



Congestion and tax competition in a parallel network

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Abstract

The purpose of this paper is to study the effects of tolling road use on a parallel road network where each link can be tolled by a different government. Using both theoretical and numerical models, the paper analyses the potential tax competition between countries that each maximise the surplus of local users plus tax revenues in controlling local and transit transport. Three types of tolling systems are considered: (i) toll discrimination between local traffic and transit, (ii) only uniform tolls on local and transit transport are acceptable, (iii) tolls on local users only. The results suggest that the welfare effects of introducing transit tolls are large, but that differentiation of tolls between local and transit transport as compared to uniform tolls does not yield large welfare differences. Also, the welfare effects of toll cooperation between countries are relatively small in comparison with the welfare gains of non-cooperative tolling of transit. The numerical model further illustrates the effects of different transit shares and explicitly considers the role of asymmetries between countries. Higher transit shares strongly raise the transit toll and slightly decrease local tolls. With asymmetric demands, the welfare gains of introducing differentiated tolling rise strongly for the country with lower local demand.

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1. Introduction

Countries' road networks are usually publicly provided, they are congestible, and they are accessible to local users and to transit transport.¹ In many cases, transit traffic has a choice between different jurisdictions' road networks. For example, there are two main routes from South-Central Europe (Switzerland, Austria, Italy) to the north (Belgium, Netherlands, etc.), one through France, the other via Germany. Or consider the transalpine crossing between Germany and Italy, where Austria and Switzerland compete for transit traffic. In both examples, transit has a choice of routes and it interacts with local traffic in each country.

In these circumstances, how would a local jurisdiction like to price access to its infrastructure?² We study this question in a model with two parallel routes that are operated by two countries, for given levels of infrastructure supply. Both local and transit traffic contribute to congestion, and the two countries compete for revenue from transit. Assuming that countries maximise a welfare function consisting of local consumer surplus and tax revenues from local and transit traffic, we study strategic tolling by individual countries under various tolling schemes. First, we assume that local traffic and transit can be tolled separately. Second, we look at the case where only uniform tolls are possible or acceptable. Third, we consider the case where only local traffic can be tolled.

In view of recent innovations in transport taxation within the EU, these three tolling regimes are policy-relevant. New forms of transport pricing instruments include kilometer charges (planned in Germany since early 2003), tolls (already existing, amongst others, on French motorways), and cordon pricing (London). More sophisticated time-of-day pricing regimes are under consideration. Among others, the case of differentiated tolls is relevant because, when Member States use different tolling instruments for local and transit transport, the implied tax levels will automatically differ. The case of uniform tolls provides an appropriate description when EU member countries use the same pricing instruments, because explicit toll discrimination between local and transit transport contradicts EU regulations. Finally, the case of 'local tolls only' resembles the current situation in many countries, where fuel taxes are the main tolling instrument. High fuel taxes can easily be evaded by transit transport, especially in relatively small countries. Hence, the exclusive use of fuel taxes can be considered as a highly stylised example of tolling local traffic only.³ It is likely that several countries will be limited to tolling local

¹To avoid confusion, note that we use the term 'transit' to refer to 'through traffic', i.e. traffic that has both its origin and destination outside the country under consideration.

²Although the discussion is set in the context of congestible road infrastructure in two countries, similar issues arise in the public provision of e.g. health, educational and recreational services. In this sense, the ideas studied in this paper are not limited to the transport sector. The key feature of the analysis is that foreign (transit) users are not restricted to a particular jurisdiction but can choose between several, and that jurisdictions compete for revenue from transit.

³Of course, there is another clear distinction between local and through traffic that is ignored here, viz., that a lot of local traffic is on other roads than transit traffic; the latter is much more concentrated on the major highways.

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