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Optimal pricing of transport externalities in an international environment: some empirical results based on a numerical optimization model

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Abstract

In small open economies, a large fraction of the externalities on the national transport network is due to international and pure transit traffic. Moreover, the existence of these flows implies a potential for tax exporting behaviour by individual countries. This paper provides an empirical analysis of welfare-optimal pricing of transport externalities in such an environment. A numerical optimization model is used to study different types of equilibria. We consider the welfare optimum for one individual country (Belgium) assuming that current policies abroad (in ‘the rest of Europe’) remain unchanged, and we compare the outcome with current pricing policies and with the welfare optimum from the viewpoint of a hypothetical federation, consisting of Belgium and the rest of Europe. We also provide some first insights into the strategic responses of individual countries to transport policies abroad by numerically evaluating the Nash equilibrium in transport prices. Among others, the empirical results indicate the order of magnitude of deviations of current prices from optimal prices, they numerically illustrate the importance of tax exporting behavior, and they provide information on the response of individual countries to changing transport policies abroad.

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1. Introduction

The large increase in mobility over the past decades has generated serious concerns about the associated external costs such as congestion, noise, accident risks and air pollution. Not surprisingly, a substantial economic literature has developed that deals with optimal pricing and regulation of these transport externalities. The theoretical literature on optimal taxation in the presence of externalities (see, e.g., Sandmo 1975; Bovenberg and van der Ploeg, 1994) has been extended to specifically fit the characteristics of the transport industry (Oum and Thretheway, 1988; Mayeres and Proost, 1997). Moreover, a number of studies have considered the pricing of transport services under various second-best conditions (see, e.g., Arnott et al., 1993; Verhoef, 1996; Parry and Bento, 2001; Small and Yan, 2001). An impressive stream of empirical studies is now also available in which the pricing implications of congestion and other external costs were numerically illustrated. Relevant references include Glaister and Lewis (1978), Small (1983), Viton (1983), Kraus (1989), De Borger et al. (1997), and Proost and Van Dender (2001).

The majority of the above-mentioned studies concentrated on correcting externalities in an urban environment or on a specific road network, and has therefore not explicitly considered the international aspects of the problem. It is clear, however, that transport flows and the associated externalities have an important international dimension that must be taken into account in designing realistic pricing and regulatory policies. First, the importance of international (and especially pure transit) transport flows implies that in many countries a substantial share of locally generated externalities is caused by foreigners. Second, to the extent that countries can tax these flows, tax-exporting behavior may result (Arnott and Grieson, 1981; Krelove, 1992). Third, international transport implies that the tax base of transport services is to a large extent mobile between countries, which may lead to inefficient tax competition. Indeed, increases in tax rates in a given country imply a fiscal externality that is likely to be ignored by individual countries (see, e.g., Mintz and Tulkens, 1986; Wildasin, 1988). Fourth, some transport externalities generate international spill-overs (e.g., global warming, acid rain, etc.). These will lead countries to underestimate the global effects of locally generated externalities and to impose corrective taxes that are too low from a global perspective (see, e.g., Markusen, 1975; Merrifield, 1988).

As far as we know, this paper provides the first empirical analysis of optimal pricing of transport externalities in an international environment. The theoretical framework we use captures all essential dimensions of transport policy-making in an international setting, including spillovers of externalities and the potential for tax competition and tax exporting behavior. However, we do make some strong simplifying assumptions to keep the problem empirically manageable. Indeed, since in a realistic international environment (e.g., within the EU) countries experience transport from a large number of foreign countries on their territory, a fully satisfactory empirical model would have to include many individual countries and all inter-country traffic flows. In this paper we strongly reduce the data requirements and computational complexity by focusing on two asymmetric regions, Belgium and its surrounding region, the 'Rest of Europe'. In each region we distinguish passenger and freight flows. Whereas passenger transport is

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