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Evaluating the effects of the latest change in Spanish port legislation: Another "*turn of the screw*" in port reform?

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ABSTRACT

This article examines the determinants of traffic generated by Spain's port authorities, using data from 2003 to 2012. The interest of the study lies on examining the impact of recent legislative measures that have implied an increasing liberalization of port charges. We find that port charges influence the amount of traffic that a port is able to generate, while traffic is also affected by geographical attributes, economic wealth, the extent of industrial activity and population. Our main result is that we find evidence that the legislation of 2003 did not have a significant impact on traffic while the impact of the legislation of 2010 seems to have been stronger. Political conflicts associated to a lack of consensus on the approbation of the 2003 legislation plus a clear decline in tariff freedom wiped out the inter-port competition slightly promoted by earlier laws, versus the 2010 reform featured by a strong political agreement and a flexible port charges framework.
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1. Introduction

Since the late 1980s, a radical revolution has been taking place worldwide regarding the traditional role of seaports (hereinafter 'ports') as critical nodes integrated into logistics supply chains (Brooks, 2004; Brooks and Cullinane, 2007). In an attempt to adapt to a changing environment defined by the current expansion of global trade, continuous economic changes, far-reaching technological development and progressively more regionalized systems (see e.g., Notteboom and Winkelmans, 2001; Woo et al., 2012), governments, public management agencies and port authorities (PAs) have shown a strong interest in applying multi-dimensional reforms to the port sector (Brooks and Cullinane, 2007).

As the literature highlights, reforms have taken place in many ports with similar key objectives, e.g., to improve productivity by providing specialized services (Musso et al., 2001); to obtain financial autonomy and economic benefits through competition (Notteboom and Winkelmans, 2001); to rationalize port structures and reduce bureaucracy in decision-making and to reduce the role of the government in port operations (Pallis et al., 2010, 2011); to become more business-orientated in the face of growing demands, while also reducing costs (Slack and Frémont, 2005), and, as Chen (2009) and Woo et al. (2012), among many others, state, to deregulate the labor market and introduce business-based criteria to attract private capital and reduce needs for public investment, and to facilitate integration between different social and spatial levels.

Therefore, the global markets' demand for competitiveness has forced the shipping industry and PAs to make greater efforts to implement institutional modernization strategies and equip the ports with new levels of efficiency, capacity and investment. The World Bank Port Reform Toolkit (World Bank, 2007) contains a set of recommendations in this respect that are based on a devolution process where port policy-makers would gradually move away from full direct public management toward an autonomous hybrid regime of mixed forms of ownership; the ports' operational responsibility would be transferred to local/decentralized public/private entities, and private capital and management incorporated into the operation of ports and terminals. A '*new port culture*' has developed through different but equivalent reform mechanisms – *decentralization*, *devolution*, *liberalization, deregulation, corporatization, commercialization, privatization and competition* (Cullinane et al., 2002; Xiao et al., 2012) – that have impacted on conventional

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organization and management, traditional concepts (Bichou and Gray, 2005) and port classification, reshaping the usual models of port governance and ownership structure (Pallis et al., 2010).

In a true 'centripetal movement' these port reform processes have resulted in the governance model that currently dominates port administration being the so-called '*Landlord Port*'. Of the four types of port organization, which are classified by their relative levels of private and public ownership and operation, this is the form that is most widely promoted by the World Bank (World Bank, 2007). The concept of the Landlord Port involves a public authority owning and maintaining the land and infrastructure (as ports have the characteristics of a public good, with the responsibility to remain in the public interest (Chen, 2009). The public authority then leases these to private operators as a concession, with equipment and operations (fully or partially) in the hands of private companies (see e.g., Brooks and Cullinane, 2007; Cullinane et al., 2002 and Xiao et al., 2012, for an approximation to this popular option of port governance in its various forms).

In the academic field, during the 2000s maritime economic research themes have been enhanced and have diversified in response to all these changes (Chen, 2009; Cullinane et al., 2002; Pallis et al., 2010, 2011; Notteboom and Winkelmans, 2001; Tongzon and Heng, 2005; Woo et al., 2012). Also, according to empirical evidence, these policies seem to have successfully achieved change in most ports, facilitating increases in investment and improvements to productivity, as well as significant reductions to user fees. However, in other cases these studies have also revealed rising capacity deficits, problems with the facilitation of trade and transport, restrictions on access systems and weak connectivity and port integration in the hinterland, demonstrating that these policies may not be sufficiently robust to address the biggest and newest challenges facing foreign trade and ports.

There are vast numbers of economic analysis studies that address the effects of implementing any aspect of port reform in terms of efficiency and competitiveness (see e.g., Woo et al., 2012 for an in-depth analysis of this topic in maritime economics research). There are scholars who have studied the political aspect of devolution (Brooks, 2004) and privatization (Cullinane et al., 2002; Tongzon and Heng, 2005) processes; others have reflected on the consequences of public action and the challenges facing port authorities tackling the transition to the landlord model (Notteboom and Winkelmans, 2001); others have considered the link between different types of governance reform and port performance (Brooks and Pallis, 2008) and, more specifically, between capacity investment and pricing (Xiao et al., 2012); there are still others who have examined the consequences of risk-sharing agreements in public-private partnerships or joint-venture contracts in the transition to a landlord system (Oliveira Cruz and Cunha Marques, 2012); and, more recently, authors who have compared the effects of privatization on efficiency and performance in the airport and port sectors (Gong et al., 2012) with the suggestion that partial privatizations are a more effective way to increase port competitiveness.

Debrie et al. (2007) show how from a geographical or territorial perspective the theoretical models of port governance and devolution processes are incomplete and how, in reality, subsequent port performance produces a much greater range of governance responses. Thus, as Cullinane et al. (2002) argue, no standard model exists for the best possible form of ownership and organization structure, but after port privatization, the situation reflects the adoption of a range of administrative, management and operational systems and styles. Thus, various empirical studies have investigated the evolution of port reform in all five continents.

For example, the impact of port governance reform is explored by Pallis et al. (2010) to evaluate Canadian port reform; Estache et al. (2002) analyze efficiency gains from the reform of Mexico's port system; a recent study by Gong et al. (2012) considers the impact of port privatization on efficiency and performance in developing countries; Everett and Robinson (2007) examine privatization and corporatization strategies in the Australian experience; Notteboom et al. (2012) and Verhoeven (2009) give an overview of the main governance challenges to European ports and the harmonizing influence of European Union (EU) law, with special attention to the awarding of port services to private operators; Lee and Flynn (2011) propose a third governance approach in addition to the *European Anglo-Saxon*, *Hanseatic* and *Latin* tradition by describing the reform process during the emergence and dominance of Asian hub container ports, which have ousted European ports as leaders in efficiency and created a new order of hub and spoke ports in the world shipping systems (as Cheon et al., 2010 and JOC, 2013 show).

In this context, our paper analyzes the reform process of the Spanish Port System from 2003 to 2012. Over the last 20 years, Spanish ports of general interest have experienced significant and ongoing change, with five successive legal frameworks. A number of measures have been implemented to separate port operations from PA functions and achieve the goal of giving the port sector and PAs their own managerial, financial and organizational autonomy.

Our study builds upon the above literature in two ways. Firstly, as Gong et al. (2012) highlight, the connection between port reform and port governance needs further investigation and clarification to enable a reliable assessment to be made of the success or failure of change, privatization, devolution and deregulation processes (and the factors that influence them). In fact, an apparent paradox seems to exist because authors such as Bergantino and Musso (2011) and Da Cruz et al. (2012) provide evidence to the effect that the introduction of greater autonomy has increased efficiency, productivity and self-funding levels in Euro Mediterranean ports as a whole, while others like Verhoeven (2009) and Verhoeven and Vanoutrive (2012) find that reform in the EU's Latin ports is still not complete, and that there is limited functional and financial autonomy influenced by political interference. Following a review of the previous literature, our contribution sheds light on the specific case of Spain with an empirical analysis of the most recent legal changes that occurred in 2003, 2010 and 2011.

The successive reforms that have been passed have dug deeper into the issue but not necessarily in a straight line, i.e., with significant contradictions between the various Laws in what is clearly a liberalization and deregulation process paralleling other countries (González Laxe, 2011). The literature published in recent years on the effects of the reforms on the Spanish Port System gives contradictory and non-homogeneous results for each of the changes in the law considered individually (see Castillo-Manzano et al., 2008 or Rodríguez-Álvarez and Tovar, 2012). However, whatever the findings of these studies, it is the high number of reforms that is the best empirical evidence that some may not have achieved their expected outcomes; perhaps because, despite all these efforts to reform, the Spanish Ports themselves are subject to their own 'path dependence'.

Two of the main and original objectives of this study are: firstly, to provide some initial econometric-based results for the latest 2010 and 2011 reforms implemented at the height of a deep economic crisis (see González Laxe, 2011, 2012 for an analysis of the Spanish port response to the economic crisis). Secondly, it offers an overview and broad evaluation of all the changes to legislation and port reforms that have taken place in the Spanish port system since the early nineteen-nineties.

The article addresses all these issues within the following structure: after this Introduction, Section 2 briefly outlines the key

arguments of the legal reforms made to the Spanish Port System during the 1990s and 2000s with the aim of achieving more efficient and autonomous port management and fostering a real change of philosophy in the Spanish model. The same section also comprehensively reviews previous academic studies that evaluate the effects of these reform processes using different methodological approaches and a complementary focus of analysis. Sections 3 and 4 set out the empirical framework and the findings. Finally, the article provides a set of conclusions, a brief outline of the main policy implications, and some suggestions for future research.

2. An analysis of Spanish port system reform against the background of the prior literature

Just like the rest of the world, the Spanish Port System has followed the trend of adapting to new types of organization and management. As is the case of most Euro-Mediterranean ports, the 64 ports of general interest that comprise the Spanish Port System, managed by 28 PAs under the coordination and efficiency control of a public body called the *State-owned Enterprise of National Ports* (SENP), have not been immune to the port reform processes and management model changes that have occurred around the world over the last 30 years.

However certain inherent characteristics make the reform process of the Spanish port system a special case study, such as Spain's geostrategic position, which, e.g., makes Spanish ports more sensitive to competition from ports in northern Africa.

Bearing in mind the specific peculiarities and conditions that characterize them (see e.g., Bergantino and Musso, 2011; Castillo-Manzano and Asencio-Flores, 2012; Castillo-Manzano et al., 2013; Coto-Millán, 1996; Da Cruz et al., 2012; González Laxe, 2011, for an analysis of port features and an evolutionary perspective within the 'Iberian Range'), Spanish Ports have undergone a far-reaching modernization and port reform process since the 1990s, involving privatization, devolution, liberalization and decentralization programs that have driven the economic development of the country (González Laxe, 2011, 2012).

During the 1992–2011 period four legal changes and one consolidated recast text resulted in Spanish legislation gradually providing the port system with the crucial instruments it required to improve efficiency and competitiveness in an international economy and global market. Private participation in infrastructure development and service delivery was increased and extensive self-management powers were put in place in PAs (especially with respect to economic and investment decisions). Authors such as Coto-Millán (1996) and Núñez-Sánchez and Coto-Millán (2012) identified timid attempts to liberalize maritime transport regulation in Spain prior to the interesting 'revolution' in Spanish ports that began in the 1990s (Castillo-Manzano et al., 2008). These split the ports into two different management models: autonomous ports (Barcelona, Bilbao, Valencia and Huelva) governed by autonomous statutes, and other ports managed by central government.

Table 1 summarizes the main goals of each of the legal frameworks implemented in Spain according to four topics: port

Table 1
Main purposes of port regulations since 1992.

Legal reform	Main objectives of Laws by topic			
	Port management framework	Financial-economic regime	Port services	Governance model
Law 27/1992 of 24 November, the State Ports and Merchant Marine Act	* New organization structure, autonomy and decentralization creation of the State-owned National Ports Company (SENP) to coordinate national ports; unification of management regimes (Port Assemblies and Autonomous Ports) into public, but autonomous, Port Authorities. * Business and efficiency criteria.	* AUTONOMY: individual budgets and proposals for self-funding.	* Civil servants replaced by private sector workers (State-owned stevedore company for cargo handling).	* Transition from a service system to a LANDLORD SYSTEM.
Law 62/1997 of 26 December, which modifies Law 27/1992	* Reinforces the autonomy of the SENP and Port Authorities: increased involvement of REGIONAL GOVERNMENTS in the structure and organization of ports.	* Self-funding and *proposal* for freedom of tariffs.	* Stimuli for private performance with Port Authorities as secondary suppliers.	* Convergence to a "subsidiary" Landlord System.
Law 48/2003 of 26 November concerning the economic regime and provisions in ports of general interest	–	* Promotion of inter-port competition, but based on reductions in tariffs with a standardized framework.	* Encouragement of private investment in port infrastructure.	–
Law 33/2010 of 5 August, which modifies Law 48/2003	* New focuses: PORT INTEGRATION (intermodality) and ENVIRONMENTAL SUSTAINABILITY.	* Further intensification of LIBERALIZATION of tariffs for each Port Authority (full freedom and flexibilization according to self-set objectives). * Control for 2.5% annual profit.	* Genuine liberalization and Intra-port Competition (free access to market).	* Consolidation of an advanced Landlord System.
Royal Legislative Decree 2/2011 (approving the consolidated text of the Spanish State Ports and Merchant Marine Act)	* Reinforcement of issues: Autonomy, Decentralization, Flexibility for Self-Funding, Liberalization of port services, Free private access, Intra- and inter-port competitiveness, Integration (multimodality, Motorways of the Sea, environmental impact). * Integration of matters included in preceding regulations, such as port taxes and port services, which had been regulated separately.			

Source: Prepared by authors from Spanish Port legislation.

management framework, financial-economic regime, provision of port services and governance model. It can be deduced that, in general terms, Law 27/1992, Law 62/1997 and Law 48/2003 concerning General Interest Ports, all aimed to produce major changes in the structure of Spanish ports. Specifically, the 1992 reform sought to introduce flexible organization and management that allowed PAs to operate flexibly according to business criteria. These were the beginnings of the landlord model, with the public sector owning the infrastructure but as many activities as possible put into the hands of the private sector.

According to e.g., Castillo-Manzano et al. (2008), Castillo-Manzano and Asencio-Flores (2012), González and Trujillo (2008); Núñez-Sánchez and Coto-Millán (2012), Rodríguez-Álvarez and Tovar (2012) the 1992 Law constitutes a genuine revolution in Spanish Maritime History, as it places the management of all port regimes in PAs under the control and coordination of the SENP and marks the beginning of the transition to a landlord governance model.

The 1997 reform moved the administrative devolution process further forward by establishing a special 'Spanish port model' in which the public Regional Governments (Autonomous Communities) were allowed to nominate members of the Port Authority governing council (see Castillo-Manzano et al., 2010). However, as Castillo-Manzano and Fageda (2014) state, this reform was aimed at political decentralization and not accompanied by financial decentralization or economic and efficiency criteria.

Furthermore, the 1997 Law also proposed freedom of tariffs for port services for the first time, but this then stalled with the 2003 reform. The 2003 Law sought to encourage private investment in port infrastructure and was aimed at increasing inter-port competition, but proposed a common framework for port tariff reductions. In short, this Law provided for standard prices to be fixed for all ports, which was a constraint on inter-port competition (Castillo-Manzano et al., 2008).

Finally, absolute freedom to set tariffs (together with the greater liberalization of port services and activities, stimulating intra-port competition in an '*advanced landlord*' model; Rodríguez-Álvarez and Tovar, 2012) would not actually materialize until the 2010 Law, which is the reform addressed in the present study.

González Laxe (2011, 2012) emphasizes the main contributions of Law 33/2010 (and Royal Decree 2/2011 to consolidate previous legislation and recast the previous four laws that had been in force in a single text, while providing the sector with a tool for greater assurances and transparency), which are summarized in Table 1: greater freedom for PAs to set tariffs with absolute flexibility according to their own economic situations; full financial control with the goal of 2.5% annual profitability for the Spanish Port System as a whole; free access to port service performance with a new management model for the stevedoring industry; greater integration of ports into the transport system (inter-modality) and cities, and the consideration of environmental sustainability. As Núñez-Sánchez and Coto-Millán (2012) suggest, this most recent reform includes an interesting goal based on the estimation of the marginal costs of facility provision. However, as Tovar and Wall (2014) state, the freedom of action afforded to PAs may be relative, as it may be limited by legislation, in the sense that PAs can modify their prices according to their traffic forecasts and costs structure in order to guarantee their self-funding.

To summarize, it can be deduced from Table 1 that the regulation of the Spanish Port System is based on a scheme that combines public ownership of port infrastructure with private superstructure. The PAs determine the conditions under which private enterprise operates by setting prices, operating conditions, and the duration and characteristics of concessions.

The literature has addressed Spanish port reforms with a number of empirical studies published since the mid-1990s (on the reforms from 1992 to 2003) but there has only been one descriptive analysis of the latest 2010 reform (González Laxe, 2012). Most focus on economic efficiency and productivity variables to capture the effects of the reforms, while another group considers maritime traffic as a proxy, and others analyze partial aspects of the legislation, such as changes in the cargo handling operations regime. Only two (Castillo-Manzano and Fageda, 2014; Castillo-Manzano et al., 2010) evaluate the influence of exogenous determinants, such as political or economic factors.

From a methodological point of view, there are some research studies that fall into the mainstream of data envelopment analysis (DEA) (Díaz-Hernández et al., 2008, 2012), others that use parametric models with trans-log functions (González and Trujillo, 2008; Núñez-Sánchez and Coto-Millán, 2010, 2012; Rodríguez-Álvarez and Tovar, 2012) and, finally, others that apply alternative techniques, such as multivariate regressions for time series (Castillo-Manzano et al., 2008, 2010; Castillo-Manzano and Asencio-Flores, 2012), panel data (Castillo-Manzano and Fageda, 2014) or even multicriteria decision-making methods (Castillo-Manzano et al., 2009).

The effective implementation of a legal reform may diverge from the initial goals because of various factors that interfere with port performance. To what extent have the reforms achieved what they set out to do? An overview of the main findings of published empirical studies allows several conclusions to be drawn as to the state of the Spanish Port System in the wake of the 1992, 1997 and 2003 the reforms:

- Gains in efficiency were uneven: Law 27/1992 seems to have been the most immediate and effective reform, with asymmetries in favor of the largest ports, but significant efforts were also made by the Laws.
- On the whole, the 1992 and 1997 Laws resulted in improvements in scale efficiency, technical progress and productivity, but there was little change in technical efficiency on average. Gains in efficiency were more modest for Law 62/1997 and the transfer of the political control of ports to regional authorities seemed to have no impact on port traffic.
- There was an under-utilization of capital in relation to labor at the same time that there was an over-investment process and overcapacity due to a politically-influenced devolution process.
- Law 48/2003 might have had a contrary effect through its imposition of a contradictory and rigid system of port tariffs, unlike the earlier reforms.
- Administrative and management decentralization without parallel financial decentralization and excessive dependency on loans and public economic support.
- Incomplete liberalization and deregulation of port services with, e.g., a difficult transition for the State-owned stevedore company.

In short, all these circumstances seem to point to legal autonomy, but this is not really the case; three changes in the legislation from 1992 to 2003 and a path dependence of Spanish ports that might result in '*much ado but nothing*' performance; fine words but few real results.

The core question addressed in this paper is whether the benefits of greater flexibility sought by the latest port reform will, at least, be greater than the legal insecurity that results from continual changes. Despite four successive reforms over a minimum of two decades marked by continual legal change, we are nonetheless talking of an advanced landlord model which, as Castillo-Manzano et al. (2008) state, could serve to support decentralization processes in other similar port systems, particularly in some Mediterranean countries.

3. Empirical model

We develop an empirical model to estimate the determinants of traffic at Spanish ports using data for the 2003–2012 period. We have considered the determinants of demand used in typical transport infrastructure demand models. The amount of traffic that any transport infrastructure is able to generate is generally related to the size of its hinterland, its geographical location, prices, some indicator of competition and, in the case of ports, the intensity of industrial activities.

Variables that capture the size of the hinterland (population and gross domestic product per capita of the province, industrial activity in the region)[1] are included as control factors. Regarding the differences between port authorities, a variable is included that measures total revenue per ton. This is implemented through dummies for islands, relative specialization in different types of traffic, and population density. An additional explanatory variable is also included in the new version of the paper to capture the potential competition between port authorities: the number of ports that are located within a one hundred mile radius. Finally, the geographical location of the port is also taken into account.

When controlling for these factors our main purpose is to examine the effect of the most recent legislative changes (2003 and 2010) on the amount of demand that each port is able to generate. The equation used to estimate this is as follows:

$$\begin{aligned}\text{Traffic}_{it} = {} & \beta_0 + \beta_1 \log(\text{revenue\_per\_tonne})_{it} + \beta_2 \text{GDP}_{it} \\ & + \beta_3 \text{pop}_{it} + \beta_4 \text{industry}_{it} + \beta_5 \text{car\_industry}_{it} \\ & + \beta_6 \text{longitude}_i + \beta_7 \text{latitude}_i + \beta_8 \text{regulation03}_t \\ & + \beta_9 \text{regulation10}_t + \varepsilon_{it} \end{aligned} \quad (1)$$

The dependent variable (TRAFFIC) is the total amount of traffic in a PA *i* during year *t* expressed in tons. Data on port traffic were taken from the historical series provided by the Ministry of Transport. We consider the following variables when explaining the traffic at PA *i* during year *t*:

(1) LOG (revenue per ton). We consider all revenue per ton for all the PAs. To calculate this we add the total revenue of all the PAs together and divide the sum by the total amount of traffic. Data for total revenue were taken from the annual reports of each PA and port traffic data were taken from the Ministry of Transport's historical series. We expect ports that charge lower prices to have more traffic; i.e., we are interested in determining the relationship between prices and the volume of traffic generated by the port. While it seems clear that a port's traffic depends on the fundamental attributes of its hinterland, including its population, GDP and geographical location, we seek to test whether these charges might also influence traffic after controlling for these attributes. Other key factors, such as land accessibility by train or road cannot be taken into consideration due to the lack of data. This variable is expressed in logs because the relationship between traffic and revenue per ton is not linear.

(2) Gross domestic product per capita in region *i* during year *t* (GDP). The information for this variable was obtained from Spain's National Statistics Institute (*INE*). These data are available at the provincial level (NUTS 3). We expect the coefficient of this variable to have a positive sign since wealthier regions should generate a greater demand for maritime transport services. Data for 2011 and 2012 are only available at the NUTS 2 level, so data at the provincial level for these two years is updated using NUTS 2 level growth rates. One lag of the GDP variable is included to take into account any potential bias due to the simultaneous determinant of traffic and GDP.

(3) Population in region *i* during year *t* (POPULATION). These data are available at the provincial level (NUTS 3) and are again provided by the *INE*. We expect the coefficient of this variable to have a positive sign, since there should be a greater demand for maritime transport services in more highly populated cities.

(4) We capture industrial activity (INDUSTRIAL) by the total number of employees in the industrial sector (data taken from the *INE*) at the autonomous region level (NUTS 2). The demand for maritime transport services should be higher in industrial areas with more intense import/export activity, so a positive relation is anticipated between industrial activity and the amount of traffic.

(5) Spain makes an interesting case study due to its geographical features, namely that it is a peninsula extending out into the Mediterranean and Atlantic Seas. We, therefore, employ two location variables. The (LONGITUDE) variable indicates whether the port is situated on the eastern (positive sign) or the western seaboard (negative sign), while the (LATITUDE) variable is positive when the port is in the north of the country and negative when it is in the south. Spain's largest ports lie on the Mediterranean Sea and absorb part of the international trade that comes from Asia, since shipping companies use the Suez Canal. We therefore expect a positive sign for the longitude variable and a negative sign for the latitude variable.

(6) CAR: We also construct a dummy variable to account for a particularly important industrial sector in Spain[2]; this dummy takes a value of 1 for a region with an automobile production plant and 0 otherwise. When assigning this variable we consider whether the production plant is located on the provincial level (NUTS 3). Here, we expect a positive sign, as we understand that if an automobile production plant is located in the region, then a port in the region should benefit from more traffic because of increased numbers of imports and exports.

(7) NUMBER OF NEARBY PORTS (N100): To consider the intensity of local competition we include a variable that measures the number of ports located within a radius of one hundred miles. Spain has 28 PAs that manage 44 ports of general interest. Such a high number means that several ports may be located in very close proximity; in some instances we even find more than one port in the same province (NUTS 3). Further information is available from the 'Puertos del Estado'. It is not clear which sign should be expected for the coefficient associated with this variable. On the one hand, traffic at some ports may be diverted to rivals nearby, while on the other hand, more competition may spur efficiency and increase the total traffic captured by ports located in close proximity to each other.

(8) Finally, we consider two dummy variables that take into account the effects of legislative changes. First, we consider a dummy variable that takes a value of 1 from 2004 onward (REGULATION_03) and a dummy variable that takes a value of 1 from 2011 onward (REGULATION_10). Note that these legislative changes came into force from the year after they had been passed.[3]

[1] Note here that a port authority's hinterland is not necessarily the province or the region. Most of explanatory variables are measured at the provincial level (NUTS 3) and the variable for industrial activities is measured at the regional level (NUTS 2). The choice of the geographical level of analysis is conditioned by the availability of information.

[2] According to the Bank of Spain (Banco de España, Boletín Económico, May 2011), automotive industry exports accounted for 22.2% of total exports (in terms of medium value) during the 1999–2009 period.

[3] Note that it is not possible to include a time trend in the econometric analysis because the time trend correlates highly with these dummy variables. Hence, a potential limitation of our analysis is that the dummies could be capturing other factors related to the time trend. We therefore control for income and industrial activity, which should capture the influence of the economic crisis on port traffic.

Table 2
Descriptive statistics of variables.

Variable	Mean	Std. Dev.	Variation coefficient	Min.	Max.
Traffic	1.32e+07	1.45e+07	1.09	507,617	8.87e+07
Log (revenue per ton)	1.09	0.58	0.53	−0.13	2.84
Lag (GDP)	16,714.36	5083.73	0.30	8474	32,251
Population	1,133,517	901,856.5	7.96	56,929	5,552,050
Industrial	221.06	182.03	0.82	0.5	775.7
Longitude	−4.45	4.68	0.23	−16.24	4.42
Latitude	39.05	4.11	0.10	28.15	43.55
Car industry	0.25	0.43	1.72	0	1
Number of nearby ports	2.15	1.06	0.49	0	4
Regulation_03	0.33	0.47	1.42	0	1
Regulation_10	0.09	0.29	3.22	0	1

The data used for estimating the equations considered here have a cross-sectional time-series structure. Hence, we run the regressions using two different techniques. First, we estimate using a pooled model. Next we estimate using a fixed effects model. The use of the fixed effects model allows us to consider unobserved port heterogeneity. One advantage of the fixed effects model is that it allows us to control for any omitted variables that correlate with the variables of interest and which do not change over time. A shortcoming of the fixed effects model is that it only captures the within variation of the data. Thus, the impact of time-invariant variables cannot be identified. We control for autocorrelation and heteroscedasticity in both techniques.

We take into account the possibility that some endogenous explanatory variables might skew the estimations. In particular, the revenue per ton variable may be endogenous. Thus, the estimation is made using the two-stage least squares estimator. The revenue per ton instruments used are as follows: the number of nearby ports, the percentages of different types of traffic, and dummies for islands and Ceuta and Melilla. As mentioned previously, one lag of the GDP variable is used to account for the potential simultaneous determination of traffic and GDP.

Table 2 shows the descriptive statistics of the variables used in our analysis, including the coefficient of variation of each explanatory variable as the ratio of the standard deviation to the mean. The coefficient of variation shows that there is high variability of data for port traffic, population, car industry, the 2003 regulation and the 2010 regulation, while it is relatively low for GDP and the number of nearby ports.

4. Results

Table 3 shows the results of the estimation of the traffic at Spanish ports equation. The first column shows the results using the pooled model and the second column shows the results with the fixed effects model.

The explanatory capacity of the estimated models based on the R^2 is quite satisfactory, especially when the pooled model is used. The following conclusions can be drawn from our findings. First, as expected, the GDP per capita lag and population variables are positive and statistically significant in both the pooled and fixed effects regressions. The industrial activity variable is positive and statistically significant in the pooled regression, while the dummy variable for the car industry is positive and statistically significant in the regression in which it can be identified. As expected, all the variables for economic activity and the size of the region in which the port is located have a substantial influence on traffic. In contrast, the variable used to capture the intensity of competition is not statistically significant in the regression in which it can be identified.

In addition, in the regressions in which they can be identified the location variables reveal that there is more traffic in the east (the longitude variable is positive and statistically significant) and in the south (the latitude variable is negative and statistically significant), reflecting the fact that the Mediterranean Sea ports handle more traffic. As discussed previously, this can be attributed to the use of the Suez Canal route which results in a concentration of traffic linking Asia with Europe.

The coefficient associated with the revenue per ton variable is negative and statistically significant in both regressions. Thus, we find that higher port charges are associated with lower volumes of traffic, as was found in Fageda and Gonzalez-Aregall (2014).

The main interest of our analysis lies in the two dummy variables that consider the impact of legislative changes. The dummy variable that considers the 2003 legislation is positive but not statistically significant, while the dummy for the 2010 legislation is positive and statistically significant at the 10% level in both estimations. Apart from its statistical significance, the magnitude of the elasticity is much higher for the variable that captures the 2010 legislation. The 2003 legislation implies a 0.3% increase in traffic in the regression that uses the pooled model,

Table 3
Demand equation estimates.

Explanatory variables	Dependent variable: traffic	
	Two-stage least squares – pooled model	Two-stage least squares – fixed effects
Constant	5.09e+07***	–
	(3,862,983)	
Log (revenue per ton)	−1.52e+07***	−6,266,638**
	(509,104.2)	(3,123,452)
Lag (GDP)	1092.009***	334.59*
	(86.41)	(213.1)
Population	5.167***	10.02***
	(0.255)	(3.812)
Longitude	285,124.4***	–
	(69,246.66)	
Latitude	−1,249,163***	–
	(68,851.6)	
Car industry	6,953,123***	–
	(919,588.4)	
Industry	3785.27**	−966.40
	(1308.56)	(8420.02)
N100	330,671	–
	(220,381.3)	
Regulation_03	50,632.27	656,760.4
	(665.137)	(735,677.5)
Regulation_10	2,030,448*	1,385,881*
	(1,254,042)	(851,814.7)
Observations	276	276
R^2	0.582	0.224
R^2_adjusted	0.568	0.224
F	26.04***	3.93***
Underidentification test	69.65***	25.15***

Note 1: Standard errors in brackets robust to heteroscedasticity and clustered by year.
Note 2: Statistical significance at 1% (***), 5% (**) and 10% (*).

while it implies a 4% increase in traffic in the regression that uses fixed effects. In contrast, the 2010 legislation implies a 13% increase in traffic when using the pooled model, while it implies a 9% increase in traffic when using fixed effects.

By controlling for several factors our analysis reveals that the 2003 and 2010 reforms have had positive effects on the amount of traffic that Spanish ports are able to generate but the most recent legislation seems to have had a stronger effect.

5. Discussion and concluding remarks

Spanish ports of general interest have experienced significant continual changes over the last 20 years with five successive legislation frameworks. This process of successive reforms has sought to boost the port sector's and the Port Authorities' (PAs) managerial, financial and organizational autonomy. However, these rapid changes over a period of just a few years have been non-linear compared to the liberalization and deregulation processes of other neighboring countries, i.e., with apparent contradictions between the various Laws, a mix of global and local approaches to governance, and evidence of the reluctance and hostility from certain groups. All of these circumstances contribute to creating a climate of uncertainty and instability that may lessen the impact of the successive reforms. In this respect, the literature published in recent years addressing the effects of the reforms on the Spanish Port System gives contradictory and non-homogeneous results for each of the changes in the law when considered individually.

Our paper specifically analyzes the two Spanish port reform processes that came into effect in 2003 and 2010. Our main findings show that the 2003 legislation did not have a significant effect on traffic, while the 2010 legislation seems to have had a stronger impact. A variety of reasons might explain this.

On the one hand, there were political conflicts with different consensuses on the passing of the two pieces of legislation. Although the 2003 reform was passed, it was strongly rejected by the political opposition and even resulted in motion being put before the Constitutional Court in 2004. In contrast, the parliamentary process for the 2010 Law obtained the highest political consensus of all the port reforms passed since Spain's return to democracy. This was the result of intense discussions held between the maritime and port community, the economic and labor sectors involved, local and regional institutions, and political groups.

This reveals how important the lack of political consensus can be for port reform, especially for the extensive Spanish port system (with 28 PAs). The rejection of the Portuguese port reform law is also evidence of this (see Castillo-Manzano and Asencio-Flores, 2012). The stability, transparency and permanent legal framework created by the new 2010 Law allows each individual port to optimize its own development and the Port System as a whole to contribute to sustainable and efficient growth.

Be that as it may, this new legal framework, which appears at a time of evident economic recession and crisis in the sector, with a general decline in activity and severe competition between all ports (at both the national and international level, the latter mainly from European and North African ports), is intended to be a key factor in attracting private investment from major global shipping operators and providing greater stability and more legal security within an efficient framework. Despite this, there are still major issues that need to be resolved, such as the liberalization of the market to provide port services, to which there is no firm commitment. And although Law 33/2010 attempted to make Spanish ports more competitive by introducing the possibility of applying discounts to tariffs, these reductions are conditioned by circumstantial aspects, such as costs and demand variability.

In reality, the 2003 reform clearly restricted freedom of tariffs to the extent that it that quashed the inter-port competition that had been timidly introduced by earlier legislation (such as the 1997 Law). In fact, unlike the uniformity established by the 2003 Law, whose main objective seemed to be to take advantage of the influx of the latest substantial wave of investment in the shape of the ERDF Funds (Castillo-Manzano and Fageda, 2014), the 2010 reform takes the final step toward the future model of the Spanish port sector based on three underlying principles: greater financial self-sufficiency for ports, a regime of flexible rates, and greater self-management, economic control and financial criteria for the PAs. And these three factors combined with another three key elements: quality and efficiency, a commitment to sustainability, and intermodality.

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