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"When supply travels far beyond demand:

Causes of oversupply in Spain's transport infrastructure"

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Abstract

Spain's transport infrastructure policy has become a paradigmatic case of oversupply and of mismatch with demand. The massive expansion of the country's transport infrastructure over the last decade has not been a response to demand bottlenecks or previously identified needs. For this reason, the intensity of use today on all interurban modes of transport in Spain falls well below that of other EU countries. This paper analyzes the institutional and regulatory factors that have permitted this policy, allowing us to draw lessons from the Spanish case that should help other countries avoid the pitfalls and shortcomings of Spanish policy. Based on our analysis, we also discuss policy remedies and suggest reforms in different regulatory areas, which could help improve the performance of Spain's infrastructure policy.

JEL classification: H54; L91; L98; R41; R42; R48
Keywords: Infrastructure, Transportation, Overcapacity, Regulation, Spain.

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1. Introduction

Spain's infrastructure policy over the last decade has been characterized by an almost overwhelming degree of public investment that has, however, been largely unrelated to current or prospective demand. This situation has affected all interurban modes of transport. Indeed, the country's policy managed to exacerbate the mismatch between supply and demand well before the economic crisis set in and provoked further reductions in demand. The reality of the situation is even acknowledged in the current Transport Infrastructure Plan (PITVI, 2012), in a section devoted to conducting a policy diagnosis [Part II, p. 57]: "Nonetheless, in recent years planning has focused on, and given priority to, the continued expansion of the system's supply without any direct correlation existing with growth in demand". Paradoxically, at around the same time, the Spanish Minister of Transportation and drafter of the Plan was recorded as saying in a speech in favor of maintaining government plans for extending the high-speed rail (HSR) nationwide: "I don't want an asymmetric Spain (…) How do I explain to the Spaniards that the people of one region are more important than those of another".[1]

Even in the throes of the current economic crisis, the Spanish government continues to spend large amounts of resources on its HSR (c. 3,300 million euro in 2013, amounting to 33% of total central investment in transport infrastructure) and to build motorways on routes that carry little more than 1,000 vehicles per day. Under such a framework, the economic crisis can only worsen the mismatch between capacity and traffic with telling consequences for government budgets and future generations of tax payers. Indeed, the *Assessment of the 2013 national reform programme and stability programme for Spain,* issued by the European Commission on 29 May 2013, reports that: "More stringent cost-benefit analysis of proposed projects is needed to avoid further over-investment and to optimize existing infrastructure. The 2013 NRP presents some conflicting goals for transport policy, e.g. reduction of the operation costs of the network and continued construction of high-speed railway lines." (p. 33)

In this paper, in addition to presenting evidence of Spain's overcapacity in all transport modes, we analyze the contribution made by institutional and regulatory policies to the existing and

[1] Presentation of Spanish proposals for the Trans-European Transportation Network. *Ministerio de Fomento*, Madrid, 12 February, 2012.

prospective oversupply and to the mismatch between traffic demand and (transport) capacity supply. This is examined both in network and single modes of transportation. By so doing, we provide further explanations for an overall design that has permitted the extreme imbalance in the present-day system. The Spanish experience, therefore, provides an example of the waste of public resources on overambitious programs of investment in underutilized infrastructure. Revealing the institutional and regulatory design that provided the mechanisms for such an irrational policy should, in itself, be a valuable lesson for any country seeking to modernize and improve its transport infrastructure.

The rest of the paper is structured as follows. First, we provide a detailed description of the extent of the system's current overcapacity and the mismatch between supply and demand by examining the statistics for each transport mode in an international benchmarking assessment. Second, we examine the rationale of the regulatory framework supporting the management and investment policies for high capacity networks (motorways and HSR) and single point-to-point infrastructure (airports and ports). Finally, we present our conclusions and discuss the policy implications that can be derived from the extreme case of mismatch between and traffic demand and capacity in Spain.

2. Spain's infrastructure policy: When supply travels far beyond demand

Spain is – by a long way – the country whose infrastructure supply (including both interurban and long distance modes) has grown most in recent years. However, demand has not kept pace with the increase in supply – truth be told, this mismatch was evident even before the economic crisis set in at the end of the last decade. For this reason, the Spanish case has come to be seen as a paradigmatic case of the wasteful use of public resources for the building of infrastructure. This section presents data that allow a comparison to be made of the infrastructure supply in Spain with that available throughout the EU and other countries. The mismatch between infrastructure and demand is also described in greater detail.

Beginning with surface networks, there can be little doubt that if anything has come to characterize Spain's infrastructure policy since the early 2000s it has been the extension of the country's high-speed rail based on the laying of new tracks and dedicated almost exclusively to passenger transport. Successive Spanish governments have presented their investment achievements at both domestic and international forums. The dedication of massive budgetary resources has

enabled Spain to build the most extensive (in absolute terms) HSR network in Europe and one that is even more extensive than the Chinese network in relative terms. Table 1 shows the extent of HSR (HSR ≥ 250 km/h) networks (in kilometers) in those countries that operate such a service (including the network that is operational and that which is under construction).

According to information provided by the International Union of Railways (UIC) on 1 April 2013, eight EU countries and fourteen countries worldwide offered a high-speed rail service. Of these, Spain was ranked second (to China) on the basis of the overall number of kilometers of network in operation, and ranked a clear first (50% more than its nearest rival France and considerably more than all the other countries) on the basis of the number of kilometers per million inhabitants. If to these figures we add the number of kilometers under construction, Spain further strengthens her leadership with a network that almost doubles France's in terms of kilometers per million inhabitants.

However, HSR ridership data tell quite a different story with figures for the EU as well as for the Asian countries being much higher than those recorded in Spain. For instance, annual ridership (number of trips) in Japan is well over 300 million, and over 110 million in France, whereas the number of trips on Spain's HSR network in 2010 was just 16.8 million. A more refined view of the massive difference in ridership is obtained from data produced by the European Commission (2013b), which provides passenger*km -pkm- per country figures for 2011. From these, we can obtain the number of pkm for each kilometer of HSR network (that is, a true measure of a network's intensity of use) in the EU countries. Table 2 compares the intensity of use of the HSR networks in France, Germany, Italy and Spain. Ridership in France is 5 times higher than Spanish ridership relative to the network length. Relative ridership in Germany is 4.4 times that of Spain, and in Italy it 2.6 times that of Spain. Recall, moreover, that the length of the Spanish network more than doubles that of Italy and Germany. These differences are likely to have increased in recent years, because low density HSR lines have been opened in Spain, while the economic crisis has reduced demand across the whole network.

Tables

Table 1. High-Speed Rail (HSR ≥ 250 km/h) in the World (November 1, 2013)

Country	Km HSR in operation	Km HSR / Million people	Km HSR operation + construction	Km HSR (op+cons) / Million people
Spain	**2431**	**52**	**3739**	**79**
France	2036	31	2793	43
Belgium	209	19	209	19
Japan	2087	16	2869	23
Italy	923	16	923	16
Taiwan	345	15	345	15
Germany	1019	12	1447	18
Austria	93	11	93	11
South Korea	412	8	598	12
Netherlands	120	7	120	7
China	8359	6	14604	11
Turkey	444	6	991	13
Switzerland	35	4	107	13
United Kingdom	113	2	113	2

Source: HSR networks, from International Union of Railways (UIC). Population, from Eurostat and different national sources. Info downloaded on March 1, 2014

Table 2. Intensity of use of the HSR network. Passenger-km per km of network. Selected countries 2011.

Country	Passenger-Km (million)	HSR network (Km)	Passenger-Km per Km of HSR network (Million passenger-Km/Km)
France	52040	2036	25,6
Germany	23310	1019	22,9
Italy	12280	923	13,3
Spain	**11230**	**2144**	**5,2**

Source: Union Internationale des Chemins de Fer

Spain is also the European Union country with the most extensive motorway network. At the end of 2011, it covered a distance of 14,554 km (a figure that does not include dual carriageways). In 2010, the last year for which Eurostat provides homogeneous data for almost all EU countries, Spain already had 14,021 km of motorway in service, followed by Germany with 12,819 km. In relative terms (i.e., km of motorways per million inhabitants), Spain, with more than 300 km per million inhabitants, was ranked well above all other large and medium-sized EU countries, as shown in Table 3. The population density of the motorway network in Spain is surpassed only by that of Slovenia and Cyprus, small countries with small populations and characteristics that are not really comparable.

Table 3. Motorways (free and tolled) in the European Union (2010)

Country	Km Motorways	Km motorways / Million inhabitants
Slovenia	771	377
Cyprus	257	314
Spain	**14021**	**307**
Luxembourg	152	303
Portugal	2737	259
Sweden	1927	206
Austria	1719	205
Denmark	1130	204
Ireland	900	198
France	11392	176
Belgium	1763	163
Netherlands	2651	159
Germany	12819	157
Hungary	1477	147
Finland	771	144
Italy	6668	111
Greece	1191	106
Lithuania	309	98
Estonia	115	86
Slovakia	416	77
Czech Republic	734	70
United Kingdom	3673	59
Bulgaria	437	59
Poland	857	22
Romania	332	16
Latvia	0	0
Malta	0	0

Source: European Commission (2013b) EU transport in figures. *Statistical Pocketbook, 2013*. Brussels: European Commission. Eurostat for Latvia and Malta, an also for population.

Clearly, the fact of having a more extensive motorway network does not mean that the traffic volume will be equally great. In order to compare the intensity of use of motorway networks in Europe, we draw on the data provided by the International Transport Forum (OECD) for road passenger traffic in 2009. Table 4 shows these figures and calculates the ratio for the total number of passenger*km (pkm) over the length of the whole network. We find that the number of million passenger-km per km of motorway in Italy was 4.3 times higher than that in Spain; in Germany it was 2.6 times higher while in France the volume of traffic was 2.8 times greater.

Table 4. Intensity of use of Motorways (free and tolled). Selected countries, 2009.

Country	**Passenger-km (Million)**	**Length of Motorways**	**Passenger-Km per Km of Motorway (Million passenger-km/km)**
Italy	800 615	6661	120,2
France	860 700	11 163	77,1
Germany	949 975	12 813	74,1
Spain	**392 531**	**14 021**	**28,0**

Source: International Transport Forum (OEDC) for passenger-km. European Commission for length of Motorways.

Unfortunately, there are no equivalent physical measures that allow us to make homogeneous cross-country comparisons of airport infrastructure supply. However, Fageda and Voltes (2012) have analyzed the average ratio of passenger numbers to the surface area of Spanish airport terminals and compared their results with a sample of international airports for 2010. They show that the mean number of passengers per square meter of terminal in Spain is 71, while the international mean is 101. Tellingly, sixteen Spanish airports have a mean number of passengers per square meter of terminal below 50. Table 5 shows the number of passengers per square meter of airport terminal in Spain.

Data on airport investment obtained from the International Transport Forum (ITF) show that, between 2000 and 2009, investment in airports in Spain rose to 16,577 million euro. This figure is much higher than investment levels in other EU air markets with more than 100 million passengers:[2] 1.5 times that of Germany (although Germany has more traffic), 1.9 times that of France, and 4.8 times that of Italy. Equally, while 46 Spanish airports offer international commercial flights, 13 of them handled fewer than 100,000 passengers in 2012. Among these small airports, only that of La Gomera (Canary Islands) serves an island with low domestic and tourist demand. As such, this is the only airport that fulfils what might be considered a public service obligation to prevent isolation and provide mobility in an insular environment devoid of suitable alternatives. [3]

[2] ITF does not provide data on investment in the UK after 2005.
[3] Other airports located on islands are subject to public service obligations but these airports handle more than 100,000 passengers per year.

Table 5. Passengers per square meter of terminal in Spanish airports.

Airport	Passengers per square meter of terminal
Albacete	5,13
Logroño	6,13
Córdoba	6,83
Vitoria	7,24
León	10,49
La Gomera	10,68
Salamanca	10,8
Badajoz	13,9
Burgos	14,44
Pamplona	23,51
Málaga	30,34
Almería	31,6
Zaragoza	37,29
Barcelona	41,53
Fuerteventura	44,88
Santander	45,09
Madrid	50,31
Jerez	64,79
Hierro	66,68
Sevilla	68,14
Tenerife Norte	75,53
Bilbao	76,92
Lanzarote	84,27
La Coruña	84,31
Tenerife Sur	86,17
Gran Canaria	86,55
Valladolid	87,26
La Palma	93,09
Palma de Mallorca	95,99
San Sebastián	104,26
Murcia	105,83
Reus	109,9
Granada	115,52
Santiago	115,86
Menorca	125,18
Valencia	132,46
Ibiza	138,1
Vigo	139,99
Melilla	159,29
Girona	162,13
Alicante	175,04
Mean Spain	**71,79**
Mean worldwide airports	**101,43**

Source: Fageda and Voltes-Dorta (2012).

Data on investment in ports (also obtained from the ITF) show that, between 2000 and 2010, investment in Spain amounted to 21,988 million euro, which is almost double that invested in ports in Italy, more than three times that spent in Germany and six times that in France. By combining investment data with figures for maritime goods transport in tons (data provided by Eurostat), we

can build a measure for investment relative to port cargo traffic in most EU countries.[4] For the period 2005 to 2010, the ratio (accumulated investment/port cargo traffic in tons) in Spain was 6.2 euro per ton. This figure is well above that of all other countries in the EU as Table 6 illustrates: for instance, it is 3 times that of Italy and Germany, 3.7 times that of Portugal and 7 times that of France.

Table 6. Accumulated investment in Ports per tons of goods (2005-2010).

Country	Accumulated Investment per tons of goods (Euro per ton)
Spain	**6,21**
Germany	2,18
Italy	2,06
Latvia	1,57
Finland	1,49
Slovenia	0,99
France	0,89
Estonia	0,85
Lithuania	0,85
Belgium	0,74
Denmark	0,63
Poland	0,32
Sweden	0,27
Greece	0,22
United Kingdom	0,1

Source: Eurostat for traffic of goods. International Transport Forum for investment figures.
Note: Data on goods is not available for The Netherlands, Ireland and Romania.

As can be seen, over-investment and the mismatch between supply and demand have been the most salient features of Spain's infrastructure policy, affecting all interurban modes of transport. The over-investment of recent decades follows a long-term pattern in Spain's infrastructure policy that is not driven by the requirements of mobility and economic activity, but rather by the desire to centralize transportation on the country's political capital (Bel, 2011 and 2012; Albalate, Bel, and Fageda, 2012). This priority for connecting all provincial capitals to Madrid was established by the Second Law of Railways, introduced in 1870 (Bel, 2011). More recently, on 25 April 2000 (in the investiture debate preceding the 2000-2004 legislation), the Spanish government once again made it a priority to connect all provincial capitals to Madrid with its plan for the HSR network. Likewise, the development of the motorway network has usually responded to this same priority, especially when it has involved funding from the state budget (Bel, 2012). To achieve this objective, the geography of Spain and the coastal location of the country's main metropolitan areas (with the

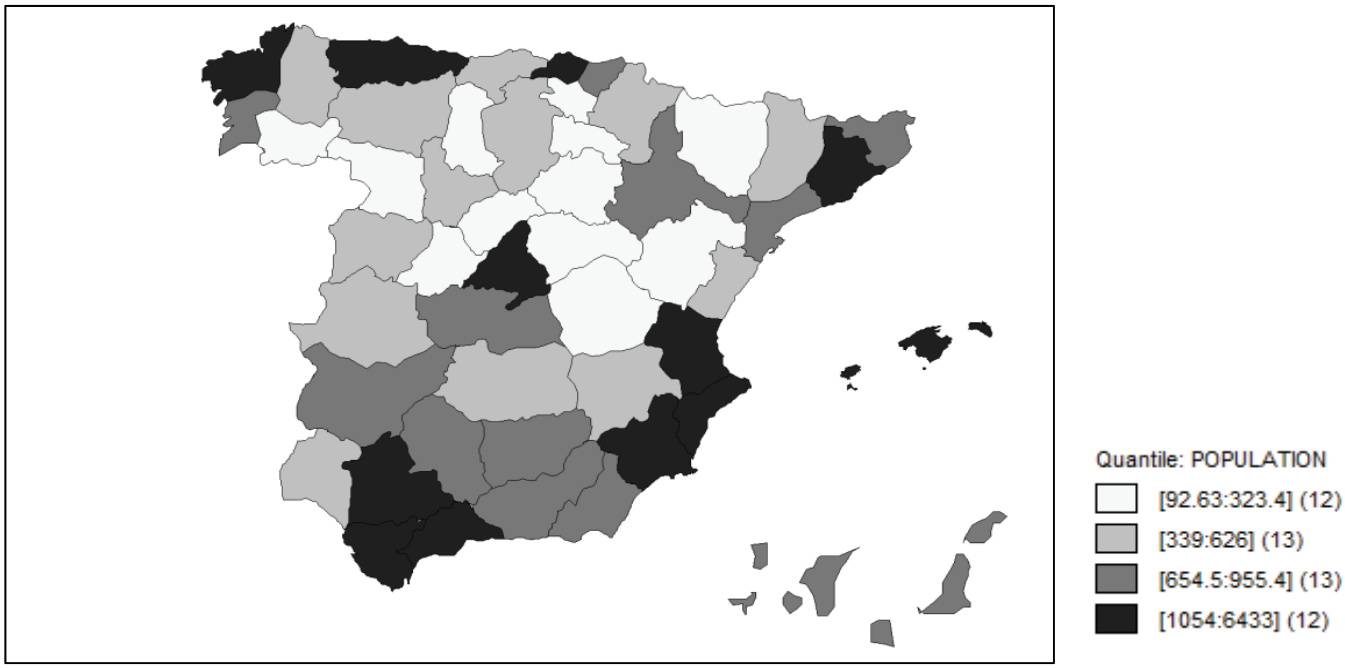
[4] ITF does not provide data on investment in the Netherlands, and data of investment in the UK is not available after 2005.

exception of Madrid) made the development of particularly long rail and road networks necessary, especially in comparison with the networks of Spain's European neighbors. However, this over-investment in transportation infrastructure, and especially spending on such facilities as airports and ports, cannot be explained solely in terms of centralization. We need to examine other motives, including the political influence wielded by the powerful construction sector – one of Spain's leading economic sectors (Bel, Estache, and Foucart, 2014), whose may also account for over-investment in other policy areas, such as the building of local facilities in a range of different fields.

Given Spain's low population density, the low concentration of population in the areas surrounding Madrid, and the distribution of economic activity throughout Spanish territory (see Figures 1 and 2), transport demand has been unable to sustain the development of this policy. As a result, state regulation and national budget subsidies have been regularly used to determine infrastructure priorities and to fund the development, maintenance, and operation of networks.

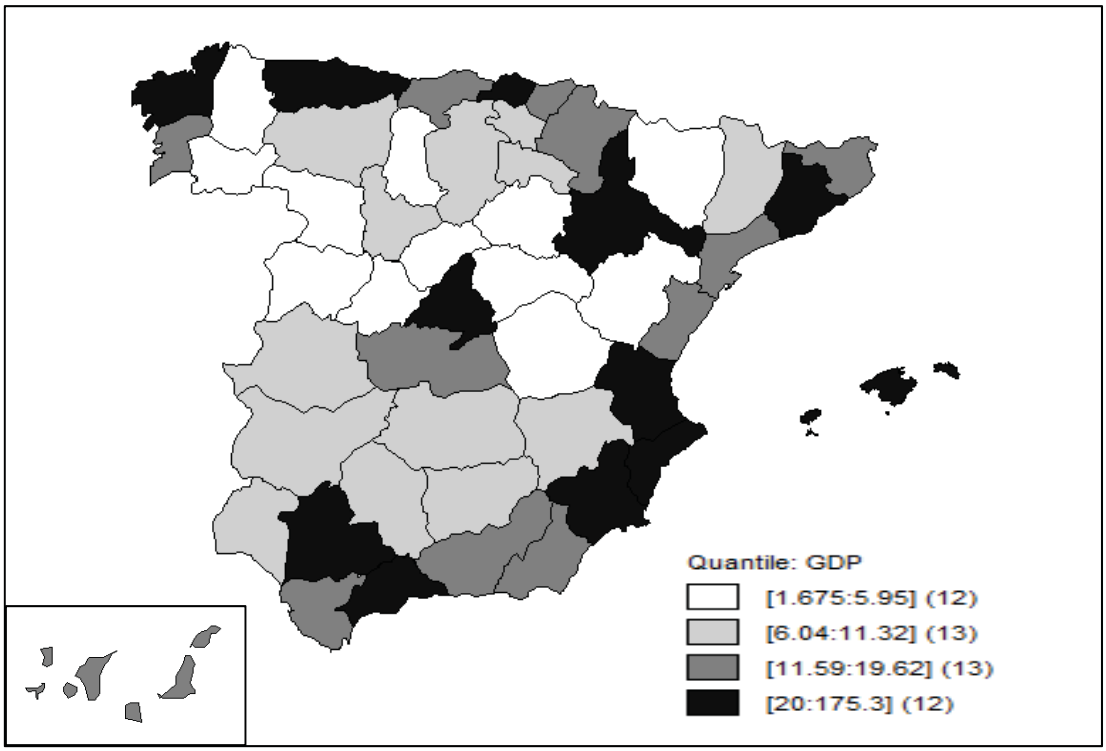
To sum up, Spanish leadership in infrastructure supply is indisputable in all modes. Yet, demand has lagged far behind, especially in surface transportation networks. Below, we analyze the contribution that institutional and regulatory policies have made to this oversupply and the mismatch between demand and supply.

Figure 1. Geographical distribution of population among Spanish regions



Source: Cambridge Econometrics

Figure 2. Geographical distribution of gross domestic product among Spanish regions



Source: Cambridge Econometrics

3. Institutional and regulatory causes of mismatch

3.1 Network modes

High capacity network modes have received – and, in fact, continue to receive – the largest share of Spanish investments in transport infrastructure. As a result, they also provide an obvious illustration of the mismatch that exists between infrastructure supply and demand. Taxpayer subsidies, together with the massive arrival of European funds for high-speed rail and free motorway projects, and the offer of favorable guarantees and the negotiation of risk mitigation agreements for private toll motorway projects, are among the main factors fueling this mismatch in network modes.

Motorways

Spain's motorway network, which is under central government regulation, is characterized by a mixed funding model in which 75% of motorways are free, while the remaining 25% are tolled and privately operated. This duality can be accounted for by the different models that have been adopted in each of the three main waves of motorway investment in the country (Bel, 1999). Overall, Spain

boasts 16,358 km of motorways, the largest high capacity network in per capita terms in Europe if we consider countries of a comparable size.[5]

The first motorways in Spain were opened to traffic under the dictatorship, which chose a privately toll motorway concession model to develop the network. Private motorway projects involve great uncertainties in terms of demand and cost risks, while private screening can be expected to provide profitable projects as it allows the selection of routes on the basis of predicted traffic volumes. However, the private advantage of being able to avoid white elephants is only possible with the right allocation of risk. In this regard, the dictatorship offered various guarantees and risk mitigating mechanisms including exchange rate insurance, an economic-financial breakeven guarantee and State-endorsed foreign debt (Bel, 1999).[6] Under these regulations, the Motorway Plan projected a frenzied construction effort of 6,430 km of tolled motorways in just over a decade. However, the international economic crisis of the seventies was to highlight the important mismatch between projected capacity and actual traffic. Eventually, only 2,042 km of construction were awarded and by the 1980s only about 1,800 km were actually in operation. Moreover, part of the industry had to be rescued through a process of renegotiation and nationalization.

In the late 90s and in the years that followed, the democratic central government continued to award new private toll motorway concessions and to offer similarly favorable guarantees. However, the most heavily used corridors were by now already covered by previous investments – both private and public. Consequently, most of the new motorways built (above all, those constructed to provide additional access routes to Madrid's six existing motorways) are proven white elephants – with traffic volumes in some cases (the R2 concession, for example) at just 34% of expectations. The use of these motorways has been badly undermined by existing free parallel motorways, while their profitability has been hit by huge (unexpected) expropriation costs. Baeza and Vasallo (2012) report a significant bias towards the overestimation of traffic volumes on Spanish toll motorways. They argue that such overestimation is a strategic move given the possibilities for renegotiating concessions. Indeed, the State has been shown to have secured

[5] This 2012 figure is obtained from the Ministry of Transport and includes free motorways, tolled motorways and free dual carriageways, which are technically similar but not the same as free motorways. Note that the figure is higher than that reported in Table 3 (section 2), as there we consider a technically homogeneous identification of motorways as provided by Eurostat.

[6] In spite of regulations favoring foreign investments, concessionaires were solely domestic. Interest in attracting capital from international financial markets was a strategy used to improve the Spanish balance of payments. Specifically, exchange rate insurance was provided to facilitate foreign private investment.

liabilities and is currently negotiating to rescue concessionaires that find themselves in trouble having accumulated debts of more than 3,500 million euro.

The free motorway network is fully funded from the government budget and received its latest boost from large scale investment programs between 1984 and 1993. The switch from toll to free motorways was adopted in part because private initiative was unable to provide coverage in regions with low traffic volumes. Motorway plans in this period acquired a centralized design, connecting Madrid to provinces in the periphery. The impressive growth in levels of investment was possible in part to the massive arrival of European funds that targeted specific regions, but without any consideration of traffic volume. Unlike the toll motorways, this free network has been extended constantly since 1984.

Since 1993, however, Spanish governments have not operated a strategic plan for the country's motorways. Only selected projects have been presented in a number of investment programs, but no specific criterion has been applied as regards capacity enlargements. Technically, it is generally accepted that conventional roads should be converted into high capacity roads when they reach an average daily traffic of around 15,000 vehicles – or 10,000 when congestion is severe or heavy traffic represents a share of 15% or more. Yet, in Spain, current plans drawn up by the central government provide for the conversion into motorways of several roads with traffic volumes below 2,000 vehicles per day – examples include the routes Cuenca-Teruel (1,399 daily vehicles), Huelva-Zafra (1,409 daily vehicles) and Alcolea del Pilar-Caminreal (1,975 daily vehicles). There are at least five more such enlargement projects with daily traffic volumes below 4,000 vehicles (Macias and Aguilera, 2013).

As for toll regulation, initial tolls are fixed at a rate that will guarantee the economic-financial breakeven of the private concessionaires. Regulatory price rules for toll motorways have evolved over time, but have always been established by law. The first concessions provided for toll updates calculated on the basis of complex polynomial equations that were dependent on the growth in inputs and materials required for construction; moreover, they were specific to each concession. The concessionaires though complained for years that such equations were only truly applicable in periods of construction, and eventually it was agreed to revise this rule. The central government opted for regular review so as to avoid involvement in constant automatic bilateral negotiations and to ensure updates that downgraded the system's rigidity. Royal Decree 210/1990 substituted the earlier rule with an automatic update that was fixed at 95% of the rise in the consumer price index.

The latest stage in price regulation was initiated in 2001. The mechanism involves a price cap rule, which in turn is based on the difference between projected and actual traffic on each motorway. This price cap system represents an attempt to link price changes to the actual evolution in traffic so that extraordinary profits can be tied to reductions in real toll prices (Albalate, Bel, and Fageda, 2009).

In spite of these changes, price regulation has played no significant role in the over-investment bias over time, especially if we consider that a large part of the Spanish network is free, which leads to well-known incentives to overinvest. Indeed, free motorways and fuel taxes are common occurrences worldwide and they have not necessarily led to oversupply. However, oversupply cannot be achieved without resorting to the budget. Even the concession contracts designed in Spain for the construction, operation, and maintenance of toll motorways have been characterized by a limited transfer of risk to private investors: first, as a result of guarantees awarded to ensure construction cost recovery;[7] and, second, as a result of lax equity to debt ratio requirements. Consequently, concession contracts result in only a limited transfer of financial risks to the private sector, which impedes the construction of projects that might be sustained by economic activity and mobility alone. As such, both budget financing and private financing with subsidies and guarantees may result in oversupply, but not all countries with toll or free models inevitably produce oversupply. Ultimately, it is the objectives and the design of a country's transport infrastructure policy that determine the financing instruments that are to be adopted.

Additional interpretations of the oversupply of free motorways include the satisfaction of short-term goals, such as winning political elections (Castells and Solé, 2005), and long-term objectives, such as centralization (Albalate, Bel, and Fageda, 2012). The latter inevitably requires budget financing because of the low density corridors that connect the political capital with a number of the country's peripheral cities. As a result, oversupply is dictated by policy design and the financial mechanism adopted is simply the instrument derived from that design.

High-Speed Rail

High-speed rail has been at the heart of Spain's transport policy. Even in the 2013 budget – which included major cuts for education, health and social security – HSR was allocated 3,302

[7] This is well illustrated by the recent discussion centered on nine toll motorway concessionaires that received concession awards over the last fifteen years and which faced financial trouble in 2013. Six were eventually declared bankrupt while the other three needed to be bailed out by the central government. Traffic forecasts were never met and to ensure construction cost recovery the State is obliged to pay around 4,000 million euro from the budget in compensation (see Albalate, 2014).

million euro, 71% of all investment for railways and 33% of the total investment provided by the Ministry of *Fomento*, responsible for almost all public investment activities (housing and postal services and not just transport infrastructure) in Spain. The Strategic Plan of Transport Infrastructure (PEIT, 2004) foresaw that 43.7% of total investment between 2005 and 2020 was to be dedicated to intercity rail, with a particular emphasis on high-speed rail, which was expected to receive a third of the Ministry's total investments. The new Transport Infrastructure Plan (PITVI, 2012), replacing the previous one, retains intercity rail investment at 39% of the total. It also confirms the general allocation of funding for high speed rail projects countrywide. The plan reflects the fact that since the year 2000, the main objective of Spain's transport policy has been to provide an HSR link between the political capital and all provincial capitals – a policy shared by the two main political parties that have ruled the country over the last few decades. President José María Aznar was the first to establish this objective and he laid the foundations for a transport policy based on a huge investment effort and a design unconnected to existing capacity concerns or mobility patterns.[8] This situation accounts for the fact that Spain continues to top the table in terms of new HSR construction (See Table 1 above), even when there is overwhelming evidence of the mismatch between supply and demand on the lines already in operation. Indeed, the market share of the rail mode in passenger-km stood at just 5.2% in 2011.[9]

Such a mismatch cannot be supported by private initiative. Both the infrastructure and the service are managed by centralized publicly owned monopolies. There is a vertical accounting separation between the manager of the infrastructure (*ADIF*) and the manager of the service (*RENFE*) and both corporations are regulated by the Ministry of Transportation.

Competition is not allowed among passenger traffic in Spain and the characteristics of the country's infrastructure – distinct from those of conventional railways – are incompatible with freight transport. High-speed rail links have concentrated all of Spain's modernization efforts in the passenger-related railway sector, with no interest for freight transport, which today suffers severe bottlenecks along the main corridors. As a result, Spain's freight rail transport presents one of the lowest (and decreasing) market shares in Europe, standing at just 2.5%.[10] As such this is the principal opportunity cost of investment efforts in passenger oriented high-speed rail, which should come as no surprise if we consider that ports and UIC-gauge railways have yet to be linked up in

[8] This objective was first introduced by President José María Aznar on 25 April 2000 (*Diario de sesiones del Congreso*, 2000, nº.2, [April 25] p.29).
[9] Estimates provided by the Ministry of Transport in the Transport Infrastructure Plan (PITVI) 2012-2024, part II, p.3.
[10] Estimates offered by the Ministry of Transport in the Transport Infrastructure Plan (PITVI) 2012-2024, part II, p. 5.

Spain. Indeed, the first project of this kind did not take place until 2012, when the Port of Barcelona was connected with a minor single dedicated track.

The declared intent of connecting all provincial capitals to Madrid by HSR was not supported by any mobility patterns or transport needs. As a result, taxpayers, together with European funds (which account for around a quarter of project investments), have borne the brunt of the expense of the high-speed rail program (See Albalate and Bel, 2012).[11] This has come about, first, because infrastructure investment has been fully subsidized, without any expectation of recovering costs via user fees.[12] Moreover, infrastructure user fees do not fully cover the maintenance costs of the network and its railway stations. In fact, these fees are insufficient to recover even the variable costs of high-speed rail in many corridors. If we assumed a fee rate that made the recovery of variable costs possible, even for projects with a demand twice that of the Madrid-Barcelona line, subsidies would be required for up to half the marginal cost value (Albalate and Bel, 2012, p. 104). As a result, the infrastructure has to be fully subsidized, as does the rolling stock in part (even though it was purchased by RENFE). Second, it reflects the fact that, during the early years of operation, prices were heavily subsidized. In this regard, the European Commission prohibited subsidies to cover operating losses on RENFE's long distance services, including its high-speed rail lines, in 2009. This aid had amounted to € 248 million in 2007, and would have risen to € 400 million in later years. None of the high speed lines fulfills public service obligations. All in all, Spain's HSR lines, obtained at great expense, have been built for passenger volumes that fall well short of targets that would justify their existence, as various cost benefit analyses of HSR investments have shown (De Rus and Inglada, 1993; De Rus and Roman, 2006). Yet, despite the financial burdens suffered, Spain enjoys the longest HSR network and continues to make a huge fiscal effort to further its expansion.

3.2 Single facilities

In Spain, single transport facilities are characterized by a centralized management model of publicly owned monopolies – *AENA aeropuertos* for airports and *Puertos del Estado* for ports – under central government control. Although ports and airports are two types of infrastructure that have a

[11] It is worth recalling that because of Spain's relief and urban density, the average construction costs of the HSR network have been lower than those in other European countries, and well below those in Italy (See Beria and Grimaldi, 2011).

[12] Note that in France – a country with a very similar network in terms of length – the recovery of infrastructure investments on none of its lines is 0%, whereas in Spain no line has an infrastructure investment recovery higher than 0%.

local economic influence within their respective hinterlands and which are funded by user payments (as a system), the main management decisions are taken by centralized institutions that implement cross-subsidy schemes between business units and price regulations that do not reflect their individual costs. These two mechanisms provide a regulatory framework that facilitates overcapacity (due to a scale of investment that would not be possible if it depended solely on their individual revenues) leading to a sizeable mismatch between infrastructure supply and demand (which, furthermore, is not justified by public service obligations).

Airports

AENA manages 47 of the 48 airports with commercial traffic in Spain.[13] This contrasts with the present situation in other European countries with various large airports, such as France, United Kingdom, Germany, and Italy, where airports are managed on an individual basis by either public or private firms (for more details on airport management practices in Europe, see Bel and Fageda, 2010).[14]

AENA is the owner of all the facilities provided by Spain's airports and it controls all the financial resources generated by them. All investment plans are drawn up jointly between AENA and the Ministry of Transport, with airport charges being fixed by the Spanish Parliament. All other relevant decisions regarding airport management are made by AENA, including those related to the undertaking of retail activities, the allocation of slots, check-in counters and airline gates.

The centralized management system means that Spanish airports are unable to compete with each other to attract airline services, as typically occurs in other European countries. Furthermore, any financial losses are compensated through a cross-subsidy system. Here, Bel and Fageda (2009) show that the cross-subsidy system is not necessarily driven by a criterion of solidarity as it is usually claimed. On the contrary, a significant positive correlation can be found between investments and GDP per capita, leading to a larger allocation of the resources raised by profitable airports to the richest territories.

As regards revenues, Law 25/1998 fixed the initial values for current aeronautical charges (the fees for landing and aircraft parking, and for terminal use, etc.) and other fees, including car parking

[13] The only commercial airport not managed by AENA is Lleida-Alguaire, a small airport that handled just 33,041 passengers in 2012. A further three airports, which do not currently carry commercial traffic, are not managed by AENA.

[14] Exceptions do exist; thus airports located in the same urban area tend to be managed by one single firm. This is the case of airports in Paris, Rome and Milan and it was the case of those in London and Glasgow before the break-up of BAA airports.

and the retail activities undertaken by AENA. The company operates four airport categories and sets aeronautical charges accordingly (note that within the same category, price differences are minimal). The airports of Madrid and Barcelona are in the first category, the main tourist airports comprise the second, while the other two categories are made up of the airports handling lower traffic volumes. This discrete categorization of regulation, however, fails to allow prices to reflect individual costs, and as such is a significant source of inefficiency.

Any changes to these charges proposed by AENA must receive the approval of the Spanish Parliament. Thus, in theory, airport charges are based on the total costs of all the airports managed by AENA; however, in practice, these charges are approved by Parliament, so they are adjusted annually in line with the charges made for other public services (except in 2011 and 2012 when airport charges in Madrid and Barcelona were increased substantially in relation to those in place at the other airports because of the huge investment debts accumulated in Barcelona and, above all, in Madrid). Thus, while charges are strictly regulated, they do not necessarily cover costs.

It should be noted, therefore, that AENA has recorded financial losses since 2007, making it the airport operator reporting the largest deficit in the world (Bel and Fageda, 2011). AENA's current debt stands at more than 14,000 thousand million euros. In 2011, only ten airports were profitable and each of them moves more than four million passengers per year. This contrasts starkly with reports for other European airports where the traffic profitability threshold can be as low as one million passengers (European Commission, 2002).

In short, the poor financial performance of Spanish airports can be attributed to a lack of competition, the cross-subsidy system and the absence of incentives to be cost efficient. All these factors, derived from the centralized management system, have a detrimental impact on the financial accounts of Spanish airports and encourage the tendency to over-invest, which is perhaps the main factor accounting for AENA's current financial distress.

Ports

Public ownership and centralized decision-making on such matters as investment and prices also characterize Spain's ports. However, the Port Authorities have a greater degree of financial autonomy than that enjoyed by the airports since here investments are more closely linked to the

amount of revenues that each port generates individually. Furthermore, privately-owned terminals, with high degrees of independence from the Port Authorities, are permitted on port premises.[15]

The two main agencies managing the ports of Spain are *Puertos del Estado* and the Port Authorities. *Puertos del Estado* is a state-owned company whose main objectives are to coordinate operations and to approve the Port Authorities' investment plans. The company is financed by four per cent of the total revenues of each Port Authority located on the mainland and two per cent of the revenues of ports situated on islands, and in Ceuta and Melilla.

Spain has 28 Port Authorities managing a total of 47 ports.[16] The Port Authorities are public institutions that have their own legal structure and a president appointed by the regional Government. The president's role is to propose investment plans and establish concession contracts with the companies that operate in the terminal. All the Port Authorities are financed by property income and port charges that are paid by terminal operators and shipping firms. The initial values of port charges are fixed by law and the annual update is approved in provisions accompanying the General Budget Law. No formal link has been established between charges and costs, although the Port Authorities are generally profitable.

The regulations provide some scope for price competition through the use of two tools: a correction coefficient and discounts. The correction coefficient is the percentage that each Port Authority can apply in order to modify the fee paid by the shipping companies. The main feature of the correction coefficient is that it involves a "regulation of maximum profits". Thus, a Port Authority with profit levels higher than the national mean has to lower its prices, while a Port Authority with lower profit levels has to increase its prices. Such a regulatory measure however can cause an economic distortion, as the price setting is not necessarily related to the costs of each Port Authority. The second tool to promote competition comprises the discounts that Port Authorities can apply under certain conditions (regulated by law) to terminal operators and shipping companies. For each Port Authority, the regulation fixes an upper limit, this being the maximum amount that discounts can represent as a share of the port's total revenue.

Ports in Spain can also receive resources from the "Inter-port Compensation Fund", which sees resources being transferred between ports to compensate for disadvantageous situations arising from hinterland limitations or island locations, and to improve the ports' road and rail accessibility.

[15] There have been several changes in the legislation regulating port management in Spain since the early nineties (see Castillo-Manzano et al., 2008, for details)
[16] Other minor non-commercial ports are subject to regional regulation.

To finance this fund, each Port Authority has to contribute up to 12 per cent of their income, with the actual share being determined by its financial status. However, in the case of the Port Authorities of the Canary and Balearic Islands, and of Ceuta and Melilla, the percentage falls 50 per cent.

However, Fageda and González-Aregall (2014) show that the current regulation of port charges does little to foster price competition, while Castillo-Manzano and Fageda (forthcoming) report a tendency towards over-investment in the Spanish port system. Since the early nineties, investment in the Spanish port system has multiplied three-fold (after controlling for inflation). Port Authorities have been accruing debt with financial institutions at a double-digit annual growth rate, so that the accumulated debt more than doubles the total annual revenue for the whole port system. In a similar vein, Hidalgo-Gallego and Núñez-Sánchez (2013) show, by estimating a cost-function for the 1986-2005 period, that most Spanish ports are operating at over-capacity. Hence, the combination of weak price competition and the financial autonomy of the Port Authorities seem to have led to capacity competition and the resulting overcapacity of the Spanish port system.

3.3. The role of management, financing and price regulation across modes

Above and beyond the specific features of the models of management, financing and price regulation for each mode of transportation, there are certain common characteristics shared across the modes that allow us to provide a brief, more horizontal review of Spain's transport infrastructure policy and its associations with the existing mismatch between demand and supply. Table 7 summarizes some of these shared features.

Table 7. Regulatory approaches of transport infrastructures in Spain

	Management	**Price regulation**	
		Scheme	**Surcharge/Discounts**
Motorways	Private concessions subject to tolls	Price-cap	Changes based on real and projected traffics
	Public management and financing	No applicable	No applicable
High-speed rails	Centralized by a public firms	Charges set annually by law	NO
Airports	Centralized by a public firm	Charges set annually by law	NO
Ports	Centralized by a public firm	Charges set annually by law	Discounts based on profits of port authorities and traffic of shipping companies/terminal operators

Source: Authors'

The origin of oversupply in Spain can be traced primarily to political meta-objectives unrelated to transportation and mobility demands. We refer above all to territorial and administrative objectives of centralization attainable through the development of transport infrastructure (see Bel, 2011, for an explanation of the historical pattern which saw centralization being made a priority, and the empirical study conducted by Albalate, Bel, and Fageda, 2013, of the objectives pursued by infrastructure investments in Spain). In addition, the provision of infrastructure in Spain has been understood as an egalitarian policy that measures inequality according to the level of infrastructure available to the country's citizens in terms of its stock and quality of service.[17]

Given a design based on oversupply, all models of management, financing and price regulation must necessarily adhere to this primary function of the infrastructure policy. As a result, this policy and the provision of transport services will typically be delivered by a centralized public entity: the Ministry itself, in the case of motorways, or specially created public corporations under Ministry ownership, in the case of ports, airports and railways. This explains why Spain is an exception – to comparable European countries – in its joint centralized management of all ports and airports by public corporations. This system permits the transfer of resources from profitable to unprofitable infrastructure and services, which is essential in a transport policy driven by investments that bear no relation to market mechanisms. It also produces highly regulated prices that diverge from the optimal amounts required to sustain national infrastructure networks and any expansions of them. In this regard, Spain is unique among comparable European countries in that it regulates the prices of all transport infrastructure services via laws enacted by its central Parliament.

Furthermore, the financing model is also conditioned by the mismatch between supply and demand because economic activity and mobility are insufficient to sustain the level of infrastructure and the quality of transport services. For this reason, budget financing of the infrastructure network is common in Spain (as we have shown in the subsections devoted to motorways and high-speed rail), to levels that hardly bear comparison with the financing of other European countries. However, this is not the case of single facilities, financed by user payments. Yet, excess investment has contributed to the current level of debt suffered by the public corporations. As we have seen, in

[17] It has been the common claim of successive Transportation Ministers that egalitarian access to such infrastructure as HSR "makes Spaniards equal". See, for instance, a public statement by the current Minister of Transportation in http://www.rtve.es/alacarta/videos/informe-semanal/informesemanal-21-04-12/1382803/ (go to 1h03'40; downloaded 1 March 2014).

2012 the corporation responsible for the management of Spain's airports had run up debts of 12,750 million euro.

All in all, a centralized public management system, based on budget financing, strict price regulation and cross-subsidy mechanisms, makes it easier to satisfy the meta-objectives that have led to the enormous oversupply of infrastructure in Spain today.

4. Discussion and Policy Implications

We have shown that Spain's transport policy in recent years has been characterized by a sizeable mismatch between capacity investment and traffic demand. In this instance, the mismatch cannot be attributed to problems of isolation or accessibility, but rather to programs of public investment and regulatory and institutional mechanisms that have actively favored overcapacity, together with a consistent and long-term pattern of centralization based on satisfying political and administrative rationales, rather than meeting the requirements of mobility and economic activity.

The management of Spain's railways, airports and ports is the responsibility of the Ministry of Transportation and it fulfills these tasks on a centralized basis. In the case of motorways a mixed model of management and financing is operated. As such, some motorways are managed by private firms through a concession and financed by the tolls paid by users. All other motorways are managed by the Ministry of Transportation and are financed exclusively from the public budget. High-speed rail is financed by the public budget (investment) and partially by user payments (operation), while airports and ports are financed through user charges and cross-subsidies.

As for the regulation of user charges, a price-cap is in place for private motorway concessionaires and pricing decisions are linked to specific parameters related to the difference between real and estimated traffic. In the case of the other modes of transport, charges are set annually by law but the criteria used for fixing these prices are not made explicit. However, some similarities exist between motorways and ports, since the Port Authorities can apply discounts under certain conditions regulated by law.

Overall, a centralized system of public management and the fixing of charges in a manner not necessarily related to costs are two significant characteristics of Spain's transport infrastructure policies. Within this context, investments do not often correlate with levels of current or expected demand, but rather seek to satisfy meta-objectives of centralization and equality in terms of the availability and quality of infrastructure. These investments, and the present absence of any

economic recovery, impose a large burden on Spain's economic policy via the annual charges on the financing of infrastructure as well as in terms of government indebtedness. Furthermore, current policy imposes another large burden on the Spanish economy, given that fiscal efforts are not devoted to the promotion of productivity gains or the relief of capacity constraints and, as such, have no link with the needs of an efficient economy in times of need.

Of further concern is the fact that no major reform is foreseen in either current or prospective policies for limiting this overcapacity. Indeed, the current economic crisis and the fiscal constraints being imposed by the European institutions do nothing to prevent the extension of large expensive transport projects that continue to be justified under the same policies as those adopted in the recent past.

As has been argued, today's network modes are the outcome of large investment programs, funded primarily from the public budget, and which have failed to take into consideration future traffic forecasts. Even in the case of private toll motorways, the institutional and regulatory design of concession contracts (and their offer of generalized guarantees) has mitigated the importance of demand risk in the valuation of projects, resulting in similar white elephant projects to those produced by the Government in its free motorway programs. In the case of single facilities, the main problems driving overcapacity can be identified as (1) institutional – due to the centralization of management under publicly owned corporations controlled by the central government; and, (2) regulatory – due to the use of price regulations based on cross-subsidy schemes not justified by public service obligations.

Reforming transport policy in Spain is urgent; yet, recent developments appear to show that current policies are limitless, even though they are having a negative impact on both current and future generations. What is required are measures that seek to link investment and capacity to different service delivery thresholds. This means accommodating investment projects and the modernization of each mode – gradually, when indivisibilities do not apply – to the demand expectations of non-commercial infrastructure. In the case of commercial infrastructure it is imperative that the institutional and regulatory framework be reformed. In this regard, the management of these units should be undertaken on an individual basis and price regulations need to be reformed so as to ensure that fees charged meet costs. However, this will only be possible if the reforms provide a (new) regulation of the public policy process.

Spain is the only example among the large and medium-sized countries of the OECD in which absolutely all interurban transportation modes are under central government control. Regulation and institutional designs are all determined by the Ministry of Transportation (either directly by the Ministry or indirectly by corporate companies owned by the Ministry) and, as shown, they have promoted over-investment. Internationally no executive enjoys a comparable concentration of powers in the transport sector. Thus, institutional reforms need to consider the establishment of an independent regulatory agency for transport (whether this should be modal-specific or cover all modes would be an issue for further research) and one that is outside central government control. This is of pressing interest; especially, if we bear in mind that the Ministry of Transportation itself is aware of the lack of correlation between investment and growth in demand; yet, the political precepts consider an equal endowment of infrastructures (in terms of both quantity and quality) to guarantee equality between the citizens of different regions.

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