

## Corporatization and Firm Performance: Evidence from Publicly-Provided Local Utilities\*

CARLO CAMBINI,<sup>a</sup> MASSIMO FILIPPINI,<sup>b</sup> MASSIMILIANO PIACENZA,<sup>c</sup>  
AND DAVIDE VANNONI<sup>d</sup>

<sup>a</sup>Politecnico di Torino and HERMES-Italy; <sup>b</sup>University of Lugano and ETH Zurich-Switzerland;

<sup>c</sup>University of Torino, Ceris-CNR and HERMES-Italy; <sup>d</sup>University of Torino and Collegio Carlo Alberto

*This study investigates the effects of the corporatization process – i.e., the transformation of a municipal firm into a limited liability company – on the production costs of local public services whose ownership is maintained by the local government. Theoretical analysis predicts that, even without privatization, corporatization is a potentially effective way to improve efficiency (Shleifer and Vishny, 1994; Stiglitz, 2000). We explore this issue by using information on a typical local utility, such as the bus service provided by public transit systems in Italy, which experienced a reform of the governance towards the corporatization structure during the '90s. The results on a sample of 33 local bus companies over the period 1993-2002 show that, even if public ownership persists, the transformation of a municipal enterprise into an autonomous company – corresponding to the first stage of the corporatization of local utilities in Italy – or into a limited liability company exerts a reducing impact on production costs.*

### 1. INTRODUCTION

Despite the huge wave of privatization started in the mid-'80s around Europe, many public utilities, especially at the local level, are still under the control of

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the State: at the end of 2000, through ownership or golden shares, central or local governments controlled more than 60% of privatized firms (Bortolotti and Faccio, 2009). Even in the case of publicly-provided services, a firm's internal governance may change over time, following a process which has been labeled *corporatization* by Shleifer and Vishny (1994). Corporatized companies represent a hybrid form between state-owned enterprises and private firms. In a corporatized firm, the transfer of control rights from politicians to managers occurs independently from pure privatization. Mainly, it implies a change in the ownership rights and the potential introduction of incentives to managers' performance. Acting as residual claimants, managers are more keen to bear additional risk and to face increased responsibility. In this case, politicians continue to exercise their control rights over the firms through regulation, but no longer through the direct provision of public services. As pointed out by Stiglitz (2000:206): "*Typically, before a government enterprise is privatized, it goes through the intermediate stage of corporatization. Most of the efficiency gains seem to occur in this stage, though there is controversy about why. Some argue that the freedom from government personnel, procurement, and budget restrictions is all that is required; under corporatization, effective incentive schemes can be put into place.*"

Theoretical predictions we can derive from existing literature show that, as long as a firm changes its ownership status, a better alignment of incentives between managers and shareholders pushes the former to increase cost-reducing efforts. We claim that this effect still holds even for a special kind of institutional change; i.e., the corporatization of a State-owned firm. When privatization is not possible or is opposed by politicians, corporatization, by structuring the internal governance system of State-owned firms to be similar to that of a modern corporation, may in fact improve the monitoring of managers and reduce governmental political intervention, as well as affect the incentives and objectives of managers (Aivazian et al., 2005). By reallocating control rights to managers, corporatization thus acts as a potentially effective instrument in providing incentives to improve performance and increase efficiency.

The aim of the present study is to contribute to the literature on the performance of State-owned enterprises by empirically investigating the effects of institutional changes on the internal governance of local utilities which continue to be owned (fully or through a majority share) by the State (i.e., local governments). To that purpose, we exploit the information on cost structure and institutional organization available for a sample of 33 Italian local bus companies observed over the period 1993-2002. Throughout this time span, all firms remain owned by a local government, but some of them change their governance status from a fully public-owned company to a corporatized one. The Italian public transit system therefore represents an ideal natural

experiment to evaluate the effect of corporatization. Such an experiment allows us to address the question of whether a restructured governance system can positively influence the performance of these companies even if public ownership persists. To the best of our knowledge, our paper represents one of the few studies that quantify the impact of corporatization within State-owned firms or other governmental agencies, and the first one that analyzes its impact on the cost performance of local public utilities.

This paper differs from previous studies aimed at evaluating the impact of *market* and *regulatory reforms* within the local public transport sector. The majority of these studies focus on the effect of competitive bidding on firms' performance. For example, Hensher and Wallis (2005) show that over fifteen years competitive tendering and privatization brought about a 50-55% reduction in real unit costs in London, whilst in Scandinavia there were savings ranging from 5 to 34%, with most in the range of 20-30%. However, this evidence is mixed. The appraisal of the French experience casts some doubts on the efficiency-enhancing properties of competitive tendering. In fact, competition has not been fostered in France after the adoption of competitive bidding and the performance indicators of the market are still mediocre (Yvrande-Billon, 2006). These results have been confirmed in Amaral et al. (2009) and Yvrande-Billon (2009), showing that, notwithstanding the introduction of auction procedures, the two alternative models for organizing local public transportation in France and London lead to very different results: few competitors, collusion, and cost increases in the French model, compared with more transparency, competition, and better performance in London. Competitive bidding can be seen as a new contractual agreement between the firm and the local government for the provision of local public transport services. However, it differs from corporatization where ownership remains unchanged and it is specifically focused on the internal re-organization of the utility firm. None of the above-mentioned studies specifically addresses this issue and analyzes its impact on firm's efficiency.

The structure of the paper is the following. Section 2 surveys the relevant literature and provides a simple theoretical framework that illustrates the efficiency effect stemming from the introduction of corporatization. Section 3 reviews the main institutional steps with which corporatization has been introduced in Italy within local public services. Section 4 presents the empirical analysis, including model specification, data, estimation strategy and results. Section 5 concludes.

## 2. CORPORATIZATION OF PUBLICLY-OWNED FIRMS: LITERATURE REVIEW

The relationship between ownership issues and managerial performance and their impact on firm's efficiency has received quite a considerable amount of attention in the economic debate, but much less so when specifically applied to local public utilities. The majority of studies focus mainly on the ownership effect, i.e., on the comparison of performance, efficiency and other economic parameters between private and State-owned enterprises.

On the theoretical side, Laffont and Tirole (1991) show that State-owned firms find it difficult to monitor managers due both to a lack of incentives for the owner to monitor manager performance, and to the absence of informational signals from stock market participants about managers' actions. Therefore, the lack of information reduces the managerial incentive to behave efficiently. In addition, State-owned enterprises are more likely to exhibit excessively high costs; since managers can obtain only a fraction of the benefits generated by cost-reducing efforts, they face less binding financial constraints and could be more influenced by political parties (Hart et al., 1997; Shleifer, 1998; Tirole, 2001). Martimort (2006) shows that contract incompleteness and, more specifically, the limits of regulatory commitment and State control, may affect the decision to privatize a utility, as well as its ex post performance. The promise not to intervene ex post is more credible under private production than under State ownership, and private firms are thus expected to invest more in cost-reducing activities that secure larger benefits and higher (implicit or explicit) rewards.

In a similar vein, Shleifer and Vishny (1994) show that *corporatization* also exerts a positive impact on a firm's relative efficiency. According to their model, when managers have additional control rights over the firm, they may (at least partially) restructure the latter and reduce excess employment. At the same time, they are still likely to obtain public transfers from the government, which means that budget constraints can remain soft under corporatization.

More recently, Hoppe and Schmitz (2010) analyze a situation in which the responsibility for certain elements of the public operations is vested in separated (private as well as public) hands. The authors depart from the standard property rights approach *à la* Hart et al. (1997), assuming that investment tasks can be separated between private and public agents, and are "contractible control actions" in the terms of Aghion et al. (2004); that is, it is possible to contractually specify who is in charge of which tasks and who bears the investment costs. One of the main results of these authors relies on the private-public partnership case: whenever bargaining power is relatively balanced between the (local) government and the private sector, and they both

agree on a partnership (i.e., on a division of tasks), it is optimal to assign the cost investment to the (private) manager and the quality investment to the government. This study theoretically confirms how an optimal allocation of tasks matters in increasing firm efficiency, and also that a specific contractual arrangement such as *corporatization* – where the firm remains publicly-owned but is run as it would be in a private context – could indeed be an institutional mechanism to enhance firm efficiency.

Some theoretical insights which are relevant for the topic of our paper also come from the literature on vertical integration and hierarchies (e.g., Williamson, 1985, and Riordan, 1990). For example, the *selection intervention* puzzle, according to which “asset mal-utilization” and “accounting contrivance” are two incentive distortions associated with vertical integration (in our case this can be seen as a State-owned enterprise that opts for the in-house provision of local public service), implies that managers will take value-reducing actions to protect their own returns and asset values (Williamson, 1984; Crémer, 2010). On the other hand, corporatization is a governance form that is less subject to bureaucratic distortions and allows higher-powered incentives than the “vertically integrated” structure.

The bulk of studies that empirically analyze the impact of ownership changes show that privatization exerts positive effects on both firm profitability and efficiency (see the survey by Megginson and Netter (2001)). In particular, for the influence of ownership structure on managerial behavior, there is evidence that when firms are transformed into private companies, the new owners start to monitor managers’ behavior and begin to introduce effective incentive mechanisms (Cragg and Dyck, 1999).

The relatively few studies that have analyzed the case of mixed ownership suggest a positive effect on performance (e.g., Boardman and Vining, 1989; and, for local public utilities, Roy and Yvrande-Billon, 2007),<sup>1</sup> which is mainly due to a better alignment of incentives between managers and shareholders, even in the presence of not completely contestable firms (Gupta, 2005).

Evidence on the effects of corporatization is even more scant. For example, both Aivazian et al. (2005) (who concentrate on manufacturing firms in China, where an important reform program introduced corporatization without privatization) and Bilodeau et al. (2007) (who deal with government agencies in Canada) found positive effects for such a form of internal governance

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<sup>1</sup> It is worth remarking that the benefits from partial privatization are not always confirmed by the empirical evidence. For instance, Garrone et al. (2007) analyze the effects of privatization and management control on the cost efficiency of a sample of local Italian utilities active in gas, electricity and water distribution and waste management. They find no evidence of inefficiently high costs for utilities owned by the municipalities and conclude that the partial privatization process does not per se generate an increase in efficiency.

structure. Our paper contributes to this limited strand of literature by offering new evidence on the impact of corporatization on the provision of local public utilities services.

### 2.1. A THEORETICAL BENCHMARK

Before presenting the dataset and the empirical analysis, we sketch a stylized model inspired by Shleifer and Vishny (1994), Hart et al. (1997) and Hart (2003) that provides an intuitive explanation of the efficiency effect stemming from the introduction of corporatization within State-owned firms.

Suppose that a government wants a certain service to be provided (i.e., local public transportation). One option is to provide it “in-house,” i.e., by hiring public employees who are then paid a fixed wage,  $P$ . Another possibility is to let the service be provided by a state-owned firm which is run independently by a public manager. The government is the owner of all assets and controls the residual rights over the service; however, in order to provide its manager with additional incentives, the government could agree to renegotiate ex post with the manager and give him part of its residual rights.

Using the incomplete contract approach, let  $M$  be the manager providing the services and  $G$  be the government. The provision of the service yields some benefit for society, denoted by  $B$ , but also some cost to be produced, denoted by  $C$ . The manager can influence both  $B$  and  $C$  through effort choices. An increase in his effort reduces the production cost, but at the same time affects the service quality in the following way:

$$B = B_0 - b(e) \quad (1)$$

$$C = F - c(e) \quad (2)$$

where  $e$  denotes the observable but not verifiable effort devoted to cost reduction.  $c(\cdot) \geq 0$  and  $b(\cdot) \geq 0$  are the reduction in cost and in quality due to the effort, respectively. The following assumptions for convexity and monotonicity hold:  $b'(\cdot) \geq 0$ ,  $b''(\cdot) \geq 0$ ;  $c(0) = 0$ ,  $c'(\cdot) = \infty$ ,  $c'(\cdot) \geq 0$ ,  $c''(\cdot) < 0$ ,  $c'(\infty) = 0$ ;  $c'(\cdot) - b'(\cdot) \geq 0$ , meaning that the quality reduction due to an increase in effort does not offset cost reduction. The total costs of  $M$  are:  $C = F - c(e) + e$ .

The time-line of the game is as follows: in stage 1, manager  $M$  and government  $G$  write a contract for service provision; in stage 2,  $M$  chooses a level of effort to maximize his own utility; in stage 3, renegotiation will occur over the net benefits generated by the manager's performance.

To determine the benchmark case, assume that  $e$  is contractible and so verifiable. The first-best allocation derives from the maximization of the net surplus generated by the provision of the service, i.e.

$$\text{Max}_e B_0 - b(e) - F + c(e) - e \quad (3)$$

The first-best effort level,  $e^*$ , is given by the following condition:  $-b'(e^*) + c'(e^*) = 1$ . The optimal solution is when the marginal social benefit of spending extra effort to reduce cost is equal to the marginal cost of that effort.

Now, assume that the service is directly managed by the local government through a public employee running the firm. The benefits from the service are collected by the government, which also pays the operating costs for the service's provision. This manager receives a fixed salary since he is a public employee and it is not possible for him to renegotiate the contract ex post. Therefore, the manager chooses the effort level ( $e^{DM}$ ) that maximizes his own utility, i.e.

$$\text{Max}_e P - e \quad (4)$$

It is straightforward to see that the optimal effort level in this case is equal to zero, i.e.  $e^{DM} = 0$ . The manager does not have any incentive to enhance his effort because he cannot benefit from his action. Therefore, in this case we expect the cost efficiency to be very small.

Suppose now that a manager has more flexibility and responsibility in his activity; therefore, he is able to renegotiate ex post his salary according to the impact of his effort on the firm's performance. Since the firm is still owned by the State, the manager is able to renegotiate only over a share  $\alpha$  of the net benefit derived from the effort choice. The parameter  $\alpha$  represents the degree of incentive power that the government can use in its contract with the manager. High values of  $\alpha$  imply strong incentives for managers and a high level of firm efficiency. The parameter  $\alpha$  can be interpreted as the different degree of responsibility of a manager: his responsibility for firm performance is null ( $\alpha = 0$ ) in a directly-managed firm, since he is only an employee of the government; on the contrary, the manager may have a larger responsibility, as in a limited liability company still owned by the local municipality, but to run the firm he requires a (monetary or non-monetary) incentive to reward the additional risk to be faced ( $\alpha > 0$ ).

We can alternatively interpret the parameter  $\alpha$  as an index of implicit incentives in a repeated relationship between the firm and the manager

(Dewatripont et al., 1999a,b; Dixit, 2002). In a “career concerns” setting, it may be unnecessary to provide explicit incentives to induce effort, since the prospect of indirect incentives in the form of improved prospects for future rewards may suffice. These implicit incentives are especially relevant in public organizations, such as a utility firm, since the explicit incentives are rather weak. This issue is relevant in our framework: in an autonomous or limited liability company, managers may be motivated by the possibility of rewards in the forms of future employment, by some other utility, or even by the private sector; while in a directly managed State-owned firm, the manager is simply an employee of the local government and implicit incentives are much weaker or even absent.

Turning back to the theoretical framework, as in a Nash-bargaining game, the Government and the Manager split the fraction  $\alpha$  of the net benefit 50:50. Therefore, the manager maximizes:

$$\text{Max}_e P - e + \frac{\alpha}{2}[c(e) - b(e)] \quad (5)$$

Then, the optimal effort level when the Manager can renegotiate his pay-off is:

$$[-b'(\hat{e}) + c'(\hat{e})] \frac{\alpha}{2} = 1 \quad (6)$$

All in all, we can observe that the effort level in the presence of a corporatized firm is higher than the effort level of a directly managed state-owned firm (i.e.,  $e^{DM} < \hat{e} < e^*$ ), and so the cost efficiency is larger in the latter case. Moreover, as long as the manager is given additional control rights over the firm (i.e., the parameter  $\alpha$  increases due to a change in the degree of corporatization passing from a direct management firm to an autonomous company, or to a limited liability company), the incentives to increase firm efficiency are enlarged.

### 3. THE CORPORATIZATION PROCESS OF LOCAL PUBLIC SERVICES IN ITALY

In Italy, local public services were traditionally carried out by local municipalities with in-house arrangements. This regime was established by the Giolitti Law in 1903 (and later confirmed in 1925 by a specific law for local municipalities) and lasted until the beginning of the 1990s. During this timeframe, local services were managed directly by local municipalities and even when a distinct business was created (the so-called *Azienda Municipalizzata*), it was subject to the same standard administrative and accounting rules as those provided for local governments.



Starting from 1990, a new regime was established with the introduction of Law 142/90, which reinforced the role of local municipalities and defined the birth of the “special company” (*Azienda Speciale*), a particular type of firm controlled by the local government but with more budgetary and operational autonomy. The main idea of this reform was to shelter the management of a firm from the influence of policy-makers. But still the process was not complete, since local utilities were in large part directly run by local governments. Therefore, the Italian government introduced a new and much more powerful reform in 1997 (Law 127/1997), with the aim of providing incentives for local municipalities to transform the special companies into standard limited liability enterprises. Then Law 448/2001 established that, by the end of June 2003, all special companies had to be reorganized as standard limited liability companies, but subsequent reforms postponed such a deadline. At the moment, each local municipality can decide to manage its services through a publicly-controlled firm (i.e., in-house) or through a limited liability company (*SpA*).<sup>2</sup>

More recently, the local public transport (LPT) sector – together with the rest of local public services, such as water and waste sectors – has been reformed by Law 166/2009. Article 23/bis states that, starting from January 2011, the LPT service should be assigned through a (compulsory) bidding process. Alternatively, a local municipality may decide to transfer the ownership (at least partially, but not below 40%) of the LPT company through an auction; obviously this is possible only after transforming the company into a limited liability one (*SpA*). However, this reform does not directly force LPT companies to change their internal organization and so to pursue a corporatization process.

All in all, the purpose of the above reforms is to spur economic efficiency within the local public sector, more specifically, within local public utilities. The separation between management and ownership was supposed to be an important instrument for reducing costs and for providing better service to citizens. The revision of budgetary and accounting rules has been the main element used by the legislature in order to provide correct incentives to the managers for reaping productive efficiency and reducing the waste of public funds.<sup>3</sup>

Differently from those local utilities active in sectors such as gas and energy distribution, where private firms compete with publicly-owned companies, and similarly to firms that provide water services, public transit systems represent a natural experiment to test the effectiveness of the corporatization process

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<sup>2</sup> It is worth noticing that, while the reform permits local municipalities to sell at least a fraction of the firms to private partners, the first of these private investors appeared only starting in 2005.

<sup>3</sup> See Bognetti and Robotti (2007) for a recent evaluation of the local public service reforms in Italy, with particular reference to the creation of mixed (public-private) companies.

involved in the above reforms. Indeed, some important interventions during the second half of the 1990's (Law 549/1995, and the subsequent *decreti legislativi* 422/1997 and 400/1999) have reformed the organization of the sector in several respects, among which changes in the governance of corporatization forms have been foreseen. However, the few attempts to introduce competitive tendering for the provision of local public transport service and to promote private public partnerships (PPPs), have been largely unsuccessful due to political resistance, especially at the local level. Therefore, our dataset includes the following three different types of governance – the municipal company (*Azienda Municipalizzata*), the autonomous company (*Azienda Speciale*) and the corporatized company (limited liability company or *SpA*) – and is particularly suitable for investigating the impact of firm type on productive performance.

## 4. EMPIRICAL ANALYSIS

### 4.1. SPECIFICATION OF THE COST FUNCTION MODEL

Empirical studies on the cost structure of bus companies traditionally assume total cost as a function of output, the price of inputs (capital, labor and energy price) and some output characteristic variables, such as network length, the number of stops, and average commercial speed.<sup>4</sup> Generally, the output characteristic variables are introduced in the model in order to capture some of the heterogeneity in the output and in the different service areas. Most of these studies also include a time trend to control for potential changes in the technology.

According to the discussion above, another group of factors likely to influence production costs concerns the internal governance system of bus companies, i.e., status as a municipal company, autonomous company, or *SpA* corporation. In this study, relying on the same empirical approach as that followed by Filippini and Prioni (2003), Mizutani and Urakami (2003), and Roy and Yvrande-Billon (2007) to assess the effects of ownership structure, we choose to investigate the impact of changes in the organizational form on total cost – which represents the main focus of our analysis – by including two binary indicators for the governance type in the model specification:

$$C = f(y, n, s, p_L, p_K, p_E, DSPA, DAU, DMIX, T) \quad (7)$$

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<sup>4</sup> Since in most cases not only the network but also the schedule of a bus operator is regulated and predetermined, it is common to estimate a cost rather than a production function.

where  $C$  is the annual total production cost and  $y$  is the output.  $n$  and  $s$  represent network size and average commercial speed, respectively.  $p_K$ ,  $p_E$  and  $p_L$  are the prices of capital, energy and labor inputs. In order to test for the effects of the governance form on the cost, we introduce into the model the following dummy variables:<sup>5</sup>  $DSPA$ , which is equal to 1 for bus companies that are corporations and 0 for other organizational types, and  $DAU$ , which is equal to 1 for firms that are autonomous companies and 0 for other governance. Moreover, since our sample includes both “specialized” companies (which provide only urban service) and “mixed” companies (which provide a combination of urban and intercity services), we add a *service-specific* dummy for “mixed” firms, so as to capture possible cost savings due to the diversification of the productive activity:<sup>6</sup>  $DMIX$  is equal to 1 for bus companies operating both in intercity and urban areas and 0 otherwise. Finally, the trend variable  $T$  reflects the effects on costs due to technical progress occurring over the observed years.

To estimate the cost function (7), a translog specification is chosen. Indeed, given the regularity conditions ensuring duality, the estimation of a translog model does not impose any other a priori restriction on the characteristics of the underlying technology. In particular, the returns to scale as well as the substitution elasticity between inputs can vary with both the output level and the specific combination of productive factors. This assumption fully satisfies the criterion of model generality.<sup>7</sup> The translog approximation to (7) is written as:

$$\begin{aligned} \ln \frac{C_{it}}{P_{E_{it}}} = & \alpha_0 + \alpha_y \ln y_{it} + \alpha_n \ln n_{it} + \alpha_s \ln s_{it} + \sum_{r=L,K} \alpha_r \ln \frac{P_{r_{it}}}{P_{E_{it}}} + \sum_{\substack{l=y,n,s \\ m=y,n,s}} \frac{1}{2} \alpha_{lm} \ln l_{it} \ln m_{it} \\ & + \sum_{\substack{r=L,K \\ q=L,K}} \frac{1}{2} \alpha_{rq} \ln \frac{P_{r_{it}}}{P_{E_{it}}} \ln \frac{P_{q_{it}}}{P_{E_{it}}} + \sum_{\substack{l=y,n,s \\ r=L,K}} \alpha_{lr} \ln l_{it} \ln \frac{P_{r_{it}}}{P_{E_{it}}} + \alpha_{SPA} DSPA_{it} + \alpha_{AU} DAU_{it} \\ & + \alpha_{MIX} DMIX_{it} + \alpha_T T_t + \varepsilon_{it} \end{aligned} \tag{8}$$

<sup>5</sup> The municipal form is excluded from the econometric model in order to avoid multicollinearity. Thus, this form is the benchmark for the interpretation of the institutional dummy variables.

<sup>6</sup> These benefits could arise from better exploitation of some sharable inputs, in particular, the workforce (drivers and administrative staff) and, perhaps to a lesser extent, the rolling stock. For more discussion on this issue, see Fraquelli et al. (2004), Di Giacomo and Ottoz (2010), and Farsi et al. (2007).

<sup>7</sup> Notice that the translog model requires the approximation of the underlying cost function to be made at a local point, which in our case is taken at the mean of all variables. Thus, all independent variables are normalized at their average points.

where the subscripts  $i$  and  $t$  denote the company and the year, respectively. The technical change is specified as a linear trend and is assumed to be neutral with respect to cost-minimizing input ratios.<sup>8</sup> Note that by normalizing total cost and input prices by one of the input prices (here, the price of energy  $p_E$ ), we impose the theoretical condition that the cost function is linearly homogeneous in input prices. The other theoretical restrictions are verified after the estimation.

The estimation of the cost function (8) enables us to derive information on the impact of governance on costs, as well as on other important characteristics of bus supply technology, such as economies of density and scale. In fact, in network industries it is important to distinguish between the cost changes that occur because of output expansions only and those cost changes that occur because of a proportional network and output expansion. Therefore, the distinction between scale and density economies is particularly important in network industries.

Economies of density are defined as the increase in total cost resulting from an increase in output, holding all input prices and the network size fixed:

$$ED = \frac{1}{\frac{\partial \ln C}{\partial \ln y}} \quad (9)$$

Economies of density exist if  $ED$  is greater than 1. For values of  $ED$  below 1, we identify diseconomies of density. The existence of economies of density implies that average unitary costs of a bus operator decrease as physical output increases. In the case of  $ED = 1$ , no economies or diseconomies of density exist.

Slightly different is the definition of economies of scale. Here, the increase in the total cost is brought about by a proportional increase in output and in the network size, holding the factor prices constant. According to this definition,  $ES$  can be written as:

$$ES = \frac{1}{\frac{\partial \ln C}{\partial \ln y} + \frac{\partial \ln C}{\partial \ln n}} \quad (10)$$

Similarly to  $ED$ , economies of scale exist if  $ES$  is greater than 1. A value of  $ES$  below 1 indicates the presence of diseconomies of scale and would highlight the opportunity of breaking-up the existing monopoly network so as to introduce side-by-side competition.

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<sup>8</sup> In other words, the technical change does not alter the optimal input bundles.

#### 4.2. DATA AND VARIABLES

To estimate the cost model described in (8), economic and technical data from sampled bus transit providers was required. In order to get these data, we carried out a survey using a mail questionnaire. In this survey we asked a sample of small, medium-sized and large operators to report cost and technical data, as well as information on the governance form of their business organization. The final sample consists of an unbalanced panel of 33 bus transit companies over the 1993-2002 time period, for a total of 261 observations.<sup>9</sup>

Our sample firms, which on aggregate are responsible for about 70% of total revenues of the sector, are fairly representative of the universe of Italian LPT operators. As for the service type, 15 companies are specialized in the urban segment, while the remaining 18 are “mixed” companies operating in both urban and intercity areas. As for their localization on the territory, 19 firms provide service in the Northern Regions, while 6 and 8 firms operate in Central and Southern Italy, respectively. The *SpA* corporation form appears in 29 cases, while the other two governance categories – autonomous and municipal companies – are responsible for 99 and 133 unit observations, respectively. The sample composition by governance structure in each year is shown in table 1, from which one can notice that most of the observations concerning *SpA* corporations are concentrated in the last three years (2000-2002).<sup>10</sup>

Preliminary descriptive statistics in table 2 show that average unitary cost (total cost divided by supplied seat-kilometers) is highest for the group of municipal companies, and lowest for the *SpA* corporations, while intermediate values are exhibited in the autonomous company category. It is precisely such a link between cost performance and organizational form that we intend to test in a context of a multivariate regression analysis.

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<sup>9</sup> In order to assess the effects of the different institutional changes leading to corporatization described in section 3, the sampled bus transit companies were observed over a significant time period (7 to 10 years). The unbalanced nature of the panel is due to difficulties in obtaining detailed information on the cost structure after 1999, principally because of some relevant organizational changes (through mergers and acquisitions, as well as through corporatization) that occurred for most companies starting from 2000. Table 1 highlights the panel structure of the sample used in the cost function estimation.

<sup>10</sup> This is the main reason why the influence of governance form has not been analyzed in previous recent studies on production costs of Italian bus transit systems, which are all limited to the 1993-1999 period (see Buzzo Margari et al., 2007; Cambini et al., 2007; Piacenza, 2006).

**Table 1. Sample Composition by Year and Governance Form**

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total nr.
<i>Municipal company</i>	94%	82%	73%	52%	33%	33%	21%	20%	20%	10%	133
<i>Autonomous company</i>	3%	15%	24%	42%	61%	61%	67%	50%	20%	20%	99
<i>SpA corporation</i>	3%	3%	3%	6%	6%	6%	12%	30%	60%	70%	29
Total number	33	33	33	33	33	33	33	10	10	10	261

**Table 2. Average Unitary Cost by Governance Form**

	<i>Municipal company</i>	<i>Autonomous company</i>	<i>SpA corporation</i>
Average unitary cost (10 <sup>2</sup> € per seat-km)	3.78	3.54	3.30
Total observations	133	99	29

The variables for the cost function specification were calculated as follows. Total production cost  $C$  is calculated as the total expenditures of the bus companies per year. The output ( $y$ ) is measured in seat-kilometers. The choice of this output measure is twofold. First, we recognize that output in cost function estimations is better represented by pure supply output measures. We believe that the alternative use of demand-related output measures (such as passenger revenue or passenger trips) is inadequate in cost function estimations as they mainly reflect consumed and not produced output. Second, seat-kilometers is the most commonly used supply-related output measure in the empirical literature, and is particularly appropriate for our sample, which includes both urban and intercity operators. The output characteristic variable  $n$  represents the network length, measured in total kilometers of bus routes, while the second output characteristic variable  $s$  indicates the average commercial speed of vehicles and reflects the number of kilometers per hour of service.

Input prices are defined as factor expenditures per factor unit. Labor price ( $p_L$ ) is defined as the ratio of annual labor costs to total number of employees. The capital price ( $p_K$ ) is calculated as the sum of depreciation and materials and services costs divided by the number of vehicles in the operator's fleet weighted by age. Unfortunately, no data were available which would allow us to calculate the capital stock using the capital inventory method. The use of a simple indicator is justified by the fact that the bus companies do not possess a significant stock of capital apart from the rolling stock. Finally, energy price ( $p_E$ )

is computed as the ratio of annual fuel costs to total number of liters of diesel fuel. All input prices, as well as total cost, are corrected for inflation over the years to the 1999 constant euros general production price index. Summary statistics of the variables used in the analysis are provided in table 3.

#### 4.3. ESTIMATION METHOD AND RESULTS

With regard to the choice of the econometric technique, it should be noted that the econometric literature on panel data offers various types of models focusing on cross-sectional variation, i.e., heterogeneity across units. The two most widely used approaches are the fixed-effects (LSDV) and the random-effects (GLS) models.

**Table 3. Summary Statistics**

<i>Variables</i> (unit of measurement)	<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>
Total production cost <sup>a</sup> (10 <sup>3</sup> €)	70,113	116,368	8,139	743,662
Seat-kilometers (10 <sup>6</sup> )	1,799	2,728	226	15,489
Network length (kms of routes)	1,448	1,177	64	5,135
Average speed (kms per hour of bus service)	20	6	10	33
Rolling stock (number of buses)	434	501	69	2,806
Workforce (number of employees)	1,305	2,096	151	13,344
Labor price (10 <sup>3</sup> € per employee)	37.97	3.57	29.59	47.38
Energy price (€ per liter of diesel fuel)	0.59	0.07	0.44	0.90
Capital price <sup>b</sup> (10 <sup>3</sup> € per bus)	28.32	9.64	11.39	62.61
Mixed service <sup>c</sup> (number of 1)	0.54	0.50	0	1
<i>Autonomous</i> company (number of 1)	0.38	0.49	0	1
<i>SpA</i> corporation (number of 1)	0.11	0.31	0	1

<sup>a</sup> Sum of labor, energy and capital costs.

<sup>b</sup> Capital cost is the sum of depreciation and materials and services expenses.

<sup>c</sup> Dummy for bus companies providing both urban and intercity services.

In the LSDV approach a complete set of cross-section dummy variables is introduced in the cost specification model. This means that the LSDV approach allows a separate constant term for each unit, while in the random effects approach the individual terms  $u_i$  are considered to be random variables. In this case, firm-specific differences across units are not viewed as parametric shifts of the regression function as in the LSDV model, but as randomly distributed shocks. For this study we decided to use a random effects model for two reasons. First, in using the LSDV model it is not possible to estimate the

parameters of time-invariant observations, e.g., the dummy variable for the type of service (*DMIX*) included in model (8). Secondly, the data show a relatively low variation over time (within variation) in some of the variables. As Cameron and Trivedi (2005) pointed out, the fixed-effects approach has an important weakness, in that the estimated coefficients of explanatory variables are “very imprecise” if the variables’ variation over time (within variation) is dominated by that across companies (between variation).<sup>11</sup> Therefore, the following comments are based on the results obtained by estimating a random effects (GLS) model, with  $u_i \sim iid N(0, \sigma_u^2)$ . This model also has a clear advantage over an alternative cross-sectional model that pools the data across companies, because it takes into account part of the unobserved heterogeneity across units.<sup>12</sup>

Table 4 presents the parameter estimates and standard errors of the translog cost function (8). The estimated model is well-behaved. Most of the coefficients are statistically significant and carry the expected sign. Parameter estimates satisfy the regularity condition of concavity in input prices at the average point of approximation, which requires that the own-price elasticities of inputs be negative and that the Hessian matrix be negative semi-definite. Because both homogeneity in input prices and symmetry of the second order terms were imposed, the estimated function satisfies all regularity conditions of a theoretically valid total cost model. Since production costs, as well as output and input variables, are expressed in natural logarithms and have been normalized to their respective average values, the first-order coefficients can be directly interpreted as cost elasticities evaluated at the sample mean.

The average cost elasticities with respect to factor prices are positive. The estimated coefficients for price of labor (0.68) and price of capital (0.16) reflect the shares of total costs attributed to labor and capital at the mean point of production. The imposed linear homogeneity condition implies that the estimated coefficient for energy is 0.16. Summarizing, on average labor expenses account for 68%, capital expenses for 16%, and energy expenses for 16% of total production cost.

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<sup>11</sup> Johnston and Di Nardo (1997) also show that the “attenuation” bias due to measurement errors is exacerbated in the fixed-effects models, depending on the fraction of the within variation due to “mismeasurement,” especially when the explanatory variables are correlated across time. In our case both reporting errors and correlation across time are plausible.

<sup>12</sup> Another alternative would have been to estimate a cost system using a seemingly unrelated regression equations (SURE) approach. In our case this cost system consists of the cost function (8) and two-factor share equations for capital and labor. However, the traditional SURE approach does not take into account the unobserved firm-specific heterogeneity. Therefore, we decided not to follow this approach.



**Table 4. GLS Estimation of the Translog Total Cost Function (8)**

Regressor	Parameter estimate	Standard error
<i>Constant</i>	39.762***	(3.355)
$\ln y$	0.842***	(0.025)
$\ln n$	0.065**	(0.030)
$\ln s$	-0.303***	(0.050)
$\ln p_L$	0.678***	(0.039)
$\ln p_K$	0.162***	(0.025)
$\ln y \ln n$	-0.008	(0.034)
$\ln y \ln s$	-0.354***	(0.085)
$\ln n \ln s$	0.215***	(0.082)
$\ln y^2$	0.033*	(0.018)
$\ln n^2$	-0.016	(0.018)
$\ln s^2$	-0.299**	(0.141)
$\ln y \ln p_L$	0.192***	(0.065)
$\ln y \ln p_K$	0.028	(0.037)
$\ln n \ln p_L$	-0.217***	(0.069)
$\ln n \ln p_K$	-0.141***	(0.033)
$\ln s \ln p_L$	0.989***	(0.222)
$\ln s \ln p_K$	0.725***	(0.093)
$\ln p_L \ln p_K$	-0.625***	(0.121)
$\ln p_L^2$	0.132	(0.160)
$\ln p_K^2$	0.153***	(0.040)
<i>DMIX</i>	-0.129**	(0.052)
<i>DAU</i>	-0.020**	(0.009)
<i>DSPA</i>	-0.037**	(0.015)
<i>T</i>	-0.011***	(0.002)
Log-Likelihood	489.425	
$\sigma_e^a$	0.042	
$\sigma_u$	0.099	
$R^2$	0.998	

\*, \*\*, \*\*\* Significantly different from zero at the 90%, 95%, 99% confidence level.

<sup>a</sup> In the random effects specification  $\varepsilon_{it} = e_{it} + u_i$ .

Output elasticity is 0.84, implying that a 10% increase in the supplied seat-kilometers will increase total cost only by 8.4%. The cost elasticity with respect to network length is, as expected, positive (0.07) and significant. Economies of scale (*ES*) and economies of network density (*ED*) estimated for the average bus operator are calculated according to the formula specified in equations (9) and (10). Notice that for the computation of *ES* and *ED*, factor prices as well

as commercial speed are held constant to their sample means. The indicator for density economies is greater than 1 ( $ED = 1.10$ ), suggesting that medium-sized operators fail to operate at the optimal density of the network: a more intensive usage of the existing network would decrease the cost per seat-kilometer.<sup>13</sup> Turning toward scale economies, the indicator is greater than 1 ( $ES = 1.19$ ), indicating that medium-sized operators fail to operate at the optimal scale: this result implies that for some bus companies that operate in adjacent territories, end-to-end mergers could be promoted. In general, the above evidence on technology properties tends to confirm that franchised monopolies, rather than side-by-side competition, are the most efficient form of production organization for public transit systems.

The cost elasticity for commercial speed  $s$  is, as expected, negative (-0.30) and significant, suggesting that a 10% increase in speed (e.g., from 20 to 22 kms per hour) is effective in reducing operating cost considerably (-3%). The coefficient of the trend variable  $T$  is negative and significant at the 99% confidence level: this implies that Italian bus companies experienced cost savings of about 1% per year over the period considered, due to the impact of technological progress. Finally, the negative and significant coefficient for the dummy variable  $DMIX$  (-0.13) highlights that “mixed” companies, by being active in both urban and intercity areas, enjoy scope economies between the two types of bus service.

The hypothesis regarding the presence of a significant influence of the corporatization process on production costs is accepted at the 95% confidence level. Our findings are consistent with the theoretical framework discussed in section 2, based on Hart et al. (1997) and Hart (2003), according to which the transformation of a State-owned firm from a municipal company to an autonomous company or an *SpA* corporation has the effect of increasing managerial effort level, and so presumably reducing production cost: the negative coefficients estimated for  $DSPA$  and  $DAU$  suggest that bus companies that are more independent from local government operate more efficiently as compared with bus companies directly managed by the public administration. Furthermore, as expected, the transformation of municipal companies into *SpA* corporations has a stronger impact in terms of cost reduction (-4%) than a transformation in an autonomous company (-2%)<sup>14</sup>; this

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<sup>13</sup> However, such a strategy would require the existence of a market for bus services, which under the actual conditions and the constantly decreasing patronage levels, cannot be assumed. However, such information can be relevant for regulatory policy, since it allows one in principle to differentiate among the subsidies to be granted to each company according to the extent of density economies associated with the provision of a specific type of bus service.

<sup>14</sup> Cost elasticities with respect to the dummy variables  $DAU$  and  $DSPA$  represent the percentage impact on costs due to a shift of governance structure from municipal firm to

is probably due to the higher degree of freedom from the typical restrictions that are imposed on government agencies as far as personnel hiring and promotion, procurement and long-term investment budgetary operations are concerned (see the literature review in section 2).

For a complete evaluation of these results, we also tried a specification in which a dummy variable is introduced in order to distinguish the regulatory regime for subsidies (i.e., fixed-price versus cost-plus contracts) applied to each bus company. Particularly, we were interested in separating the effects on costs due to the introduction of fixed-price regulation from the influence of the corporatization process. The empirical results did not show a statistically significant impact of this variable, so that the latter has been excluded from the final model. While this result could suggest that incentive contracts, which were found to be effective in past studies focusing on the 1990's (Piacenza, 2006; Buzzo Margari et al., 2007), are less effective in reducing costs as compared to changes in governance structure, our dataset does not allow us to reach a conclusive answer. In fact, while fixed-price regulation started in the mid 90's, the transformation of bus operators into *SpA* corporations largely took place in the last three years covered by this study (i.e., 2000-2002). The analysis of the combined effect of the two institutional reforms represents an appealing topic for future research.<sup>15</sup> However, for that purpose a richer and updated information set on regulatory contracts and governance structure will be needed. The latter would also permit us to assess whether the highlighted efficiency gains from the corporatization process can be sustained over the years, without introducing a real privatization of local utilities and the associated profit motivation.<sup>16</sup>

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autonomous company or *SpA* corporation, respectively. These elasticities are computed as  $[\exp(\alpha_{AU}) - 1]$  and  $[\exp(\alpha_{SpA}) - 1]$ .

<sup>15</sup> It is worth noticing that, while Roy and Yvrande-Billon (2007) analyzed both ownership structure (private versus public) and contractual practices (fixed-prices versus cost-plus) in their study on French bus companies, they did it in two separate regressions, so that it is not possible to evaluate the joint (and possibly complementary) effect on production efficiency.

<sup>16</sup> On this issue, Stiglitz (2000:6) points out that according to some authors the gains implied by corporatization could not be maintained without the profit motive derived from private ownership. This occurs because “*often the managers of government enterprises do well after privatization – becoming highly paid executives in the new private company and/or receiving hefty shares or options in the newly privatized company – and it is these economic returns which drive them to improve efficiency during the corporation stage.*”

Finally, for robustness purposes, we also carried out a stochastic frontier estimation of our cost function model, obtaining results which are qualitatively very similar to those discussed above.<sup>17</sup>

## 5. CONCLUSIONS

In many industries, especially in local public utilities, institutional reforms aimed at increasing cost efficiency have been characterized by a change of the internal governance system of the firms and their privatization. More specifically, in highly subsidized industries like local public transport, as noted by Stiglitz (2000), before a government enterprise is privatized, it typically goes through an intermediate stage labelled as *corporatization*, i.e. the transformation of a municipal firm into a limited liability company still under governmental control. It is therefore relevant, from both the policy and market efficiency points of view, to understand the effects of this governance reform on the cost of those local public services whose ownership is maintained by local government. Indeed, such an analysis sheds light on the issue of whether pure privatization is the only solution to agency problems in the governance system, or whether a restructured governance system can positively affect firms' performance even if the ownership remains public.

To the best of our knowledge, the present paper represents the first attempt to investigate the impact of the corporatization process within publicly-provided local utilities. To this purpose, we use information on a typical local utility, such as bus services provided by public transit systems in Italy, which have experienced a change of their governance towards the corporate form during the 90's and especially in the first years of the 2000's, without

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<sup>17</sup> We are grateful to an anonymous referee for this suggestion. In particular, we first estimated a panel data version of the Aigner et al. (1977) half-normal frontier cost function. Moreover, in order to take into account the unobserved firm-specific heterogeneity, we also estimated the "true" random effects frontier model proposed by Greene (2005), but we incurred convergence problems during the estimation procedure. In both frontier specifications we had to exclude the time trend variable. Indeed, as pointed out by Kumbhakar and Lovell (2000), the introduction in a frontier model of a time trend or a series of time dummies among the regressors, as a proxy for technical progress, can cause non-unusual problems in estimation. However, the main results on the presence of economies of scale and density remain unchanged. The indicator for density economies is greater than 1 and larger than in the previous case ( $ED = 1.60$ ). The indicator for scale economies is still greater than 1 and greater than before ( $ES = 1.35$ ). In sum, the effect of scale and network dimensions appears to matter even more. Most importantly, focusing on the corporatization effect, we notice that the transformation of municipal companies into *SpA* corporations still has a stronger impact in terms of cost reduction, and this effect is greater than in the random estimation (-6%); the same holds true for a transformation into an autonomous company (-3.5%).

introducing private ownership. A total cost function approach is applied to a sample of 33 local bus companies over the period 1993-2002, relying on a random effects estimation procedure. The results suggest that the transformation of a municipal firm into an autonomous company – corresponding to the first stage of the corporatization process of Italian local utilities – or into a limited liability company can exert a reducing impact on production costs. This evidence supports the theoretical argument that effective incentive schemes can be put into place under corporatization (Shleifer and Vishny, 1994; Hart et al., 1997), and therefore that considerable efficiency gains can also occur in such an intermediate stage preceding a privatization process.

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