Transport Policy 44 (2015) 158–168

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Commuting to college: The effectiveness and social efficiency of transportation demand management policies

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ARTICLE INFO

Article history:
Received 24 February 2015
Received in revised form
31 July 2015
Accepted 10 August 2015

Keywords:
University students
TDM policies
Commuting
Social efficiency
Effectiveness

ABSTRACT

Commuting is the single largest impact a University has on the environment and represents a noticeable share of urban traffic, when the University is located within a city. There is a large amount of literature on which policies could reduce car use and improve the environmental and social sustainability of commuting to college. However, most studies focus, to the best of our knowledge, only on the effectiveness of such policies, disregarding their social efficiency, measured as the difference between the social costs and benefits. This paper presents an estimate of the effectiveness and the efficiency of nine hypothetical transport policies regarding the University of Trieste, Italy, on the basis of a transport demand model estimated via revealed and stated choice data. All policies but one are effective in reducing car use, but only six of them appear to be efficient. We find that fully subsidizing bus fares would be the most effective and efficient policy. However, it is doubtful whether fully subsidizing bus fares is financially sustainable. The second best policy would be a mix of bus subsidies and parking restrictions. In case of the University of Trieste, our model suggests the adoption of a policy mix based on a relatively low hourly parking tariff (€0.3 per hour) and the use of the parking revenues to subsidize the bus users. The methodology and the results presented in this paper can be used by the college Mobility Managers to design better transport policies.

1. Introduction

The efficiency and the environmental sustainability of the transport system is a critical factor in order to provide access to work, training, and social and cultural activities especially in urban areas, where more than 74% of the EU-27 population live (DG MOVE, 2013) and 85% of the European GDP is produced (European Commission, 2009). Education-related journeys account for 25% of the total journeys made. Universities, like other types of public and private institutions, are among the largest generators/attractors of commuters and, according to Tolley (1996), commuting is the single largest impact a University has on the environment. Commuting to college is, hence, a very interesting area on which to test the performance of mobility management policies (European Platform on Mobility Management, 2013).

In fact, in an attempt to increase their environmental sustainability, several universities implemented strategies aimed at reducing the dependence on private cars and at increasing the use of alternative transport modes. In Italy, since 1998, a law entrusted the management of the mobility of the college employees to the Mobility Manager who is required to periodically survey the employees' travel behavior in order to design policies consistent with their needs and the characteristics of the university sites (location, public transport availability, parking facilities). The implementation of this law is, however, still patchy. Some Italian universities, like Milan and Bologna, have been particularly effective in reducing the percentage of car users. Their mobility strategy is based on limiting the use of the parking facilities to faculty and staff only, granting discounts of parking tariffs to bus users, supporting carpooling programs, financing discounts for bike sharing services. Most Italian universities have granted some form of discount on the monthly or annual bus ticket to their employees and students. Almost all universities provide bike parking areas and most of them offer bike sharing services. Most universities allow employees only and not students to use their private car parking lots (Rotaris and Danielis, 2014a). The effectiveness of these policies, however, has seldom been evaluated (Barata et al., 2011; Browder et al., 2013; Delmelle and Delmelle, 2012; Dorsey, 2005; Brown et al., 2003; Zhou, 2014; Shannon et al., 2006; Brockman and Fox, 2011; Shiftan and Golani, 2005) and their efficiency has never been assessed. Consequently, Mobility Managers have little or no information on the overall performance of the transport demand management (TDM) policies that are or could be implemented in their universities.

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http://dx.doi.org/10.1016/j.tranpol.2015.08.001
0967-070X/

The aim of this paper is to provide Mobility Managers with some guidelines derived from an ex-ante evaluation of the effectiveness and the efficiency of nine hypothetical TDM policies that could be implemented in a university setting. The effectiveness of such policies has been already described and discussed in Rotaris and Danielis (2014b). This paper adds the evaluation of their social efficiency, which is performed on the basis of the cost-benefit analytical approach, and examines whether the most effective policies are also the most efficient ones. The analysis is based on a study of the mobility choices of the employees and the students of the University of Trieste, a medium-size city in the northeast of Italy, close to the Slovenian border. The policy suggestions derived from this case study could be useful to design TDM policies both for universities and for other institutions located in urban areas such as hospitals, courts, high schools, administrative offices, shopping centers, banks, and headquarters of large firms.

The paper is innovative both with respect to the topic-since, to the best of our knowledge, there is no literature assessing both the effectiveness and the efficiency of TDM policies designed by universities-and with respect to the methodology used, since the scenario analysis and the cost-benefit analysis performed are based on revealed and stated preference data collected ad hoc.

The paper is structured as follows. Section 2 presents a review of the literature on universities' transportation policies and commuting behavior. Section 3 summarizes the methodology used to collect the preference data from a sample of employees and students of the University of Trieste and the results of the scenario analysis performed for nine TDM policies. Section 4 explains the methodology and the results of the cost-benefit analysis for each policy. Section 5 compares the effectiveness and efficiency of the policies analyzed. Section 6 concludes.

2. Literature review

In spite of recent contributions to the literature on the effectiveness of universities' TDM policies (Table 1), to the best of our knowledge, there are no contributions on the efficiency of these policies. As in Verhoef et al. (1996) by effectiveness we refer to the extent to which a policy is able to achieve a specific goal set by the Mobility Manager, in our case study a decrease of private car use in favor of alternative more environmental sustainable transport modes. By efficiency we mean the net social benefit of a policy, defined as the difference between its social benefits and costs. Hence, our efficiency analysis is to be interpreted as a social efficiency evaluation, in line with the welfare analysis theory, performed via the cost benefit methodology and not as a technical efficiency evaluation of a production process or system (i.e., the estimation of the production function frontier).

Some authors, like Barata et al. (2011), focus mainly on parking policies, acknowledging that the provision of parking is one of the most troublesome transportation problems at university campuses. They find that 45% of the parking supply of the University of Coimbra (Portugal) does not involve any kind of economic regulation and that existing underpriced parking places are largely insufficient to meet current demand, so that illegal parking is widely used. According to the authors, increasing control over non-regular parking and eliminating free on-street parking would encourage modal shift from private car to public transportation. Browder et al. (2013) also find that the main problems of parking on campuses are related to insufficient parking spaces to accommodate growing university communities, with parking lots being located far from central gathering points of offices and classrooms, with narrow parking spaces complicating vehicle maneuvering and causing space encroachment issues and accidents. Differently from Barata et al. (2011), they suggest the implementation of park and ride programs, to allow students and faculty to park their vehicles at a safe designated parking lot and the provision of a shuttle service to and from campus. Delmelle and Delmelle (2012) explore the spatial, temporal and gender differences in the modal choice among students commuting to the University of Idaho (USA), with the goal of uncovering incentives to increase the use of non-motorized or public transportation alternatives. They find that the maximum willingness to pay (WTP) for parking of 70% of the interviewed students is $400, while, at the time the survey, the maximum cost for a yearly permit for the lots closest to campus was $262 and the cheapest was as low as $59. Both this and other studies which suggest increasing the parking cost or replacing seasonal passes with daily passes (Shannon et al., 2006; Molina-García et al., 2010; Whalen et al., 2013), provide no estimate on the effectiveness and efficiency of the proposed policies.

A second area of research focuses on the subsidization of public transport. Dorsey (2005), analyzing the impact of mass transit incentive programs at the University of Utah and at the Weber

Table 1
Recent studies on TDM policies for college mobility.

	Main focus on	Outcome	Main results/policy implications
Barata et al. (2011)	Parking policies	Effectiveness	Need to reduce free on-street parking
Browder et al. (2013)	Parking policies	Effectiveness	Insufficient parking space, suggested park-and-ride
Delmelle and Delmelle (2012)	Parking policies	Effectiveness	Max WTP for parking facilities $400; need to increase the yearly parking permit
Dorsey (2005)	Transit and bus subsidies	Effectiveness	Financially beneficial to students, faculty, and universities
Brown et al. (2003)	Transit and bus subsidies	Effectiveness	56% increase in bus ridership and 20% decrease in campus visits by solo drivers
Zhou (2014)	Transit and bus subsidies	Effectiveness	Share of transit usage among students increased by 51%
Shannon et al. (2006)	Parking policies, transit and bus subsidies	Effectiveness	Subsidizing public transport services, increasing the cost of parking, and improving the quality of bus services are among the most promising policies to induce a modal change
Brockman and Fox (2011)	Parking policies, active transport, car-sharing, transit and bus subsidies	Effectiveness	Staff members car commuting dropped from 50% in 1998 to 33% in 2007
Lavery et al. (2013)	Demand analysis	Segmentation	Influence of demographic, attitudinal and spatial/land use variables, and role played by faculty staff
Miralles-Guasch et al. (2014)	Demand analysis	Segmentation	Influence of demographic, attitudinal and spatial/land use variables, and role played by faculty staff
Limanond et al. (2011)	Demand analysis	Segmentation	Social interdependency
Duque et al. (2014)	Demand analysis	Segmentation	More environmentally friendly attitudes of staff compared to off-campus students, inadequate policies given the attitude of the most polluting segment
Fürst (2014)	Demand analysis	Segmentation	Six different commuter groups, need for segment specific policy mixes
Miralles-Guasch and Domene (2010)	Demand analysis	Segmentation	For undergraduate students public transport is the preferred means, for staff the use of public transport is higher among teaching and research members