PORTUGUESE PUBLIC SECTOR INVOLVEMENT IN URBAN TRANSPORTATION SYSTEMS: A COMPARATIVE AND CRITICAL ASSESSMENT

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ABSTRACT

The emerging collapse of the mobility paradigm based on the mass use of automobile and high levels of exhaustible resources consumption, as been cited as an additional reason in favour of public transportation systems capable of matching the growing needs of commuting for workplaces and services. In Portugal, the public sector (central and/or local governments) has major historical responsibilities in the supply and management of urban transport systems. Currently, the Portuguese Central Government has significant direct influence concerning the financing and administration of two companies of urban road passenger's transport systems located in high density areas of Lisbon and Oporto. Simultaneously, there are four local governments which decided to create and develop corporations or municipal services with the purpose of implementing public passenger's transportation systems within their own municipalities.

Concerning the existing public sector transportation networks and the distinction between local and central government systems involvement, this research paper aims to present a set of indicators in order to improve the knowledge on the impacts of each of these transportation companies, considering different dimensions such as the municipality population, the network size, the quantity and quality of the services provided, the productivity of these transport services and their level of sustainability.

This critical and comparative analysis is expected to decisively contribute to a deeper understanding of the current reality of road urban transportation in Portugal.

Keywords: Public Transport; Performance Indicators; Subsidies.

1. INTRODUCTION

Public transport systems contribution has been reissued as a key strategy to mitigate the major economic and environmental problems underlying the massive use of private automobile. However, in Portugal, the relative weight of bus travel has declined from 19.8% in 1995 to just 12.8% in 2006, while the use of private road transport for commuting reached, in 2006, 82.8% of the total passengers.km. Conversely, it should be noted that in cities outside metropolitan areas of Lisbon and Oporto, the existence of public transport services companies managed, directly or indirectly, by local municipalities, has been achieving significant results in promoting a more friendly modal distribution.
This study includes the six existing (in 2008) corporations, whose main object is the public road transport service provision, namely: the Municipal owned companies MoveAveiro and Transportes Urbanos de Braga (TUBraga), the Municipal Services Transportes Urbanos de Coimbra (SMTUCoimbra) and Transportes Colectivos do Barreiro (TCBarreiro), as well as the Central Administration owned companies Carris de Ferro de Lisboa (CARRIS) and the Sociedade de Transportes Colectivos do Porto (STCPorto). The first four corporations (MoveAveiro, TUBraga, SMTUCoimbra and TCBarreiro) depend directly on the municipalities in which they were created, and operate in the areas belonging to each of the different municipalities. CARRIS and STCPorto are under supervision of the Ministério das Obras Públicas, Transportes e Comunicações, and have a wider territorial coverage, operating within the Municipalities of Lisbon, Amadora, Oeiras, Loures and Odivelas (CARRIS) and the municipalities of Porto, Gaia, Gondomar, Maia, Matosinhos and Valongo (STCPorto).
Each of these corporations provides services with specific economic and financial results. This work intends to highlight these differences, recognizing potential virtues or drawbacks of each, as well as identifying eventual best practices associated with the funding model (including the way the services provided are being subsidized). Therefore, a set of indicators constructed from information provided in management reports of each corporation are proposed, considering three main dimensions: resource-efficiency, service-effectiveness and resource-effectiveness.

2. LITERATURE

The discussion about the importance of urban transport systems in metropolitan areas gained a renewed importance with the increasing awareness of the impacts of massive use of the automobile (Banister, 2000; Ferreira and Cruz, 2009). Concerns about the limitations of transport infrastructures, in addition to the emergence of significant environmental externalities, strengthened the role of alternative transport modes to promote a more efficient and sustainable development (Kirchhof, 1995; Litman, 1997; Murray, 2001; Small, 1997).
The transport demand management is seen as a key strategy for introducing a model that minimizes the costs associated with car use. To do so, car drivers should bear the true cost of their options (Verhoef et al. 1995; Button, 2006; Proost and Dender, 2008; Ferreira, 2010). Meanwhile, the underlying benefits derived from increased use of so-called commuting "soft modes" within a metropolitan area should be strongly enhanced (Calthrop et al., 2000; Marshall and Banister, 2000; Shannon et al., 2006; Dorsey, 2005 ; Holmgrem et al. 2008), with a special emphasis on the reduction of costs associated with traffic congestion,

pollution, environmental degradation and infrastructure use (Banister, 2000; Verhoef, 1997), while contributing to match other ambitions of transport users such as comfort, speed and service reliability (Litman, 2009, Shannon et al., 2006; Yao, 2007). Other studies (Marsden, 2006, Brown et al. 2001; Balsas, 2003; Dorsey, 2005) argue that public transport tariffs reduction, e.g. through subsidies, should be considered as a strategy to increase the use of these transportation systems.

Indeed, public transport companies benefit from public subsidies either from central or local governments in several countries of the world (Karlaftis and McCarthy, 1998; Bouf and Hensher, 2007; Obeng and Sakano, 2000; Gwilliam, 2008). According to data of the American Public Transportation Association (cited by Borck and Wrede, 2009), in 2006 the tariffs charged by public transport companies in the United States cover only 33% of transport costs and 28% of the sum of operating costs with capital costs, while in several European countries these figures are about 50% of total expenditures.

Gwilliam (2008) argues that gains associated with investing in public transport networks can produce results at three different levels: the first derives from the reduction of costs (private and social) incurred in the use of transport system in a given metropolitan area; the second has an instrumental nature through a long-term influence on the choice of transport mode and reduction in volume of fuel consumed; the third concerns the goal of minimizing the overall costs associated with the transport sector borne by municipalities while maximizing the use of "soft mode" transportation systems, namely by those subject to significant budget constraints. However, the allocation of subsidies has been the subject of much debate. Parshigian (1976) and Bly and Oldfield (1986) argue that the subsidies led to a decrease of performance indicators by the increase in staff costs and lower productivity per worker or per bus. Karlaftis and McCarthy (1998) and Pucher (1995), argue that these results may be more onerous if subsidies are allocated by the central government, rather than local or regional authorities, to the extent that there is greater pressure to control costs and raise efficiency when users are closest to the entity that decides to spend money with certain specific transport system. Conversely, other authors advocate the advantages associated with the subsidies, with emphasis on the gains from better use of economies of scale, i.e., the introduction of subsidies, leading to a reduction in tariffs, might help to achieve a significant passenger's increase, with a diminishing marginal cost associated (Obeng, 1987; Tisato, 1997). Likewise, Tisato (1998) considers that subsidies can play a useful role in terms of reliability of public transport while improving its acceptance rate. Another dimension that has been invoked to evaluate the goodness of subsidies to transport companies is social equality (Lucas, 2006; Gwilliam, 2008), i.e., to the extent that subsidies allow the public transport systems to charge relatively low prices to specific parts of the population (the poor, the elderly and the students) they are promoting a social activity, which can be determined by moral, ethical or political criteria. To sum up, the majority of studies that discuss the impact on financial indicators following the granting of subsidies underline the emergence of net negative effects. The authors that argue in favor of the allocation of subsidies mainly assess the impacts of these in terms of social and environmental impacts or on the prospects of maximizing economies of agglomeration.

In the following sections, this discussion is deepened, considering data published in Annual Financial and Management Reports (2008) of the six Portuguese public transport corporations above mentioned.

3. METHODOLOGY

Table 1 below shows the number of people served, the total passengers carried in the year of 2008, the kilometers (km) traveled, the number of vehicles, the number of employees and the total crew members, for each of the corporations analyzed.

Table 1: General Indicators of the Portuguese Public Corporations providing Transport Services

Corporation	Service Area Pop. (2008)	Annual Passengers	Vehicle.km (v.km)	Total Vehicles	Total Employees	Total Crew Members
MoveAVEIRO	73 100	1 614 671	1 108 735	49	135	80
TUBraga	176 154	11 292 136	4 503 527	116	314	181
SMTUCoimbra	135 314	27 689 000	5 807 000	144	469	304
TCBarreiro	77 893	21 088 100	3 385 700	74	218	126
CARRIS	1 182 312	228 524 000	41 009 000	814	2766	2107
STCPorto	1 109 990	111 254 000	29 535 000	481	1591	1055

Source: Annual Reports.

According to the data collected, transport services for which local administrations are responsible, serve a population that represents 20,2% of the population covered by the transportation systems analyzed, transport 18,2% of total passengers, travel 21,0% of total kilometers, with 29,6% of the vehicles and 26,1% of the employees.

In Table 2 below, these data are supplemented with data on energy consumption (in terms of tonnes of oil equivalent (toe) of fuel used), extension of the network (single lane) and the average fleet. Finally, taking into account the public dimension of these services, the total value of subsidies (either with origin on central or on local administrations) is presented, as well as the share of subsidies in each system total revenues. As these services' total revenues, even after subsidies allocation, are normally insufficient to cover the total costs, the values shown in Table 2 combine the sum of the subsidies with the deficits.

Table 2: General Indicators of the Portuguese Public Corporations providing Transport Services

Corporation	Energy (toe) used	Network Extension (km)	Fleet Age (years)	Subsidy plus Deficit (€)	% of the subsidy on revenue
MoveAVEIRO	532,3	197,0	16,6	2 436 020 €	102,0%
TUBraga	2 531,0	238,2	13,2	4 272 999 €	37,7%
SMTUCoimbra	2 632,1	547,4	12,8	4 105 270 €	26,0%
TCBarreiro	1 728,1	58,8	14,7	1 360 447 €	19,8%
CARRIS	43 133,3	678,0	7,3	66 359 834 €	40,6%
STCPorto	14 352,0	537,0	7,5	47 657 000 €	65,2%

Source: Annual Reports.

According to information provided in Table 2, the Central Administration owned companies have a more modern fleet. The sum of subsidies and the total net revenues for the transport services corporations depending on Local Administrations is about only 10,7% of the corresponding total values. The corporation MoveAveiro deserves a special note considering that the sum of subsidies plus the deficit is less than the total annual value of revenues generated. Finally, as one would expect, the two Central Administration owned corporations,

that operate in metropolitan areas of Oporto and Lisbon, quantitatively provide more service and also benefit from higher levels of demand.

The performance of public transport systems can be evaluated according to three different dimensions (Karlaftis and McCarthy, 1998; Anh et al., 2005):

1. Resource-Efficiency (service output against resource input): measures services produced according to the amount of services used;
2. Resource-Effectiveness (service consumption against resource input): measures the service inputs to exact service provided for commuters; and
3. Service-Effectiveness (service consumption against service output): measures the extent to which service passengers consume outputs.

The presentation of the various indicators within each of these dimensions will be complemented by the construction of a ranking in which the corresponding result for each corporation is ordered. Finally, the ranking that considers all the indicators will be presented.

3.1 Resource-Efficiency Indicators

Regarding Resource-Efficiency it is possible to analyze indicators that equate distinct situations, namely Labor and Vehicle-Efficiency, as well as Energy and Cost-Efficiency.

Labor-Efficiency indicators reflect labor-productivity, i.e. the amount of labor used to generate the service output (one regarding the vehicle.km, and other the passenger trips, both per employee). Concerning the Vehicle-Efficiency indicators, the aim is to assess vehicle use to produce the service output (considering the v.km and the passenger trips, per bus). The results achieved and respective rankings are presented in Table 3, below.

Table 3: Labor and Vehicle-Efficiency Indicators

Corporation	Labor-Efficiency				Vehicle-Efficiency			
	v.km per employee	*Rank.*	Passengers per employee	*Rank.*	v.km per vehicle	*Rank.*	Passengers per vehicle	*Rank.*
MoveAveiro	8 213	*6*	11 961	*6*	22 627	*6*	32 952	*6*
TUBraga	14 342	*4*	35 962	*5*	38 824	*5*	97 346	*5*
SMTUCoimbra	12 382	*5*	59 038	*4*	40 326	*4*	192 285	*4*
TCBarreiro	15 531	*2*	96 734	*1*	45 753	*3*	284 974	*1*
CARRIS	14 826	*3*	82 619	*2*	50 380	*2*	280 742	*2*
STCPorto	18 564	*1*	69 927	*3*	61 403	*1*	231 297	*3*

Source: Annual Reports.

Although the differences regarding Labor and Vehicle-Efficiency indicators, their rankings reveal a relatively consistent situation. Indeed, it is apparent in Table 3 that TCBarreiro, CARRIS and STCPorto have performed relatively well (ranking for all the indicators among the top 3), while MoveAveiro, TUBraga and SMTUCoimbra have not performed so well.

Nevertheless, depending upon the measure, there are some variations in the rankings. For example, the TCBarreiro company ranks number one in the analysis of efficiency considering the number of passengers' trips (per employee and per vehicle); however, if we use vehicle.km, per employee or per vehicle, to measure efficiency, TCBarreiro 's ranking falls to second or third, respectively. These ranking positions are switched with STCPorto, which performs first in terms of vehicle.km and third in terms of passengers' trips (both per

employee and per vehicle). Conversely, the MoveAveiro company occupies the last place for all the rankings, transporting only 12.4%, and 11.6%, of the number of passengers per employee, and per vehicle, respectively, carried out by TUBraga.
The results for Energy and Cost-Efficiency are shown in Table 4, below. More specifically, Energy-Efficiency is measured by two indicators: the energy use (in terms of toe of fuel) per thousand of vehicle.km, as well as per thousand of passenger trips. Regarding Cost-Efficiency, the two indicators considered are: Operating Expenses (in €), per vehicle.km, and per Passenger trip.

Table 4: Energy and Cost-Efficiency Indicators

Corporation	Energy-Efficiency				Cost-Efficiency			
	toe per 10^3 v.km	*Rank.*	toe per 10^3 Passengers	*Rank.*	Operating Expenses (€) per v.km	*Rank.*	Operating Expenses (€) per Passenger	*Rank.*
MoveAveiro	0,48	*2*	0,33	*6*	3,92€	*6*	2,69€	*6*
TUBraga	0,56	*5*	0,22	*5*	2,47€	*2*	0,98€	*5*
SMTUCoimbra	0,45	*1*	0,09	*2*	2,59€	*3*	0,54€	*2*
TCBarreiro	0,49	*3*	0,08	*1*	2,22€	*1*	0,36€	*1*
CARRIS	0,56	*5*	0,10	*3*	3,50€	*5*	0,63€	*3*
STCPorto	0,49	*3*	0,13	*4*	2,88€	*4*	0,76€	*4*

Source: Annual Reports.

Considering the results estimated for the Energy-Efficiency of the transport services in this study, it is interesting to note that there is a strong similarity on the values for the energy used per vehicle.km. Alternatively, regarding the energy used per passenger trip, it is noticeable that TUBraga and MoveAveiro present levels of fuel consumption per passenger, respectively, approximately two and three times higher than the levels registered by TCBarreiro, SMTUCoimbra and CARRIS. This indicates that TUBraga and MoveAveiro may present structural difficulties related with reduced levels of occupancy.
Cost-Efficiency indicators are critical to confirm the overall efficiency level for each of the six transport services companies considered. Firstly, the results presented above show the existence of distinct situations regarding vehicles.km travelled and the amount of passengers transported. Secondly, it is admissible that an inferior number of passengers transported per vehicle.km can explain better results regarding the Cost-Efficiency per vehicle.km. The results, in Table 4, show that this may be the case for TCBarreiro, followed by TUBraga and SMTUCoimbra. Thirdly, the results concerning Cost-Efficiency per passenger reveal better efficiency, in relative terms, for the Municipal Services (TCBarreiro and SMTUCoimbra), followed by the companies owned by Central Administration (CARRIS and STCPorto). The Municipal owned companies, particularly MoveAveiro, present significantly above average values, indicative of the fact that these transport services support larger costs (i.e. higher expense per unit of produced output).

3.2 Service-Effectiveness Indicators

The indicators regarding the assessment of the services offered by each of the public transport companies are presented in this section, with results shown in Tables 5 and 6.

Concerning the ones presented in Table 5, below, it is important to note that the first, regarding the Mobility Rate, equates the impact that each transport company has in its area, namely trough the monthly average ratio of Passengers per Inhabitant. Regarding the Revenue Generation, it is evaluated through the Operating Revenue (excluding subsidies), per passenger, and also per vehicle. Finally, although the inexistence of a methodology entirely suitable to perform the complex assessment of any transport services supplier's social contribution (Abreha, 2007), we admit, for the purposes of this study, that the social effectiveness depends on the amount of operational revenues that each transport service 'abdicates' in favour of a specific segment of the population.

Table 5: Mobility Rate, Revenue Generation and Social Equity Indicators

Corporation	Mobility Rate		Revenue Generation				Social Equity	
	Passenger per Inhabitant (per Month)	*Rank.*	Operating Revenue (€) per Passenger	*Rank.*	Operating Revenue (€) per vehicle	*Rank.*	Social participation (€) per Total Operating Revenue (€)	*Rank.*
MoveAveiro	1,84	*6*	1,16 €	*6*	38 280,61 €	*6*	7,9%	*5*
TUBraga	5,34	*5*	0,56 €	*5*	54 983,67 €	*5*	35,3%	*1*
SMTUCoimbra	17,05	*2*	0,36 €	*2*	68 467,57 €	*4*	13,0%	*2*
TCBarreiro	22,56	*1*	0,26 €	*1*	74 355,69 €	*3*	12,6%	*3*
CARRIS	16,11	*3*	0,47 €	*4*	131 362,41 €	*1*	n.a.	*6*
STCPorto	8,35	*4*	0,46 €	*3*	106.927,23 €	*2*	11,39%	*4*

Source: Annual Reports.

The results presented in Table 5 show that the TCBarreiro is the company that is better ranked in terms of the Mobility Rate[1].

Considering the analysis of Revenue Generation indicators, the option to use the operational revenue per passenger derives from the consideration that a company presenting lower operational results per passenger imposes an inferior financial effort to their users, which means that this company will be in better condition to compete with alternative modes of transport (either collective or individual). Contrarily, it is important to clarify that it is also assumed that a lower operational revenue per vehicle represents a worst result for the company. It is apparent from the results, except for the two companies' worst ranked (i.e., TUBraga and MoveAveiro), that there are significant variations in the rankings for these two indicators of revenue generation. Indeed, e.g., CARRIS performs fourth on the Operating Revenue per Passenger, but the ranking improves to first if we consider the Operating Revenue per vehicle; conversely, TCBarreiro falls in the rankings, from first to third, if we move from the Operating Revenue per Passenger to the Operating Revenue per vehicle.

Additionally, the results reveal that TUBraga is clearly the company better positioned regarding the Social Equity criteria, followed by SMTUCoimbra and TCBarreiro.

Moreover, the analysis of Service-Effectiveness may involve the consideration of further indicators, with the aim of exploring each corporation's weakness or strengths, namely: the number of Passengers per km (which may decode the route adequacy to travellers'

[1] However, it is important to note that while the transport companies under control of the local authorities (i.e., the Municipal Services and Municipal owned companies) operate mainly without the competition of alternative (collective) transit systems in their urban networks, the companies owned by the Central Administration (i.e., the ones in the metropolitan areas of Lisbon and Oporto) operate in competition with rail and metropolitan systems.

expectations), the number of Vehicles per km of route length, the Average Network Speed, the Daily Frequency and the average rate of occupancy. The results for this set of indicators are presented in Table 6, below.

Table 6: Other Service-Effectiveness Indicators

Corporation	Passenger per km	*Rank.*	Vehicle per km of route length	*Rank.*	Average Network speed (km/h)	*Rank.*	Daily Frequency	*Rank.*	Overall Occupancy Rate	*Rank.*
MoveAveiro	1,46	*6*	0,25	*6*	n.a.	*6*	15,42	*6*	25,7%	*2*
TUBraga	2,51	*5*	0,49	*4*	19,4	*1*	51,81	*4*	10,0%	*6*
SMTUCoimbra	4,77	*3*	0,26	*5*	17,0	*2*	29,06	*5*	20,3%	*4*
TCBarreiro	6,23	*1*	1,26	*1*	16,7	*4*	157,75	*2*	29,9%	*1*
CARRIS	5,57	*2*	1,20	*2*	14,5	*5*	165,71	*1*	20,4%	*3*
STCPorto	3,77	*4*	0,90	*3*	17,0	*2*	150,68	*3*	17,6%	*5*

Source: Annual Reports.

According to the results presented, it is possible to identify an almost complete homogeneity for the rankings regarding the indicators Vehicles per km of route length and Daily Frequency, which may be interpreted as a sign that the existence of an higher number of vehicles per km of route allows for improved frequency of the service, therefore representing better-quality of the transport service (as it appears to be the case for TCBarreiro and CARRIS). On the other hand, the MoveAveiro company, even if presenting a high rate of occupancy, is the one that presents worse results in the remaining indicators, denoting a reduced number of seats.km when compared with the remaining companies.

3.3 Resource-Effectiveness Indicators

Finally, regarding the Resource-Effectiveness dimension, it is considered the difference between the Operating Revenues (excluding subsidies) and Operating Costs, as well as the difference between the Operating Revenues (excluding subsidies) and total Costs, both per passenger. The 'profitability' associated with the subsidies (granted by the Local administration City councils or by the National Central Administration) is also evaluated, considering an indicator that equates the Operating Revenue per Operating Subsidy.

Table 7: Resource-Effectiveness Indicators

Corporation	Operating Revenue *less* Operating Expense (€), per passenger	*Rank.*	Operating Revenue *less* Total Expense (€), per passenger	*Rank*	Operating Revenue per Operating Subsidy	*Rank.*
MoveAveiro	-1,53€	*6*	-1,60€	*6*	0,98	*6*
TUBraga	-0,42€	*5*	-0,49€	*5*	2,65	*3*
SMTUCoimbra	-0,19€	*3*	-0,19€	*2*	3,85	*2*
TCBarreiro	-0,10€	*1*	-0,10€	*1*	5,04	*1*
CARRIS	-0,16€	*2*	-0,31€	*3*	2,46	*4*
STCPorto	-0,30€	*4*	-0,45€	*4*	1,53	*5*

Source: Annual Reports.

According to the results estimated, all the transport services considered in this study present a situation of deficit. CARRIS and STCPorto are the companies that present greater difference concerning the Euro per passenger regarding the indicators Operating Revenue less Operating Expense and Operating Revenue less Total Expense. These results must be interpreted taking into account the circumstance that these companies have negative results strongly influenced by substantial financial payments (interests from accumulated passives).
Regarding the Operating Revenue per Operating Subsidy, it is important to note that this indicator is calculated adding the subsidies and the deficits (or superhavits). The idea is that this indicator denotes the 'return' generated by each monetary unit granted by Local or Central Administration. Therefore, it is possible to infer that the Municipal Services are the ones that present better performances, while the companies owned by Central Administration (CARRIS and STCPorto) present more modest results. Moreover, it is important to notice that in the cases of CARRIS and STCPorto the value of the subsidy is directly supported by all the tax-payers in Portugal.
The relevance that has been given to the discussion on subsidies justifies the consideration of additional information to complement the one already presented in Table 7, namely to consider the impacts (regarding the services supplied) generated by subsidies. For this, in Table 8, bellow, four additional indicators are considered. The first two had been originally suggested by Karlaftis and McCarthy (1997), and intend to evaluate the Deficit per passenger and per inhabitant. The remaining two indicators consider, respectively, the number of passengers using the service per euro of subsidy given to the company, and the increase that would have to happen in demand, *ceteris paribus*, in order to reach a hypothetical situation of 'dispensable' subsidies.

Table 8: Subsidies' impact in each service company

Corporation	Deficit per Passenger (€)	Rank.	Deficit per inhabitant (€)	Rank.	Passenger per Subsidy	Rank.	Demand's increase required to 'replace' the subsidy	*Rank.*
MoveAveiro	-1,51€	*6*	33,32€	*4*	0,66	*6*	129,87%	*6*
TUB	-0,38€	*4*	24,26€	*2*	2,64	*4*	66,99%	*4*
SMTUCoimbra	-0,15€	*2*	30,34€	*3*	6,74	*2*	41,64%	*2*
TCBarreiro	-0,06€	*1*	17,47€	*1*	15,50	*1*	24,72%	*1*
CARRIS	-0,29€	*3*	56,13€	*6*	3,44	*3*	62,06%	*3*
STCPorto	-0,43€	*5*	42,93 €	*5*	2,33	*5*	92,66%	*5*

Source: Annual Reports.

As can be observed in Table 8, the deficit per passenger differs significantly depending on the company considered. Thus, the TCBarreiro is the one that presents the lower volume of expenses per passenger and per inhabitant. It is noteworthy that while TCBarreiro supports a deficit of 0,06€ per passenger, the MoveAveiro service supports a deficit of 1,51€ (i.e. a value 25 times superior).
On the other hand, regarding the deficit per inhabitant of the urban/metropolitan area enclosed in each transport system, the companies with social capital from Central Administration are those where the values are more significant. Again, it is worth mentioning that these deficits are supported by all the tax payers and not only by the ones inhabiting the respective metropolitan area.

Additionally, it is important to take into account that, e.g., the 33,32€ per inhabitant supported by the Local Administration of Aveiro are associated with substantially different results of the 'analogous' 30,34€ for inhabitants spent by the City Council of Coimbra. Indeed, per each euro invested by the Local Administration, there are 6,74 citizens of Coimbra that opt to use the respective public transport service, while in Aveiro only 0,66 passengers decide to use the public transport system (i.e., the subsidies granted in Coimbra have an impact nearly ten times superior to the ones given in Aveiro). Moreover, the Local Administration of Barreiro is the one that gets the most out of the subsidies, as it is estimated that each Euro is associated with the preference for the public transport system of 15,50 passengers. Again, it is noteworthy that the results of CARRIS and STCPorto regarding this indicator can be considered as poor.

Finally, the last indicator proposed in Table 8 allows the identification of the level of increase in demand that would be required, maintaining current supply characteristics and costs, in order to achieve the balance between revenues and expenses, in case of subsidies' absence. Thus, and consistent with previous results, TCBarreiro will be the company that would need a more modest growth in demand (24,72%), while the Moveaveiro company would need more than double the current demand. It is also significant to emphasize that, apart from TCBarreiro, only the SMTUCoimbra company could achieve a null deficit with the demand of the service growing less than 50%.

4. DISCUSSION AND CONCLUSIONS

Based largely on information published on the management and financial reports, this study highlights the profound differences in the performance of six public capital corporations that provide urban road transport services in Portugal. A set of reflections to contribute to understand the reasons for these discrepancies is proposed. Table 9 below presents a summary of the estimated rankings for the three major dimensions analyzed for each of the six corporations considered.

Table 9: Final Ranking

Corporation	Resource-Efficiency	Service-Effectiveness	Resource-Effectiveness	*Global Ranking*
MoveAVEIRO	6	6	6	*6*
TUBraga	5	5	4	*5*
SMTUCoimbra	3	4	2	*3*
TCBarreiro	1	1	1	*1*
CARRIS	3	2	3	*2*
STCPorto	2	3	5	*4*

According to the results presented in Table 9, the performances of the Municipal owned company MoveAveiro and the Municipal Service TUBraga, are the least satisfactory. The analysis has highlighted significant weaknesses of these companies for the indicators considered. The Daily Frequency estimated to MoveAveiro (an indicator of Service Effectiveness), shows that the network of this company is traveled by bus on average 15.74 times per day, a figure which is well below the 165 times estimated for CARRIS and almost 158 times for TCBarreiro. In short, it is assumed that a good coverage and route frequency

within the network are fundamental conditions for the citizens of a given area realize the advantages offered by the existing mass transit systems.

The TUBraga, although reporting better results in various indicators (namely in what concerns to the Resource-Effectiveness dimension), has a very modest performance in the dimension of Resource-Efficiency, and the high value of Operating Expenses per Passenger greatly influences the estimated figures in terms of Labor-Efficiency and Vehicle-Efficiency per passenger. The number of passengers per employee and passengers by bus is only about one third of that in local administration service TCBarreiro. In turn, considering the Service-Effectiveness dimension, it should be noted that TUBraga has small impact on the corresponding population as illustrated by low values of inhabitants per passenger and Overall Occupancy Rate. In summary, the results show the need to achieve improvements in terms of greater control over costs and, essentially, the nature of service provided.

Companies under supervision of the Ministério das Obras Públicas, Transportes e Comunicações (CARRIS and STCPorto) confirmed reasonable results in terms of Resource-Efficiency and Service-Effectiveness. In fact, only in what concerns to Resource-Effectiveness dimension, the results obtained by these companies should be considered less positive, namely the overall costs indicators. According to our analysis, one can admit that these results are due to the fact these two companies have high levels of indebtedness originating weighty financial costs. Indeed, while the operating costs in SMTUCoimbra, MoveAveiro and TCBarreiro account for more than 97% of total costs, in CARRIS and STCPorto financial costs account for 19% and 14% of total costs (respectively 34 million and 14 million euros).

Finally, the results achieved by municipal services and TCBraga and SMTUCoimbra must be considered as positive, in particular those of TCBraga.

In fact, the high Average Occupancy Rate and the high number of passengers.km indicate the existence of well organized services capable of achieving significant numbers of Passengers per inhabitant per month. For that, it should also be stressed that the TCBraga is the company where average charge per passenger is lower (0.26 €), in spite of presenting also the lowest deficit per passenger (0.06 €).

In turn, the SMTUCoimbra, have equally positive results for a large number of indicators, despite a more modest performance in terms of the Effectiveness Service dimension, including the indicators that weigh the appropriateness of service network (Dairy Frequency and vehicle.km per route).

In conclusion it is important to highlight the conservative nature of the analysis undertaken, and the interpretations offered for the results obtained, having in mind the comparative assessment of the six organizations studied.

To reinforce this study and consolidate their conclusions, one should consider, e.g., the possibility of attaching different weights to different indicators, as well as integrate in the analysis the differences between the territories of influence of these corporations or the long term implications on the type of their inhabitants mobility.

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