRESPONDENCE</sup>*). Information for this variable was obtained from the Ministry of Domestic Affairs website. This variable is used to examine the degree to which political pressure from platforms that are usually headed by the mayor of the town/city that is most affected by the investment influences central government decisions.

- (10) A dummy variable that takes a value of 1 in provinces where nationalist parties are in power in the regional government (Basque Country, Catalonia, Canary Islands) during the periods where the party in the central government does not have the absolute majority (*D<sup>STRENGTH\_REGIONAL\_PARTIES</sup>*). Information for this variable was obtained from the Ministry of Domestic Affairs website. This variable may allow one to capture the pressure of nationalist parties when the party in the central government may need their support in parliamentary votes.
- (11) A difference in the percentage of votes in the national elections between the incumbent party in the central government and the political party with the second largest number of votes at the national level (*SWING*) across regions. Previous studies typically use a variable for the difference in a province's votes between the two main parties in the national elections to test the so-called swing voter hypothesis; regions will receive more investment if the difference in votes between the two main parties is smaller. Information for this variable was obtained from the Ministry of Domestic Affairs website.
- (12) A ratio which is constructed by dividing the percentage of votes in the province over total national votes in relation to the percentage of seats in the province over total national seats (*VOTES/SEATS*). With this variable, the authors wanted to test if the incumbent party in the central government invests more resources in those regions with higher electoral productivity; that is, in those regions where fewer votes are needed to gain seats. Information for this variable was obtained from the Ministry of Domestic Affairs website.

## ECONOMETRIC ISSUES

The data used for estimating the investment determinants equation have a data panel structure. There are various techniques and estimation models available for estimating equations with data panels. Furthermore, the estimates can present heteroskedasticity, non-stationarity and temporal autocorrelation problems in the error term.

Table 1 shows the results of different specification tests. First, it reports tests related to the time series



properties of the data (stationarity and autocorrelation). The augmented Dickey–Fuller (ADF) test indicates that the dependent variable does not contain a unit root and hence it is confirmed that there is no long-term co-integration relationship. The Wooldridge test for autocorrelation in panel data claims that one may have a problem of serial autocorrelation that must be treated. Second, Table 1 report tests of appropriateness of different estimation techniques in the context of panel data. The Breusch–Pagan Lagrange multiplier (LM) test for random effects shows that random effects are not statistically significant and, hence, a pooled model may be more appropriate than a random-effects model. Furthermore, the Hausman test shows that systematic differences between the random and fixed effects are found and thus the fixed-effects model should be preferred to the random-effects model.

Note also that there may be a simultaneous determination of the variables of traffic and investment.<sup>15</sup> In order to deal with this potential bias in the estimation, two different approaches are followed. First, two lags of the variable of the traffic/capital stock ratio are used because the correlation between the first lag and the contemporaneous variable is too high. Secondly, an instrumental variables regression is performed where the following instruments for the two lags of the traffic/capital ratio are used: the third and fourth lag of the same ratio and geographical variables related to location and centrality: longitude and latitude.<sup>16</sup>

It would be difficult to maintain that geographical location might be a variable that would explain a bias in the distribution of investment over twenty-four years. On the other hand, geographical location, including the linked attributes of centrality (proximity to origin/destination markets) and intermediacy (insertion in carrier networks),<sup>17</sup> might have an influence on the evolution of a port's traffic. Thus, for the case of Spain, experience shows that being on a latitude closer to the Straits of Gibraltar brings with it a competitive advantage for bunker traffic, whereas, in more general terms, a longitude in the area of the Mediterranean seems to have a competitive advantage for container transshipment and getting supplies by rail to the great central market of the Iberian peninsula, with the over 6 million inhabitants in the Madrid metropolitan area. Geographical features make this difficult in the area of the Cantabrian Sea.<sup>18</sup>

It is argued here that it is important to present the results of different estimation techniques as a robustness check. Hence, the results of the estimation using three different techniques are presented:

- A pooled model using the Prais–Winsten regression (panel-corrected standard errors) with an AR-1 disturbance.
- An instrumental variables regression where the variable of traffic is considered to be endogenous.
- A fixed-effects model with an AR-1 disturbance.

All continuous variables are expressed in logarithms. All these estimations include time-fixed effects. Furthermore, they are performed in such a way that standard errors are robust to any heteroskedasticity problem.

An advantage of the fixed-effects models is that it allows one to control for any omitted variable which is correlated with the variables of interest and does not change over time. Thus, the fixed-effects model is more reliable than other estimation techniques. A shortcoming of the fixed-effects model is that it may be less informative than other estimation techniques because the within variation of data may be low. Indeed, the political variables of the model only vary each four years as much and the variation rate of the economic variables may be also modest.

Note also that different variables in the model may have implications in terms of efficiency, equity and solidarity so that it may be difficult to disentangle all these effects in practice. Hence, different specifications of the equation for the determinants of investments in ports are presented. First, the results considering all variables are presented. Second, the political variables are excluded. Then, the results excluding the variables of stock of capital and GDP per capita are also presented. Finally, the variable of traffic is excluded.

## RESULTS

Tables 2 and 3 present the descriptive statistics and the correlations matrix for the variables used in the empirical analysis. Table 4 reports the results of the estimation of the determinants of investments in Spanish ports when the panel-corrected standard errors with an AR-1 disturbance are used. Table 5 reports the results when an instrumental variables regression is used;

Table 1. Specification tests

Tests	Null hypothesis	Results
Augmented Dickey–Fuller (ADF) test	Dependent variable contains a unit root	−0.46***
Wooldridge test for autocorrelation in panel data	No first-order autocorrelation	170.90***
Breusch–Pagan Lagrange multiplier (LM) test for random effects	No random effect: the pooled regression model is appropriate	2.05
Hausman test	No systematic differences in the coefficients of random and fixed-effects models	58.86***

Table 2. Descriptive statistics of the variables used in the empirical analysis

Variable	Mean	Standard deviation	Minimum	Maximum
INVESTMENT (€, thousands, year 2000)	21 391.92	19 366.76	703	173 193
TRAFFIC/CAPITAL (tonnes/€)	28.25	17.98	0.65	113.29
STOCK CAPITAL (€, thousands, year 2000)	467 897	304 234	47 076	1 684 006
GDP PER CAPITA (annual €, year 2000)	13 278.56	5 186.406	7 300.002	26 135.89
WEIGHT CONTAINERS (percentage over the total number of containers in the Spanish port system)	4.54	7.63	0.01	33.94
VOTES (percentage of votes for the incumbent party in central government in the national elections)	42.07	10.22	15	63
WEIGHT INDUSTRIAL ACTIVITY (percentage gross valued added in manufacturing and construction)	27.51	8.94	8	45
$D^{REGIONAL\_CORRESPONDENCE}$ (dummy that takes a value of 1 when there is a correspondence between the incumbent party in the central and regional governments)	0.14	0.35	0	1
$D^{LOCAL\_CORRESPONDENCE}$ (dummy that takes a value of 1 when there is a correspondence between the incumbent party in the central and local governments)	0.55	0.49	0	1
$D^{STRENGTH\_REGIONAL\_PARTIES}$ (dummy that takes a value of 1 in provinces where nationalist parties are in regional government during the periods where the party in the central government does not have an absolute majority)	0.10	0.30	0	1
VOTES/SEATS (percentage of votes in the province over total national votes/percentage of seats in the province over total national seats)	0.88	0.22	0.11	1.37
SWING (difference in the percentage of votes in the national elections between the incumbent party in the central government and the political party with the second largest number of votes at the national level across provinces)	11.13	15.30	-25.56	43.87

Table 6 shows the results using the fixed-effects model with an AR-1 disturbance. The explanatory capacity of the estimated models is quite satisfactory with a high  $R^2$ .

Results do not vary substantially when panel-corrected standard errors or instrumental variables are used. However, several variables lose statistical significance with the fixed-effects model because the within variation may not be sufficiently strong. In fact, only the variable of investment during the previous period is clearly positive and statistically significant with the fixed-effects model in all the considered specifications. The variable of traffic/capital ratio is also statistically significant when the lag of investments or political variables are excluded. If one focuses on the fixed-effects regressions, weak evidence is found that only efficiency matters as a determinant of investments in ports.

There are stronger results when panel-corrected standard errors or instrumental variables are used. With the use of these techniques, it is found that the variables of the traffic/capital ratio, investment during the previous period, the stock of capital and specialization in containers are positive and statistically significant in all the specifications. Furthermore, the variable of the same political parties being in power in the central and regional governments is positive and statistically significant in most of the specifications. All these variables seem to have a substantial influence on port investment decisions taken by the central government. The remaining variables are generally not significant.

The following conclusions can be drawn from the findings. First of all, as expected, there is some degree

of inertia in the level of investments for different years. The coefficient associated with the investment lag is positive and statistically significant at the 1% level. Furthermore, the variable of the stock of capital in the previous period is also positive and statistically significant. Hence, those provinces with a higher endowment of capital in port infrastructures receive more resources. This provides evidence that port policies in Spain have not pursued an equity objective; equity would require spending more resources in those territories with a lower endowment of capital.

Importantly, considerations of efficiency and performance seem to bear some influence on the regional allocation of investment in ports. Indeed, the coefficient associated with the variable of the traffic/capital stock ratio variable is positive and statistically significant at the 1% level. Hence, more efficient airports seem to receive more resources. It should be remembered that that this variable is used to capture infrastructure use and, therefore, the marginal productivity in economic terms that might be expected of investment in improvements and expansion of port capacity.

Nevertheless, the roles played by the inter-port compensation fund in redistribution and solidarity, together with some financial instruments, such as the ERDF, also seem to have some influence. The elasticity that comes from the estimated coefficient of the traffic/capital stock ratio variable is somewhat low because it is much lower than 1. This implies that resource allocation for investment may have also favoured ports with small traffic volumes (and likely with low efficiency rates). Note that the solidarity objective in the Spanish port policy

Table 3. Correlation matrix of the variables used in the empirical analysis

	Investment	Traffic/ capital	Containers	Votes	Regional_ correspondence	Local_ correspondence	Industrial	Strength_ regional	Stock_ capital	GDPc	Votes/ seats	Swing
Investment	1											
Traffic/capital	0.06	1										
Containers	0.55	0.12	1									
Votes	-0.14	0.11	-0.02	1								
Regional_correspondence	0.20	-0.08	-0.02	0.14	1							
Local_correspondence	-0.15	0.03	-0.09	0.44	0.09	1						
Industrial	0.22	0.11	0.07	-0.26	-0.12	-0.11	1					
Strength_regional	0.20	-0.05	0.09	-0.32	-0.01	-0.23	0.10	1				
Stock_capital	0.76	-0.02	0.45	-0.22	0.12	-0.25	0.44	0.27	1			
GDPc	0.55	0.05	0.59	-0.28	0.30	-0.22	0.48	0.28	0.59	1		
Votes/seats	0.55	-0.01	0.29	0.60	0.15	-0.01	0.55	0.06	0.60	0.52	1	
Swings	-0.005	0.10	0.08	-0.02	-0.02	0.31	0.04	-0.22	-0.02	-0.14	0.06	1

Table 4. Results of estimations of the determinants of investment in the Spanish port system. Panel-corrected standard errors with AR-1 disturbance (1)

Explanatory variables	Dependent variable: <i>INVESTMENT</i>			
	(1)	(2)	(3)	(4)
<i>LAG_INVESTMENT</i>	0.62 (0.05)***	0.66 (0.05)***	0.78 (0.04)***	0.72 (0.04)***
<i>STOCK CAPITAL</i>	0.25 (0.05)***	0.22 (0.04)***	–	0.17 (0.004)***
<i>TRAFFIC/CAPITAL</i>	0.15 (0.04)***	0.13 (0.03)***	0.09 (0.02)***	–
<i>GDP PER CAPITA</i>	0.02 (0.07)	0.05 (0.07)	–	0.10 (0.07)
<i>WEIGHT CONTAINERS</i>	0.01 (0.008)**	0.02 (0.009)**	0.02 (0.008)**	0.01 (0.008)**
<i>WEIGHT INDUSTRIAL ACTIVITY</i>	–0.06 (0.05)	–0.015 (0.04)	0.01 (0.05)	–0.02 (0.04)
<i>VOTES</i>	0.07 (0.09)	–	0.005 (0.08)	0.13 (0.09)
<i>D<sup>REGIONAL_CORRESPONDENCE</sup></i>	0.15 (0.06)**	–	0.04 (0.06)	0.09 (0.05)*
<i>D<sup>LOCAL_CORRESPONDENCE</sup></i>	0.009 (0.04)	–	–0.009 (0.04)	–0.06 (0.04)
<i>D<sup>STRENGTH_REGIONAL_PARTIES</sup></i>	0.03 (0.07)	–	0.02 (0.06)	–0.007 (0.07)
<i>SWING</i>	–0.001 (0.001)	–	0.0006 (0.001)	–0.001 (0.001)
<i>VOTES/SEATS</i>	0.21 (0.11)*	–	0.24 (0.09)**	0.07 (0.10)
<i>CONSTANT</i>	–0.60 (0.99)	–0.65 (0.73)	1.92 (0.47)	–1.18 (0.98)
Time fixed effects	Yes	Yes	Yes	Yes
<i>R</i> <sup>2</sup>	0.85	0.84	0.87	0.86
$\chi^2$ (Wald test of joint significance)	1.53e+11***	3.52e+06***	2991.36	1.73e+11***
<i>N</i>	468	468	468	490

Notes: Standard errors are given in parentheses.

\*Statistically significant at the 10% level; \*\*statistically significant at the 5% level; and \*\*\*statistically significant at the 1% level.

may have been pursued through the relationship between the levels of traffic and investment, but not through the levels of income because the variable of GDP per capita is not statistically significant.

This finding contrasts with that of BEL and FAGEDA (2009) in an analysis of the determinants of investment in Spanish airports. In this study, it is found that increases in traffic entail more than proportional investment increases (that is, the elasticities are greater than 1) as a result of which airports with greater traffic are benefiting more proportionally.

The aggregated analysis for investment in different modes of transportation might conceal the fact that there is a range of transportation policies in the same country. In the case of Spain, airport policy seems to favour traffic concentration at certain airports located in rich areas, whereas port policy seems to favour the wider spread of traffic across a number of facilities (along with some efficiency considerations).

Furthermore, the coefficient associated with the variable of weight of container traffic is positive and statistically significant at the 1% level. Hence, the specialization in

containers variable used to capture the promotion of this type of traffic with high added value but also with the greatest investment requirements is also relevant. The priority given to these criteria may be one of the explanations of the efficiency gains (GONZÁLEZ and TRUJILLO, 2008) and improved port performance, measured through traffic increases (CASTILLO-MANZANO *et al.*, 2008) that Spanish ports have achieved in recent years.

The significance of the specialization in container traffic variable favours three large ports especially: Algeciras Bay, Valencia and Barcelona. This could be interpreted as indirect empirical evidence of solidarity criteria being complemented with a deliberate central policy to exploit the geographical location of the Spanish peninsula as the western gateway to the Mediterranean and to favour the attraction of international container transit traffic, compared with real competitors such as Gioia Tauro (Italy), Port Said (Egypt), Marsaxlokk (Malta) and Ambarli (Turkey) and, more recently, Tangiers (Morocco). Furthermore, the three above-mentioned port authorities are the logical Spanish choice for supplying the large markets of the Spanish interior in the face of Portuguese

Table 5. Results of estimations of the determinants of investment in the Spanish port system. G2SLS random effects – instrumental variables

Explanatory variables	Dependent variable: INVESTMENT		
	(1)	(2)	(3)
LAG_INVESTMENT	0.58 (0.04)***	0.62 (0.04)***	0.73 (0.03)***
STOCK CAPITAL	0.29 (0.05)***	0.27 (0.04)***	–
TRAFFIC/CAPITAL	0.16 (0.03)***	0.13 (0.03)***	0.09 (0.03)***
GDP PER CAPITA	0.02 (0.08)	0.04 (0.07)	–
WEIGHT CONTAINERS	0.02 (0.008)**	0.02 (0.008)***	0.02 (0.009)***
WEIGHT INDUSTRIAL ACTIVITY	–0.08 (0.07)	–0.0004 (0.06)	0.05 (0.07)
VOTES	0.09 (0.10)	–	0.01 (0.01)
D <sup>REGIONAL_CORRESPONDENCE</sup>	0.14 (0.07)**	–	0.01 (0.06)
D <sup>LOCAL_CORRESPONDENCE</sup>	0.02 (0.04)	–	0.003 (0.04)
D <sup>STRENGTH_REGIONAL_PARTIES</sup>	0.02 (0.07)	–	0.03 (0.07)
SWING	–0.0011 (0.001)	–	0.001 (0.001)
VOTES/SEATS	0.17 (0.10)*	–	0.26 (0.09)***
CONSTANT	–0.98 (1.19)	–0.70 (0.87)	2.46 (0.52)***
Time fixed effects	Yes	Yes	Yes
R <sup>2</sup>	0.81	0.80	0.79
$\chi^2$ (Wald test of joint significance)	1641.26***	1607.97***	1559.52***
N	424	424	424

Notes: Standard errors are given in parentheses.

\*Statistically significant at the 10% level; \*\*statistically significant at the 5% level; and \*\*\*statistically significant at the 1% level.

Instruments for the variable *TRAFFIC/CAPITAL* in the instrumental variables regression are as follows: the third and fourth lag of the variable, longitude and latitude.

competitors (NOTTEBOOM, 2009) and given the difficult geography that makes connections between these markets and the Cantabrian coast port authorities difficult.

Less importance seems to be given to political criteria for the allocation of resources in investment than in the case of other infrastructure, such as airports and railroads, since most of the political variables that might have a degree of influence on the central government's investment decisions are not statistically significant. It should be remembered that previous studies on other transport infrastructures find that several political variables play a relevant role in the regional allocation of investments (BEL and FAGEDA, 2009; BILOTKACH, 2010; CADOT *et al.*, 2006; CASTELLS and SOLÉ-OLLÉ, 2005; KEMMERLING and STEPHAN, 2002, 2010; SOLÉ-OLLÉ, 2010, 2012).

In this regard, it could be argued that if an investment plan is over a period of several years, it could well be that the party in government when the decision on investment is made is different to the party that executed the investment projects. The authors have

experimented with further lags of the political variables, and the coefficients of these variables are highly insignificant. In any case, it must be recognized that the analyses focus on the execution of the investment plans that are approved each year in parliamentary laws.

Several of the political variables are not statistically significant. However, the fact that the same political party is in power in both the central and the regional governments does have an influence on the amount of resources for investment that the various territories with ports received from 1998 on, the year when the presidents of the port authorities were elected by the regional governments. Indeed, the coefficient associated with the dummy variable for the same party in the central and the regional governments is positive and statistically significant in several specifications. This finding coincides with those of studies for other modes of transportation (BEL and FAGEDA, 2009; CASTELLS and SOLÉ-OLLÉ, 2005; KEMMERLING and STEPHAN, 2002; SOLÉ-OLLÉ, 2010, 2012). Note also that the variable of the ratio votes/seats is statistically



Table 6. Results of estimations of the determinants of investment in the Spanish port system. Fixed-effects model with AR-1 disturbance

Explanatory variables	Dependent variable: <i>INVESTMENT</i>				
	(1)	(2)	(3)	(4)	(5)
<i>LAG_INVESTMENT</i>	0.41 (0.04)***	–	0.43 (0.04)***	0.39 (0.04)***	0.43 (0.04)***
<i>STOCK CAPITAL</i>	0.20 (0.20)	0.55 (0.23)**	0.31 (0.19)	–	0.13 (0.17)
<i>TRAFFIC/CAPITAL</i>	0.13 (0.08)	0.20 (0.11)*	0.16 (0.08)**	0.08 (0.07)	–
<i>GDP PER CAPITA</i>	–0.09 (0.17)	0.04 (0.24)	–	–	–0.11 (0.16)
<i>WEIGHT CONTAINERS</i>	0.02 (0.02)	0.008 (0.03)	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)
<i>WEIGHT INDUSTRIAL ACTIVITY</i>	–0.15 (0.21)	–0.07 (0.26)	–0.04 (0.20)	–0.10 (0.22)	–0.13 (0.19)
<i>VOTES</i>	0.22 (0.18)	0.38 (0.23)	–	0.28 (0.18)	0.31 (0.18)*
<i>D<sup>REGIONAL_CORRESPONDENCE</sup></i>	0.01 (0.08)	–0.02 (0.08)	–	0.007 (0.07)	0.04 (0.08)
<i>D<sup>LOCAL_CORRESPONDENCE</sup></i>	–0.02 (0.04)	0.002 (0.06)	–	–0.03 (0.05)	–0.05 (0.04)
<i>D<sup>STRENGTH_REGIONAL_PARTIES</sup></i>	0.02 (0.08)	–0.05 (0.11)	–	–0.02 (0.08)	–0.006 (0.08)
<i>SWING</i>	0.001 (0.002)	0.001 (0.002)	–	0.001 (0.002)	0.0008 (0.002)
<i>VOTES/SEATS</i>	0.26 (0.16)*	0.25 (0.16)	–	0.33 (0.16)**	0.25 (0.16)
<i>CONSTANT</i>	2.67 (3.33)	0.20 (0.61)	0.99 (3.14)	4.32 (0.84)***	3.73 (2.75)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
<i>R</i> <sup>2</sup>	0.77	0.64	0.79	0.73	0.75
<i>F</i> -test of joint significance	11.29***	8.02***	13.81***	11.02***	13.65***
<i>N</i>	446	446	446	446	468

Notes: Standard errors are given in parentheses.

\*Statistically significant at the 10% level; \*\*statistically significant at the 5% level; and \*\*\*statistically significant at the 1% level.

significant at the 10% level in several regressions, but with a positive sign.

As a result, although port infrastructure should a priori be less susceptible to the political interests of the party that governs in the central administration compared with infrastructure where there is a greater movement of voting persons, such as airports and high-speed train links, what is true is that there is also the risk that reforms aimed at political decentralization which are not accompanied by financial decentralization might raise tactical political aspects over economic criteria, whether of efficiency/performance or of solidarity. In a similar vein, VERHOEVEN (2009) claimed that, in the context of governance reform processes, limited financial autonomy and political influence seem to hint at imperfect situations leading to a weak and uncertain position of port authorities.

Finally, there is no evidence that pressure from companies that have interests in port investment is relevant. In this regard, the coefficient associated with the variable of the proportion of manufacturing and construction activities is not statistically significant.

## CONCLUSIONS

This study conducted an empirical analysis of the factors that determine investment by the central administration in ports in the Spanish regions. A number of studies have dealt with this issue for other types of transportation infrastructure, but this is the first study that has focused on the case of port infrastructure.

Given the importance that ports have for economic growth, a study of how resources are distributed for investment in ports is considered to be of great importance in countries such as Spain, where the institutional framework is characterized by financial centralization and both political decentralization and decentralized management.

The main findings of the empirical analysis are as follows. Firstly, efficiency considerations have some influence in the regional allocation of investments in ports. Indeed, the variable that measures the use of the infrastructure (the traffic/capital stock ratio) has a statistically significant influence on the amount of resources for investment in ports that a region receives. The specialization in

the containers variable that captures the promotion of this type of traffic, which has high investment requirements, also has a statistically significant influence.

However, evidence is also found for solidarity being a relevant criterion that guides investment in ports as the elasticity that comes from the traffic/capital stock variable coefficient is low. As such, the allocation of resources for investment takes into account the financial difficulties that ports with less traffic are experiencing. It should also be acknowledged that economies of scale and the existence of indivisibilities could be having an adverse effect on ports with low traffic volumes.

Although economic considerations seem to play an important role in investment in ports, the reform processes aimed at greater political (but not financial) decentralization are also found to give greater weight to tactical political criteria, such as the same political party being in power in both the regional and local governments.

Political criteria carrying a greater weight allied with solidarity criteria is a dangerous combination that during times of great prosperity might lead to an over-investment process like that experienced in the Spanish port system from the end of the 1990s onwards. With the economic downturn, with less traffic and, therefore, less revenue from port dues, excessive committed expenditure on ongoing investment processes and growing financial costs endangered the port system's economic sustainability as a whole, which went from a consolidated profit of €177 millions in 2007 to one of €21 millions in 2009, with a number of port authorities registering losses. In this context, additional performance criteria need to be introduced that prevent these risks by putting a brake on any excess a priori, such as the recent obligation included in Law 33/2010 for all port authorities to achieve a 3% profitability rate on their fixed assets. It is also likely that public financial resources from outside the port system, that is, taxpayers' money, will have to be used in future to come to the aid of port authorities that are excessively indebted or, as has been done on specific occasions in recent years, to complete some of the investment projects in progress. This would introduce new elements which would complicate the political criteria versus economic criteria dichotomy in as much as voters, even those in distant areas from the ports, are directly financing construction works there.

The proposed empirical model can be easily extrapolated to other port systems as long as the limitations imposed by the lack of data are not an obstacle. Apart from the conclusions given here, which might be for a specific case but that can be corroborated in future studies, some of the lessons that can be learned from this paper, such as the need to demand a priori that cost-effective use be made of public investments, can also be extrapolated to any other port systems where decisions continue to be taken by a centralized public organization. This is the case in many Asian and

Mediterranean countries, for example, where the central state continues to play a major role or has the last word on investments despite the numerous decentralization processes carried out to the benefit of local, provincial or municipal governments (for the case of China, see WANG *et al.*, 2004, for example).

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## NOTES

1. Some complementary articles, namely CASTELLS and SOLÉ-OLLÉ (2005), and SOLÉ-OLLÉ (2010, 2012), extend the analysis to cover a longer time period (1964–2004), differentiating between tactical redistribution, where resource allocation is motivated by the policy-makers' political interests, and programmatic redistribution, where the allocation obeys specific criteria, such as efficiency and equity. From the findings of the analysis it can be inferred that both tactical and programmatic redistribution impact on public decisions on investment in infrastructure.
2. In an analysis for Spain, ALBALATE *et al.* (2012) found that investment in network modes (roads, rails) is influenced by strategies of directing funding to the regions immediately surrounding the political capital. Their analysis excluded investment in ports.
3. For an analysis of the advantages of this approach compared with other alternative methodologies in port economics, see CASTILLO-MANZANO *et al.* (2008).
4. For a general introduction to port devolution processes, see BROOKS and CULLINANE (2006) and CASTILLO-MANZANO and ASENCIO-FLORES (2012).
5. For an analysis of the different port management models, see BICHOU and GRAY (2005) and CASTILLO-MANZANO and ASENCIO-FLORES (2012).
6. For a detailed analysis of the different components that make up port equipment and port superstructure, see TALLEY (2009).
7. For the Spanish port system's fees and concessions structure, see CASTILLO-MANZANO *et al.* (2009).
8. The statistical definition used by Eurostat to define regions is Nomenclature des Unités Territoriales Statistiques (NUTS), which divides up the economic territory of the European Union in a harmonized way. NUTS-2 refers to areas with a range of population between 800 000 and 3 million inhabitants, while NUTS-3 refers to areas with a range of population between 150 000 and 800 000 inhabitants. In practice, the statistical territorial units are defined in terms of the existing administrative units in the member states and do not necessarily meet the said population ranges. In Spain, NUTS-2 are 'Comunidades Autónomas' (Autonomous Communities, that is, autonomous regions) and NUTS-3 are 'provincias' (provinces).

9. This specifically affects data for the provinces of A Coruña, Asturias, Cádiz and Pontevedra. The following port authorities are located in A Coruña province: A Coruña and Ferrol-San Cibrao; in Asturias province: Avilés and Gijón; in Cádiz province: Algeciras Bay and Cadíz Bay; and, finally, in Pontevedra province: the port authorities of Marín-Ría de Pontevedra, Vigo and Vilagarcía. Conversely, the Almería-Motril Port Authority straddles two provinces, Almería and Granada. In this case it was decided to assign the observation to Almería province, where the largest of the port facilities are located.
10. For the data, see <http://www.ivie.es/>.
11. Past traffic is generally considered the most suitable strategy to forecast future traffic through ARIMA models (MEERSMAN, 2005).
12. See <http://www.puertos.es/en/index.html/>.
13. It is reasonable to use the variable of GDP in relation to the stock of capital as an indicator of efficiency in aggregate studies that place attention on roads and rails. However, it should not be used in the analysis that focuses on specific infrastructures such as ports or airports. For the considered period, roads and rails account for 87.5% of the total stock of capital in transportation infrastructures in Spain.
14. The existence of indivisibilities and economies of scale can also distort the ratio between traffic levels and investment levels, although it is not clear in which direction. On the one hand, a minimum amount of investment is required, whatever the level of traffic, and, on the other hand, highly congested facilities require additional investments that might result in subsequent excess capacity for a certain period of time.
15. In any event, experience in port traffic shows that the endogeneity between traffic and public investments is not so powerful as it might seem a priori, unlike private investments, where if a major shipping line such as the Maerks Line or Hapag-Lloyd spends its own money on a new terminal, its future use by the same shipping line is guaranteed. This guarantee does not exist for public investment, as the use of the new infrastructure will ultimately depend on decisions taken by private and independent companies. For this reason, numerous examples of public over-investment can be found both in- and outside the Spanish port system which have not produced the expected increase in traffic (and this will most probably occur in the medium- or long-term with many of the new ports that are being constructed on the Cantabrian Sea, for example). Furthermore, there may be an endogeneity bias between the political variables and the investment variables. It is difficult to find ways to deal with this problem, which has not been addressed by previous studies on the regional allocation of investments.
16. This is also a way to include the geographical component in the analysis. A weighted average of both variables is included for provinces with more than one port authority based on the volume of annual traffic at each of the port authorities.
17. For a definition of both these concepts, see FLEMING and HAYUTH (1994) and DUCRUET and NOTTEBOOM (2012); and for their application, see DUCRUET *et al.* (2010b).
18. For a detailed analysis of the importance of the geographical component in modern logistics, see AOYAMA *et al.* (2006).

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