Assessing standard costs in local public bus transport: Evidence from Italy

Alessandro Avenali [a], Andrea Boitani [b], Giuseppe Catalano [a], Tiziana D'Alfonso [a,*], Giorgio Matteucci [a]

[a] Department of Computer, Control and Management Engineering, Sapienza Università di Roma, Via Ariosto 25, Roma, Italy
[b] Department of Economics and Finance, Università Cattolica del Sacro Cuore, Via Necchi, 5, Milano, Italy

ARTICLE INFO

ABSTRACT

We present a regression model for estimating unit standard costs for the Italian local public bus transport services. We account for quantitative and qualitative characteristics, which contribute to explain the variability of the cost structure. Economic and transport data have been collected from companies producing more than 500 million of bus-kilometers. We find that commercial speed is the most important cost driver, while economies of scale are low and only present in small size services. Results prove a positive correlation between investments in bus fleet and the cost incurred in service provision. Finally, we show how the regression model can be augmented with policy targets in order to fairly allocate among Italian Regions the public funds yearly earmarked to the local public transport sector.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

The principle of standard costs was introduced in the Italian legislation as far back as 1997 (legislative decree n. 422, art. 17, comma 1, 19 November 1997) to pursue the goal of a fairer distribution and a more efficient use of public resources devoted to local public transport (LPT). The standard cost should reflect the cost of a LPT service provided by an efficient operator and given a specified service quality (where the efficiency level are defined on the basis of the activities and costs of several operators and/or knowledge of the industrial process for the provision of LPT services). Actual unit costs varied in 1997 widely across regions and cities, presumably reflecting varying degrees of (in)efficiency. A history-dependent cost-plus allocation of public funds to LPT subsidies contributed to build up differential inefficiencies and to differently inflate costs. An inequitable distribution of public funds among regions and cities resulted.

The mentioned 1997 bill stated that non-tendered concessions were to be banned by 2004. The programming of the services and the management of the subsidies have been shifted from the national to the regional level. Later legislative interventions left discretion to local authorities whether tendering out concessions or making use of *in house* provision. Because of the fluctuations in the governance rules, competitive tendering did take place in just a few regions and in one large city (Milan), where only one bid (by the incumbent) was submitted in a largely tailor-made tendering procedure. Since 2009, all legislative interventions reaffirmed the crucial role played by standard costs in pursuing the goal of improving the allocative and productive efficiency of LPT operators.[1] The 2013 Budget (Law n.147/2013, art.1, clause 84) explicitly defines the unit standard cost as total cost per vehicle-kilometer, to be determined by taking into account commercial speed, economies of scales, production technologies, the rolling stock renewal and a reasonable profit. Local authorities and LPT firms are required to sign a *service contract*, whether tendering out concessions or making use of in house provision (Boitani and Cambini, 2006; Hensher and Wallis, 2005; Boitani et al., 2013b), and, according to a bill passed in 2012 (L. 135/2012), related economic compensations to LPT firms should not generally exceed the standard cost of the service. This implies that standard costs should be used as reserve-prices in tendering procedures. However, to the present date, standard costs have not been applied, nor an appropriate methodology for their calculation has been adopted.

The kick-start to the present paper was the appointment of the

---

* Corresponding author.
  E-mail address: dalfonso@dis.uniroma.it (T. D'Alfonso).

[1] Reference is to be made to: L. 42/2009; L. 216/2010; L. 228/2012; L. 147/2013.

authors in a ministerial committee in charge of collecting data and developing a workable model for gauging standard costs in the Italian local public bus transport sector (see Avenali et al., 2014a). We do not use a frontier approach in order to define the minimal efficient cost for the provision of LPT services, because of the general will of the Minister of Infrastructures and Transport (MIT) and of the Italian Regions for a *gradual* financial reorganization of the LPT sector. Thus, the proposed standard cost reflects an achievable average-efficient cost of LPT services provided by an operator, given a specified service quality. The paper contributes to the literature and to the policy debate on three counts. First, at a macro-level, the model can be employed by policy makers to introduce regulatory constraints on the allocation of public funds among regions and local authorities. Second, similarly to the approach suggested in Hensher et al. (2013),[2] our results might be used at a micro-level to define the upper bound on firms' compensation in competitive tendering procedures, by exploiting the favourable incentive properties of yardstick competition (Shleifer, 1985). Indeed, local authorities have an incentive to design contracts to be auctioned in such a way that bidders have in turns an incentive to "beat" the standard which (by the law) must be available to potential competitors prior to any competitive tendering procedure. However, the yardstick competition principle is at work also were contracts are not tendered out, as local authorities may either increase the quantity/quality of the service or put resources to alternative uses if the local monopolistic LPT operator is able to reduce its actual cost below the standard level. Third, a detailed data set is used to estimate the model: economic and transport data have been collected from companies producing more than 500 million of bus-kilometers. In particular, detailed information has been gathered in order to fairly compute the total economic cost of the local bus transport services observed in 2011.

The paper is organized as follows. Section 2 contains the literature review. Section 3 identifies cost categories which define the standard cost model and the key aspects of the production process of local public bus transport services. Section 4 describes the data set and variables. Section 5 presents the model and the results, while Section 6 develops some test examples and policy implications. Section 7 concludes.

2. Literature review

A burgeoning literature explores the cost structure of LPT bus companies. Most empirical studies make use of a parametric regression approach (for a critical review see Daraio et al., 2016): in most cases Ordinary Least Squares (Merewitz, 1977; Alexandersson et al., 1998); in other cases, Seemingly Unrelated Regressions such as Cambini et al. (2007). While earlier studies (such as Koshal, 1970; Miller, 1970; Pucher et al., 1983) mainly focus on input-output relations, more recent studies estimate variable and total costs (e.g., among others, Obeng and Sakano, 2002; Fraquelli et al., 2004; Cambini et al., 2007; Ottoz and Di Giacomo, 2012). Two different approaches have been used in order to measure output: supply-side indicators such as vehicle-kilometers (Cambini and Filippini, 2003) or seat-kilometers (Farsi et al., 2007; Gagnepain and Ivaldi, 2002); demand-oriented measures, such as passenger-trips or passenger-kilometers (Bhattacharyya et al., 1995). Which of the two approaches is the most appropriate has been widely debated without achieving an agreement (see

Berechman and Giuliano, 1985; De Borger and Kerstens, 2000; De Borger et al., 2002). However, when the focus is on costs, as in this paper, seat-kilometers or vehicle-kilometers are usually considered as appropriate output measures. Most papers include, among the explanatory variables, hedonic characteristics. Commercial speed, service size and the average fleet age are the most frequently employed (see Daraio et al., 2016). In the model presented in this work we consider size, commercial speed and the average fleet age as fundamental drivers in a standard cost function. In Section 3 we further discuss the role of each driver in defining quality (and thus cost) of a LPT service.

The focus of the above mentioned literature is on scale and density economies. Cambini et al. (2007) points towards the presence of economies of network density and scale economies, especially for urban LPT services. Fraquelli et al. (2004) finds evidence in support of both scale and scope economies. In the same vein, Filippini and Prioni (2003) finds the presence of considerable economies of scale for all size classes, comparing Italian and Swiss companies. Conversely, scale diseconomies are found in the studies by Bhattacharyya et al. (1995), Jha and Singh (2001), Levaggi (1994) and Matas and Raymond (1998). Diseconomies of scales are found also in Boitani et al. (2013a). Finally, Fraquelli et al. (2001) finds that the average cost per seat-kilometer is U-shaped.

Another branch of the literature related to the present paper focuses on the impact of alternative contract schemes within one country, such as, for instance, Norway (Dalen and Gómez-Lobo, 1996, 2003), France (Kerstens, 1996; Gagnepain and Ivaldi, 2002; Roy and Yvrande-Billon, 2007; Gautier and Yvrande-Billon, 2013), Italy (Piacenza, 2006; Buzzo Margari et al., 2007). These studies confirm that firms operating under high-powered incentive schemes, such as fixed-price contracts, are more efficient than firms operating under low-powered incentive schemes, such as cost-plus contracts. Dalen and Gómez-Lobo (2003) points out that by 1992-1993, the standard-cost model had become the most popular contract within 9 out of 19 Norwegian counties. They use a linear model that links driver costs, fuel costs, and maintenance costs (excluding the cost of capital) to the number of bus-kilometers produced for different categories of routes. Overall, their results suggest that firms regulated under the yardstick type contract exhibit less than half of the cost inefficiency compared to those firms regulated under the individual contract or subsidy-cap contract.[3] Within individual contracts, counties bargain annually and individually with each company over both costs and transfers. Within subsidy-cap contracts, the companies and the county agree upon a reduction in the level of governmental transfers by X% per year, over a five years period (Dalen and Gómez-Lobo, 2003). In addition, the firms regulated with the yardstick type contract reduce cost inefficiency faster.

These studies mainly target the causes of inefficiencies and the cost structure of firms in order to identify the proper configuration of a network, or else they enquire to what extent the standard-cost model and different type of regulatory contracts affect the cost performance of LPT companies. However, they disregard the *ex-ante* definition of the standard cost of a service as an instrument either for the allocation of public funds to local authorities or the definition of the economic compensation earmarked to LPT firms in competitive tendering procedures. The present paper is aimed at filling this gap by developing a model for the estimation of unit standard costs for the Italian local public bus transport sector. For the sake of notation, we simply refer to LPT as to indicate the local public *bus* transport.

---

[2] Hensher et al. (2013) introduce a simplified performance-linked payment (SPLP) model that can be used as a benchmark in assessing the subsidies that an Authority should recognize to a LPT operator. Similarly to ours, the cited model internalizes the effects of exogenous variables (not under the control of operators), such as commercial speed, on the cost of LPT services.

---

[3] For an early theoretical assessment of the efficiency properties of a subsidy cap contract see Boitani and Cambini (2002).