Institut de Recerca en Economia Aplicada Regional i Pública
Research Institute of Applied Economics

Document de Treball 2014/18, 25 pàg.
Working Paper 2014/18, 25 pag.

"Public and Private Production in a Mixed Delivery System: Regulation, Competition and Costs"

Germà Bel and Jordi Rosell

Institut de Recerca en Economia Aplicada | *Research Institute of Applied Economics*

IREA
Institut de Recerca en Economia Aplicada Regional i Pública
Research Institute of Applied Economics
Universitat de Barcelona
Av. Diagonal, 690 • 08034 Barcelona

WEBSITE: www.ub.edu/irea/ • CONTACT: irea@ub.edu

The Research Institute of Applied Economics (IREA) in Barcelona was founded in 2005, as a research institute in applied economics. Three consolidated research groups make up the institute: AQR, RISK and GiM, and a large number of members are involved in the Institute. IREA focuses on four priority lines of investigation: (i) the quantitative study of regional and urban economic activity and analysis of regional and local economic policies, (ii) study of public economic activity in markets, particularly in the fields of empirical evaluation of privatization, the regulation and competition in the markets of public services using state of industrial economy, (iii) risk analysis in finance and insurance, and (iv) the development of micro and macro econometrics applied for the analysis of economic activity, particularly for quantitative evaluation of public policies.

IREA Working Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. For that reason, IREA Working Papers may not be reproduced or distributed without the written consent of the author. A revised version may be available directly from the author.

Any opinions expressed here are those of the author(s) and not those of IREA. Research published in this series may include views on policy, but the institute itself takes no institutional policy positions.

Abstract

Academics and policy makers are increasingly shifting the debate concerning the best form of public service provision beyond the traditional dilemma between pure public and pure private delivery modes, because, among other reasons, there is a growing body of evidence that casts doubt on the existence of systematic cost savings from privatization, while any competition seems to be eroded over time. In this paper we compare the relative merits of public and private delivery within a mixed delivery system. We study the role played by ownership, transaction costs, and competition on local public service delivery within the same jurisdiction. Using a stochastic cost frontier, we analyze the public-private urban bus system in the Barcelona Metropolitan Area. Our results suggest that private firms tendering the service have higher delivery costs than those incurred by the public firm, especially when transaction costs are taken into account. Tenders, therefore, do not help to reduce delivery costs. Our results suggest that under a mixed delivery scheme, which permits the co-existence of public and private production, the metropolitan government and the regulator can use private delivery to contain costs in the public firm and, at the same time, benefit from the greater flexibility of private firms for dealing with events not provided for under contract.

JEL classification: H0, H7, K00, L33
Keywords: costs, transaction costs, mixed delivery, local governments.

Germà Bel: GiM-IREA, Department of Economic Policy. University of Barcelona, Barcelona (08034), Spain. gbel@ub.edu Av. Diagonal, 690. 08034 Barcelona (Spain) Tel: (+34)-934021946. Fax: (+34)-934024573 www.ub.edu/graap/beling.htm

Jordi Rosell: GiM-IREA, Department of Economic Policy. University of Barcelona. Barcelona (08034), Spain. jrosell@ub.edu Av. Diagonal, 690. 08034 Barcelona (Spain). Tel: (+34)-934021946. Fax: (+34)-934024573

Acknowledgements

This research received support from the Spanish Government - project ECO2012-38004-, and the Regional Government of Catalonia - project SGR2014-325. Germà Bel acknowledges support from ICREA-Academia. Jordi Rosell acknowledges support from Societat Econòmica Barcelonesa Amics del País. Comments and suggestions received by Pelayo González when the paper was presented at the XXI Encuentro de Economía Pública in Girona have been very helpful. We are thankful to Transport Metropolitans de Barcelona, particularly to Joaquim Forn, Cinto Soler and Gabriel Sansa, and also to Pelayo Martínez, Maria Teresa Carrillo and Eduard Unzeta (Metropolitan Transport Area -AMB) for providing information to carry out our empirical analysis.

1. INTRODUCTION

Local governments in many developed countries have introduced competition and private delivery in the production of their public services, including local transportation provision. This has given rise to much discussion among both policy makers and scholars as they examine the relative merits of pure public and pure private forms of delivery. In this debate, a growing body of evidence seems casts doubts on the existence of systematic and sustainable cost savings over time attributable to privatization (Bel and Warner, 2008; Bel et al., 2010), owing primarily to competition failure and the high transaction costs incurred when contracting out.

The role of the spatial dimension of competition in the provision of local public services was first taken into consideration in the seminal studies of Warner and Hefetz (2002, 2003), who show that different geographical areas (e.g., rural vs. urban) are characterized by differences in the respective availability of private vendors and so offer dissimilar prospects for competition. Indeed, the geographical area seems to be a critical determinant of the level of market competition. Bel and Fageda (2011), for example, report that the number of firms bidding for contracts in smaller cities is lower than that in larger cities. In the same vein, Girth et al. (2012) find a positive correlation between the choice of delivery form and the level of competition in metro core areas. They also obtain interesting qualitative results on the dynamics of government "relational contracting": regulators tend to devote more time and resources in building and sustaining competition and so a low level of competition tends to add to transaction costs.

Transaction costs are a key issue in the debate concerning potential cost savings from privatization, and have become a regular focus in the literature on public service privatization since the seminal studies of Sappington and Stiglitz (1987) and Williamson (1991, 1999). Contracting procedures are costly, as are the monitoring and supervision of contracted services. Brown and Potoski (2003, 2005) show that transaction costs have a marked influence on the privatization of local services, and identify the importance of two dimensions related to transaction costs: asset specificity and ease of measurement. Contracting agencies may underestimate the costs of the overall process as transaction costs are often excluded from the analysis. The role of transaction costs has also been examined in studies of the contracting out of transportation services (Croissant et al., 2013). However, to date, transaction costs have received very little attention in the empirical analysis of the advantages of competitive tendering as the main alternative to deregulated regimes (Van de Velde and Beck, 2011).

Owing to a lack of systematic cost savings from privatization, scholarly analyses have shown a growing interest in alternative forms of service delivery that break with the traditional dichotomy between pure public and pure private production (Bel et al., 2014). Among these alternative production forms, the mixed delivery of public services is particularly interesting. In a mixed delivery system, pure public and pure private firms provide a service within one local jurisdiction,[1] and regulators can compare the firms' respective production processes and costs, while retaining direct involvement in service delivery (Miranda and Lerner 1995). Mixed delivery allows a government to divide its jurisdiction in several areas, with pure public delivery being used in one or more areas and pure private production in other district(s) within the same jurisdiction (Warner and Bel, 2008). Miranda and Lerner (1995) claim that this 'redundancy' or duplication in delivery methods may in fact be efficient, as a form of benchmarking with the

[1] Note mixed delivery differs from a mixed firm. In the latter case, the government and private partners share ownership of a firm, which is typically granted the monopolistic provision of services in the local jurisdiction. See Cruz et al. (2014) for a recent review of local mixed firms.

private sector, and as a means of promoting bureaucratic competition in house. As such, mixed delivery can promote competition by means of introducing competitive pressures on public firms, i.e., by disciplining public managers and labor unions (Hatry, 1999), and by preventing private firm monopolization. The rise in mixed forms of delivery reflects a continuing process of change and innovation at the local government level that combines the benefits of both market and public delivery (Warner and Hefetz, 2008; Hefetz et al., 2014): private firms are interested in profit, efficiency and control; the public sector is also interested in efficiency, but it is also expected to provide failsafe delivery and a higher level of public accountability and involvement.

While mixed delivery is relatively frequent in local services such as solid waste, it is much more rare in that of local bus transit. The aim of this paper is to analyze a mixed delivery local transportation service, and – specifically – to compare the costs of the public and private firms delivering bus services within the same local jurisdiction. Additionally, we take into consideration the transaction costs incurred when contracting out to private firms, which allows us to refine our analysis of the cost comparison. In order to do so, we focus on the Barcelona Metropolitan Area bus system, which is a notable case among the relatively few examples of the mixed delivery of local transportation. The advantage of analyzing different firms within a single jurisdiction as opposed to studies elsewhere that draw comparisons between different cities (or even different countries) is that we do not need to rely on the assumption of homogeneity of regulators and spatial homogeneity.

In short, this paper makes two major contributions to the literature. First, we analyze cost differences between public and private firms under a mixed delivery regime. Second, we include the regulator's transaction costs (contracting procedures plus monitoring and supervision of contracted services) in the cost comparison, which allows us to refine the cost analysis for different types of service delivery.

This paper is organized in five sections. First, we briefly review the empirical evidence reported to date on local bus cost analyses, with a particular focus on the comparison of public and private provisions. Second, we describe the local bus sector in the Barcelona Metropolitan Area, including the regulatory institutions and the firms operating within the jurisdiction. Next, we present the main elements in our empirical strategy: data and model. Then we report our empirical results and discuss their implications. Finally, we conclude.

2 PUBLIC AND PRIVATE DELIVERY OF LOCAL BUS SERVICES: EMPIRICAL EVIDENCE

In recent decades many countries have initiated the private delivery of bus transportation systems, above all in the wake of the far-reaching privatization reform in this sector implemented in the United Kingdom in the 1980s. Early studies of the impact of privatization have typically reported cost savings and greater efficiency with private delivery, for example, in the UK (Savage, 1993; White, 1997), New Zealand and Chile (Lee and Rivasplata, 2001), and Switzerland (Filippini and Prioni, 2003). Empirical analyses dedicated to urban bus systems report U-shaped average cost functions. In other words, as suggested earlier by Berechman (1993), economies of scale become constant or even revert to decreasing returns to scale as companies grow in size (Jørgensen et al., 1997 and Matas and Raymond, 1999). This is an important outcome for the management of local bus systems, since it implies that in large cities the service can be fragmented between different firms without foregoing any of the potential benefits from economies of scale.

The existence of scale economies allows several concessions to be created in large cities where private operators compete for the market. Before the present century, no studies had been undertaken that controlled for such competition. Leland and Smirnova (2009) compared the evolution in efficiency and effectiveness of US urban bus services, taking as their reference Perry and Babitsky's (1986) earlier work, and found that privately owned and managed transit systems were no longer more efficient and effective providers than government owned agencies. They identified the lack of competition between contractors and higher transaction costs as factors. However, both studies concluded that general-purpose governments that contract out services are more efficient and effective than special-purpose governments.

The market for bus services is imperfectly contestable (Mackie et al., 1995): competitors may enter the market when the incumbent is inefficient, when the incumbent is efficient but weak enough to be replaced or simply because the incumbent is over-optimistic; incumbents, for their part, may deter entry by tightly controlling costs and by not leaving any profitable gaps in the service. Moreover, incumbents are better informed than potential entrants with regard to assets, quality, and demand. In their study of service measurability and asset specificity of local public services, Brown and Potoski (2005) examined operation and maintenance costs and ranked bus systems 27th out of 64 services in terms of service measurability (the lower the ranking, the easier it is to measure the service), and 39th out of 64 in terms of asset specificity (the lower the ranking, the lower the specificity). However, asset specificity might not represent such a great problem to the bus sector as buses are not a sunk cost (given that they can be sold on the used vehicle market) or, alternatively, they can be transferred to other services. Furthermore, provision by the government of buses and of bus depots can also help to mitigate asset specificity, thus increasing market contestability. All in all, Girth et al. (2012) classify bus systems as lying somewhere between monopoly and low competition services.

The most common means of introducing competition in the provision of urban bus services is through competitive tendering[2]. The evidence provided by stochastic frontier studies in favor of private sector delivery should be weighed against the fact that almost none of these studies controls for the degree of competition and the nature of government (De Borger et al., 2002). Roy and Yvrande-Billon (2007) find that private operators selected through competitive tendering are more efficient than public operators, but they do not measure the impact of the contests. Using a stochastic production frontier for 135 urban transport networks, they find only marginal gains on technical efficiency from regulatory changes that involve a shift to delegated management and high-powered incentive regulatory contracts. A trans-European study finds that public firms are less productive than private ones, and firms selected through competitive tendering are more productive (Boitani et al., 2013). However, the most telling result is that during the second round in the tendering process (some years after the first), an increase in the gross cost is found in most countries. Not only are there no cost savings, but there is also some deterioration in the quality of the service provided, especially when the incumbent is replaced by a new entrant (Mouwen and Rietveld, 2013).

Falls in the number of bidders and in bus market concentration have been described in Sweden (Alexandersson et al., 1998), France (Yvrande-Billon, 2006) and Norway (Mathisen and Solvoll, 2008), among others. This situation is paralleled in Italy, where moreover the incumbent operator

[2] Here, several studies have focused solely on regional services or on mixed urban/regional services (see, for example, Fazioli et al., 1994, Ottoz et al., 2009 and Cambini et al., 2011) and are not directly applicable to our study.

tends to win the majority of tender processes (Boitani and Cambini, 2006)[3]. Hensher and Wallis (2005) express a concern that tendering is open to regulatory capture by powerful monopolist bus providers. It is clear that the relationship between buyer and vendor evolves over time, and that the dependence of one party on the other grows. Local governments tend to place greater trust in the faithfulness and honesty of their vendors when the latter party has a known reputation from prior to the relationship, strong community ties, and performs its tasks well (Lamothe and Lamothe, 2012). Thus, welfare gains from extending contract length can be significant but accrue mostly to operators (Gagnepain et al., 2014)

Putting this relationship out to tender, in a process that attracts few bidders and involves complex contracts and incompleteness may not be the best solution if compared to negotiated performance-based contracts (Hensher and Stanley, 2008). Hensher (2014) concludes that the gains from competitive tendering are generally illusory or overstated (outside the situation of an incumbent public firm):

> "While noting that many governments suggest that competitive tendering ensures transparency, our experience with the practice of competitive tendering does not ensure such a claim is necessarily valid, for often the details of tender review and assessment are rarely published, and claims of cost savings have been known to be fabricated."

The next step therefore is to consider the role that can be played by a public operator when compared to that of private firms in the competitive tendering vs. negotiated performance-based contracts debate.

3. THE BARCELONA METROPOLITAN BUS SYSTEM: REGULATORS AND OPERATING COMPANIES

The provision of public transport in the Barcelona Metropolitan Area has remained largely stable over recent decades. Local bus transit in the metropolitan area is provided under a mixed delivery system, in which one public and several private firms supply the service in different areas under the supervision of a regulator.

The *Entitat Metropolitana del Transport* (EMT) is the regulator, and is responsible for regulating local bus transit in the city of Barcelona and the towns in its metropolitan area. The EMT defines the characteristics of the service offered by the concessionaires, establishes network routes, draws up bus schedules, defines quality levels, organizes the tenders, and covers the deficits run up by the private firms[4] (Albalate et al., 2012). EMT has considerable experience as a management contractor and has been tendering services since the 1990s. Private companies can operate services by means of competitive tendering contracts (net-cost contracts) or negotiated performance-based contracts (gross-cost contracts), both with quality incentives. The EMT is the owner of bus fleets and bus depots, and provides vehicles and facilities to the operating companies.

The publicly owned firm *Transports Metropolitans de Barcelona* (TMB) operates 106 lines, and in 2012 it carried around 174 million passengers. The number of passengers has remained stable

[3] In Germany there is an incumbent renewal rate of 74% and an average of more than five bidders per tender (Beck and Walter, 2013).

[4] Another public agency, *Autoritat Metropolitana del Transport* (ATM) is responsible for setting fares for all transport modes. Since 2001 an integrated fare policy exists for all public transport supply (including buses) with the exception of the airport shuttle bus and the city tour bus.

since 1980, as several lines formerly operated by TMB have been privatized, and the metropolitan subway network has also been expanded. Correspondingly, supply has also remained quite stable: TMB offered 3,182 million seats-km in 2012, just a little above the 3,050 million seats-km supplied on 1989. TMB has not participated in any tender process in the Barcelona Metropolitan Area. However, in 2011 a joint venture group formed by TMB and Vectalia (a private group based in Valencia) was awarded the provision of public transport in the Perpignan Méditerranée Metropolitan Area (France). TMB enjoys freedom to design and plan its own services, and is not subject to a concession contract with the EMT. As such, TMB can be described as a *corporatized* company, enjoying greater managerial flexibility than that typically enjoyed by a traditional bureaucratic organization.

Several of the private concessions overlap with the TMB delivery area as both connect Barcelona (including downtown) with the surrounding municipalities and operate in the surrounding municipalities. The difference is that only TMB operates the intra-city routes. Bus services operated by private firms under competitive contracts represent 81% of the EMT's total passengers (excluding TMB).[5] Private concessionaires operate under net-cost contracts, with vehicle and depot facilities being supplied by the EMT. Tender concessions follow a net-cost contract scheme or a minimum subsidy: firms receive a subsidy from the EMT that is equal to the difference between the expected revenues from passengers and the bidding cost. Private operators enjoy far less managerial autonomy than TMB. The average concession length is five years, with the possibility of an extension (average length of extensions is three years).

The first tendering process took place in 1998, and Table 1 shows all the tendering processes implemented up to and including 2012, and which are considered in our analysis.[6] The number of firms bidding to obtain a concession has varied from between two and five, but the incumbent firm has yet to be removed by a new entrant (even in the first process). In seven of the eight tenders, the incumbent did not offer the lowest price (required subsidy). This only ever occurred in 2008 in the case of the west concession awarded to Soler i Sauret. The weight of the financial proposal represents between 25 and 30% of the total valuation of the bid. Greater weighting is attached to characteristics of the bids other than the financial proposal (required subsidy), including experience in the sector, expected ridership, or staff and equipment used. As a result, incumbents almost always obtain higher valuations in the non-financial aspects of the bid, which allows them to retain the contract.

[5] Our analysis focuses on net-cost contracts as gross-cost contracts are subject to a different fares policy, and more especially because data are scarce with firms not being required to report data to the regulator. Additionally, most lines operated under gross-cost contracts lie some distance from the city of Barcelona. The airport route, under competitive tendering, has been excluded for the same reason.

[6] A more recent tender took place in 2013, but it is not included here, as the new contract did not come into operation until January 2014. However, the incumbent retained the service.

Table 1: Bus concessions in the Barcelona Metropolitan Area

	Concession area	Winner (Group)	Tender date	Number of bidders	Winner lowest price?
Competitive tendering	Barcelonès Nord	Tusgsal	1998	4	No
		Tusgsal	2010	2	No
	Barcelonès Nord (Night)	Tusgsal	1998	4	No
		Tusgsal	2006	3	No
	Hospitalet de Llobregat	Rosanbus (Baixbus)	2001	5	No
		Rosanbus (Baixbus)	2011	5	No
	West Barcelona	Soler Sauret	1998	4	No
		Soler Sauret	2008	3	Yes
Negotiated performance-based contracts	U1	Mohn (Baixbus)			
	U2	Oliveras (Baixbus)			
	Barcelona South Coast	Mohn (Baixbus)			
	West Barcelona (Night)	Mohn (Baixbus)			

Source: Based on documentation from the tendering processes.

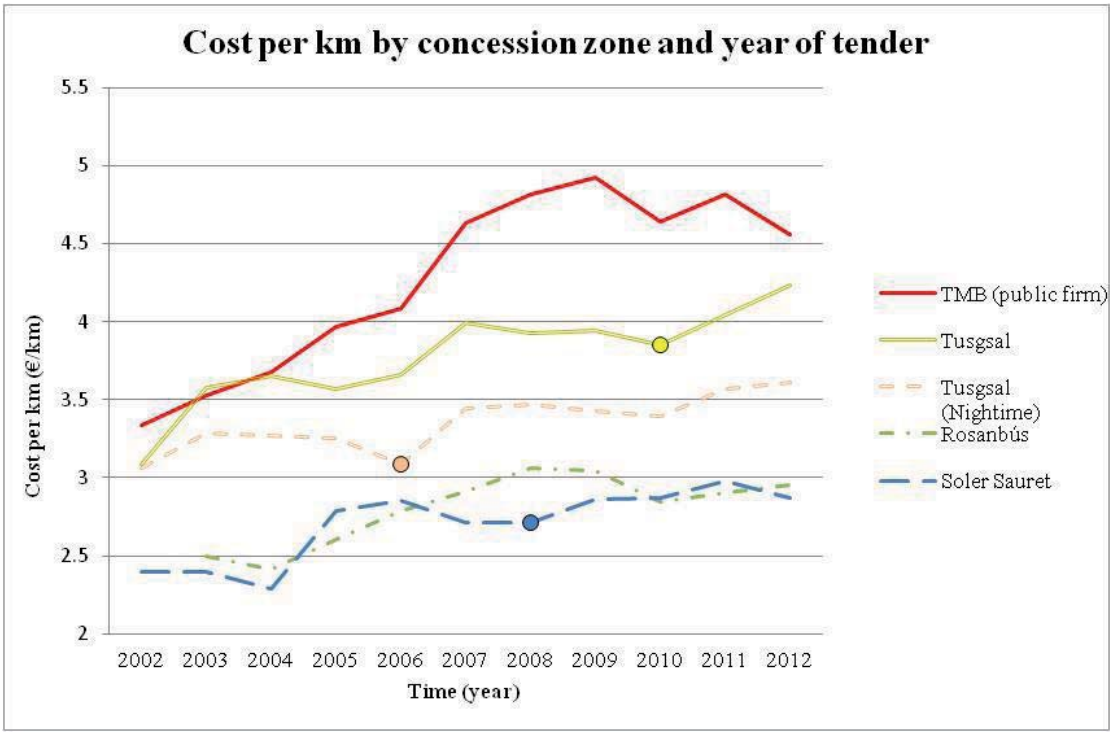
The majority of private firms offering services operate according to the concession awarded in the corresponding tendering process. A small number of firms concentrate the market for tendered services, even though there were several bidders in the contests. It is worth noting that no "outsiders" (that is to say, firms or groups based outside the Barcelona Metropolitan Area) has ever won a tender, even when requesting the lowest subsidy (lowest contract price). This points to the existence of relational considerations and/or rent-seeking costs, that is, the regulator has incentives to avoid changing the firm because the day-to-day relationship would change. For example, unexpected changes not provided for in the contract might be harder to implement. A further possibility is that the regulator expects the incumbent to provide a higher quality service and thus prefers to maintain the contractual partner.

The Catalan external auditor has analyzed three concession areas: the Barcelonès Nord day and night concessions and L'Hospitalet de Llobregat. The Barcelonès Nord day concession was modified various times between 1999 and 2006: 32 modifications involved lines and schedules, four involved general contract clauses, and two operational cost clauses, among others. In 1999, Tusgsal operated 17 lines in this zone and covered 6.6 million annual vehicle-kilometers. By 2008, the number of lines had risen to 30, and the company covered 10.1 million annual vehicle-kilometers. The net yearly hours increased by 80% in this concession period. The Barcelonès Nord night concession experienced an increase of 36.4% in its expected annual vehicle-kilometers. The contest was controversial, not only because several entrants were disqualified and economic proposals were changed by the regulator, but also because the public firm TMB was not allowed to bid, as officials from this public company were also members of the regulator. Finally, in the case of the L'Hospitalet de Llobregat concession, the contract was modified several times between 2002 and 2008: 16 modifications involved lines and schedules and one involved operational cost clauses, among others. In 2002, Rosanbus operated seven lines in this zone and covered 2.2 million annual vehicle-kilometers. By 2008, the number of lines had increased to ten, and the annual vehicle-kilometers had increased to 2.9 million. Table 1 also includes the negotiated

performance based-contracts. All these contracts are held by the same metropolitan based firms/group.

Figure 1 shows the evolution in cost per kilometer over time, for several concessions under tender. A dot on the line indicates the year in which the tender process took place (the new contract coming into force the following year). An initial inspection of the data shows that no cost reductions occurred in the years immediately following the bidding processes in the Barcelona Metropolitan Area.

Figure 1 Temporal evolution in the cost per km by concession zone and year of tender



4. EMPIRICAL STRATEGY

a. Data

The data set is an unbalanced panel for the period 2002-2012, comprising 378 observations and four companies, one of them fully publicly-owned (TMB) and the other three completely private. The data are provided by the public bus company (TMB) and the regulator (EMT), the latter providing data for the private firms. The year 2002 is the first year after the integrated fare policy was introduced.

We choose private bus lines that connect Barcelona with neighboring towns and urban lines in surrounding towns in areas under concession. We exclude lines that run parallel to motorways or high capacity roads, since the characteristics of these lines are not similar to those operated by the public company TMB. We choose all TMB lines that connect Barcelona with neighboring towns, as well as lines within the municipality of Barcelona but at some distance from downtown Barcelona. We exclude all night routes because they differ markedly from day routes in terms of wages, average speed, network length, etc.

Figure 2 shows our study area. The municipalities are represented by polygons, the largest of which is Barcelona, with a length of 9 km and a width of 8 km. The solid lines represent public bus routes and the broken lines represent those operated by private concessionaires. The three private companies operate in three different geographical areas: the northern area is operated by Tusgsal, the western by Soler i Sauret, and the southern by Rosanbus. It is worth noting that the various lines overlap, and even though the concession areas are different, they are sufficiently similar to be compared.

Table 2 reports summary statistics for the concessionaire firms included in the analysis. The available information includes – for each concession – the number of lines analyzed, the line length, the number of passengers carried, the number of vehicles, the number of employees, and the cost and revenue per net km (thus, not taking into account trips without passengers from and to depots; 'per km' hereafter), among others. The main differences between the concessionaires concern the number of lines analyzed, the number of passengers carried, the number of vehicles and the costs, total costs and the cost per km covered.

More than half the lines analyzed are publicly managed, while the others are distributed among the three private companies. Differences also occur between the public and private companies in terms of the cost per km, the number of passengers carried and the number of kilometers covered. Given the similarity in line length, it is clear that TMB has a higher bus frequency than that operated by the private companies. The public company also carries more passengers. However, some private companies employ a larger workforce than that employed by TMB relative to the number of kilometers covered. A further difference is the age of the fleet: the fleet renewal rate of the public company is much lower than that of the main private operators. In this regard, TMB has its own purchasing policy, while the EMT purchases the private bus fleet. Additionally, the number of employees is higher and significantly different in the public company compared to the private firms. There are marked differences in costs: the public company is the most expensive firm by line, but when we compare the total costs by km covered, it is not the most expensive. The transaction costs for the private lines remain constant each year. However, these costs can represent between 3.5 and 14% of their total costs.

Figure 2. Public and private bus lines in our study area

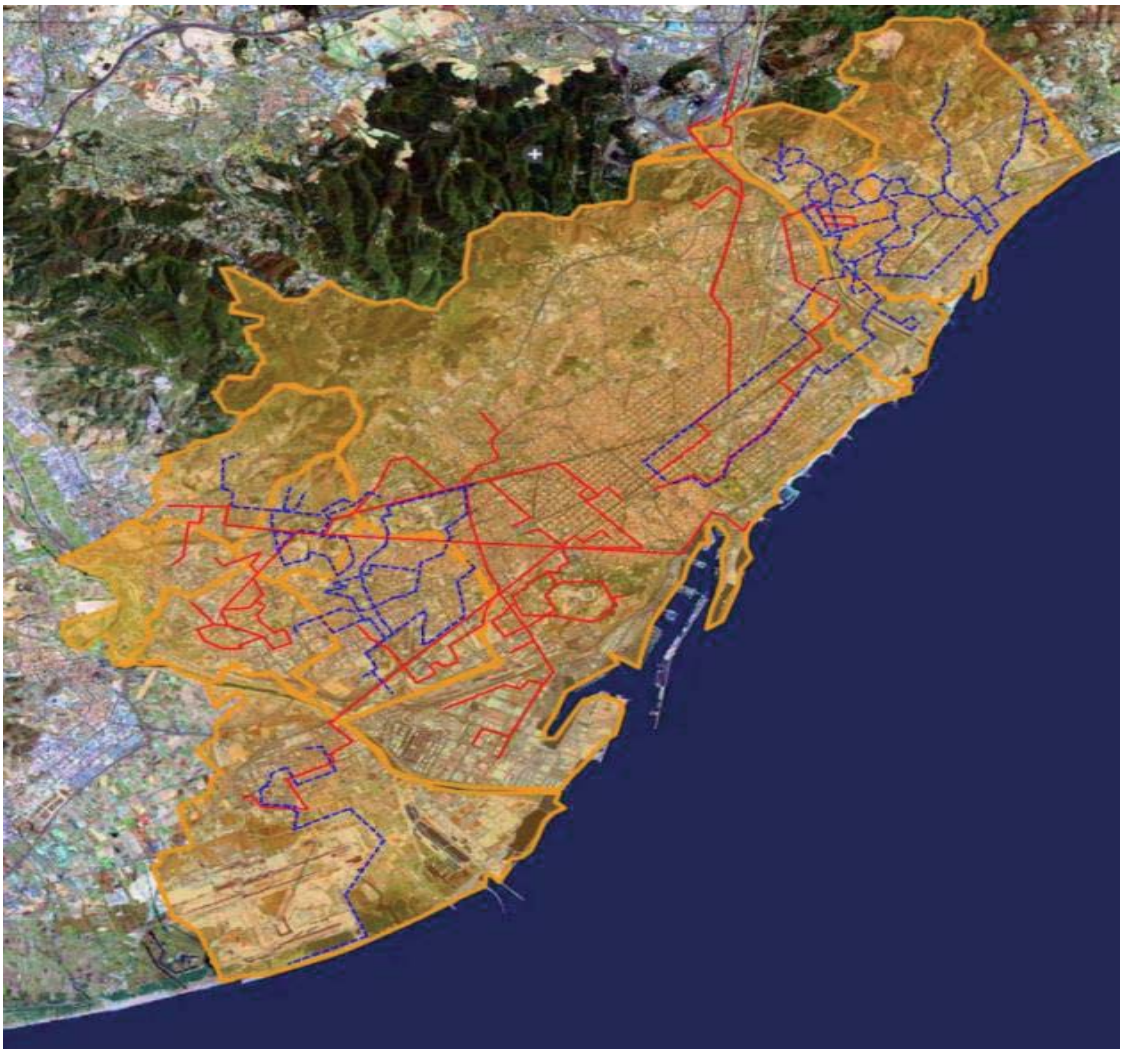


Table 2: Mean (standard error) based on 378 bus line observations (2002-2012)

	Concessionaires			
	TMB	Barcelonès Nord (Tusgsal)	Hospitalet de Llobregat (Rosanbus)	West Barcelona (Soler Sauret)
Average speed (km/h)	12.91 (0.147)	10.72 (0.203)	12.604 (0.307)	12.58 (0.408)
Length line (km)	10.454 (0.223)	8.576 (0.496)	11.396 (0.82)	10.308 (0.364)
Net km (km)	430,924 (13337.5)	293,336 (20,762.6)	306,643 (19,145.1)	123,505(10,751.1)
Vehicles	10.96 (0.343)	5.48 (0.399)	6.155 (0.392)	2.63 (0.176)
Bus age (years)	6.49 (0.04)	4.47 (0.05)	5.02 (0.09)	6.23 (0.29)
Employees	32.0 (1.05)	27.02 (1.46)	16.59 (1.28)	6.25 (0.5)
Passengers	1,569,978 (69639)	883,722 (61,527)	1,129,646 (121,391)	176,540 (20,299)
Cost per net km	4.10 (0.059)	5.13 (0.116)	3.85 (0.131)	3.33 (0.183)
Revenues per net km	1.62 (0.04)	1.47 (0.06)	1.55 (0.13)	0.59 (0.04)
Total costs (€)	1,784,709 (62,653)	1,391,206 (78,470)	1,073,187 (76,330)	379,854.4 (44,492)
Transaction costs (€)	0	52,217.17 (971.9)	51,435.91 (1389.95)	51,172.17 (2556.0)
Analyzed lines	21	9.4	5.4	1.6

b. The model

A firm converts inputs into output. Thus, a bus company uses employees as labor force, fuel and other materials to obtain energy, and rolling stock as capital. The purpose is to cover kilometers and transport passengers, assuming total costs to be a function of input and output prices. When data are comparable and consistent over time, the most functional form found in the literature is a translog cost function (Coelli, 2003). The translog cost function, initially proposed by Viton (1981), considers cost as a function of input prices and the production level. We use an approximation of the translog cost function as used previously by Matas and Raymond (1998), Fraquelli et al. (2004), and Ottoz et al. (2009). This flexible functional form is a second-order logarithmic approximation to any arbitrary twice-differentiable cost function. We assume that input prices and output are exogenous. We assume that the cost function is the result of cost minimization given input prices and output. Therefore, it should satisfy concavity in input prices and monotonicity in input prices and output. Based on the literature, we specify the following cost function:

$$\mathrm{TC}_{it} = f(Y_{it}, PL_{it}, PC_{it}, PM_{it}, N_{it}) \tag{1}$$

where the total cost of an urban bus firm *TC* is assumed to be a function of output *Y*, factor prices *P* (labor *L*, material and energy *M*, and capital *C*) and the network N (length line and commercial average speed). As a result, the cost function equation to be estimated can be expressed in the following double log form:

$$\begin{aligned}\ln \mathrm{TC}_{it} = {} & \beta_0 + \beta_Y \ln Y_{it} + \beta_N \ln N_{it} + \beta_{SP} \ln \mathrm{SP}_{it} \ \tfrac{1}{2}\beta_{Y'}(\ln Y_{it})^2 + \tfrac{1}{2}\beta_{N'}(\ln N_{it})^2 + \tfrac{1}{2}\beta_{SP'}(\ln \mathrm{SP}_{it})^2 + \\ & \beta_{YN} \ln Y_{it} \ln N_{it} + \beta_{YSP} \ln Y_{it} \ln \mathrm{SP}_{it} + \beta_{NSP} \ln N_{it} \ln \mathrm{SP}_{it} + \beta_{PL} \ln \mathrm{PL}_{it} + \beta_{PC} \ln \mathrm{PC}_{it} + \\ & \tfrac{1}{2}\beta_{PLPL}(\ln \mathrm{PL}_{it})^2 \ + \tfrac{1}{2}\beta_{PCPC}(\ln \mathrm{PC}_{it})^2 + \beta_{YPL} \ln Y_{it} \ln \mathrm{PL}_{it} + \beta_{YPC} \ln Y_{it} \ln \mathrm{PC}_{it} + \beta_{NPL} \ln N_{it} \ln \mathrm{PL}_{it} + \\ & \beta_{NPC} \ln N_{it} \ln \mathrm{PC}_{it} + \beta_{SPPL} \ln \mathrm{SP}_{it} \ln \mathrm{PL}_{it} + \beta_{SPPC} \ln \mathrm{SP}_{it} \ln \mathrm{PC}_{it} + \beta_{PLPC} \ln \mathrm{PL}_{it} \ln \mathrm{PC}_{it} + \\ & \beta_{YT} \mathrm{Tender\_year}_{it} + \beta_{OW} \mathrm{Private}_i + \beta_{CON} \mathrm{Concession}_i + \beta_{BCN} \mathrm{Barcelona}_i + \beta_{MET} \mathrm{Metro}_{it} + \\ & \beta_{MUN} \mathrm{Municipality}_{it} + \upsilon_{it} + u_{it}\end{aligned} \tag{2}$$

with $i = 1, 2, \ldots, 42$ *and* $t = 2002, 2003, \ldots, 2012$

where subscripts *i* and *t* denote the line and year respectively. Linear homogeneity in input prices is imposed by dividing total costs and input prices by material and energy price. U_{it} follows a truncated normal distribution $N^+(\mu, \sigma^2)$. To begin with, we use a specification in which the error term is uncorrelated with the explanatory variables and is assumed to be constant over time $(t = T_i)$.[7]

$$u_{it} \equiv exp\{-\eta(t - T_i)\}u_i \tag{3}$$

[7] The other specification involves considering time-variation inefficiency, as described by Battese and Coelli (1995), where η is the decay parameter.

The actors affected by transaction costs are the private firms and the regulator. Private companies need to devote some of their time to preparing their tender bid and to relating with the regulator if they win the contest. The regulator needs to organize the tender process and monitor the private winner during the period of concession. However, most of the regulator's budget is paid for by the taxpayers, and there is no specific transfer of the regulator's cost to the private firm's services. While some earlier studies take into account the intra-firm administration costs, our paper is the first – to the best of our knowledge – to consider the regulator's transaction costs. Thus, allocating regulator costs equally to all private lines allows us to undertake a more refined and robust cost comparison.[8]

c. Variables

The cost function includes three inputs, one output and several other variables.

TC: The *total cost* is the dependent variable, and includes labor, fuel, maintenance, bus fleet, and other indirect costs (such as administration and coordination costs at the firm level, both for public and private firms). We evaluate these costs in two different scenarios, depending on whether we include transaction costs, or not. The transaction cost is the regulator's total budget, and we distribute it equally between each private line.

Y: The *output* variable is *vehicle·kilometers*, a supply-related measure. Seat-kilometers would have been another suitable measure, but we have no data here for private companies.[9] The three inputs and output are expected to have a positive sign.

N: *Line length* is a network characteristic that influences total costs. This variable can serve as a proxy for exogenous characteristics such as public service obligations. Expectations regarding the effects of *line length* on costs are ambiguous. On the one hand, longer lines involve more output, and hence higher costs; on the other, longer lines probably operate more frequently outside of the downtown area, and hence are associated with higher speeds.

SP: Network *average speed* is a typical indicator. If a trip is covered in a shorter time, fewer vehicles and less labor force are required. Therefore, costs are expected to decrease with increasing network speed.

PL: The *price of labor* is given by the ratio of total salary expenses to the total number of hours worked. Costs should increase with the price of labor.

PM: The *price of material* is obtained by dividing fuel and maintenance material costs by net kilometers covered. Costs should increase with the price of materials.

PC: The *price of capital* is given by the ratio of vehicle costs to the number of vehicles. The cost is expected to increase with the price of capital.

[8] Recall that EMT's costs are not allocated to TMB lines, because the EMT does not regulate TMB and does not undertake any other functional activity with respect to TMB.

[9] We choose a supply-related measure as opposed to a demand-related indicator (such as the number of passengers or passenger-km) as supply-related measures vary with inputs.

Tender Year: This dummy variable takes a value of 1 for the year immediately following a tender process held (that is, the year in which the new concession terms are applied). The new contracts come into force on January 1, even though the contest has been celebrated in the previous year. If tenders were cost-minimizing artifacts, costs should decrease following a tender process.

Private: This binary variable takes a value of 1 if the line is operated by a private company, and 0 if it is operated by the public company TMB. Most empirical evidence for bus services indicates that private companies incur lower costs, but this evidence is not systematic across other local service sectors, such as solid waste and water.

Concession dummies: A dummy that clusters the same concession's bus lines up to a total of four.

Time dummies: Time dummies seek to capture the temporal effects of each year on all lines.

Barcelona (BCN): This dummy variable takes a value of 1 if the whole bus line is within the municipality of Barcelona, and 0 otherwise. In this way we control for the effect of the city of Barcelona on the cost function.

Municipality (MUN): This dummy takes a value of 1 if the bus route is within the same municipality (but outside Barcelona), and 0 otherwise.

Metro (MET): This dummy variable takes a value of 1 if the bus line is affected by the new metropolitan subway lines opened in 2010, and 0 otherwise.

RESULTS

We estimate the model by applying OLS to equation 2 (Table 3). For concession dummies we take as our reference TMB. Since all variables are expressed in logarithms (with the exception of the dummy variables), the coefficients can be interpreted as elasticities. The original values of the monetary variables are deflated by a price index. The explanatory capacity of the estimations is high (γ ranges between 0.87 and 0.99).

Half of the specifications are estimated with the dependent variable (total cost) without including the transaction costs (left-hand columns), while the other half include the transaction costs (right-hand columns). Overall no significant differences were found when using either one or other of the alternative specifications for the dependent variable, with the exception of the costs of private companies, to which we return later.

Table 3: Total-cost parameter estimates with time invariant inefficiency term (standard errors in parentheses)

Significance levels: * 10 per cent; ** 5 per cent; *** 1 per cent

	Without transaction costs			*With transaction costs*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
β_Y	0.632***	0.601***	0.577***	0.460***	0.466***	0.397***
	(0.0922)	(0.0103)	(0.0855)	(0.0913)	(0.081)	(0.0804)
β_N	0.189	0.085	0.233	-0.124	-0.278	0.157
	(0.3139)	(0.2795)	(0.281)	(0.3021)	(0.279)	(0.2762)
β_{SP}	-1.056**	-0.954**	-0.885**	-1.099***	-0.954**	-0.824**
	(0.419)	(0.3909)	(0.373)	(0.4129)	(0.381)	(0.3724)
β_{PL}	0.667**	0.502	0.396	0.546*	0.613*	0.497
	(0.3372)	(0.3281)	(0.3205)	(0.3225)	(0.3143)	(0.3131)
β_{PC}	-0.471***	-0.448***	-0.432***	-0.433***	-0.504***	-0.464***
	(0.10793)	(0.1063)	(0.107)	(0.1026)	(0.0883)	(0.085)
Tender year		0.014	0.017		-0.004	-0.001
		(0.0102)	(0.0101)		(0.0099)	(0.0099)
Private		0.07***			0.1283***	
		(0.0139)			(0.0147)	
Tusgsal			0.101***			0.149***
			(0.0147)			(0.0143)
Rosanbus			0.063***			0.11***
			(0.0148)			(0.0149)
Soler Sauret			0.022			0.07***
			(0.0188)			(0.019)
β_{BCN}		0.01	0.006		-0.006*	-0.02
		(0.0096)	(0.0089)		(0.0139)	(0.0142)
β_{MUN}		-0.013	0.0033		-0.031**	-0.003
		(0.0099)	(0.0089)		(0.0122)	(0.0102)
β_{MET}		0.013	0.011		0.009	0.007
		(0.0083)	(0.0082)		(0.0081)	(0.0082)
Γ	*0.873*	*0.9926*	*0.997*	*0.875*	*0.868*	*0.985*
Log likelihood	*722.41*	739.93	748.88	723.64	750.01	758.29
Observations	*378*	*378*	*378*	*378*	*378*	*378*

In general, the main variables present the expected sign and are statistically significant. Output elasticity lies between 0.632 and 0.397, implying that a 1% increase in the bus vehicle-kilometers supplied will increase total costs by just 0.632-0.397%. Average speed is negative and always significant and our findings confirm that it is negatively related with the firms' cost performance. Therefore, public policies oriented towards increasing bus transit speeds might be desirable, because passengers (and/or taxpayers) would pay less for bus transportation. By contrast, network length is not statistically significant in any specification.[10]

In the case of input variables, we find mixed results for labor input price, which appears to be significant in half the estimations. Significant coefficients vary between 0.55 and 0.67, in line with results elsewhere in the literature. The coefficient for the price of capital is negative and highly

[10] Ottoz et al. (2009) suggest that a possible multicollinearity problem between output and the network length variables affects the estimation. To check for this problem we ran the estimations again this time excluding the network length variable. Our results remained unchanged, above all as regards the signs of coefficients and their significances.

significant, ranging from 0.43 to 0.50. This result is contrary to expectations, but might be in line with the suggestion made by Levaggi (1994) with regards to the generous government programs for subsidizing investments. In fact, the regulator (EMT) owns the buses operated by the private firms, which do not minimize their costs in the long run.

None of the geographical (Barcelona and Municipality) and intermodal (Metro) variables are significant. This indicates that are no differences between interurban lines and the intra-municipal lines. Furthermore, the new subway services do not exert any competitive pressure on the bus lines, probably because the routes offered do not overlap significantly.

Our primary focus is, first and foremost, to compare the costs of public and private delivery. Interestingly, we do not find any cost savings with private delivery. In fact, private firms appear to have higher costs than the public firm, this being true for two of the three private firms when transaction costs are not taken into consideration. When transaction costs are included, we find that the firms' total costs increase by around 5%, and all private firms have significantly higher costs than the public firm.

Second, we are interested in determining the effects of competition on costs. Here, the year of tender year is not significant in any case. As such, our results confirm our descriptive data in the sense that tender processes do not reduce bus costs (Figure 1). Interestingly, for specification 3, we find no cost differences between the private firm Soler i Sauret and the public firm TMB. Recall that Soler i Sauret was the only company to be awarded a concession when tendering the lowest price, in 2008. This lack of effect of tenders on costs would appear to be related to the fact that the lowest price offered has not generally been the main factor driving the award of concessions.

In Table 4 we regress the same specifications including time controls. We take as our references the year 2002 and TMB. We obtain very similar results (sign and significance) for all variables in the equation. Note that in this case, however, the price of labor is significant in all the estimations. The time dummies are significant and positive, there being a cost increase over time.

In the case of the variables related to ownership, we find that Rosanbus and Soler i Sauret have similar costs (not including transaction costs) to those of the public firm TMB, while Tugsal reports higher costs. When we include the transaction costs, all the private firms' costs are higher than TMB's by between 5 and 11%. Finally, it is worth noting that our competition variable is slightly significant and negatively related to costs in one out of four specifications.[11]

[11] We conducted a robustness check estimating the model with time-varying effects on the error term, allowing η to differ from zero. The signs were maintained, as were approximate significances for all variables. Private production was found to be more expensive than public, and the year of tender was once more not significant. See results in Table A-1 in the Appendix.

Table 4: Total-cost parameter estimates with time invariant inefficiency term and temporal effects (standard errors in parentheses)

Significance levels: * 10 per cent; ** 5 per cent; *** 1 per cent

	Without transaction costs			*With transaction costs*		
	(7)	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
β_Y	0.547***	0.579***	0.533***	0.319***	0.423***	0.401***
	(0.0748)	(0.076)	(0.073)	(0.076)	(0.0739)	(0.0716)
β_N	0.191	0.024	0.185	0.42*	-0.05	0.164
	(0.2493)	(0.2604)	(0.240)	(0.2538)	(0.266)	(0.2408)
β_{SP}	-1.364***	-1.276***	-1.215***	-1.448***	-1.00***	-0.923***
	(0.3393)	(0.3362)	(0.322)	(0.3645)	(0.3408)	(0.3226)
β_{PL}	0.552*	0.647***	0.476*	0.858***	0.537*	0.487*
	(0.2925)	(0.297)	(0.2867)	(0.3068)	(0.3001)	(0.2939)
β_{PC}	-0.641***	-0.646***	-0.656***	-0.715***	-0.588***	-0.607***
	(0.0909)	(0.2969)	(0.096)	(0.0806)	(0.0794)	(0.0775)
Tender year		-0.016	-0.018*		-0.014	-0.015
		(0.011)	(0.01)		(0.0102)	(0.0102)
Private		0.006			0.083***	
		(0.0159)			(0.0169)	
Tusgsal			0.045***			0.115***
			(0.016)			(0.0159)
Rosanbus			-0.007			0.07***
			(0.0165)			(0.0164)
Soler Sauret			-0.018			0.051***
			(0.0179)			(0.0188)
β_{BCN}		0.011	0.006		-0.018	-0.018
		(0.009)	(0.0077)		(0.0136)	(0.0122)
β_{MUN}		-0.013	0.001		-0.013	0.0 (0.0063)
		(0.0092)	(0.0067)		(0.0116)	
β_{MET}		0.0013	-0.002		0.008	0.004
		(0.0083)	(0.008)		(0.0086)	(0.0085)
2003	0.023***	0.023***	0.024***	0.038***	0.025***	0.025***
	(0.0084)	(0.0086)	(0.0087)	(0.009)	(0.0087)	(0.0088)
2004	0.032***	0.032***	0.033***	0.048***	0.032***	0.032***
	(0.0085)	(0.0089)	(0.0089)	(0.009)	(0.009)	(0.009)
2005	0.038***	0.038***	0.038***	0.063***	0.041***	0.04***
	(0.0084)	(0.0092)	(0.0092)	(0.0089)	(0.009)	(0.0093)
2006	0.039***	0.039***	0.039***	0.061***	0.034***	0.032***
	(0.0087)	(0.0098)	(0.0099)	(0.0091)	(0.0098)	(0.0099)
2007	0.014*	0.014	0.013	0.029***	0.009	0.007
	(0.0083)	(0.0089)	(0.089)	(0.0087)	(0.009)	(0.009)
2008	0.016*	0.017*	0.017*	0.042***	0.013	0.011
	(0.0087)	(0.01)	(0.0101)	(0.0091)	(0.0102)	(0.0102)
2009	-0.011	-0.009	-0.010	-0.003	-0.016*	-0.018**
	(0.0084)	(0.0089)	(0.088)	(0.0089)	(0.009)	(0.0089)
2010	0.024***	0.026**	0.027***	0.04***	0.01***	0.011
	(0.0087)	(0.0105)	(0.0104)	(0.0092)	(0.0105)	(0.0105)
2011	0.041***	0.046***	0.047***	0.048***	0.019***	0.019
	(0.0093)	(0.0116)	(0.0116)	(0.01)	(0.0116)	(0.0116)
2012	0.073***	0.081***	0.084***	0.069***	0.036***	0.038***
	(0.0097)	(0.0127)	(0.0128)	(0.0102)	(0.0128)	(0.0129)
γ	*0.848*	*0.976*	*0.997*	*0.90*	*0.785*	*0.947*
Log likelihood	796.75	799.53	810.9	776.11	797.81	808.79
Observations	*378*	378	*378*	378	378	*378*

5. DISCUSSION

We find that public delivery costs are similar to, or lower than private costs (depending on the firm) even when transaction costs are excluded. Thus, when we do include transaction costs private ownership is systematically more costly. As such, our results show the importance of considering transaction costs, as they reflect the costs paid by the citizens to maintain the regulator, and they ensure a better comparison of the total costs paid by bus users and taxpayers. The failure to consider transaction costs in previous empirical studies may well have biased the results of the cost comparisons undertaken to the detriment of public firms.

It is worth emphasizing as well that tenders for concessions did not help to achieve lower costs. And only in the case of the Soler i Sauret bus company, awarded the sole concession when the lowest price was offered, do we find costs that are not systematically higher than those of the pubic firm TMB. In the case of the Barcelona Metropolitan Area, incumbents know they need not offer the most competitive price, as price is given comparatively little weight in the evaluations of tender submissions, never exceeding 35% of the total, and the regulator has considerable discretionary powers in relation to criteria other than price. The fact that concessions tend to be awarded to incumbents that do not offer the lowest price could be the result of regulatory capture, but it could also be a consequence of the regulator expecting higher relational costs with the incumbent than if a new firm were to enter the market. We do not have sufficient empirical information to draw a definitive conclusion. However, it is worth noting that our results are consistent with the conclusions presented in Albalate et al. (2011), which suggest that the EMT uses its bargaining power to complement formal contracts with relational contracting.[12]

Our results from Barcelona show that competition between private firms is not effective and that private firm delivery is more costly, particularly when we take into account their transaction costs. Governments and regulators face different challenges. First, they have to fulfill the requirements of competitive tendering that emanate from higher legal frameworks promoting contests in which there is no common carrier providing the service. Second, they are forced to seek more flexible agreements to guarantee a workable relationship based on trust with the private operator. Competitive tendering involves greater rigidities than a negotiated contract, since it reduces government opportunities for modifying the delivery conditions. In the case of Barcelona, these rigidities are weakened somewhat by the constant changes introduced by the regulator into the contract. Likewise, the fact that incumbents tend not to be replaced by new entrants, and that few of them share the geographical market, suggests a partnership of trust exists between the regulator and private operators. All this seems to indicate that competitive tendering conditions are increasingly tending to resemble a negotiated performance-based contract. In this context, regulator accountability is weakened. Moreover, cost minimization does not appear to be the main driver introducing private delivery in the area of Barcelona. However, private production (which implies supply from private vendors) within Barcelona's mixed delivery system has also been used as the basis for a credible threat for the privatization of some of TMB's public lines. Indeed, this threat has been used in Barcelona at the time of labor conflicts within the public firm (see Albalate et al., 2012: 97). As such, it may have contributed to cost containment in the public firm, thus helping to explain its relatively good economic performance (compared to that of the private firms).

[12] The Barcelona Metropolitan Area is not unique in this regard, as this type of behavior appears to be emerging in places where competitive tendering has gained ground (Yvrande-Billon, 2006), and where the regulator has acquired sufficient experience.

6. CONCLUSIONS

In this paper we have evaluated the impact of firm ownership and competition on the total costs of a local bus transit service within a mixed delivery regime, paying particular attention to the presence of the transaction costs involved in private delivery. Based on an examination of the Barcelona metropolitan bus transit system, we have estimated a translog stochastic cost frontier in an attempt at shedding light on the effect of the delivery choices. The main results can be summarized as follows.

First, the public firm has been found to perform better than the private operators selected via competitive tendering. The public company provides bus services at a lower, or similar cost, to that incurred by the private companies. Indeed, when we take transaction costs into account, the private firms' total costs increase by around 5%, and all private firms are systematically more costly than the public firm. This result is a clear indication that cost comparisons that ignore transaction costs may well be underestimating private costs and giving a misleading picture of the costs associated with public and private delivery.

Second, we find that operating under tender procedures does not imply cost savings, not only because the lines operated by private operators are more costly than public lines, but because the tender process does not affect total costs. This might be attributable to the fact that the price offered is given comparatively little weight in the evaluations of tender submissions (i.e., in the case analyzed, an average of between 30 and 35% of the total points). A further possible – and compatible – explanation is the existence of relational contracting due to complex contracts and incompleteness. The regulator might prefer to establish strong relationships based on trust with specific private providers because it needs to make constant changes to the contract. All in all, our results are consistent with growing concerns in the literature that competitive tendering loses effectiveness (in terms of any systematic cost savings) overtime.

The debate concerning the reform of public service delivery has most frequently focused on the dilemma between pure public and pure private delivery modes. Our analysis suggests that mixed delivery (as long, that is, as the economic conditions for service fragmentation exist) creates a framework in which policy makers and regulators can employ different tools to pursue different objectives, for instance, using the pressure from potential private competitors to contain costs in public firms, and using the more flexible management practices of private firms to adjust to non-contractual events or unforeseen needs. At the same time, the partial maintenance of public delivery provides guarantees for failsafe delivery and, also, prevents monopolization by private firms. Therefore, future research needs to devote more attention to analyzing in greater depth the characteristics and effects of mixed and hybrid delivery choices.

REFERENCES

Albalate, D., Bel, G. & Calzada, J. (2012). Governance and regulation of urban bus transportation: Using partial privatization to achieve the better of two worlds. *Regulation & Governance*, 6(1), pp. 83-100.

Alexandersson, G., Hultén, S. & Fölster, S. (1998). The effects of competition in Swedish local bus services. *Journal of Transport Economics and Policy*, pp. 203-219.

Battese, G.E. & Coelli, T.J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, 20, pp. 325-332.

Beck, A., & Walter, M. (2013). Factors Affecting Tender Prices in Local Bus Transport Evidence from Germany. *Journal of Transport Economics and Policy*, 47(2), pp. 265-278.

Bel, G., Brown, T. & Warner, M.E. (2014). Mixed and Hybrid Models of Public Service Delivery. *International Public Management Journal, 17* (forthcoming)

Bel, G. & Fageda, X. (2011). Big Guys Eat Big Cakes: Firm Size and Contracting In Urban and Rural Areas. *International Public Management Journal*, 14 (1), 4-26.

Bel, G., Fageda, X., & Warner, M. E. (2010). Is private production of public services cheaper than public production? A meta-regression analysis of solid waste and water services. *Journal of Policy Analysis and Management*, 29(3), pp. 553-577.

Bel, G. & Warner, M. (2008). Does privatization of solid waste and water services reduce costs? A review of empirical studies. *Resources, Conservation & Recycling*, 52(12), pp. 1337-1348

Berechman, J. (1993). Public Transit Economics and Deregulation Policy (Amsterdam: North-Holland).

Boitani, A. & Cambini, C. (2006). To bid or not to bid, this is the question: the Italian experience for local bus services. *European Transport*, 33, pp. 63-81

Boitani, A., Nicolini, M. & Scarpa, C. (2013). Do competition and ownership matter? Evidence from local public transport in Europe. *Applied Economics*, 45 (11), pp. 1419-1434.

Brown, T. & Potoski, M. (2003). Managing Contract Performance: A Transaction Costs Approach. *Journal of Policy Analysis and Management,* 20, pp. 275-297.

Brown, T. & Potoski, M. (2005). Transaction costs and contracting: the practitioner perspective. *Public Performance & Management Review*, 28(3), pp. 326-351.

Cambini, C., Filippini, M., Piacenza, M., & Vannoni, D. (2011). Corporatization and firm performance: evidence from publicly-provided local utilities. *Review of Law and Economics*, 7(1), pp. 196-217.

Coelli, T. (2003). *A Primer on Efficiency for Utilities and Transport Regulators*. World Bank Publications.

Croissant, Y., Roy, W., & Canton, J. (2013). Reducing urban public transport costs by tendering lots: a panel data estimation. *Applied Economics*, *45*(26), pp. 3711-3722.

Cruz, N.F., Marques, R.C., Marra, A. & Pozzi, C. (2014). Local Mixed Companies: The Theory and Practice in an International Perspective. *Annals of Public and Cooperative Economics,* 85(1), pp. 1-10.

De Borger, B., Kerstens, K. & Costa, A (2002). Public transit performance: What does one learn from frontier studies? *Transport Reviews*, 22(1), pp. 1-38.

Fazioli, R., Filippini, M. & Prioni, P. (1993). Cost Structure and Efficiency of Local Public Transport: The Case of Emilia Romagna Bus Companies. *International Journal of Transport Economics*, 3, pp. 305-324.

Filippini, M. & Prioni, P. (2003). The influence of ownership on the cost of bus service provision in Switzerland-an empirical illustration. *Applied Economics*, *35*(6), pp. 683-690.

Fraquelli, G., Piacenza, M. & Abrate, G. (2004). Regulating Public Transit Networks: How do Urban Intercity Diversification Speed up Measures Affect Firms' Cost Performance? *Annals of public and Cooperative Economics,* 75(2), 193-225.

Gagnepain, P., Ivaldi. M. & Martimort, D. (2014). The cost of contract renegotiation: Evidence from the local public transport. *American Economic Review*, forthcoming.

Girth, A., Hefetz, A. Johnston, J. & Warner, M. (2012). Outsourcing Public Service Delivery: Management Responses in Noncompetitive Markets. *Public Administration Review*, 72(6), pp. 887-900.

Hatry H.P. (1999) Privatization: The Provision of Public Services by the Private Sector. McFarland & Company Inc., Jefferson, NC.

Hefetz, A., Warner, M.E. & Vigoda-Gadot, E. (2014). Concurrent sourcing in the public sector: A strategy to manage contracting risk," *International Public Management Journal,* 17 (forthcoming)

Hensher, D.A. (2014). Cost Efficiency under Negotiated Performance-Based Contracts and Benchmarking – Are there gains through Competitive Tendering in the absence of an Incumbent Public Monopolist? *Transportation Research Part A: Policy and Practice,* forthcoming.

Hensher, D. A., & Stanley, J. (2008). Transacting under a performance-based contract: The role of negotiation and competitive tendering. *Transportation Research Part A: Policy and Practice*, 42(9), pp. 1143-1151.

Hensher, D. & Wallis, I. (2005). Competitive tendering as a contracting mechanism for subsidising transport: The bus experience. *Journal of Transport Economics and Policy*, 39(3), pp. 295-321.

Jørgensen, F., Pedersen, P. A., & Volden, R. (1997). Estimating the inefficiency in the Norwegian bus industry from stochastic cost frontier models. *Transportation*, *24*(4), pp. 421-433.

Lamothe, M., & Lamothe, S. (2012). To Trust or Not to Trust? What Matters in Local Government-Vendor Relationships? *Journal of Public Administration Research and Theory*, 22(4), pp. 867-892.

Lee R.W., Rivasplata C.R. (2001). Metropolitan Transportation Planning in the 1990s: Comparisons and Contracts in New Zealand, Chile and California. *Transport Policy* 8, 47–61.

Leland, S. & Smirnova, O. (2009). Reassessing Privatization Strategies 25 Years Later: Revisiting Perry and Babitsky's Comparative Performance Study of Urban Bus Transit Services. *Public Administration Review*, 69 (5): 855–867

Levaggi, R. (1994). Parametric and non-parametric approach to efficiency: The case of urban transport in Italy. *Studi Economici*, 49(53), pp. 67-88.

Mackie, P., Preston, J. & Nash, C. (1995). Bus deregulation: ten years on. *Transport Reviews*, 15(3), pp. 229-251.

Matas, A. & Raymond, J.L. (1998). Technical characteristics and efficiency of urban bus companies: The case of Spain. *Transportation*, 25, pp 243-263.

Mathisen, T. A. & Solvoll, G. (2008). Competitive tendering and structural changes: An example from the bus industry. *Transport Policy*, *15*(1), pp. 1-11.

Miranda, R. & Lerner, A. (1995). Bureaucracy, Organizational Redundancy, and the Privatization of Public Services. *Public Administration Review*, 55, pp. 193–200.

Mouwen, A. & Rietveld, P. (2013). Does competitive tendering improve customer satisfaction with public transport? A case study for the Netherlands. *Transportation Research Part A: Policy and Practice*, 51, pp. 29-45.

Ottoz, E., Fornengo, G. & Di Giacomo, M. (2009). The impact of ownership on the cost of bus service provision: an example from Italy. *Applied Economics*, 41, pp. 337-350.

Perry, J. & Babitsky, T. T. (1986). Comparative performance in urban bus transit: Assessing privatization strategies. *Public Administration Review*, 46(1), pp. 57-66.

Roy, W. & Yvrande-Billon, A. (2007). Ownership, contractual practices and technical efficiency: The case of urban public transport in France. *Journal of Transport Economics and Policy*, 41(2), pp. 257-282.

Sappington, D. & Stiglitz, J.E. (1987). Privatization, information and incentives, *Journal of Policy Analysis and Management*, 6(4), pp. 567–957.

Savage, I. (1993). Deregulation and privatization of Britain's local bus industry. *Journal of Regulatory Economics*, 5, pp. 143-158.

Van de Velde, D. & Beck, A. (2010). "Workshop report-Beyond competitive tendering." *Research in Transportation Economics,* 29(1), pp. 145-151.

Viton, P. (1981). A Translog Cost Function for Urban Bus Transit. *Journal of Industrial Economics*, 29(3), pp. 287-304.

Warner, M.E. and Bel, G. (2008). Competition or monopoly? Comparing privatization of local public services in the U.S. and Spain. *Public Administration*, 86(3), pp. 723-735.

Warner, M.E. and Hefetz, A. (2002). The Uneven Distribution of Market Solutions for Public Goods. *Journal of Urban Affairs*, 24(4), pp. 445-459.

Warner, M.E. and Hefetz, A. (2003). Rural-Urban Differences in Privatization: Limits to the Competitive State. *Environment and Planning C: Government and Policy*, 21(5), pp. 703-718.

Warner, M. E. and Hefetz, A. (2008). Managing Markets for Public Service: The Role of Mixed Public/Private Delivery of City Services. *Public Administration Review*, 68(1), pp. 150-161.

White, P.R. (1997). What Conclusions Can Be Drawn about Bus Deregulation in Britain? *Transport Reviews*, 17, pp. 1–16.

Williamson, O. (1991). Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. *Administration Science Quarterly*, 36, pp. 269-96.

Williamson, O. (1999). A Transaction Cost Economics Perspective. *Journal of Law, Economics and Organization* 15, pp. 306-342.

Yvrande-Billon, A. (2006). The attribution process of delegation contracts in the French urban public transport sector: why competitive tendering is a myth. *Annals of Public and Cooperative Economics*, 77(4), pp. 453-478.

Appendix A

Table A1: Total-cost parameter estimates with time invariant inefficiency term (standard errors in parentheses)

	Without transaction costs			*With transaction costs*		
β_Y	0.62***	0.576***	0.596***	0.483***	0.526***	0.513***
	(0.0887)	(0.0789)	(0.0794)	(0.0914)	(0.0793)	(0.0803)
β_N	0.554	0.768**	-0.622	-0.032	-0.012	0.076 (0.324)
	(0.3734)	(0.3161)	(0.3274)	(0.3072)	(0.3106)	
β_{SP}	-0.874**	-0.854**	-0.682**	-0.962**	-0.786*	-0.718*
	(0.4293)	(0.379)	(0.37)	(0.4206)	(0.422)	(0.4029)
β_{PL}	0.701**	0.567*	0.505**	0.552*	0.535**	0.551*
	(0.3311)	(0.311)	(0.3191)	(0.3199)	(0.3139)	(0.3108)
β_{PC}	-0.439***	-0.436***	-0.428***	-0.425***	-0.423***	-0.459***
	(0.1083)	(0.0972)	(0.1006)	(0.1018)	(0.087)	(0.0878)
Tender year		0.027***	0.024**		0.014	0.008
		(0.0096)	(0.01)		(0.0099)	(0.0103)
Private		0.062***			0.115***	
		(0.0143)			(0.016)	
Tusgsal			0.089**			0.154***
			(0.0196)			(0.0196)
Rosanbus			0.07***			0.117***
			(0.0154)			(0.0153)
Soler Sauret			0.039**			0.09***
			(0.0182)			(0.0183)
β_{BCN}		0.007	0.008		-0.012	-0.008
		(0.009)	(0.0084)		(0.0102)	(0.1035)
β_{MUN}		-0.01	-0.003		0.0	0.002
		(0.0103)	(0.0097)		(0.0094)	(0.0083)
β_{MET}		0.021***	0.017**		0.023***	0.014
		(0.0077)	(0.0081)		(0.0079)	(0.0088)
γ	0.968	0.992	0.94	0.857	0.388	0.872
η	0.038*	0.082***	0.09***	0.013**	0.138***	0.168***
	(0.02)	(0.017)	(0.021)	(0.01)	(0.033)	(0.051)
Log likelihood	723.15	749.34	751.69	726.61	763.80	766.69
Observations	*378*	*378*	*378*	*378*	*378*	*378*

IREA
Institut de Recerca en Economia Aplicada Regional i Pública
Research Institute of Applied Economics
Universitat de Barcelona
Av. Diagonal, 690 • 08034 Barcelona

WEBSITE: www.ub.edu/irea/ • **CONTACT:** irea@ub.edu