Transportation Research Part A 44 (2010) 359–375

Contents lists available at ScienceDirect

Transportation Research Part A

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

The urban road pricing scheme to curb pollution in Milan, Italy: Description, impacts and preliminary cost–benefit analysis assessment

Lucia Rotaris [a,*], Romeo Danielis [a], Edoardo Marcucci [b], Jérôme Massiani [c]

[a] Università di Trieste, Dipartimento di Scienze Economiche e Statistiche, Piazzale Europa, 1 – 31024 Trieste, Italy
[b] Università di Roma Tre, Dipartimento di Istituzioni Pubbliche, Economia e Società, Via G. Chiabrera, 199 – 00145 Roma, Italy
[c] Università di Trieste, Dipartimento di Ingegneria Civile e Ambientale, Piazzale Europa, 1 – 31024 Trieste, Italy

ARTICLE INFO

Article history:
Received 27 February 2009
Received in revised form 15 February 2010
Accepted 6 March 2010

Keywords:
Congestion charge
Road pricing
Cost–benefit analysis

ABSTRACT

Starting from January 2008 Milan implemented a charging scheme to enter an 8 km^2 area of the city centre. The term used to denote the scheme is Ecopass, conveying the stated political objective of the scheme: a pass to improve the quality of the urban environment (ECO). The charge depends on the Euro emission standard of the vehicle. The paper illustrates the main features and impacts of the Milan Ecopass scheme, and presents a preliminary cost–benefit analysis. The scheme has been effective in curbing not only pollution emissions, but also congestion, and the result has been achieved with low implementation costs and without major political opposition. The cost–benefits analysis presents an overall net benefit. The identification of the winners and losers of the policy is conditioned by penalty payments. Without including the penalties, the surface public transport users and the society at large are the main winners, whereas car and especially freight vehicle users are net losers.

1. Introduction

Following the recent introduction in London and Stockholm, starting from January 2008, an urban road pricing has been introduced in Milan, Italy. The gain in popularity of road pricing schemes among decision makers in Europe has come after transport economists had long advocated road pricing as a socially beneficial policy (Pigou, 1920; Vickrey, 1963, 1969; Walters, 1961).

However, many issues are still controversial both at a theoretical and empirical level.

At a theoretical level, road pricing has proved to be a welfare-increasing policy which, when jointly planned with network capacity provision, can significantly strengthen the financial sustainability and cost-effectiveness of road infrastructure investments. However the first-best, link-based, partial-equilibrium road-pricing model, which requires each road user to pay a price equal to the value of the congestion delay imposed on all other users, represents a mere benchmark solution and its real world implementation raises numerous theoretical, technical, social, and political issues. These have been addressed in many second- and third-best models (see, e.g., Tsekeris and Voß, 2008; Small and Verhoef, 2007; de Palma et al., 2006; Lindsey, 2006; and Santos 2004).

From an empirical point of view, the number of real world implementations is yet far too small and too case specific to allow the scientific community to draw definite conclusions. Yet, some empirical evidence does exist. The literature on the recent London and Stockholm schemes shows that road pricing:

* Corresponding author. Tel.: +39 339 7437671; fax: +39 040 567543.
E-mail addresses: lucia.rotaris@econ.univ.trieste.it (L. Rotaris), danielis@units.it (R. Danielis), emarcucci@uniroma3.it (E. Marcucci), jmassiani@units.it (J. Massiani).

0965-8564/$ - see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.tra.2010.03.008

- is effective in reducing congestion and, consequently, travel times (Transport for London, 2003 and 2007; Eliasson et al., 2009);
- causes a modal shift toward public transport and non-motorised modes;
- improves, as a side effect, the urban and environmental quality of the urban areas where it is implemented (Banister, 2003);
- is financially beneficial for the local authorities that implement it;
- does not always raise public discontent and can be politically accepted;
- does provide substantial toll revenues to the local administration who can allocate them according to the political agreement with its constituency; and
- can be a progressive tax in its own right, before any compensation scheme is implemented (Santos and Rojey, 2004, p. 38).

The scheme applied in Milan provides yet another possibility to test the various issues at stake. The term Ecopass summarises the meaning and the stated political objective of the scheme: a *pass* to improve the air quality of the city (*eco*).

The literature shows that the final results of the implemented policies depend on how they are tailored to the specific characteristics of the city and on the specific objectives pursued. No easy and robust generalization is possible, as is often the case in social sciences. However, the examination of the Milan Ecopass scheme – an important scheme since, in Italy, Milan is the second largest metropolitan area in terms of population, and the most important in terms of wealth – can provide further useful evidence on the advantages and disadvantages of a road pricing policy in an urban agglomeration.

The paper is structured as follows. Section 2 illustrates the characteristics of the Milan Ecopass scheme. Section 3 illustrates its main short-term impacts on pollution, the number and type of circulating vehicles, congestion, trip scheduling, modal transfer and toll revenue. Section 4 presents a preliminary cost–benefit analysis based on available data in order to compare it with those performed for London and Stockholm. Section 5 summarises the main results and discussed the future prospects.

Throughout the paper, comparisons will be made with the schemes implemented in London and Stockholm, and, to a lesser degree, in Singapore.

2. The Milan Ecopass scheme: characteristics and implementation

Milan is one of the largest Italian metropolitan areas. It comprises 3.7 million inhabitants (1.9 million within the city boundaries) and is the centre of the polycentric Lombardy region of about 9.5 million inhabitants (ARPA, 2006, p. 62). Although the area is served by an important transport public network, there is a perception that road traffic is excessive and generates a lot of congestion as well as air pollution. This perception is consistent with the high level of car ownership in the city, 0.6 cars per inhabitant (0.74 including all vehicles), which ranks Milan among the cities with the highest car concentration in the world.

The high reliance on car use for travel in Milan together with adverse geoclimatic conditions of the Padania region result in very high pollution levels. In the period 2002–2007 the 50 $\mu g/m^3$ PM_{10} concentration limit set by EU environmental regulation was exceeded during 125 days (Agenzia Milanese Mobilità Ambiente, hereafter AMMA, 2008), with an annual average value of 51.2 $\mu g/m^3$. The NO_2 annual average daily concentration was 60 $\mu g/m^3$ (ARPA, 2006, p. 86) and the 0_3 was about 30 $\mu g/m^3$, and both increasing.

Since the national legislation requires Mayors to drastically intervene to curb pollution (even with a temporary ban of private vehicles' traffic)[1] and to improve the quality of the urban environment, the Milan city administration, with the Major Letizia Moratti, decided to introduce, starting January 2008, a package of transport policies including Ecopass.

The main features of Ecopass are presented below, together with some elements of comparison with road pricing schemes implemented in other cities.

Vehicles entering the 8 km^2-wide area (see Fig. 1) between 7:30 and 19:30 are subject to the payment of a charge. The charging area is relatively small compared to London (22 km^2 before 2005, and 40 km^2 after 2005) and Stockholm (30 km^2), but is comparable to Singapore (7 km^2). The choice of the location and of the dimension of the charging area has been based on the historic urban layout, rather than on theoretical transport planning considerations described in the literature (Stewart, 2007; Maruyama and Sumalee, 2007; Safirova et al., 2007; Mun et al., 2005; Shepherd and Sumalee, 2004). Such an area, we reckon, is too small to allow a substantial effect on transport speeds such as the one recorded in the Stockholm case (Eliasson et al., 2009).

A crucial decision was made to set the charge according to the 5 Euro emission standard classes (Table 1). In contrast with theoretical prescriptions, no differentiation is made according to access time to the charging area, within the charging window (7:30–19:30). This is because the charge is mainly conceived and communicated as a pollution charge and not as a congestion charge.

[1] The major piece of legislation is the Ministerial Decrete 15 April 1994 and 25 November 1994 ("Livelli di attenzione e di allarme per gli inquinanti atmosferici nelle aree urbane"). Milan, like many other Italian cities, has a record of drastic traffic policies including traffic bans, free-of-cars Sundays and even-odd plate regulations.