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UNCONVENTIONAL FACTORS OF EFFICIENCY IN PUBLIC TRANSPORT. A CASE STUDY AND THEORY.

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ABSTRACT

In this paper we analyse some possible unconventional factors of efficiency in public transport. The occasion for such analysis rises from a case study in the southern Italian region of Sicily. Most of the regional bus service is here historically franchised to some local private bus companies, without tenders or any other form of competition. The structure of the network has never been planned *ex-ante*, as it is the result of negotiations among bus companies, local and regional authorities. Though this situation is obviously quite far from indications of the regulation theory, it results in a surprisingly efficient system, with very low unit costs.

An analysis of this situation is here carried out in order to understand which factors are forcing those companies to be efficient and which problems this situation may generate. The quality and effectiveness of the offered service is also reckoned.

Two factors seem to be most relevant to this results: the relatively low level of subsidies together with the fact of being private operators (rather an exception than a rule in Italy). In order to improve their efficiency, those companies also merged together but eventually split again in the last decades in order to reach a more efficient size and suggesting the presence of possible diseconomies of scale in the sector.

Taking for granted that a form of regulation is needed, it is here suggested that regulatory strategies should adapt to this counterintuitive fact and not destroy the incentives already effective in the present situation. Our suggestion is to prefer medium sized tenders rather than large ones, not only for granting more contestability, but also for financial reasons.

Keywords: regulation; bus; economies of scale; public transport; tender.

1. INTRODUCTION

The organization of public transport in Europe has changed a lot during the last decades, often as a consequence to changes in the regulatory framework. In general, previous situations of monopolistic “in house” provision of public transport services have generally evolved towards market models, with the aim of introducing competition and thus improving the efficiency, usually not assured due to the local monopoly conditions. In market models, services are usually franchised by means of competitive tendering or in a few cases (e.g. the UK) the provision of bus services has been deregulated.

In this paper we study a quite peculiar case of non regulated monopolistic provision of public transport in Sicily, where some unconventional (and perhaps unexpected) factors of efficiency seem to have emerged. Most of the regional bus service is here historically franchised to some local private bus companies, without tenders or any other form of competition. Moreover the structure of the network has not been planned *ex-ante* by any public body, as it is the result of negotiations among bus companies, local and regional authorities.

The paper is structured as follows. In section 2, we carry out an analysis of the literature related to public transport economics, with a focus on the weakly regulated monopolies. In section 3, a brief description of public transport provision in Sicily is given, with particular reference to regulation, planning and organisational forms. An analysis of the Sicilian situation under a regulatory perspective follows in section 4, also by means of a model describing incentives. Some possible explanations of the results are given in section 5. Finally, some conclusion are derived in section 0, together with hints on regulatory strategies that could take into account those factors.

2. LITERATURE AND ECONOMIC THEORY OF MONOPOLIES

The literature on public transport, and in particular on regulatory issues, is broad, but especially focusing on specific themes. As Gwilliam (2008) in his recent review points out, the literature followed some “waves” in the last four decades, focusing its main interests on some key issues for the period. The most recent contributions, for example, frequently refer to the forms and mechanisms of competition franchises or in the in-deep analysis of conditions for efficiency in bus subsidisation (Karlaftis and McCarthy,1997). Other topics, such as equity effects associated to different fare systems generated much more interest in the past than now.

This section will provide a brief look into the issues of literature on public transport that are more relevant for our case, namely the effect of subsidisation and ownership in firms efficiency, the regulation (or de-regulation) and its effects, the behaviour of public transport firms in an unregulated or weakly regulated environment. We will also quote some descriptive studies or cases of non-planned transport networks.

Subsidisation, ownership and efficiency

The issue of efficiency of bus firms and the related conditions is heavily present in literature. The methodological approach generally used is econometric, with less contributions using a case-study approach. In this sense, the present paper has few parallels in international academic literature. We will focus here only on the papers looking at the relationships between efficiency and subsidisation and ownership. Only few words on the important topic of efficiency and dimension will be given.

The effect of subsidies on efficiency and social welfare has been addressed in the seminal contributions of Ramsey (1927), Boiteaux (1956), Baumol and Bradford (1970). Particular importance in more recent literature is given on “how” subsidies are given, for example in form of lump sum subsidy for capital expenses (typically buses), as end-of-balance deficit coverage or, more correctly, on an output basis. In this case the key difference is between incentivising subsidies or not.

Karlaftis and McCarthy (1997) analyse the effects of public transit subsidies on the performance of the system. They confirm the general belief that subsidies increase effectiveness but compromise efficiency of firms. In addition, they stress that the effect of subsidies varies according to firms’ and system’s size and source of subsidy.

Obeng and Azam (1997) look at a sample of US bus companies, from 1983 to 1992. Their efficiency is analysed taking into account also some less-conventional factors in econometric studies, such as rent seeking phenomena, bureaucratic behaviours, principal-agent model. These factors appear in the real world to be extremely important in explaining firms behaviours in terms of efficiency. The major findings are that subsidies determine an overuse of fuel and labour relative to capital among the input factors, and the dependence of allocative distortions induced by subsidies on management type (public, private). More in general, variables show that “politics play an important role in the level of operating subsidies a firm receives” and, consequently, also in firms’ efficiency. Looking at ownership, subsidisation to public firms tend to generate an inefficient use of the factor labour, differently from private ones.

Ownership affects in various ways the efficiency and, in particular, the labour costs. Some authors (de Rus and Nombela, 1997; Hensher and Wallis, 2005) find that wages are higher in the public sector and that overall costs are even higher compared to cases of private provision. However, the threat of competition is a necessary condition to the exploitation of private sector’s better efficiency (Gwilliam, 2008). One explanation is that when the ownership is public (fully or partially), unions’ power results to be higher and no effect on labour costs can be seen, even if part of the services is contracted out (Talley, 1998).

The issue of economies of scale cannot be analysed in this paper, due to its vastness, despite the importance of the topic in regulatory practice. We just want to remind, using different sources, that literature is not perfectly aligned on one result. The majority of studies stress the existence of economies of scale associated with network size (for example: Obeng and Azam, 1997; Viton, 1997; Odeck and Alkadi, 2001; Fazioli et al., 1993 and 2003; Cambini and Filippini, 2003). However, using different samples and approaches, different or less unidirectional answers may be found: the existence of diseconomies of scale, at least above a certain level of output, can be seen (Preston, 1997; Buzzo, Margari and Erbetta, 2005;

Ottoz et al., 2005; Iseki, 2008; Giordano, 2007; Iacono, 2009; Beria and Grimaldi, 2010). A further review can be found in Gwilliam (2008).

Regulation

The economic theory of monopolies suggests that a private non-regulated monopolist will set prices at a value that maximises profits and that this value is, in general, non coincident with the value that maximises social surplus for the society (Stiglitz, 2000). A situation of unregulated legal monopoly in public transport often translates in a situation of inefficiencies, increase in public expenditure and decrease in quality and quantity. Two simplified cases can be analysed.

The first case (*commercial services*) is quite simple: a private monopolist would rise the tariffs as far as profits grow (which depends on elasticity of users with respect to the tariff), while a public monopolist - which can't make profits by definition - would probably become inefficient in time letting costs grow as far as they become equal to tariffs. This is actually another form of "profit", in form of reduced effort needed to obtain the same output. Both situations generate a surplus loss.

In the second case (*non-commercial services*), if the service is considered to be socially useful, a subsidy should be given by the public authority in order to make the service commercially attractive for a firm. If the provider of the service is a monopolist, it would try to make the public authority believe the efficient level of costs to be higher than the real one, in order to receive higher subsidies: this again would generate profits for a private monopolist while would make costs grow for a public one.

Historically, bus local public transport has been publicly planned in all the relevant aspects: network, supply level, quality, fares. Often in Europe this was associated also with public ownership of transport companies, typically under municipalities.

This scheme has showed increasing problems, as theory suggested. Partially, the failure of public provision laid in the exogenous radical change of European economy and land use, in particular by increasing car ownership rates and by sprawl effects. Other motivations internal to transport sector were however significant. First of all, the downward spiral of quality decrease and (public) cost increase caused a general degradation of the system. The public companies became less and less capable of meeting users' needs and more and more costly for the public budget.

Some countries, for example Switzerland, went on in the way of public provision and planning, pursuing networks more and more integrated and increasing the quality of transport (Pucher and Kurth, 1995). However, in many other cases the way followed has been different, ranging from full deregulation to the regulation of legal monopolies under public planning. Europe saw both experiences of total deregulation or "competition in the market" model (in the UK since 1984) (Beesley and Glaister, 1985) and regulation or "competition for the market" model (Gwilliam, Nash and Mackie, 1985). Today both models remain used, with EU that moved towards the "competition for the market" model (van de Velde, 2005), even if considerably softened with respect to initial formulations (van de Velde, 2008). Twenty years after the first experiences the primary goal, even if not the unique, remains that of promotion of efficiency. At the level of single countries, within the EU framework, different models are

applied (Costa, 1996) according to which subject holds planning functions and to the level of direct competition possible.

The principle at the basis of the “competition for the market” model is the introduction of contestability in local transport market, changing the previously unregulated monopolies into temporary local monopolies. The main tool used to simulate competition is the competitive tendering of such monopolies, usually associated with a certain level of subsidies. Usually in this model fares and network design are fixed in the tendering process. The auction selects the most efficient provider, i.e. the one accepting a lower subsidy, possibly associated to quality indicators. Sometimes regulation and tendering are associated with the privatisation of the former public company (typically municipal firms). Apart the principle, many variants are possible in the mechanism, for example between gross cost (fares are collected by the public subject) and net cost (fares are left to the company, to contribute to subsidies revenues) auctions.

Going to the results of such process, it is not easy to point out one single figure for efficiency gains and cost savings achievable with competition in bus industry, as the starting conditions are too different and the ways deregulation has been implemented vary. Preston (2001) reports the experience from two of the most advanced cases in the field, namely Great Britain and Sweden: unbundling and deregulation experiences resulted in a cost reduction of 40%. It has also been possible to exploit economies of density, increasing the output much more than subsidies. In the UK it has been seen that complete deregulation determined a contraction of supply and demand on lower density areas (typically outside of London), whilst in high density networks demand and supply increased, despite reduction of subsidies. Hensher and Wallis (2005) review more tendering results in various countries (UK, Norway, Sweden, Finland, Denmark, the Netherlands, Italy, USA, New Zealand, Australia) finding 5% to 54% reductions in pre-tendering subsidies. The New Zealand case is particularly interesting for the purpose of our paper, because clearly illustrating the role of ownership in this regard: the private operators had substantially lower costs than the public operators already in the previous situation. This corresponded to a better efficiency and, in fact, the post-auction savings resulted much lower for the already private services.

Swedish and UK buses are among the less costly of the continent also in absolute value, with average unit costs per buskm equal to 1.8 and 1.9 (OECD, 2009). Other countries average range from 2.4 to more than 4 € (OECD, 2009; Ufficio Federale dei Trasporti, 2009). This, of course, is not only due to deregulation effects but also to network structure, land use, quality of services, etc. However, the difference remains sharp.

A final word should be spent to a detail aspect of some importance for our case study: the fares regulation. Kidikoro (2003) determines whether it is more desirable for local government to regulate price even after contracting out or to delegate price setting to the private transport companies. The variables considered are output, quality and fares, showing that regulated fares maximize social surplus and output, but lower quality. To the contrary, fares setting let to the operator increases quality and private profits, but determines a decrease in output and finally in surplus. The prescription is then to regulate fares. However, a more advanced vision (summarised by Gwilliam, 2008) is to leave the day-to-day decisions

to private subject, within a framework of publicly set strategic decisions. For example, fares should be kept low by public to maximize the use and the associated welfare, but the private operator can set even lower fares to capture also the demand with lower willingness to pay, increasing its own profits but also social surplus. This is done, for example, in some French cities (Yvrande-Billon, 2006) or in some German regions by the rail operators.

Behaviour under weak regulation and non planned transport networks

Theory, in general, postulates the need to change forms of bus provision, from unregulated monopolies to tendered (where cost coverage is possible or network effect is important) or deregulated markets (where demand is point to point and potentially sufficient to cover costs), as pointed above. However some cases of interesting results in terms of efficiency and social contents are found also in case of weak regulation or no regulation at all, just for the behaviour of the stakeholders and for the relationships occurring among them and the authorities. This situation is quite similar to the one presented in this paper and thus significant even if not perfectly comparable.

Sohail et al. (2006) review the transport services and regulation present in three case cities: Colombo (Sri Lanka), Faisalabad (Pakistan) and Dar es Salaam (Tanzania). Effective regulation in these contexts must avoid the extremes of fully regulated public transport sector and the completely deregulated model. Intermediate forms of light self-regulation have proven to be been useful to protect both operators and users of the services. Nearer to European situation are the cases presented in van de Velde et al. (2008). They describe the regulatory and planning regimes of Netherlands regions. Two opposite situations are found: on one side some transport authorities gave substantial service redesign freedom to operators in a first contracting round, on the other side some authorities chose to keep in house the planning of services and network and tendering out only the production of such services. Both choices are, in the opinion of the authors, too extreme to be successful: agreed contracts between operators and authority would be much more successful than completely open or completely closed contracts.

Similarly, it must be analysed also the situation of non-planned or loosely-planned local networks, i.e. networks where the inputs and prescriptions from public planners are absent or weak and where network characteristics come from the operators.

Literature on this kind of networks is not wide, despite their huge presence in large parts of the world. Attard and Hall (2003) describe the case of Malta, characterised by “ancient buses, individually owned and licensed by the country’s transport authority” and by the permanence of a network existing since one century. Zyryanov and Sanamov (2001) describe the transport system of Rostov-on-Don city, where the past choices and the insufficiency of public subsidies left transport companies in bad financial conditions. The city has undergone a process of reorganisation, that moved towards the implementation of regulation and the increases of private involvement. The case is significant because of the introduction of private bus companies competing with the existing municipal company. This resulted in a generalised betterment of ridership and improvement of economic efficiency, demonstrated by the lowest transport costs in Russia among comparable cities.

Finally, aside to loosely planned networks, typical of developing countries or of specific situations in not dense areas of Europe (Sicily, Scotland), also perfectly deregulated markets

are, or become, not planned. In this case, differently from spontaneous networks, effects seem generally negative. This fact is particularly evident in UK regions outside London: the effect of deregulation in terms of loss of co-ordination between services (ticketing, spatial connection, timetabling) became evident in UK already few years after the reform (Tyson, 1990). Deregulated services tend to become independent from the rest of the network, causing a welfare loss for users that are forced to inconvenient changes or multiple tickets.

3. DESCRIPTION OF PUBLIC TRANSPORT IN SICILY

The context

Sicily is a southern Italian island and administrative region of 25,708 km² with a population of some 5 million inhabitants distributed among 9 provinces. It is characterised by some coastal conurbations and two metropolitan areas: Palermo (1 million inhabitants) and Catania (700k inhabitants). The rest of the island is structured upon some 30 towns among 25k and 30k inhabitants and a lot of small dispersed villages on hills and mountains.

Railways have historical characteristics that make them not competitive with respect to road transport, in particular in the internal areas and where road transport can conveniently use highways. Some factors contribute to this low performance:

- quite often, railway stations are not close to towns because of orographic reasons (towns are often on the top of hills, while railways are usually inside the valleys);
- the dispersion of inhabitants outside the major centres makes rail transport unsuitable at ensuring a sufficient extensive territorial coverage;
- the present conditions of the rail network and services is well below Italian average, making rail unattractive except for few corridors.

For these reasons road public transport represents the only effective alternative to private transport, serving some 15,2% of total systematic movements on the island with respect to only 1,3% served by railways (source: ISTAT, 2001).

Public transport regulation, planning and organisation

Local public transport in Sicily is characterised by a quite peculiar situation with respect to regulation and planning, deriving from the history and the evolution of the public transport system in the region. Numerous private firms produce nowadays some 80% of the total kilometres of bus extra-urban service, which is much higher than what can be observed in other Italian regions.

Some 110 franchised bus operating companies produce 139 million vehicle-kilometres per year in Sicily, 42% of which is made of urban services and the remaining 58% of extra-urban services. The largest firm is the only publicly owned (AST, regional) and produces some 22 million of buskm. The next six companies are all private and ranging from 6 to 2 million of buskm. In the region only 15 companies produce more than 1 million vehicle-kilometres.

Planning of lines and services has been done mainly by the firms themselves inside the areas they have been franchised, according to their "internal" rationale and only finally negotiated with local authorities. As a result, the current structure of public transport supply in

Sicily is focused on direct and fast relationships for main traffic volumes, trying to accommodate as much as possible the needs of the usual demand and/or demand concentrated on main urban centres. The supply is strongly characterized by the connection between all pairs of origin and destination served with direct services and some possible stops, without planned interchanges.

In order to accommodate the present demand, the supply is frequently modulated with continuous adjustments:

- addition of services, generally during peak hours in the morning;
- direct services in the morning towards the main centres, given the concentration of users and favouring speed;
- return services with more stops in the afternoon, in order to favour frequency of the service even with fewer users, although reducing speed;
- modulation of services among peaks and off-peaks, among week days, among periods of the year;
- use of shorter reinforce services or even service doublings in high demand hours/days.

Only major relationship characterised by large demand volumes have clockfaced departures at even intervals. In general there is little or no integration among services, that can then be considered as “point to point”. This might generate some surplus losses in terms of not served potential demand.

In general the basic social and territorial objectives seem to have been maintained since the services cover almost any location of the island.

4. ECONOMIC FIGURES

The Sicilian situation is somehow particular with respect to the rest of Italy. In fact, as already seen in section 3, regional public transport is produced by one big public operator representing the 16% of the supply and numerous medium and small private firms, producing the rest of the service.

The regulatory framework is particular too, because those firms (both public and private) - most of which are somehow historically present on the territory since the birth of public road transport in the Twenties of the 20th century - have their service franchised by the public administrations without any competitive tender and, being private, they do not even represent a case of *in house* provision. The characteristics of service and the economical aspects are contracted in a dialectic relationship between operating companies and public administrations.

It is possible to say indeed that this is a case of non contestable monopoly: we would expect this situation to be inefficient, with higher operating costs and/or higher tariffs - with respect to the rest of Italy and Europe - which would eventually generate extra-profits for those firms. Moreover, being most of the firms (with exception of the public one) medium- to small-sized, we would expect them to suffer from the absence of economies of scale (see section 2), resulting in higher operating costs. As we will see in this chapter, this does not seem to be the case.

Operating costs

In Table 1 and in Table 2 some data are shown, referring to operating costs of bus provision in some European countries and in Sicily.

Table 1. Average operating costs per buskm
 (Source: our elaborations for Sicily; OECD, 2009 for remaining countries).

Country	Sicily (all firms)	IT	UK	GER	FR	SWE	NL	BE
Operating costs [€/bus-km]	2.65	3.5	1.8	4.0	2.9	1.9	2.4	3.0

Table 2. Operating costs of the main bus operating companies in Sicily (2007 data).

Firm #	Ownership	Province	Service [mln.km]	Operating costs [€/km]
1	Public	PA	22.83	2.9
2	Private	EN	6.27	2.2
3	Private	PA	6.24	2.1
4	Private	EN	5.86	2.2
5	Private	CT	3.85	2.2
6	Private	PA	3.02	2.3
7	Private	AG	2.55	2.3

Table 1 and Table 2 might not be completely comparable, because the second one only refers to the biggest firms and thus could benefit some economies of scale; however if we analyse operating costs of the Sicilian main firms we can observe that they are on average lower of 29% with respect to the Italian average costs, and they are among the lowest in Europe (comparable with those of countries where it is used the competition *for the market* model, e.g. Sweden and the Netherlands, or even *in the market*, e.g. the UK,). However, if we consider all the companies, Sicilian average operating costs are approx. 24% lower with respect to the Italian average costs.

Also, analysing Table 2, some diseconomies of scale seem to emerge between fully comparable¹ medium- to small-sized firms (from 2.5 to 6.27 million kilometres of production per year) and the largest one (22.83 million kilometres of production per year): it is difficult to separate the effect of ownership (the largest firm is also the only public one) from the effect of the dimension, however some consideration about this fact will be done in section 5.

Moreover, it seems worth to compare average operating costs of medium-sized firms of Sicily with those of medium-sized firms of Lombardy (a northern Italian region), as shown in Table 3.

¹ The networks of all firms seem perfectly comparable per commercial speed and land coverage.

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Table 3. Comparison of average operating costs of medium-sized bus firms in Sicily and Lombardy (Italy).
 Source: ANAV data (<http://www.anav.it/>)

Region	Average operating costs	Capital costs
Sicily <small>(firms producing 1 to 7 mln.km/year)</small>	2.2 €/vehic·km	Included <small>(self-financed bus purchase)</small>
Lombardy <small>(firms producing 1 to 7 mln.km/year)</small>	2.58 €/vehic·km	Partially included <small>(public co-financed bus purchase)</small>

In Lombardy regional public transport services are provided by a mix of public and private firms, but with a much lower share of private firms with respect to Sicily. A large share of services have been tendered out (27 tenders), even if the effect of tenders seem to have been weak due to the fact that most tenders were won by the incumbents and that often it was also the only competitor. This fact makes realistic the hypothesis that true contestability was actually scarce (OECD, 2009). Table 3 shows that operating costs of medium-sized bus firms of Sicily are on average lower of a 15% with respect to those of medium-sized bus firms in Lombardy. Such difference is even higher because in Lombardy bus renewal is co-financed by Regional Government.

Thus, it seems possible to say that Sicilian bus operating companies have a good level of costs compared to similar situations in Italy. This can be partially explained by an higher efficiency.

Tariffs

In Sicily, tariffs are decided by the regional administration and their unit values decrease with distance, ranging from 13.5 €cent/km for shorter trips (<10km) to 4.7 €cent/km for longer trips (>200km)². Those value are in general low and comparable with those of other Italian regions, e.g. in Lombardy (Regione Lombardia, 2002 and 2009) regional tariffs range from 12 €cent/km for shorter trips (<10km) to 4.6 €cent/km for longer trips (>200km).

Subsides

The presence of financial contributions (or subsidies) to local public transport is common and widespread throughout Europe. Even in the UK, where the maximum degree of liberalization has been introduced, almost all lines receive government grants to cover operating costs. This allows the planner to ensure the provision of services that are not able to sustain themselves with revenues from the market. It is thus possible to provide a level of supply, according to the desire of the planner and of the resources that can be used. Usually the supply of local public transport responds to a social function (minimal services), recently the concept has been extended in terms of reducing emissions and, in some contexts, the excessive levels of congestion.

The present structure of subsidies in Sicily is the result of a normative evolution: before 1996 Italian national government used to provide and regulate subsidies by means of the *Fondo Nazionale Trasporti* (FNT, National Transport Fund). In 1996 the system evolved towards a

² Tariffs are shown on websites of bus operating companies (e.g. www.aziendasicilianatrasporti.it)

regional standard costs system and eventually Service Contracts were introduced in 2007, but the total amount of subsidies was maintained constant.

The average level of subsidies results extremely low compared to the average of some EU countries (OECD, 2009). Sicilian buses receive on average 0.95 €/km (obtained dividing the total amount of subsidies of 132 M€ per year over the 139 million km per year production).

Table 4. Average public subsidies per buskm
 (Source: our elaborations for Sicily; OECD, 2009 for remaining countries).

Country	Sicily	IT	UK	GER	FR	SWE	NL	BE
Public subsidies [€/bus-km]	0.95	2.2	0.6	1.5	1.9	0.9	1.5	2.0

5. ANALYSIS AND POSSIBLE EXPLANATIONS

This particular Sicilian situation with respect to regulation and organisational forms, as seen in section 2, can be defined a private monopoly subjected to a weak *ex-post* efficiency regulation and fixed fares. One could expect this situation to generate extra-profits for the private monopolist, resulting in high costs and a surplus loss.

However, the indicators of economic efficiency for local transport in Sicily indicate an overall efficiency based on the fact that present costs and, above all, subsidies are on average lower than in the rest of the country and in line with the European countries where the effects of liberalization have emerged (see section 3).

Thus, it seems worth to try to understand what's behind this situation, i.e. which incentives have driven the sector to this sufficient level of efficiency, especially for medium-sized companies (that seem to be more efficient than smaller ones and also of the only big one).

Let's write the two possible formulas describing the profit of the firm π , one in which total subsidy is a fixed sum (S) that does not depend on production and the other in which the subsidy is dependent on production (P) via a unitary subsidy (s_u). The firm also gains unit tariffs (t_u) from users (D).

The first case is that of Sicilian bus companies.

$$[1] \quad \pi_{\text{sicily}} = D \cdot t_u + S - P \cdot c_u$$

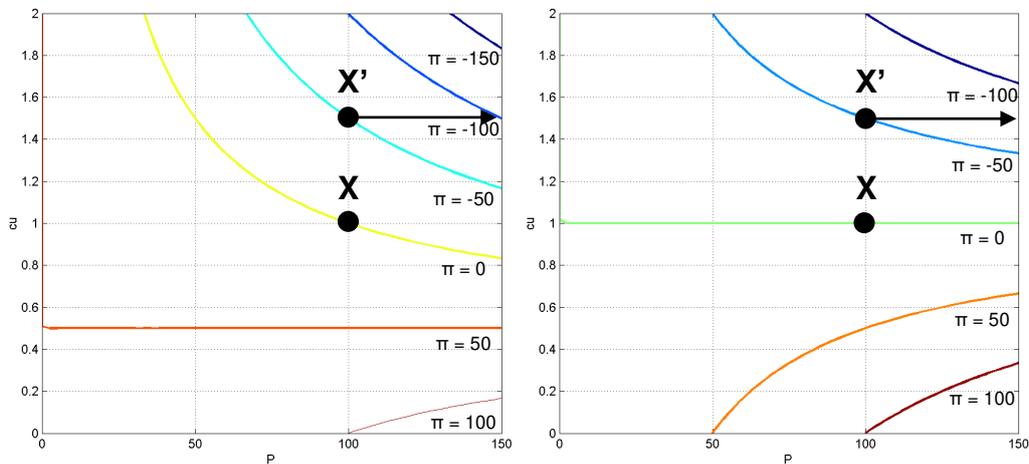
$$[2] \quad \pi_{\text{generic}} = D \cdot t_u + P \cdot (s_u - c_u)$$

Plotting the two functions in a range in which demand (D) can be written in function of production (P) multiplied by a coefficient ϵ , one can demonstrate that:

1. Starting from point X of zero profit, in the "Sicily" case, where S is fixed and for a given production P, profit can be risen by acting on two variables only: increasing demand (D, for example with quality services or with appropriate timetabling) or decreasing unitary costs (c_u). In the "generic" case, instead, production plays a role also on revenues side (aside to costs side), independently from how demand reacts to increase in supply (Figure 1).
2. Also when the initial point is not the particular case of zero profit, "Sicily" curves are less sensitive to production than "generic" case. If "Sicily" expand production from X', the loss will be larger than for "generic". Similarly, profit will be lower in the symmetric

case. So, the incentive to overproduction is less pressing for “Sicily” than “generic”³ (see Figure 1).

Figure 1. Plotting of profit function (π) for the “Sicily” case (left) and for the “generic” case (right), in function of unitary costs and production. Other inputs refer to the specific case of zero profit for both situations, at production $P=100$, $\varepsilon=1$, unit tariff $t_u=0.5$, total subsidies $S=50$ and unit subsidies $s_u=0.5$. Point X of zero profit has $P=100$ and $c_u=1$; point X' has $P=100$ and $c_u=1.5$.

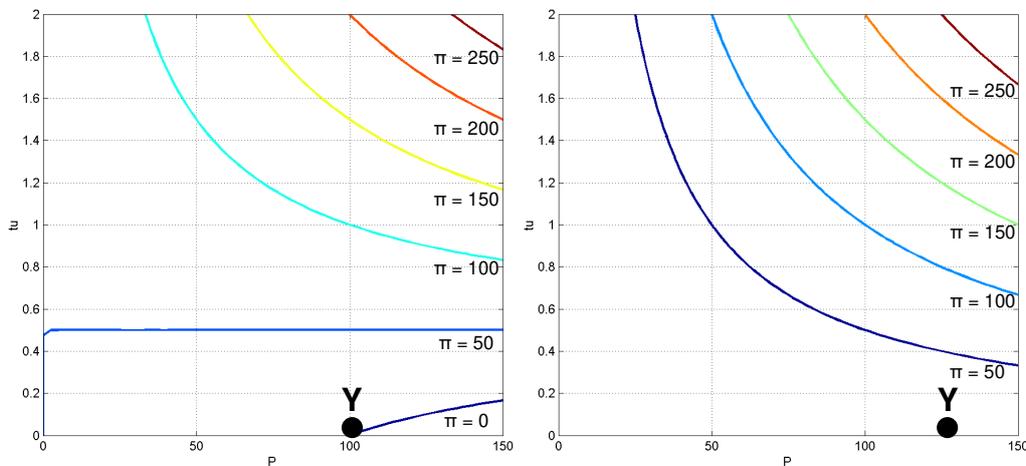


- The behaviour of “generic” in profit maximisation is independent from the revenue/cost ratio (t_u/c_u in our formula), while for “Sicily” there exists a threshold t_u/c_u below which increasing P reduces profit π (for example point Y in Figure 2). In other words, for “generic”, if π is positive, any further increase of supply P generates more profit. To the contrary, more production is healthy for “Sicily” case only if the revenue/cost ratio is above a certain value: production will be increased only if it can increase more than proportionally demand and improve the revenue/cost ratio. Otherwise, the service will not be supplied (Figure 2).

³ For example starting from a generic point X' with $P=100$ and $c_u=1.5$ and increasing production P up to 150, profits π will worsen from -50 to -100 in the “Sicily” case, but only from -50 to -75 in the “general” case (see Figure 1). Conversely, if profit π were positive in X' (for example with higher unit tariffs $t_u=1$ and lower unit costs $c_u=0.5$) they would increase more in the “Sicily” case (from 100 to 125) than in the “generic” case (from 100 to 150) as a consequence of an increase in the production P from 100 to 150.

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Figure 2. Plotting of profit function (π) for the “Sicily” case (left) and for the “generic” case (right), in function of unitary fares and production. Other inputs refer to the specific case of zero profit for both situations, at $P=100$, $\varepsilon=1$, unit tariff $t_u=0.5$, $S=50$ and $s_u=0.5$ (point Y).



The peculiarity of Sicilian case is, then, that the ways firms have to increase profits are all related to efficiency increase. To the contrary, other regulatory regimes provide an incentive also to the provision of inefficient supply (lowering revenues / cost ratio), because profitable for the firm thanks to the subsidies proportional to supply and large compared to market revenues.

Summarising, Sicilian private firms had a set of incentives that went in the direction of more efficient provision and production. They had three contemporary conditions that determined their behaviour:

1. Very low absolute values of subsidies, which require good revenue/costs ratios (probably ranging from 45% to 60%) and fixed independently from production;
2. Great freedom of planning the services;
3. Total managerial freedom concerning operations.

The first two determined that Sicilian private bus operators are supplying only lines that can guarantee a very good revenues / cost ratio. This is obtained also by continuously modify the supply characteristics in order to “follow” the demand. Simply, buses must be always full (fares are fixed and low), otherwise can't pay back in any case their costs with subsidies only. At the same time (condition 3) it is guaranteed that production costs are really minimised, thanks to the pressing incentive to extreme cost control.

The fact that firms are private guarantees also that deficits are avoided. To the contrary, a public firm in a similar situation would probably become inefficient because it would increase services as much as it could, or otherwise would let production costs grow counting on public make-up of deficit. The public firm would not have incentives in improving the revenue/cost ratio, because it can't make profit.

Leaving the model, it seems quite obvious that giving some freedom of planning the services to operating companies could lead to better efficiency and, in some ways, this has probably been one of the factors behind the decision to deregulate services in the UK outside London. As we have seen in Sicily, and as observers noted in the UK (e.g. Nash, 1993), this may

have lead to some surplus loss because of the lack of integration between services and the loss of a portion of potential demand. However, in context where demand potentially benefiting from the possibility of interchanges is considered to be little (and this could be the case in Sicily), socio-economic cost-benefit considerations should probably take into account this surplus loss with respect to the reduction in operating costs (and thus needed subsidies). Moreover, probably a punctual *ex-post* coordination could limit this losses without losing the advantages of leaving some freedom of planning to firms.

Along with the usual measures (externalisation of the maintenance operations, optimisation of turn management, etc.), one of the strategies that those firms seem to have adopted in order to achieve cost reduction seem to be strictly related with their dimensions. In fact, until 1996 five private firms out of the six largest ones, were part of the same single firm. In that year the society was split among three owners, but the bus firms generated by that division were more (five, plus some smaller and specialised ones). This seem to have been justified in terms of industrial organisation, in order to find the best smaller dimension in terms of cost control. Moreover, subsequently, the private firms pursued a strategy of merging with other smaller firms, only when economies of scale due to specific conditions existed. The present situation is thus made of five medium-sized firms, each one producing less than 7 million vehicles-km instead of one producing more than 20 together, and this seem to have been done in order to avoid some diseconomies of scale.

A possible explanation of this could be that, even if economies of scale should reduce unit costs with dimensions, other forces - related to political and regulatory context - go in the opposite direction of increasing the costs with dimension for larger firms (Beria and Grimaldi, 2010).

6. CONCLUSIONS AND REGULATORY POLICIES

Some suggestions could be derived from the analysis of the Sicilian public transport provision and translated into regulatory conclusions.

This system presents quite good efficiency in terms of costs and load factors, showing costs among the lowest in Italy and comparable with European best practices. This result comes despite the context of weak regulation; rather, in absence of any explicit efficiency incentivising regulation. In the paper we tried to find out the motivations of this result, that appear as “unconventional”, both in Italy and outside:

1. Subsidies low in absolute value and packed together for a certain amount of services. In other words, an extra km required by local administrators or provided by firms to fulfil demand, or even cost increase, are not paid extra;
2. Great freedom of planning the services, allowing firms to directly discuss output with municipalities before than with the regulator (the regional government), but also to follow the needs of the demand maximising it;
3. Total managerial freedom concerning operations, that forced firms to optimise everything, but also allowed them to generate temporary profits of cost reduction (or simply to manage out a cost increase otherwise unsustainable).

These factors, or incentives, are present in Sicily probably by chance. It should however be noticed that they work only because present at the same time together: planning freedom alone, for example, would not give similar results in case of higher subsidies. Last, but not least, firms are often private and medium sized. Their size is the result of a multi-decade long societal reorganisation and represents today the “best” situation for the owners in terms of cost reduction.

This fact, and the ones before, allow to derive also some considerations for the possible evolution of this system in a more contestable one, possibly without losing the interesting benefits generated by the present situation (e.g. the low costs and the excellent land coverage).

Firstly, largest firms look less efficient than medium-sized ones, because with the increase of dimensions political and regulatory effects seem to counterbalance the well known industrial economies of scale. So, a process of concentration does not look appropriate, especially in a region where point to point traffic dominates on network effects. Secondly, competition in the market seems not appropriate in the present situation, as the large majority of lines is in deficit without subsidies and large further cost reduction seem not realistic. Thirdly, a traditionally planned tender based on artificial geographical divisions could fail in defining the best lots to minimise systemic costs (it is difficult to say where economies of scale really are). So, when tendering bus services, small sized lots should be preferred to larger ones, not only for granting more contestability, but also because leaving the possibility for competitors to bid for multiple small lots reveals more easily where economies of scale are. Moreover, given the fact that freedom of planning the tactical level of the services has proved to be a key factor for Sicilian case, this freedom should be kept as much as possible also after the introduction of competition for the market.

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