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Corporatization and Firm Performance: Evidence from Publicly Provided Local Utilities

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Abstract. This study investigates the effects of the corporatization process – i.e. the transformation of a municipal firm into a limited responsibility 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 nineties. 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 utilites in Italy – or into a limited responsibility company exerts a reducing impact on the production costs.

Keywords: Corporatization; State-owned local utilities; Production costs; Bus transit systems; Panel data

JEL codes: H42; H82; K23; L33; L92

1. Introduction

Despite the huge wave of privatization started in the mid of eighties all around Europe, many public utilities, especially at the local level, are still under the control of the State: at the end of 2000, through ownership or golden shares, central or local governments were controlling more than 60% of privatized firms (Bortolotti and Faccio, 2009). Even in the case of publicly-provided services, firm's internal governance may change over time following a process which has been labeled *corporatization* by Shleifer and Vishny (1994). Corporatized companies represent an 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, p. 206): «*Typically, before a government enterprise is privatised, 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 derive from existing literature show that, as long as a firm changes the ownership status, a better alignment of incentives between managers and shareholders pushes the former to increase cost-reducing effort. 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 contrasted by politicians, in fact, corporatization, by structuring the internal governance system of State owned firms similar to that of a modern corporation, may improve the monitoring of managers, 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 acts thus as a potentially effective instrument in providing incentives to improve performance and increase efficiency.

Therefore, 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 in 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 systems therefore represents an ideal natural experiment to evaluate the effect of corporatization. Such an experiment allows us to address the question 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 analyses its impact on the cost performance of local public utilities.

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: A literature review

The relationship between ownership issues and managerial performance and their impact on firm's efficiency has received a quite considerable attention in the economic debate, but less much so when specifically applied to local public utilities.

The majority of studies focuses mainly on the ownership effect, i.e. on the comparison of performance, efficiency and other economic parameters between privately and State-owned enterprises.

On the theoretical side, Laffont and Tirole (1991) show that State-owned firms find it difficult to monitor managers due to a lack of incentive for the owner to monitor managers' performance and to the absence of informational signals from the 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 are facing 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 to regulatory commitment and State control, may affect the decision to privatize the 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* too exerts a positive impact on 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 likely still to obtain public transfers from the government, which means that budget constraints can remain soft under corporatization.

Some theoretical insights which are relevant for the topic of our paper can come also 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 malutilization" and "accounting contrivance" are two incentive distortions associated with vertical integration (that, in our case, can be seen as a State-owned enterprise who opts for the in-house provision of the local public service), implies that managers will take value-reducing actions to protect their own returns and asset values (Williamson, 1984, Crémer, 2009). On the other hand, corporatization is a governance form which is less subject to bureaucratic distortions and allows higher-powered incentives than the "vertically integrated" structure.

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

Relatively few studies have analyzed the case of mixed ownership, suggesting a positive effect on performance (e.g. Boardman and Vining, 1989, and, for local public utilities, Roy and Yvrande-Billon, 2007)[1], 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).

The 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 privatisation, and Bilodeau et al. (2007), who deal with Government Agencies in Canada, found positive effects of such a form of internal governance

[1] It is worth to remark that the benefits from partial privatization are not always confirmed by the empirical evidence. For instance, Garrone *et al.* (2007) analyse 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 generate per se 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.

Before presenting the dataset and the empirical analysis, we sketch a stylised 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). An option is to provide it "in house", i.e. by hiring public employees which are 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, it could accept to renegotiate with the manager ex post 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 the 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:

$$B = B_0 - b(e) \qquad [1]$$

$$C = F - c(e) \qquad [2]$$

where *e* denotes the observable but not verifiable effort devoted to cost reduction, $c(.) \geq 0$ and $b(.) \geq 0$ are the reduction in cost and in quality due to the effort, respectively. The following assumptions for convexity and monotonicity hold: $b'(.) \geq 0$, $b''(.) \geq 0$; $c(0) = 0$, $c'(0) = \infty$, $c'(.) \geq 0$, $c''(.) < 0$, $c'(\infty) = 0$; $c'(.) - b'(.) \geq 0$, 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 it follows: in stage 1, the manager *M* and the government *G* write a contract for the service provision; in stage 2, *M* chooses the 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 derive from the maximization of the net surplus generated by the provision of the service, i.e.

$$\underset{e}{Max}\, B_0 - b(e) - F + c(e) - e \qquad [3]$$

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 who pays also the operating costs for the service's provision. This manager gets a fixed salary since he is a public employee and it is no 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.

$$\underset{e}{Max}\, P - e \qquad [4]$$

It is straightforward to see that the optimal effort level is in this case 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 α of the net benefit derived from the effort choice. The parameter α represents the degree of incentive power that the government can use in its contract with the manager. High values of α imply strong incentives for managers and a high level of firm's efficiency. The parameter α can be interpreted as the different degree of responsibility of a manager: his responsibility on firm's performance is null (α = 0) in a directly managed firm, since he is only an employee of the government; on the contrary, the manager could have a larger responsibility, as in a limited responsibility company still owned by local municipalities, but to run the firm he requires a (monetary or non monetary) incentive to reward the additional risk to be faced (α > 0). Typically, as in a Nash-bargaining game, the Government and the Manager split the fraction α of the net benefit 50:50. Therefore, the manager maximizes:

$$\underset{e}{Max}\, P - e + \frac{\alpha}{2}\left[c(e)-b(e)\right] \qquad [5]$$

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

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

All in all, we can observe that the effort level in 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 gets additional control rights over the firm, i.e. the parameter α increases due to a change in the degree of corporatization passing from a direct management firm to an autonomous company, or to a limited responsibility company, the incentives to increase firm's efficiency are enlarged.

3. The corporatization process of local public services in Italy

In Italy local public services were typically carried on by local municipalities with in-house arrangements. This regime were 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 nineties. In this time frame, the local services were managed directly by local municipalities and even when a distinct business was created (the so-called *Azienda Municipalizzata*), it was subjected to the same standard administrative and accounting rules 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 the firm from the influence of policy makers. But still the process was not complete, since local utilities were by large 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 to provide incentives for local municipalities to transform the special companies into standard limited responsibility enterprises. Then law 448/2001 established that, by the end of June 2003, all special companies had to be reorganized as standard limited responsibility 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*).[2]

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

[2] It is worth to notice that, while the reform was permitting to local municipalities to sell at least a fraction of the firms to private partners, the first private investors appeared only starting from 2005.

[3] See Bognetti and Robotti (2007) for a recent evaluation of the local public services reforms in Italy, with particular reference to the creation of mixed (public-private) companies.

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

Indeed, some important interventions during the second half of the nineties (law 549/1995 and subsequent *decreti legislativi* 422/1997 and 400/1999) have reformed the organization of the sector under several respects, among which changes in the governance towards corporatization forms have been foreseen. However, the few attempts to introduce competitive tendering for the provision of the 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 – i.e., the municipal company (*Azienda Municipalizzata*), the autonomous company (*Azienda Speciale*) and the corporatized company (limited responsibility 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, price of inputs (capital, labor and energy price) and some output characteristic variables, such as for instance network length, the number of stops, and average commercial speed.[4] 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.[5] 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 the production costs concerns the internal governance system of the bus companies, i.e., the status of municipal company, autonomous company, or *SpA* corporation. In this study, relying on the same empirical approach followed by Filippini and Prioni (2003), Mizutani and Urukami (2003) and Roy and Yvrande-Billon (2007) to assess the effects of ownership structure, we choose to investigate the

[4] 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 See Berechman (1993) for an overview of the application of cost functions in public transport.

[5] See, among the others, Matas and Raymond (1998), Filippini and Prioni (2003), Fraquelli *et al.* (2004), Farsi *et al.* (2006).

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:

$$C = f\left(y,\, n,\, s,\, p_L,\, p_K,\, p_E,\, DSPA,\, DAU,\, DMIX,\, T\right) \qquad [7]$$

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 in the model the following dummy variables:[6] *DSPA*, which is equal to 1 for bus companies that are corporations and 0 for the other organizational types, and *DAU*, which is equal to 1 for firms that are autonomous companies and 0 for the other governance forms.[7] *DMIX* is a dummy variable that distinguishes bus companies offering the service only in urban areas from those operating also in rural areas (intercity service); *DMIX* is equal to 1 for bus companies that operate both in rural and urban areas and 0 otherwise. Finally, the trend variable T reflects the effects on costs due to technical progress occurred over the observed years.

To estimate the cost function [7], a translog functional form is chosen.[8] The translog approximation to [7] is written as:

$$\ln\frac{C_{it}}{p_{E_{it}}} = \alpha_0 + \alpha_y \ln y_{it} + \alpha_n \ln n_{it} + \alpha_s \ln s_{it} + \sum_{r=L,K} \alpha_r \ln\frac{p_{r_{it}}}{p_{E_{it}}} + \sum_{\substack{l=y,n,s \\ m=y,n,s}} \frac{1}{2}\alpha_{lm} \ln l_{it} \ln m_{it}$$

$$+ \sum_{\substack{r=L,K \\ q=L,K}} \frac{1}{2}\alpha_{rq} \ln\frac{p_{r_{it}}}{p_{E_{it}}} \ln\frac{p_{q_{it}}}{p_{E_{it}}} + \sum_{\substack{l=y,n,s \\ r=L,K}} \alpha_{lr} \ln l_{it} \ln\frac{p_{r_{it}}}{p_{E_{it}}} + \alpha_{SPA} DSPA_{it} + \alpha_{AU} DAU_{it} + \alpha_{MIX} DMIX_{it} + \alpha_T T_t + \varepsilon_{it} \qquad [8]$$

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.[9] Note that by normalizing total cost and input prices by one of the input prices (here the price of

[6] 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.

[7] There is an alternative approach that can be used to analyze the impact of governance change on the production costs. This approach proposes to estimate a cost frontier function and then to conduct some statistical tests on the differences of inefficiency levels across companies with different governance forms. We decided not to use the frontier approach because it is not free from the estimation errors incurred in the inefficiency assessment. These random errors may mask the transition between sub-samples, thus may result in under-rejection (too few rejections) of the null hypothesis of similar cost inefficiencies across different types of governance. Moreover, for some cost frontier specifications we also incurred in convergence problems during the estimation procedure.

[8] A translog function requires the approximation of the underlying cost function to be made at a local point, which in our case is taken at the average point of all variables. Thus, all independent variables are normalized at their average points.

[9] In other words, the technical change does not alter the optimal input bundles.

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 the 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 cost changes that occur because of output expansions only and 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 (Caves, Christensen and Tretheway, 1984):

$$ED = \frac{1}{\frac{\partial ln\, C}{\partial ln\, y}} \qquad [9]$$

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:

$$ES = \frac{1}{\frac{\partial \ln C}{\partial \ln y} + \frac{\partial \ln C}{\partial \ln n}} \qquad [10]$$

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.

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 conducted a survey using a mail questionnaire. In this survey we asked a sample of small, medium-sized and large operators to report cost and operating 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.[10] 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 the *SpA* corporation are concentrated in the last three years (2000-2002).[11]

INSERT TABLE 1 HERE

Preliminary descriptive statistics in table 2 show that average unitary cost (total cost divided by supplied seat-kilometers) is the highest for the group of municipal companies, the lowest for *SpA* corporations, while intermediate values are exhibited by 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.

INSERT TABLE 2 HERE

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 measures in the empirical literature, and is particularly appropriate for our sample, which includes both urban and intercity operators.[12]

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. Following Friedlaender *et al.* (1983), the capital

[10] 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 up 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.

[11] This is the main reason why the influence of the governance form has not been analyzed in previous recent studies on the production cost of Italian bus transit systems, that are all limited to the 1993-1999 period (see Buzzo Margari *et al.*, 2007; Cambini *et al.*, 2007; Piacenza, 2006).

[12] See for example Berechman (1987), and Filippini and Prioni (1994, 2003).

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, the energy price (p_E) is computed as the ratio of annual fuel costs to total number of liters of diesel oil.

All input prices, as well as total cost, are corrected for the inflation over the years to 1999 constant euros general production price index. Summary statistics of the variables used in the analysis are provided in table 3.

INSERT TABLE 3 HERE

4.3. Estimation procedure 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.[13] In the LSDV approach a complete set of cross-section dummy variables is introduced in the cost model specification. This means that the LSDV approach allows a separate constant term for each unit. In the random effects approach the individual terms u_i are considered as 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, 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).[14] 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 has also a clear advantage over an alternative cross-sectional

[13] For a detailed presentation of the econometric methods that have been used to analyse panel data, see Balestra and Nerlove (1966), Greene (2003) and Hsiao (2003).

[14] Johnston and DiNardo (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.

model that pools the data across companies, because it is taking into account part of unobserved heterogeneity across units.[15]

INSERT TABLE 4 HERE

Table 4 presents 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 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 cost 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 labour (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 estimated coefficient for energy is 0.16. Summarizing, on average labor expenses accounts for 68%, capital expenses for 16% and energy expenses for 16% of total production cost.

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 in operating at the optimal density of the network: a more intensive usage of the existing network would decrease the cost per seat-kilometer.[16] Turning towards scale economies, the indicator is greater than 1 (*ES* = 1.19), pointing out that medium-sized operators fail in operating at the optimal scale: this result implies that for

[15] 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.

[16] 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 an information can be relevant for the regulatory policy, since it allows in principle to differentiate the subsidies to be granted to each company according to the extent of density economies associated with the provision of a specific bus service.

some bus companies that are adjacent 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 the 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.[17]

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 municipal company to autonomous company or *SpA* corporation has the effect to increase managerial effort level and so presumably reduce production cost: the negative coefficients estimated for *DSPA* and *DAU* suggest that bus companies that are more independent from local government operate more efficiently with respect to 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%)[18]; this is probably due to the higher degree of freedom from the typical restrictions 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 subsides (i.e. fixed-price versus cost-plus contracts) applied to each bus company. Particularly, we were interested to separate 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 statistical 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 90's (Piacenza, 2006 and

[17] For more discussion on this issue, see Fraquelli *et al.* (2004), Di Giacomo and Ottoz (2009), and Farsi *et al.* (2007).

[18] Cost elasticities with respect to dummy variables *DAU* and *DSPA* represent the percentage impact on costs due to the shift of governance structure from municipal firm to autonomous company and *SpA* corporation, respectively. Following Halvorsen and Palmquist (1980), these elasticities are computed as [exp(α_{AU}) -1] and [exp(α_{SPA}) -1].

Buzzo Margari *et al.*, 2007), are less effective in reducing costs compared to changes in governance structure, our dataset does not allow us to reach a conclusive evidence. 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 combined effect of the two institutional reforms represents an appealing topic for future research.[19] However, for that purpose a richer and updated information set on regulatory contracts and governance structure is needed. The latter would also permit us to assess whether the highlighted efficiency gains from corporatization process can be sustained during the years, without introducing a real privatization of local utilities and the associated profit motivation.[20]

5. Conclusions

In many industries, especially in local public utilities, institutional reforms aiming at increase 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 the local public transport, as stated 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 responsibility 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 local public services whose ownership is maintained by local government. Indeed, such an analysis sheds light on the issue 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 exploit the information on a typical local utility, such as the bus service provided by public transit systems in Italy, which have experienced a change of their governance towards the corporation form during the 90's and especially in the first years of 2000's, without introducing private ownership. A total

[19] It is worth to notice 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 their joint (and possibly complementary) effect on production efficiency.

[20] On this issue, Stiglitz (2000, p. 6) points to that according to some authors the gains implied by the corporatization could not be maintained without the profit motive derived from private ownership. This occours 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*».

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 point to that the transformation of a municipal firm into an autonomous company – corresponding to the first stage of corporatization process of Italian local utilities – or into a limited responsibility company exerted a reducing impact on the production costs. This evidence supports the theoretical argument that under corporatization effective incentive schemes can be put into place (Shleifer and Vishny, 1994; Hart *et al.*, 1997) and therefore that considerable efficiency gains can occur also in such an intermediate stage preceding a privatization process.

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Table 1. Sample composition by year and governance form

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total nr.
Municipal company	94%	82%	73%	52%	33%	33%	21%	20%	20%	10%	133
Autonomous company	3%	15%	24%	42%	61%	61%	67%	50%	20%	20%	99
SpA corporation	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

	Municipal company	*Autonomous* company	*SpA* corporation
Average unitary cost (10^{-2} € per seat-km)	3.78	3.54	3.30
Total observations	133	99	29

Table 3. Summary statistics

Variables (unit of measurement)	***Mean***	***St. dev.***	***Min***	***Max***
Total production cost [a] (10^3 €)	70,113	116,368	8,139	743,662
Seat-kilometers (10^6)	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 (10^3 € per employee)	37.97	3.57	29.59	47.38
Energy price (€ per liter of diesel oil)	0.59	0.07	0.44	0.90
Capital price [b] (10^3 € per bus)	28.32	9.64	11.39	62.61
Mixed service [c] (number of 1)	0.54	0.50	0	1
Autonomous company (number of 1)	0.38	0.49	0	1
SpA corporation (number of 1)	0.11	0.31	0	1

[a] Sum of labour, energy and capital costs.

[b] Capital cost is the sum of depreciation and materials and services expenses.

[c] Dummy for bus companies providing both urban and intercity services.

Table 4. GLS estimation of the translog total cost function [8]

Regressor	Parameter estimate	Standard error
Constant	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)
DMIX	-0.129**	(0.052)
DAU	-0.020**	(0.009)
DSPA	-0.037**	(0.015)
T	-0.011***	(0.002)
Log-Likelihood	489.425	
σ_e [a]	0.042	
σ_u	0.099	
R^2	0.998	

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

[a] In the random effects specification $\varepsilon_{it} = e_{it} + u_i$.