Available online at www.sciencedirect.com
ScienceDirect
European Economic Review 51 (2007) 1177–1204
EUROPEAN ECONOMIC REVIEW
www.elsevier.com/locate/eer

Optimal taxation of car ownership, car use and public transport: Insights derived from a discrete choice numerical optimization model ☆

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Received 30 November 2004; accepted 15 August 2006
Available online 18 October 2006

Abstract

We formulated and numerically evaluated a model of car ownership, car use and public transport use for peak and off-peak hours of the day. The model was used to study the optimal tax structure for passenger transport in Belgium, with special emphasis on the optimal tax treatment of diesel versus gasoline cars. We obtained a number of interesting results. First, if the government can set all fixed and variable transport taxes optimally, the higher marginal external cost of diesel use implies that the optimal tax per kilometre for the use of a diesel car is higher than for the use of a gasoline car. Moreover, high congestion implies that the taxes on car use in the peak period are more than twice their current levels. However, the optimal tax on ownership of a diesel car is some 200€ below its current level. Second, if the government uses kilometre taxes that do not differentiate between fuel types, the optimal ownership tax on a diesel car is twice as high as the tax on a gasoline car. Furthermore, if political constraints restrict user taxes to their current levels, we find that optimal ownership taxes on diesel cars double, whereas those on gasoline cars rise by 30%. Finally, subsidies

☆ The ideas expressed in this paper do not necessarily reflect the official viewpoint of the Federal Planning Bureau. We are grateful to Didier Swysen and Christophe Courcelle for research assistance at the early stages of this project, to Larry Goulder, Ronnie Schöb, Matthew Kötchen and seminar participants at the universities of Antwerp, Leuven and Munich for useful comments on a previous version, and to FWO-Flanders for financial support. Two referees, an associate editor and an editor of this journal provided detailed written remarks that substantially improved the final version of the paper. In addition, we thank Fay Dunkerley and an editor for editorial help.

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doi:10.1016/j.euroecorev.2006.08.004

to public transport are found to be optimal as long as variable car taxes are not differentiated between periods.

JEL classification: H21; H23; R41

Keywords: Optimal taxation; Two-part tariffs; Externalities

1. Introduction

The social costs associated with transport externalities such as congestion, pollution and accidents are known to be substantial. Recent estimates suggest that, in highly congested European cities such as Amsterdam and Brussels, the marginal external cost of car use amounts to more than 1€/km (De Borger and Proost, 2001). Consequently, policies to reduce time losses and other external transport costs are high on the political agenda in many countries. Economists have strongly emphasized the need to use pricing instruments, such as road pricing, to correct transport externalities. Not surprisingly, a large theoretical and empirical literature on the optimal tax treatment of transport externalities has developed over the past decades.[1]

With very few exceptions, the available studies ignore the two-part tax structure on vehicles that is typical of real-world tax systems. It is well known that most European governments tax car ownership (e.g., through annual vehicle taxes) and car use (e.g., through fuel taxes, road tolls, etc.) separately. The purpose of the current paper is, therefore, to explicitly consider the optimal tax treatment of car ownership, car use and public transport use in the presence of externalities. The analysis was motivated by two observations. First, policy-makers face restrictions on the variable pricing instruments they can use to correct external costs of congestion and pollution; this implies a potential role for fixed ownership taxes to cope with externalities (see e.g., Chia et al., 2001; De Borger, 2001; Fullerton and West, 2000). To appreciate this, assume that it would be feasible to implement 'Pigovian' taxes that perfectly tax users of transport services at the relevant marginal external cost. The optimal tax literature then convincingly suggests that there would be no explicit role for annual ownership taxes in correcting externalities.[2] Unfortunately, application of Pigovian taxes would require measuring the external costs of congestion, emissions and noise of various car types, at each point in time and space, and to charge users accordingly. Such a sophisticated system of full electronic road pricing on the complete transport network is not feasible in the short-run. Moreover, it is unclear

[1]Early contributions include Vickrey (1969), Keeler and Small (1977), Glaister and Lewis (1978) and Viton (1983). Recent extensions have focused on three broad issues: (i) The interaction of transport taxes and the labour market (Parry and Bento, 2001; Van Dender, 2003); (ii) the implications of restrictions on pricing instruments (Arnott et al., 1993; Verhoef et al., 1995, 2002; Van Dender, 2001); (iii) evaluating the welfare effects of specific policy proposals, including road pricing and changes in fuel taxes (see e.g., Kraus, 1989; Mayeres and Proost, 1997; Mayeres, 2000; De Borger and Proost, 2001; Parry and Small, 2005).

[2]For example, both Cremer et al. (1998) and Kopzcuk (2003) study optimal second-best nonlinear tax structures in the presence of externalities. They show that, regardless of what other tax instruments are available, the optimal tax structure requires taxing the externality at marginal external cost. This confirms the 'targeting' principle (Dixit, 1985): the externality problem should be resolved by directly targeting its source.