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The political economy of cordon tolls[☆]

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ABSTRACT

This paper studies the political economy of cordon tolls in a monocentric city consisting of three zones: center, mid-city and suburbs. The cordon toll may give rise to several interrelated conflicts: between residents within and outside the cordon, between car and public transport users, between the rich and the poor and, as the toll capitalizes into rents, between landowners and renters. These conflicts drive all our results. In the short-run, we assume the population is immobile and rents are fixed. With identical individuals, the toll then increases commuting costs only for those outside the cordon. Unless residents within the cordon are the majority, the equilibrium toll resulting from the political process is below the optimal level. Allowing for heterogeneous values of time, rich car commuters prefer a toll higher than socially optimal but, unless access costs to public transit are small, the poor majority prefers a toll below the optimum. When the toll capitalizes into land rents within the cordon, we show that only voters owning land in the center support it. In all scenarios, earmarking revenues for public transport mitigates the effect of the toll on commuting costs, raising voter support. Finally, we find that it is easier to get support for a cordon close to the center than for one further out in the suburbs. We illustrate our results using a calibrated model based on data for Milan.

1. Introduction

Economists have long advocated road pricing to reduce the external costs generated by automobile traffic. Ideally, first-best pricing requires sophisticated, distance-based instruments that allow charging users in function of congestion and pollution levels. Unfortunately, in urban areas such instruments are difficult to implement, as one would have to monitor each car's path to compute the relevant charges. City governments have therefore focused on less ambitious but feasible second-best policies: almost all urban road pricing schemes that currently exist (or have recently been contemplated) are *cordon tolls*. The idea, implemented in London, Milan, Singapore and Stockholm among other cities, is to place a 'cordon' around the city center and charge drivers entering the area so defined.

Although the issue is on the political agenda in many cities, governments often appear unable or unwilling to implement cordon pricing. The list of examples where tolls have been discussed, but not adopted, is much longer than the few examples of successful introduction given before; it includes New York, San Francisco, Birmingham, Edinburgh, Manchester, Paris, several cities in Belgium and the Netherlands, etc. Political acceptability of road pricing seems still a major challenge (Small and Verhoef (2007)). To better understand why this is the case, this paper develops a simple political economy model of cordon pricing. Intuitively, imposing a cordon toll gives rise to several potential conflicts between inhabitants: between residents within and outside the cordon, between car and public transport users, between the poor and the rich and, when the toll capitalizes into rents, between landowners and renters. These potential conflicts drive our results. A numerical application based on data for Milan, Italy, illustrates our findings.

Following Brueckner and Helsley (2011) and Brueckner (2015), we model a monocentric city consisting of three zones: the center, where all employment is located, a midtown and a suburban zone. Residents commute daily to the center, either by car or public transit. The road system is congestible and transit suffers from peak-hour crowding. We model the cordon toll as a tax on all cars entering the central zone and consider various ways to recycle the toll revenues, including lump-sum redistribution and earmarking to subsidize public transport. The toll is decided by majority voting.

The analysis proceeds in several steps. First, the baseline model

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considers a short-run scenario where populations in the various zones are immobile, so that the toll has no impact on the land market. Individuals are identical. Unless the toll is used to a large extent to subsidize public transport, it increases the cost of commuting for all those outside the cordon: car users pay more than the value of the reduction in congestion, public transport users face increased crowding. Residents within the cordon benefit. As a result, unless residents inside the cordon are the majority of the population, voting results in a toll below the socially optimal level (or even no toll). The government can mitigate the increase in commuting costs – and thus buy support for the toll – by using it to finance public transport subsidies. Specifically, the difference between the socially optimal toll and the equilibrium one is smaller the higher the subsidy.

Second, we introduce differences in value of time between poor and rich commuters. We let the rich commute by car, whereas the poor either drive or use public transport. This choice depends on user costs, including an idiosyncratic cost of accessing the transit network. We show that the rich prefer a toll higher than socially optimal, because they gain from lower congestion. However, poor car commuters suffer. The higher the user cost of public transport, the larger the share of poor individuals who drive and, thus, the larger the fraction of people that prefers a toll lower than the socially optimal level. When this fraction is large enough, the voting equilibrium entails a toll below the optimum. As in the baseline model, earmarking toll revenues for public transit improves acceptability.

Third, we reconsider the baseline model when urban residents are mobile. To avoid the toll, individuals can now move to the area enclosed in the cordon. The toll then capitalizes into central land prices, redistributing wealth in favor of those who own land there. Hence, regardless of where they live, voters generally fail to internalize the social benefits of the toll, except if they own a substantial lot of land inside the cordon. Only voters who own much land in the central zone will support the socially optimal toll. However, by attenuating the increase in commuting costs, higher transit subsidies mitigate the increase in land rent. They weaken the redistributive effects that work through the land market and, thus, voters' opposition to the toll.

Finally, the conflict between residents within and outside the cordon suggests that the location of the toll may be important for the political outcomes. The question then arises whether it is easier to get voters to favor a toll close to the center or one further out towards the suburbs. Although theoretical arguments do not provide an unambiguous answer, numerical analysis calibrated for Milan data indicates that voters are more likely to support a small cordon. Intuitively, this toll generates more revenues than one further out, and it is more effective at reducing congestion. Hence, both central residents (who do not pay the toll, independently of where it is located) and suburban residents (who pay in any case) prefer a smaller cordon area.

Our findings are consistent with several stylized facts. First, tolls generally find low political support. This is what the model would suggest, as both the small area of real-world cordons and the scarcity of land within the cordon make it highly unlikely that the majority of voters resides or owns land there. Second, support is typically much lower among non-central than among central city residents.[1] Third, our findings are in line with city governments tying tolls to public transport to increase acceptability. Finally, cordons are typically limited to a small area close to the center.

This paper belongs to a small but growing literature on the political economy of transport policy. Few papers in this literature model space and the land market.[2] Brueckner and Selod (2006) focus on the trade-off between monetary and time costs in choosing the city's transport system. In a model with rich and poor individuals, Borck and Wrede (2005, 2008) describe conditions under which voters support a commuting subsidy. Our paper differs by incorporating road congestion. Furthermore, it distinguishes between the short- and the long-run. In addition, whereas Borck and Wrede's focus is on kilometer charges, we study a cordon toll. The discontinuous nature of this tax leads to remarkably different implications.

Our analysis also contributes to the literature on cordon tolling. Mun et al., (2003) studied a monocentric city with no land market. They show that an optimally located toll yields almost as much benefit as the first-best Pigouvian toll. Mun et al., (2005) extend the analysis to a polycentric city. Verhoef (2005) allows for endogenous rents, residential densities and labor supply, but still finds cordon tolls to be close to first-best. More recently, Tikoudis et al., (2015) extended the model further to consider different toll rebate rules. Brueckner (2015) emphasizes that a cordon toll has an effect on land rents that is non-monotonic in distance from the city center. He shows that the absence of pricing on suburban roads implies that the second-best toll is higher than the first-best one.[3] Takayama and Kuwahara (2017) analyze bottleneck congestion in a monocentric city, showing that, depending on the distribution of schedule-delay costs, a time-varying toll may lead the city to expand outwards.

A brief overview of the paper follows. We introduce the model in Section 2. In Section 3 we analyze voting behavior by residents in a short-run setting when households are immobile so that rents are fixed. We first present a baseline model assuming identical households (Section 3.1), next we extend the model to allow for heterogeneity in the value of time between the rich and the poor (Section 3.2). Section 4 introduces household mobility into the baseline model, so that the cordon toll will capitalize into higher rents within the cordon. Section 5 gives some insight into the political economy of toll location. A numerical application for Milan is developed in Section 6. The conclusion follows in Section 7.

2. The model

We adopt the spatial structure proposed by Brueckner (2015). We consider an urban area consisting of three 'islands' or zones: a central zone C where the employment center (CBD) is located, a midtown zone M and a suburban zone S, which includes the urban area's boundary.[4] See Fig. 1. We normalize the size of C to one, and let the size of M be $Q_M \geq 1$. The suburban zone S is "large", in the sense that there is a perfectly elastic supply of land there, at a constant rental price denoted r_s.

The total population of the urban area is exogenous and denoted by N, where

$$N = n_c + n_m + n_s. \quad (1)$$

In this expression, n_c, n_m, n_s refer to the number of individuals that live in zones C, M and S, respectively. We assume that residential lot sizes in each zone q_j $(j = c, m, s)$ are exogenous. In accordance with real-world observation, we assume that $q_c < q_m < q_s$.

Commuting. All individuals commute to the CBD. To simplify the analytics, we assume the following. First, we normalize the cost of traveling to the CBD to zero for inhabitants of zone C. Second, we

[1] The case of Stockholm provides one example: the majority of residents within the Municipality voted in favor of the toll, whereas outside residents voted against (Winslott-Hiselius et al., 2008, Figs. 6 and 7).

[2] See, e.g., De Borger and Proost (2012) and Russo (2013) for political economy studies ignoring the land market. Bento, Franco and Kaffine (2006) study anti-sprawl policies

(*footnote continued*)
distinguishing landowners according to where they own land, though not in a political economy framework.

[3] A number of papers have developed large-scale numerical models to study the implications of cordon tolling. These include Safirova et al. (2006), De Lara et al. (2013), and Anas and Hiramatsu (2013) focusing on Washington D.C., Paris and Chicago, respectively. A few papers evaluate real-world cordon tolling experiences (e.g., Santos (2008), Eliasson (2008) and Rotaris et al. (2010)).

[4] Some of our results can be derived having only two zones, but for other sections having three zones is essential (most obviously for analyzing toll location).