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Inclusion of quality criteria in public bus service contracts in metropolitan areas

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ABSTRACT

The aim of this research is to amend the current contracting system to improve the quality of inter-urban bus services in metropolitan areas and thereby increase demand and reduce externalities.

A methodology is proposed for tendering transport contracts which is applied in the Spanish region of Castilla and León. Based on a previous demand model, new incentives are proposed to encourage the operating companies to make improvements in the quality of service they provide on their metropolitan bus routes. The main contribution made by this research with respect to other similar methodologies is found in the incorporation of the subjective value of time and willingness to pay in exchange for improvements in service quality. This information is used to determine the optimal formula for public subsidies.

The results show that, without any increase in costs for the administration, the amount of the subsidy due for underuse of the service could be reduced by increasing demand through providing a more attractive public transport service. It has also been shown that improvements in quality could be profitable, not only for society at large but also for the operating companies themselves.

1. Introduction

In many cases, inter-urban public passenger transport services are normally high loss makers and require substantial subsidies to keep going; this is particularly true on lines connecting urban centres with sparsely populated areas and even more so when the population is very spread out. Furthermore, the poor quality of some of these services in terms of their frequencies, routes and the condition of the vehicles produce a kind of "vicious circle". The poor quality of service generates low demand so any investments made by the bus companies to improve quality turn out not to be profitable. Added to this is the recent trend that, in spite of a rise in the number of inter-urban journeys being made, the proportion being made on public transport is falling. So, the internal and external costs borne by the rest of society to provide this service continue to grow.

This paper suggests a system for providing bus services within a metropolitan area. The system would incorporate quality criteria and would guarantee a minimum demand for the service and a maximum limit to subsidies, adding extra economic incentives to the operators to improve the quality of the services they provide and increase demand volumes.

The paper will be divided into five sections. The Section 1 presents a brief introduction to the subject. This is followed by a description of the most relevant work found in the bibliography. Sections 3, 4 and 5 describe the methodology followed, its practical application to a case study with a discussion and an analysis of the results. Finally, the main conclusions are presented in Section 6.

2. Bibliographic review

The quality provided by a public transport service is a fundamental criterion for travellers when choosing which mode of transport to use (dell'Olio et al., 2010; Bordagaray et al., 2014). However, inter-urban bus transport is often "forgotten" in favour of its urban equivalent. Even so, there are some interesting examples of research work carried out in this field (Rojo et al., 2011, 2012, 2013).

Because the aim of this research was to propose a methodology for introducing questions of quality into public transport contracts providing inter-urban bus services, an initial review was

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undertaken of studies specialising in contracting and some interesting experiences were found.

Mohring (1972) proposed studying the need to include subsidies in the provision of public transport services, because economies of scale for the users meant that greater frequencies reduced their costs by reducing their waiting time. This result, known as the "Mohring effect", has been analysed in numerous later studies (Van Reeven, 2008; Basso and Jara-Díaz, 2010; Savage and Small, 2010). Bar-Yosef et al. (2013) specifically study this effect from the point of view of the vicious or virtuous circles generated in loss making public transport services where investments are not made to improve quality. They conclude by making certain proposals for breaking the vicious circle in different fields of study.

Another interesting factor is the effect of daily mobility capacity on the risk of social exclusion. Stanley et al. (2011a, 2011b) have contributed with significant research on this subject, showing that this risk is lower if people have regular contact with others, a sense of community, a sustainable economic situation and the ability to get around.

Van de Velde (2008) analysed how the European method has evolved over recent years. Other interesting studies (Van de Velde, 2009; Van de Velde et al., 2008) concentrated on existing contracting systems which rewarded public transport quality, as well as the demand transferred from the private car. Working along similar lines, Walters and Jansson (2008) highlighted the interest in negotiated contracts somewhere in between the strict fulfilment of public service obligations and free competition, where quality and trustworthiness in the service are also rewarded.

It is worth pointing out there are some specific methodologies which propose a system of contracts based on quality such as performance based contracts, PBC (Hensher and Houghton, 2004; Hensher and Stanley, 2003). Hensher et al. (2007) expressed their concern for the improvement in the quality of contracts and analysed their optimal formulation. The authors believe that the search for efficiency is an important factor in obtaining this goal and that the roles of local authorities and operating companies should be differentiated, yet still work together because the quality of a public service is at stake. A similar proposal has been addressed in this article and includes a series of incentives for operators to invest in making improvements to service quality which will encourage people to switch over from less sustainable modes of transport.

Finally, the work of Tirachini et al. (2014a, 2014b) used a social welfare maximisation approach to analyse the effect of certain highly influential variables in urban bus transport, such as congestion, bus crowding and travel time variability. They concluded by highlighting the existence of a relationship between the optimal number of places on a bus and the minimum service frequency, whereby, if a lot of users do not have a seat available then this lack of quality must be compensated by providing more buses.

3. Methodology

This research follows on from the methodology proposed by Hensher and Houghton (2004) and Hensher and Stanley (2003) and incorporates the subjective value of time and willingness to pay for service improvements in order to determine the optimal formula for subsidies.

It is essential to know the current demand for metropolitan public transport bus lines as well as the breakdown of the costs required to run the services. A study of the satisfaction levels and the demand for the service should reveal the level of willingness to pay for different service improvements as well as the demand elasticities with respect to the main variables. A control mechanism will also be needed for the increased demand caused by any

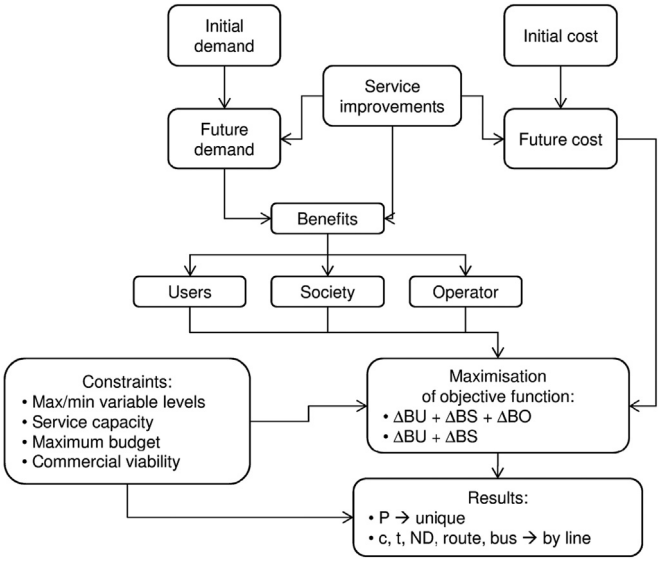

Fig. 1. Set-up of the optimisation methodology.

improvements, the economic parameters that need to be imposed, such as the maximum proportion of the subsidies aimed at improving quality and the minimum standards demanded by the operators, etc.

The aim is to determine the improvements that need to be made to the service using current prices and operating costs. This will be done by maximising surplus in two scenarios: users, society and operating company, or only users and society. The independent variables will be the following service characteristics: journey time, fare, number of daily services, route and bus type. Furthermore, a parameter P needs to be determined representing the proportion of benefits which favour users and society as a result of improvements made to the service by the operating company due to incentives provided by the public administration.

Fig. 1 shows a summarised set-up of the different stages in the process, and the results to be obtained:

An annual time scale was chosen for the calculations because it allows us to know in greater detail and precision the demand, profit and cost data associated with running the service. As in the base methodology (Hensher and Houghton 2004; Hensher and Stanley 2003), a series of steps will be taken towards completing the formulation.

3.1. Annual passenger demand

The base methodology (Hensher and Houghton 2004; Hensher and Stanley 2003) estimates the future demand as a function of the changes made to fares and service standards (vehicles-kilometre). This is achieved by using elasticities considering two types of users: those with a free service and the rest.

The present study considers that service demand will be a function of, among other variables, journey time, fare, number of daily services, route followed and vehicle characteristics. Compared with these, the effects of the remaining variables (delay, number of stops, air conditioning, television and WC on the bus, good connections and station location, clear information about services, installations for buying tickets and customers services at the station) are considered to be relatively insignificant, in accordance with the adjusted demand models (Rojo et al., 2012, 2013). The number of daily services can be considered as a demand measuring factor, however it can also affect the use of the service. The more services that leave every day on a certain line make it more attractive for potential users because it better suits