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Second-best urban tolls in a monocentric city with housing market regulations

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ABSTRACT

This paper investigates second-best congestion pricing in a monocentric city characterized by distortionary regulations in the housing market (building height restrictions, no-development areas and property taxation). We demonstrate that the welfare gain of a Pigouvian tax may first fall and then increase as building height restrictions become more stringent. For example, a Pigouvian toll imposed in a city without restrictions may produce up to 40% larger welfare gains than Pigouvian tolling in a city with a mild, uniform in space, floor-to-area ratio restriction. In the presence of a tax-induced distortion, deviations of the Pigouvian toll can lead to non-negligible welfare gains. We discuss the important policy implications of the above findings.

1. Introduction

Second-best issues are a prominent theme in the contemporary literature on externality regulation. This is true for the transport economics literature in the context of road pricing (Verhoef et al., 1996), the urban economics literature in the discussion on urban growth boundaries (Brueckner, 2007; Anas and Rhee, 2007) and the environmental economics literature, where the double dividend hypothesis is an important theme (*e.g.* Goulder et al., 1997). Second-best issues may emerge for a variety of reasons. One is that the market for an externality-generating commodity is directly related to the market of another imperfectly priced commodity, because the two commodities are either substitutes or complements. This provides a motive to adjust Pigouvian taxes in the market of primary interest: welfare losses due to deviations of the corrective taxes from marginal external costs are motivated by welfare gains in the related market.

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As an example, in the absence of road pricing, second-best fares in public transportation will reflect unpriced congestion on the road: they will be adjusted downwards (upwards) when public transportation functions as a substitute (complement) to private road use. Similarly, optimal tolls will deviate from their Pigouvian values when traffic-induced externalities in links, routes or entire areas of a network go unpriced. Verhoef (2002a, b) offers a general analytical solution for the second-best problem where not all links of a congested network can be charged; an algorithm based on this analytical solution is then tested on a medium size network. Also, van Dender (2004) shows that constraints in network pricing can cause the optimal toll to deviate from the marginal external cost of congestion in a complex way. These considerations, as well as the corresponding second-best adjustments, vanish once optimal road pricing is implemented.[1]

The impact of labor tax distortions on optimal urban road pricing has received considerable attention in the transportation branch of the double-dividend literature. The well-known contribution by Parry and Bento (2001) was the first to examine, in a non-spatial framework, the efficiency of a congestion tax during the peak commuting hours in the presence of a distortionary tax on labor income; Mayeres and Proost (2001) examine the double-dividend in transportation in the presence of heterogeneous agents; van Dender (2003) expanded the analysis by Parry and Bento (2001) to account for traffic that generates externalities but is not subject to a tax-interaction effect; Tikoudis et al. (2015) examined the role of a spatially-varying interaction effect between the labor and road tax, as well as its implications for the design of optimal pricing schemes in a monocentric city; Tikoudis (2018) derived analytical expressions for the traditional double-dividend effects in a polycentric model and showed that, under specific conditions, a Pigouvian tax rule could be welfare-decreasing even if tax revenue is used to reduce the tax on labor income.[2] The effect of other tax-induced distortions or inefficient pricing mechanisms within the transportation system (*e.g.* fuel taxes, urban transit subsidies) has also been examined extensively (Parry and Bento, 2002; Parry and Small, 2009).

At the same time, the associated impact of imperfectly functioning land and housing markets on the optimal design of urban road pricing schemes has remained under-researched. In this paper we examine optimal road pricing from that new perspective, *i.e.* in the presence of various regulations in housing and land markets that are: i) *distortionary*, and thus suboptimal to begin with, and ii) *non-adjustable, i.e.* they are assumed to be fixed, in contrast to road pricing schemes which will be optimized. Both assumptions are relevant for a variety of reasons.

Regarding the first, most urban land and housing markets are heavily distorted due to a range of suboptimal pricing policies (*e.g.* housing taxation, mortgage interest deduction) and quantity restrictions (*e.g.* regulated building height, zoning including no-development areas). Empirical observation suggests that quantity restrictions are present in a substantial part of the world. For example, in the Netherlands most municipalities set maximum height restrictions for residential buildings. In most other European countries, similar regulatory restrictions have been implemented.[3] Via different channels, housing and land market regulations may cause welfare losses through a suboptimal allocation of space across economic agents and activities, as they are decided in the sphere of politics and do not correspond to a welfare maximization plan.

The second assumption is also reasonable in many respects. Command-and-control regulations might be difficult to adjust when homeowners have strong incentives to lobby for building height restrictions, as well as no-development areas (Fischel, 2001; Schuetz, 2009). That is, quantity restrictions have been shown to increase housing prices in specific contexts (*e.g.* Ihlanfeldt, 2007) and are, therefore, very likely to remain intact in the years to come. Furthermore, command-and-control restrictions are rigid because of physical reasons, as most of these regulations cannot be adjusted towards certain directions in a formed urban landscape. For instance, once urban fabric has reached the growth boundary of a city, there may be no way to contract that boundary inwards, as that would outlaw existing private property. Similarly, once buildings have been constructed, responses to laxer or tighter building height restrictions are hardly possible, as they imply substantial conversion costs.[4] Theoretically, property taxes might be less rigid than quantity restrictions. However, housing property taxation has been established as a standard way to raise public revenue.[5] Furthermore, its adjustment in light of the associated external effects in the transportation sector may be hampered by the lack of coordination between the authority that sets the property tax and the regulator that controls the road charges in an urban area. Most often, these authorities belong to different levels of government and may use these instruments to obtain different objectives.

[1] More recently, the problem of second-best pricing in networks has been examined under the hypothesis of bounded rationality (Di et al., 2013, 2016). Furthermore, a growing literature examines second-best issues resulting from the interactions of independent regulators controlling different parts of a network (see for instance De Borger et al., 2005, 2007; Watling et al., 2015). De Borger and Proost (2012) provide an extensive review of this literature stream.

[2] Throughout the paper, the terms *Pigouvian (road) toll, Pigouvian (road) tax, Pigouvian tax rule* and *marginal external cost pricing* are used interchangeably as synonyms, *i.e.* they all refer to a corrective road tax whose level has been set equal to the marginal external cost of congestion.

[3] Building height restrictions are one specific form of land-use planning. Cheshire and Sheppard (2002) find a negative welfare effect of land-use planning in general.

[4] Even if these regulations were easy to adjust, empirical research suggests that the accompanying land-use changes might not be sufficient to substantially reduce vehicle miles travelled (Heres-Del-Valle and Neiemeier, 2011). For example, Bento et al. (2005) show that the elasticity of vehicle miles travelled with respect to population density is just −0.07. The effect of city size regulation on travel energy consumption is examined by Larson and Yezer (2015). Vermeulen and van Ommeren (2009) attempt to estimate the effect of regulated housing supply on jobs-housing balance.

[5] Taxation in the housing market includes transaction as well as property taxes. Taxation may also be negative in case of mortgage interest deduction. Other regulatory channels include rent control (Gyourko and Linneman, 1989,1990; Arnott, 1995) and public housing. See Cheshire and Hilber (2008) for the effect of building height restrictions in the market of office space.