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Strategies of state and local government in management of urban transport problems – A case of Delhi

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In India, different layers of Government control different policy instruments to tackle transport externalities which might result in coordination problems and possible efficiency losses. This paper, therefore, addresses the coordination problem resulting from the division of policy instruments between two different government levels that face different types of externalities in varying degrees of magnitude in the urban transport sector by developing three types of theoretical models: the Full Control Centralised Model where the state government has full control over all pricing instrument; a Nash equilibrium model where each of the government levels controls only one instrument and takes the behaviour of the other as given; and a Stackelberg equilibrium mode where the behaviour of the state government is influenced by the fact that one of the price instruments is controlled by the local government. With an empirical illustration of the model for Delhi, the paper finds that since there are many interactions and many externalities between the two levels of government, a division of roles between them does not guarantee an efficient pricing outcome and the efficiency of pricing would depend on the institutional set up and on the correspondence between the objective functions of the two government levels.

1. Introduction

Delhi has been experiencing a consistently high rate of growth of motor vehicles during the last few decades. Rising real incomes, the dissatisfaction with public transport and the consequent increase in personalized mode of transport is leading to tremendous increase in traffic volume in peak period resulting in longer travel time, reduction in average speed due to congestion on the road, greater fuel consumption, higher levels of pollution and overall discomfort to road users. All these are resulting in considerable environmental damage, health hazards and road accidents, which need to be mitigated by proper planning of the transport systems and road networks. Another challenge for the city planners is that how to fix the prices for the transport systems and the infrastructure associated with it which may lead to optimal utilization of the infrastructure.

In this regard there is a growing interest in the use of transport pricing and taxation to address transport externalities, mainly, of congestion, air pollution, accidents and noise. The traditional prescription is to make all transport users pay the marginal social costs. Often a combination of pricing instruments is used, varying from fuel taxes to tolls and parking charges. In many instances the authority over the different instruments is not vested with a single government level but is spread over different government levels. In India, for example, tax on fuel such as petrol and diesel taxes are usually determined at the central government level while fixation of road tolls is a state subject. Similarly, parking fees are typically fixed at the urban or city government level. In Delhi, the prevailing practice is that the civic bodies, Municipal Corporation of Delhi (MCD) and New Delhi Municipal Council (NDMC) fix and levy the parking fees in their respective jurisdictions. As transport problems have a strong local component, one is inclined to delegate this task to the city government. However, this prescription is difficult to put into practice for two reasons: (i) It is not possible to perfectly match externality taxes with external effects; and (ii) Even if the city government had perfect instruments to address different externalities, it might not apply them correctly. For example, it tends to give lower importance or weightage to non-residents of the city because the city government is not accountable to the non-residents of the city, and it will disregard certain tax externalities (Ochelen & Proost, 1996). Tax externalities exist whenever one

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government affects the tax base of other government through tax competition or through tax base overlap (Dahlby, 1996). Since different layers of Governments involved in solving various transport issues, these might result in coordination problems and conflict of interests among different them. This motivates us to study the coordination problems and possible efficiency losses when different pricing instruments are controlled by different levels of governments to address external costs in transportation.

This paper addresses the problem of the division of policy instruments between two different government levels that face different types of externalities in varying degrees of magnitude in the urban transport sector (congestion, air pollution, accidents and noise). We examine a case where two local governments in Delhi, namely, Municipal Corporation of Delhi (MCD) and New Delhi Municipal Council (NDMC) determine parking fees in their respective jurisdictions and the state government, the Government of National Capital Territory of Delhi (GNCTD), controls the road tolling. Decentralising the use of policy instruments is important because the extent of the different types of externalities generated from the use of urban transport is region specific.

The structure of this paper is as follows. In Section 2, we give a survey of literature on the issue of urban transport pricing in a multi-governmental framework. In Section 3, we discuss the problem structure of two levels of government in designing optimal policies for tackling urban transport and environmental problems. Section 4 examines the policy preferences of two government levels through a simple partial equilibrium model. Their preferred mix of policy instruments differ because they face different environmental and transport problems and because they can exploit different fiscal externalities. To study the type of externality taxes we can expect from the city and the state governments when there is imperfect coordination between both government levels the paper models behaviours of different government levels as constrained optimisation models in three different equilibria: the full control centralised equilibrium; the non-cooperative Nash Equilibrium[1]; and the Stackelberg equilibrium.[2] In Section 5, we describe briefly the empirical model used and the relative importance of the different external effects. In Section 6, we explore numerically the case where the city government controls parking fees and where the state government controls a cordon toll around the city. we show the welfare effects of alternative divisions of responsibilities through the help of an empirical model: the centralised solution, the Nash solution and the Stackelberg solution to the urban transport pricing problems. Section 7 presents concluding remarks.

2. Survey of literature

Optimal and efficient transport pricing with multiple government levels and externalities is complicated because different types of externalities occur simultaneously. There are the spillovers of congestion and environmental externalities and also tax externalities. De Borger and Proost (2004) summarized some of the most important externality problems that are relevant in devising optimal urban transport policy. They distinguished between two types of tax externalities: horizontal tax externalities and vertical tax externalities. A typical horizontal tax externality is tax exporting where a city government tries to shift the tax mainly on the outsiders to the city (see, e.g., Arnott and Grieson (1981) or Dahlby (1996)). This means a higher tax on goods that are consumed more heavily by commuters or tourists to the city. A second type of horizontal tax externality is the competition between city governments for the same tax base. Many researchers suggest that tax competition puts downward pressure on tax rates and yields too low a level of public good supply (Wilson, 1999). A vertical tax externality is the taxation by both city and state governments of the same tax base. This is an externality because whenever a city government decides to raise taxes it will not take into account fully the losses of tax revenues for the state government because only part of the taxes collected by the state will be returned to the city governments in grants. This may lead to too high tax levels.

When a local government sets transport charges and taxes, it will also take into account the traditional transport externalities (e.g. congestion, air pollution, accidents, noise, etc.) but will do this in a different way than a state/central government. Consider congestion on urban roads. A local government will be mainly concerned with the time delays of its citizens and not by the delays experienced by commuters and tourists as long as these delays do not affect the local tax base. The same holds for air pollution or accident externalities that affect mainly non-residents. Simply relying on city governments to set optimal transport taxes does not guarantee welfare optimal pricing. Over the years many instruments have been developed to overcome the tax externality problems. States may agree on minimum fuel taxes to avoid downward pressure on fuel taxes. Most countries have tax sharing agreements and use transfers of tax revenues from central to regional authorities to overcome horizontal and vertical tax externalities (Proost & Sen, 2006).

The study of the role of local or city governments in the use of new pricing instruments to deal with congestion is emerging as an important area of research. For example, Ochelen and Proost (1996) studied the externality issues, the division of policy instruments between city and state governments and the resulting coordination problems associated with the multi-government setting by the help of a simplistic partial equilibrium model where the behaviour of each layers of government was modelled. They found that the use of correct Pigouvian taxes by the city governments couldn't be expected because of transboundary pollution and fiscal externalities. Proost and Sen (2006) studied the potential tax exporting problems in urban transport pricing. They examined a case where a city government controls parking fees and the state government controls the tolling. They found that although both government levels have different objective functions, the overall efficiency losses in the non-cooperative Nash and Stackelberg equilibria are limited compared to the centralised solution where the state government has both the instruments under its control. De Borger, Proost, and Van Dender (2005) studied another dimension of the urban transport pricing which is the tax competition dimension that is more relevant for interregional transport. They examined 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, they analysed the potential tax competition between countries that each maximise the surplus of local users plus tax revenues in controlling local and transit transport. Their results suggested that the welfare effects of introducing transit tolls were large, but that differentiation of tolls between local and transit transport as compared to uniform tolls did not yield large welfare differences. Also, the welfare effects of toll cooperation between countries were relatively small in comparison with the welfare gains of non-cooperative tolling of transit. With asymmetric

[1] The **Nash equilibrium** (named after John F. Nash) is a kind of solution concept of a game involving two or more players, where no player has anything to gain by changing only his or her own strategy unilaterally (see Fudenberg & Tirole, 1993; Gibbons, 1992).

[2] The **Stackelberg Equilibrium** (named after Heinrich von Stackelberg) is a kind of leadership model where the players of this game are a *leader* and a *follower* and they compete on quantity. The leader moves first, choosing a quantity. The follower observes the leader's choice and then picks a quantity (see Fudenberg & Tirole, 1993; Gibbons, 1992).