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Analysis of light rail systems in Spain according to their type of funding

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Abstract

Since the year 1994, when the city of Valencia reintroduced the tramway (more specifically, the second generation of trams, known as Light Rail System), this means of transport has been introduced in many urban areas in Spain. It is an innovative transport system that substantially improves the features of the old trams that crossed Spanish cities until 1976.

The technical characteristics of this means of transport make it a sustainable alternative for urban settings, as it produces less acoustic and environmental pollution, and it is safer than other modes of transport. In comparison with the underground and the bus, the Light rail offers an intermediate transport capacity, which makes it adequate for medium-sized cities or certain zones within large metropolitan areas. Finally, the modern design of these modern trams, together with the urban regeneration of the zone where it circulates, is frequently used to improve the image of a city. In 2012 there were 16 Light Rail Systems in 13 Spanish cities (Valencia, Alicante, Madrid, Barcelona, Parla, Sevilla, Vitoria, Bilbao, Murcia, Tenerife, Zaragoza, Jaén, and Vélez-Málaga).

However, in some cases these Light Rail Systems have involved high costs of implementation and operation that the respective financing entities (Public Administration and/or private enterprise) can hardly face. Moreover, they are functioning at a much lower level of demand than their capacity, meaning they could be considered an economic and social failure.

At this point in time, two decades after the introduction of Light Rails in Spain, there is a need to analyse the factors that may have influenced the success or failure of this novel type of transport. Although such an analysis should be approached from diverse perspectives, the present contribution focuses on the influence of private financing in these projects. More specifically, a qualitative and quantitative analysis is carried out to determine if there is a significant relationship between the percentage of private participation in financing this transport system and a series of relevant variables: total investment, cost per unit of length, operating and maintenance costs, percentage of length underground, passengers' demand, investment per passenger, fares and subventions, etc. In view of the results, it will be assessed whether the private funding behind the Light Rail Systems in Spain has proven efficient for society.

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1. Introduction

According to Rivas (1996), the reason to use private funding to finance those infrastructures that traditionally have been publicly funded is the strict deficit policy required by the European Economic and Monetary Union. It requires Member States to reduce budget allocations for infrastructure investments. The situation compels to find new ways of funding to ensure a continued pace of investment without compromising the ultimate objectives of economic development and convergence. In this context, one of the mechanisms proposed more enthusiastically is participation of private enterprises in financing and infrastructure management of public interest. Thus, the model of Public-Private Partnership (PPP) is created in order to fund both the construction and management of transport infrastructures.

Glaister (1999) states that, despite the progress in the use of the PPP model, the involvement of private sector has led occasionally to waste resources. Moreover, in several cases, projects have been carried out that would have been done at a lower cost. Thereby, it is an essential that part of the risk is borne by private participation for the proper functioning of a PPP model. As a result, private enterprise would operate more efficiently.

Meanwhile, Resor and Tuszynski (2012) note that use of PPP model has increased due to the incapacity of Public Authorities to finance transportation projects from revenues of journey fare and taxation. PPP model particularly best fits to infrastructures that have long payback period, especially if these investments generate a considerable profit. Thus, PPP allows private companies to participate in the financing of transport infrastructures, sharing business risks with public administrations and obtaining in return a profit on their investment, as compensation for assumed risks.

In his PhD. thesis, Sastre (2009) compares between Spanish Light Rail (LR) that have been executed by private funding or awarded through concessions to build and exploit them; and which have been carried out by public funding. Furthermore, he established the advantages, disadvantages and adequacy of each of these systems, in terms of different characteristics of the project and its environment.

1.1. Aim of the study

This paper analyses the potential influence that the presence of private funding has had on the cost of light rail systems in Spain. Nevertheless, it should be noted that this analysis is a simplified approach to the problem, since there also are plenty of factors that affect these projects.

2. Light Railway systems in Spain

To perform the analysis, we have selected 14 Spanish LR systems, each of them is described below, emphasizing on the financing system.

2.1. Madrid

Madrid has three LR lines, all of which were opened in 2007.

Line 1 runs from the metro station of Pinar de Chamartín to Las Tablas. It provides service to the new neighbourhoods of Sanchinarro and Las Tablas, whose development has been greatly benefited by the development of this means of transport (Calvo et al., 2013). It is a line of 5.4 km, 3.62 km of them are cut-and-cover tunnel. The line has 2 interchange stations from a total of 9 stations. The rolling stock is 8 trams, Alstom Citadis model 302, that take about 15 minutes per journey. The low-intensity building of these new neighbourhoods developed next to the line and the fact that there are still several no built plots has contributed to the low demand captured by this line. In 2011, it was used by 4.9 million passengers (Romeu, 2012).

Construction works of this line (as well as lines 2 and 3) were initiated in 2006 by public funds through the public company Mintra (Madrid Infraestructuras de Transporte). Due to a major change in accounting consideration of debt of Mintra, it was decided to tender works, financing and exploitation (Consorcio de Transportes de Madrid, 2010).

This concession was awarded to the bid submitted by Metros Ligeros de Madrid S.A., whose shareholders are the public company Metro de Madrid (42.5 %), the infrastructure management company Globalvia (42.5 %) and the transportation company Alsa (15 %) (Consorcio de Transportes de Madrid, 2010). The required investment was 254 M€ (Consorcio de Transportes de Madrid, 2010), which is equivalent to a unit cost of more than 47 M€/km. This cost is extremely high and is mainly due to the fact that a large portion of this line was built underground (67%). Part of this additional cost could have been avoided, especially considering that most of the route of the line was newly developed, so it would be on surface.

Line 2 runs through the outskirts of Madrid from the subway station of Colonia Jardín to the commuter station of Aravaca, going through the town of Pozuelo de Alarcón. It provides service to office centres, shopping malls and university centres. It has 12 stations and a length of 8.7 km, 2.7 of them are underground. The rolling stock is 12 trams, Alstom Citadis model 302 travelling at a commercial speed of 24 km/h. Journey time is about 22 minutes (Consorcio de Transportes de Madrid, 2010). Except the two ends, line 2 runs through a sparsely populated area and no chance to be urbanized. Its demand is rather low, being used by 3.7 million passengers in 2011 (Romeu, 2012).

The investment was 260 M€ (Consortio de Transportes de Madrid, 2010), which is about 30 M€/km. This elevated cost is owing to the large number of underpasses and overpasses built to avoid road level crossings. However, many of them could have been avoided by changing the layout and building some level crossings with traffic lights priority to the tram.

Line 3 runs from the metro station of Colonia Jardín to Boadilla del Monte. Its length is 13.7 km, 1.4 km of them are underground. This interurban radial line has 16 stations and provides service to leisure areas, office centres and university centres. The rolling stock is 15 trams Alstom Citadis model 302, developing an operating speed of 25 km/h. It takes 32 minutes to complete the route (Consortio de Transportes de Madrid, 2010). Similarly to line 2, line 3 runs through sparsely populated areas, with the exception of both ends. Its demand was 3.7 million passengers in 2011 (Romeu, 2012).

The investment was 262 M€ (Consortio de Transportes de Madrid, 2010), which is approximately equivalent to a unit cost of 20 M€/km. This is extremely high for a line that runs on surface, and it may be due to the excessive number of underpasses and overpasses to circumvent road infrastructure.

The concession for the construction and operation of lines 2 and 3 was awarded to Metro Ligero Oeste S.A., whose shareholders are the construction and infrastructure management company OHL, the investment group Ahorro Corporación and the construction, infrastructure management and exploitation company Comsa (CRTM, 2010)

2.2. Parla

Parla is a dormitory town located in the south of Madrid. The tram of Parla is a circular line of 8.4 km that runs as a whole on surface and which was opened in 2008. It has a total of 15 stations, being 1 of them an interchanger with rail commuter. The trams are 9 units Alstom Citadis model 302, which cover the route in about 25 minutes (Tranvía de Parla S. A., 2013)

This tram involved an investment of 128 M€. The City Council of Parla contributed with 33% of total. This amount came from tax burden application to the new urban district of Parla Este, which was built around the new line. The remaining investment was previously provided by the concessionaire, who was also responsible for drafting the project, financing it, implementing the works, acquiring the rolling stock and exploiting the line. The awarded company was Tranvía de Parla S.A., whose shareholding belongs to Globalvia, the rail transport company Detren and the bank Caja Castilla La Mancha (CRTM, 2010).

Although a portion of this line runs through the centre of Parla, it mostly crosses the outskirts of the town, providing service to some industrial areas and the neighbourhood of Parla Este. This district is characterized by low intensity of building and no built plots. Due to these facts, the captured demand of the line is rather low, approximately 5 million passengers per year (Tranvía de Parla S.A. 2013).

2.3. Barcelona

Barcelona has two LR networks: Tambaix and Trambesós. The first sections were inaugurated in 2003, and last of them, in 2007. Currently, it is being analysed the possibility of connecting both by a 3.8 km line. It would have five stations and would double the current demand (Tram, 2013).

Tambaix network has three lines, T1, T2 and T3, which represent 15.1 km of railway, totally on surface. They have 29 stations, 3 of them are interchange stations; and run from Avenida Diagonal, in Barcelona, to the commuter towns of Bajo Llobregat. 23 trams Alstom Citadis model 302 run by these lines. T1 spends approximately 34 minutes per journey, while lines T2 and T3 take 39 and 35 minutes per trip, respectively. These lines run through densely populated areas, so they capture a high demand. In 2011, 16.1 million of passengers used them. (Romeu, 2012)

The investment needed to carry out this project amounted to more than 303 M€, which means approximately 20 M€/km. This high cost was due to the fact that the line runs through highly inhabited districts, whereupon the works to replace the affected services and the redevelopment increased the investment of the project. Tramvia Metropolità S.A. proved to be the concession holder, whose responsibilities were the drafting of the project, the civil works and the exploitation of these lines. Tramvia Metropolità S.A. is a consortium formed by the company of railway rolling stock Alstom, the construction and infrastructure management companies FCC, Coms and Acciona, accumulating a 65% of the shareholding; the transport operators Veolia, Moventis, FCC and Detren (24%); the financial institutions Banco de Sabadell and Société Fenérale (6%) and the public transportation operators FGC and TMB (Vizcaino, 2012)

The network of Trambesós is composed by the lines T4, T5 and T6 and measure 14.1 km, 11% of them are underground (Vizcaino, 2012). It has 10 interchange stations from a total of 27 stations. These lines run from Plaza Glòries, down Avenida Diagonal, to several neighbourhoods of the east of the outskirts of Barcelona, traversing extremely densely populated areas. These lines are traversed by 18 Alstom Citadis 302 trams, taking approximately 20 minutes per trip to line T4, 29 minutes to T5 and 15 minutes to T6. The frequency at rush hour is 8 minutes (Vía Libre, 2013b), representing an offer of 1530 passengers per hour and direction. Owing to the density of the population that inhabits the crossed areas, the captured demand is rather large, above 8 million passengers (Romeu, 2012).

The investment of the works amounted to 280 M€, which is equivalent to approximately 20 M€/km. The reasons of this fact are similar to those discussed for Tambaix. The concession holder was Tranvía Metropolità del Besós S.A., whose shareholding is the same as Tramvia Metropolità S.A. (Tram, 2013; Vizcaino, 2012).

2.4. Bilbao

The LR of Bilbao was opened in 2002 and it is a line of 5.57 km that traverses on surface along Ría de Bilbao, from the train station of Atxurito Basurto. It has 1 interchange station from a total of 14 stations. The rolling stock is 8 CAF Urbos 1 trams that take about 20 minutes per route. In 2011, this line was used by nearly 3 million passengers (Euskotren, 2011).

This LR was promoted and funded by the public company Bilbao Ría 2000, Autonomic Government of País Vasco and City Council of Bilbao. The cost of this project was 40.3 M€ (ABC, 2012). Despite the fact that this LR has helped to improve of the public transport, the main objectives of the project were addressed to an urban regeneration of the zone, which previously was an industrial one; and to boost the image of Bilbao, in conjunction to Guggenheim Museum. Therefore, due to these objectives, its use is rather reduced (Fernández et al., 2008), and it is understandable that Public Authorities has funded and exploited it.

2.5. Tenerife

The network of LR of Tenerife has two lines: the first one, opened in 2007, running from the interchange station of Santa Cruz de Tenerife to Avenida de la Trinidad, in the city of San Cristóbal de la Laguna; and the second one, from La Cuesta to Tíncer, both in the city of San Cristóbal de la Laguna. While the Line 1 has a length of 12.3 km, and 21 stations, the Line 2 measures 3.6 km and has 6 stations. 26 trams, model Alstom Citadis 302, taking about 37 and 11 minutes to route respectively (Oromi, 2007). Both lines traverse heavily populated zones and provide service to hospitals, museums, university centres and interchange stations, whence the captured demand is important. 13.9 million passengers used them in 2011 (MTSA, 2011).

The company in charge of hiring and directing the works was Metropolitano de Tenerife, S.A. (MTSA). MTSA is a joint enterprise, owned by Tenemetro (14%), which is integrated by construction, transportation operators and engineering consultancy companies; the bank Caja Canarias (6%) and public administration Cabildo Insular de Tenerife (80%) (Vía Libre, 2007; MTSA, 2011). At the same time, Tenemetro is responsible for the operation of the tram through a 50-year concession. The total cost of line 1 amounted to 305.6 M€ and the line 2 to 54.5 M€, both including mobile material, civil works and installations (Oromi, 2007). The high unit cost of line 1, almost 25 M€/km, is due mostly to the complicated topography of the area.

2.6. Zaragoza

The LR of Zaragoza is a line that has 12.8 km and runs on surface. It was inaugurated in 2011. It has a total of 25 stations, 3 of them are interchange stations. Currently, the rolling stock is 21 units of the Urbos III model. The journey takes 40 minutes (Ayuntamiento de Zaragoza, 2013). The frequency at rush hour is 5 min. In 2011, 11.5 million passengers used the tram of Zaragoza (Vía Libre, 2013d). This important captured demand is due to the fact that the line links the historic city centre with the two main nodes of urban sprawl of Zaragoza (Valdespartera and Parque Goya).

The construction and operation of the line, whose investment was 400 M€, was awarded by a concession to mixed economy society Traza. It is integrated by the City Council of Zaragoza (20%) and a set of civil engineering companies, railway rolling stock companies, transportation operators and banks: FCC, Acciona, CAF, Tuzsa, Ibercaja and Concessia (Tranvía Zaragoza, 2013). The investment was distributed as follow: 130 M€ were provided by the Government of Aragón and the City Council of Zaragoza and the remaining amount was provided by Traza (Vía Libre, 2013d).

2.7. Vitoria

The LR of Vitoria was inaugurated in 2008. This line has form of Y, and it connects the neighbourhoods further from the city centre. It has a length of 7.2 km and runs entirely on surface. It has 18 stations and the rolling stock is 11 units CAF Urbos II model. The journey takes about 17 minutes from both ends to the downtown area, being its highest frequency 6 minutes. In 2011 a total of 7.4 million passengers used the Vitoria tram (Vía Libre, 2013c; Romeu 2012).

The 100 M€ of the investment was provided by the Autonomic Government of País Vasco, the Provincial Council of Alava, the City Council of Vitoria and the public railway company EuskoTrenbideak–FerrocarrialesVascos S.A.. The Vitoria tram is exploited by Euskotran, the brand name under which operates EuskoTrenbideak (Vía Libre, 2013c).

2.8. Murcia

The LR of Murcia consists on an 18 km line and has 28 stations. It has 11 trams Alstom Citadis 302 model (Tranvía de Murcia S.A., 2013). In 2011, 3 million passengers used it (Montesinos, 2012). Its low demand is due to traversing low densely inhabited areas, as university centres, industrial area, sparsely populated areas and neighbourhoods of leaned houses.

The investment required for the project (264 M€) was provided by the concessionaire in exchange for the exploitation of 40 years (Murcia metropolitana, 2010). The shareholding of the concessionaire (Tranvía de Murcia) belongs to the construction companies FCC and Comsa (Tranvía de Murcia S.A., 2013).

2.9. Valencia

The first modern tram in Spain was the LR of Valencia and was opened in May 1994. Currently, the Valencia tram is composed by the line 4, which connects the underground to areas of high demand such as university centres and Playa de la Malvarrosa; and line 6 that circumvents Valencia. It amount to a total of 20 km, running on surface. It has 43 stations, which 6 are interchange stations. A total of 44 trams provide service in these lines, 25 of them manufactured by Siemens; and another 19 units manufactured by Bombardier (Vía Libre, 2013e). While line 4 takes 51 minutes, the line 6 spends 33 minutes (Levante-emv, 2012). In 2011 a total of 9.5 million passengers used tram of Valencia (Vía Libre, 2013e).

The LR in Valencia has been built directly by the Generalitat Valenciana with public funds. The public company Ferrocarrils de la Generalitat Valenciana (FGV) exploits it (Romeu, 2012). The investment amounted to 375 M€ (Vía Libre, 2013f).

2.10. Alicante

In 2004, the LR was implanted in Alicante. Most of the network comes from the partial transformation of narrow gauge railway Alicante-Denia. Thus, this tram connects Alicante with the cities of the metropolitan area, acting as a mixed system between tram and train (Vía Libre, 2013a).

The network of LR of Alicante consists of 5 lines and a total length of 53 km, being 1.7 km underground (FGV, 2013). It has a total of 44 stations, 8 of them are shared by different lines. The rolling stock is 34 trams of the model Bombardier Flexity Outlook Tram-train Vossloh. In 2011, a total of 5.4 million passengers used these lines (Romeu, 2012).

The Alicante tram has been funded and built directly by the Conselleria de Obras Públicas, Urbanismo y Transportes of the Generalitat Valenciana (Romeu, 2012). The agency responsible for the exploitation is the public railway company FGV (Ferrocarrils de la Generalitat Valenciana).

2.11. Sevilla

The LR of Sevilla was opened in 2007, and expanded in the year 2011. This line consists of 2.2 kilometres and 5 stations, being the journey time about 9 minutes. The operating speed is nearly 14 km/h. The rolling stock is 4 trams CAF Urbos III model (Tussam, 2013). This line runs from the historic city centre to San Bernardo, where are located both commuter and metropolitan bus stations. In 2011, it transported to 4.8 million passengers (Romeu, 2012). This high demand for a short line is due to the fact that it runs through the most emblematic streets of Sevilla and circulates at a very low speed, so that tourists use it to see the area in a quiet and comfortable way.

The investment was 53,43M€ (El País, 2006), funded by the City Council of Sevilla (33%) and the Autonomic Government of Andalucía (66%). The exploitation is the responsibility of Tussam, the municipal transportation company (Romeu, 2012). Its high cost, running on surface entirely, is caused by the important works of pedestrianisation and redevelopment of the traversed streets.

2.12. Data

Table 1 (appendix 1) includes the variables and data that are used in the analysis of LR systems in Spain.

3. Analysis of the variables

Private financing of the investment cost has been present in 9 cases of 14 LR systems considered, ranging from 3.3% to 100%.

3.1. Total investment

In the figure 1, it could be seen a preponderance of private funding in expensive projects, considering expensive as those system that equal or exceed the average. Thus, private financing is majority in 7 of 9 systems of LRT whose cost is above the average, while this only happens in 1 of the 4 cheaper projects, and these costs are much lower than the average.

This conclusion could be interpreted considering public administrations have to resort to private funding for more expensive projects. Theoretically, this kind of funding takes place when public administrations do not have sufficient resources to deal with a project that is necessary for the society. Thereby the construction and commissioning can be carried out without the government being required to have the necessary budget. Assuming equal efficiency between public administration and private enterprise, those projects are proved to have a higher cost than if Public Administration face them by itself, since it have to resort to external resources. So, these additional costs are due to the payment of industrial benefits.

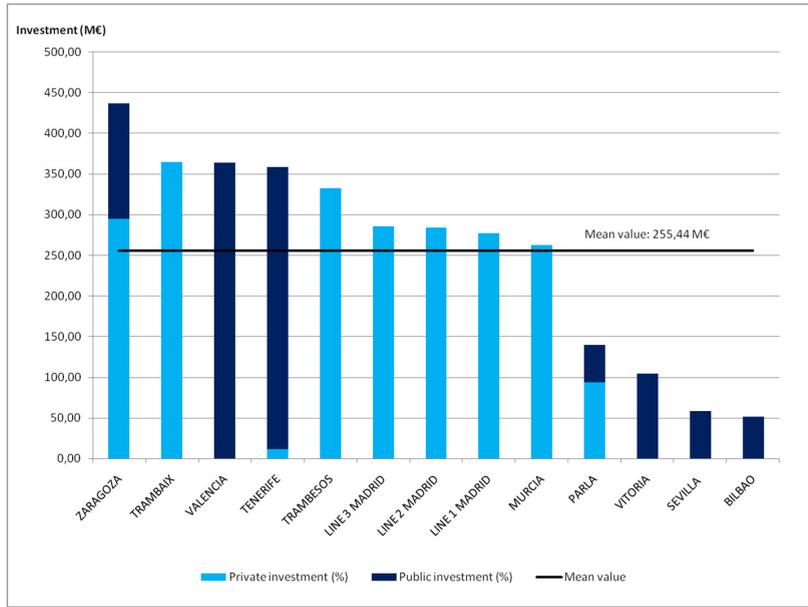


Fig. 1. Investment cost of LR system in Spain.

3.2. Unit cost

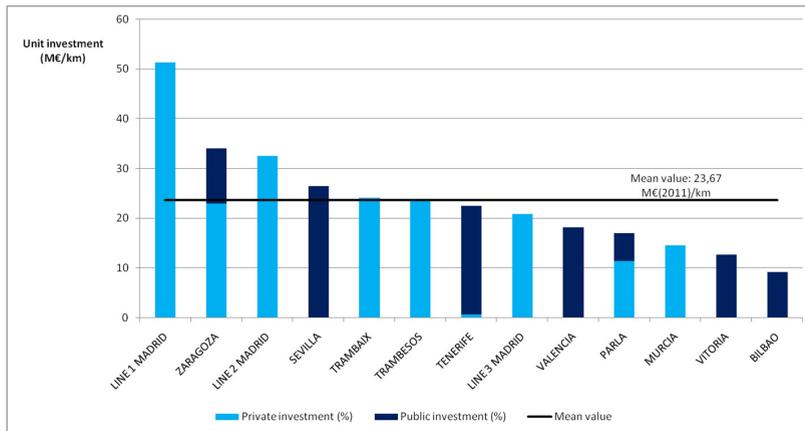


Fig. 2. Unit cost of LR in Spain.

Regarding to the unit cost, figure 2 shows that in 5 of 6 more expensive projects, the private investment is majority; whereas it only happens in 3 of 7 cheaper projects. This could be interpreted as a tendency of the unit cost of investment to increase with the percentage of private participation in their funding.

3.3. Operation Cost

The figure 3 shows that 4 more expensive cases correspond to projects funded only by private initiative, while in 4 of the 5 cheaper cases has public financing. It seems to indicate that mostly private financed LR tends to have higher costs of exploitation than the total or partially funded with public money. This tend can be seen in the left side of the figure 3, where are grouped the more expensive LR operation cost, and all of them are totally funded by private enterprises.

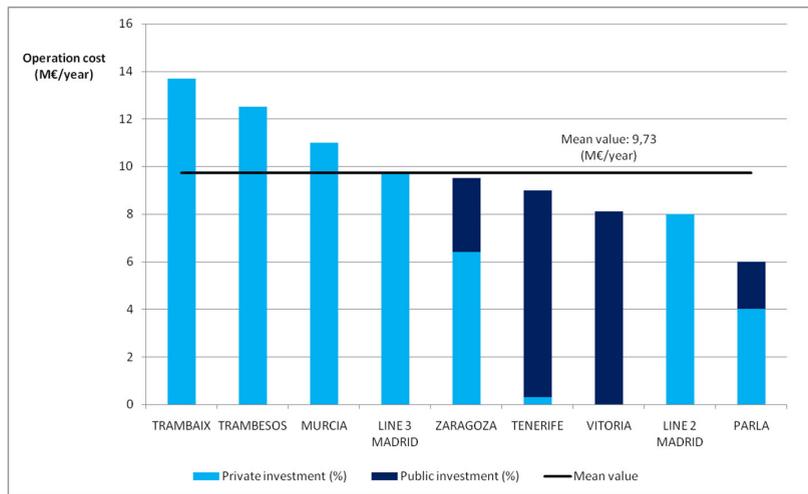


Fig. 3. Operation cost of LR in Spain.

3.4. Investment per passenger

An intuitive way to evaluate the social profitability of a project is to calculate its benefit or cost per each passenger who uses it. Since in this case the investment is being analysed, the project that most benefits to society will be the one that required less investment per passenger.

The figure 4 shows that more expensive LR projects to society, with the exception of Valencia, are those whose funding was provided by private companies. In addition, it can be observed a tendency indicating that the social cost seems to increase with the percentage of private financing of the investment cost (see the entire sequence in Figure 4 from left to right, with the exceptions of Trambaix and Valencia). Both results question the social profitability of these projects and lead us to ask why projects, which at the stage of preliminary drafts, had been expected to be very expensive and scarcely demanded, therefore, to have a high social cost, were awarded to private companies, which raise the investment required theoretically even more.

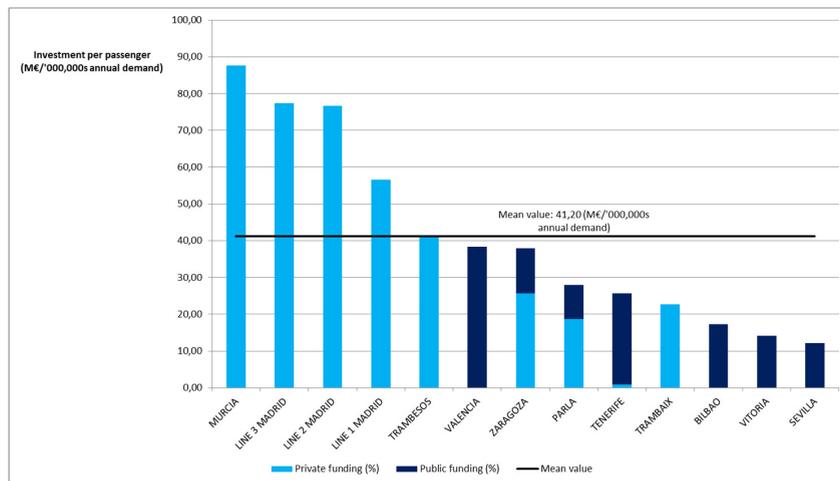


Fig. 4. Investment per passenger of LR in Spain.

4. Conclusions

Despite the simplification involved analysing the costs of the projects of LR in Spain considering only the influence of private participation in their financing, some interesting indications might be extracted:

- Firstly, private investment has been concentrated mainly in projects of greater cost.

- While in the majority of LR that has a higher cost per kilometre, funding is mostly private, the majority of the cheaper LR were mainly funded by public administration. This can be interpreted in two ways: either that governments resort to finance more expensive projects with private money; or cost per kilometre of LR has a tendency to increase with the participation of private firms in their financing.
- Regarding operation costs of LR, they are greater in projects financed entirely with private capital.
- Finally, and most important of all, investment by passenger increases with private participation in the financing, generally. Thus, while LR projects that involved a greater social cost have been funded entirely by private companies, more beneficial projects to society (i.e. LR projects with a lower investment per passenger) have been funded total or partly by public administrations, with the one exception mentioned. This result question on the social profitability of several LR lines and lead us to ask why several projects were carried out and why its construction and operation were awarded to private companies.

In conclusion, the advantages of the tram, as a transportation system with costs, capacity and construction period intermediate between the conventional metro and bus, are not enough to justify its implementation when the demand is too low, given the high investment required. This has taken place in some Spanish cities in which the LR has been built mainly for political purposes, benefiting from the introduction of a modern means of transport, of the redevelopment of the area and the improvement of the image to the city (de Oña et al., 2010; Carpenter and Petersen, 2014). It must be kept in mind that annual demand of LR systems in France is 20.6 and 15.6 million passengers in lines 1 and 2 of tramway system of Ile-de-France, respectively; more than 14 in each line of Lyon, 21.7 in line 1 of Montpellier and 13.2 in line 1 of Rouen (Semaly and Maunsell, 2004). In the United Kingdom, the annual demand is about 40 million passengers for LR system of Tyne and Ware, 20 in line of Croydon, 17.2 in line of Manchester, 12 in line of Nottingham, 11 in line of Sheffield and 5 in line of West Midlands. Nevertheless, 8 of the 14 analysed Spanish LR systems have an annual demand similar or lower than the minimum of the previously reviewed cases of France and United Kingdom.

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Apendix 1. Data used in the analysis.

Table 1. Data used in the analysis.

	LINE 1 MADRID	LINE 2 MADRID	LINE 3 MADRID	PARLA	TRAMBAIX	TRAMBESOS	BILBAO	TENERIFE	ZARAGOZA	VITORIA	MURCIA	VALENCIA	ALICANTE	SEVILLA
Total investment (M€)	277.28	283.83	286.02	139.95	364.51	332.23	51.59	358.35	436.66	104.77	262.72	364.43	-	58.38
Public investment (M€)	0	0	0	46.18	0	0	51.59	346.63	141.92	104.77	0	364.43	-	58.38
Private investment (M€)	277.28	283.83	286.02	93.77	364.51	332.23	0	11.72	294.75	0	262.72	0	-	0
Private funding (%)	100	100	100	67	100	100	0	3.27	67.5	0	100	0	0	0
Length (km)	5.4	8.7	13.7	8.2	15.1	14.1	5.57	15.9	12.8	8.2	18	20	51.34	2.2
Underground (%)	67	31.5	10.4	0	0	11	0	0	0	0	0	0	3.3	0
Unit investment (M€/km)	51.35	32.62	20.88	17.07	24.14	23.56	9.26	22.54	34.11	12.78	14.60	18.22	-	26.54
Operation cost (M€/year)	-	8	9.8	6	13.7	12.5	-	9	9.5	8.1	11	-	-	-
Franchising company private ownership (%)	57.5	100	100	100	95	95	0	100	80	0	100	0	0	0
Duration of the concession (years)	30	30	30	40	25	25		50	35		40			
Type of concession	BOT	BOT	BOT	DBOT	DBOT	DBOT		DBOT	DBOT		DBOT			
Annual demand ('000.000s passengers)	4.9	3.7	3.7	5	16.1	8.05	3	13.96	11.5	7.4	3	9.5	5.4	4.8
Daily demand ('000s passengers)	13.42	10.14	10.14	13.7	44.11	22.05	8.22	38.25	31.51	20.27	8.22	23.84	14.79	13.15
Maximum capacity (passenger/hour in each direction)	2448	2040	2040	1754	2640	1650	1152	2412	2472	2440	1116	2400	3780	2040
Investment per passenger (M€/annual demand)	56.59	76.71	77.30	27.99	22.64	41.27	17.20	25.67	37.97	14.16	87.57	41.89	-	12.16
Minimum frequency (minutes)	5	6	6	7	5	8	10	5	5	6	10	5	10	6
Fare (€)	1.5	1.5	1.5	1.3	2	2	1.4	1.35	1.25	1.25	1.35	1.4	1.25	1.4
Reference	CRTM (2010); Romeu (2012); Consorcio de Transportes de Madrid (2010)			Tranvía de Parla S.A. (2013); CRTM (2010)	Romeu (2012); Tram (2013); Vizcaino (2012); Via Libre (2013b)		ABC (2012); Euskotren (2011); Fernández et al (2008)	Oromi (2007); MTSA (2011); Via Libre (2007); Via Libre (2009)	Via Libre (2013d); Ayuntamiento de Zaragoza (2013). Tranvía de Zaragoza (2013)	Via Libre (2013c); Romeu (2012)	Montesinos (2012); Murcia Metropolitana (2010); Tranvía de Murcia (2013)	Levante-emv (2012); Romeu (2012); Via Libre (2013e); Via Libre (2013f)	Via Libre (2013a); FGV (2013); Romeu (2012)	Tussam (2013); Romeu (2012); El País (2006)