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Residential parking permits and parking supply ☆

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ABSTRACT

We estimate welfare losses of policies that provide on-street parking permits to residents almost free of charge in Dutch shopping districts that are predominantly downtown. Our empirical results indicate that parking supply is far from perfectly price elastic, implying that there are substantial welfare losses related to underpriced parking permits. Our results suggest that the provision of residential parking permits in downtown shopping districts induces a yearly welfare loss of about €275 per permit, which is about 15% of the supply cost of a parking place.

1. Introduction

On-street parking pricing receives much attention in economic theory (e.g., Arnott et al., 1991; Verhoef et al., 1995). Theory recommends that parking prices should be used to allocate on-street parking places to users with the highest willingness to pay (Vickrey, 1954). In many parts of the world, this recommendation is not followed. For example, in the US, minimum parking requirements and below-market street parking prices are the norm. In the Netherlands, this principle is widely used, particularly in downtown cities, except when it comes to residential parking. Dutch cities allocate street parking to downtown residents by supplying residential parking permits almost free of charge to all residents in paid parking areas. As a consequence, the number of residential parking permits is non-negligible. For example, in the historic city center of Amsterdam, the number of residential parking permits is almost equal to the number of street parking places (about 100,000), see Gemeente Amsterdam (2000). Arguably, the provision of residential permits distorts the parking market through demand, because (street) parking places are occupied by residents with a willingness to pay for parking that is lower than the visitors' willingness to pay, and through supply, as it encourages supply of expensive (garage) parking to address visitors' demand.

Residential parking permits are not only common in the Netherlands but can be observed in many European countries. For example, in the UK, 'residential permit holders only' districts, where nonresidents are not allowed to park, can be observed in the smallest villages as well as in the main cities. A good example is the wealthy borough of Kensington and Chelsea (London, UK), where 82% of the 34,000 on-street parking places are allocated to residential permit holders only, and the number of permits exceeds the number of street parking places. While residents pay £0.30 per day for a parking permit, the parking costs for nonresidents are £30 per day (Kensington and Chelsea, 2012).[1]

We can only speculate why we observe parking permit policies which make parking cheap for residents but not for nonresidents. One potential explanation is that residents are voters, whereas visitors do not vote. It then makes sense for local governments to maximize residents' welfare at the expense of nonresidents by differentiating parking tariffs. Our empirical results later on are consistent with this. We find that residential parking permits decrease the consumer surplus of nonresidents. Note that we ignore general-equilibrium effects, which may occur because high nonresidents' tariffs might be detrimental to profits of downtown shops.

We are not aware of any estimates in the literature about the induced welfare losses of residential permits. In the current paper we aim to derive these costs for parking permits that are offered to Dutch residents who live within large shopping districts that are predominantly downtown. These districts are usually mixed in the sense that they contain both shops and residential housing, so shoppers and residents both have a demand for parking in the same location. Frequently, the parking

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[1] Residential parking permits are apparently not extremely common in the US, perhaps because minimum parking requirements usually induce an oversupply of off-street parking (Shoup, 2005; Cutter and Franco, 2012). Nevertheless, they can be found in San Francisco, Chicago and Boston and have recently been approved in New York. In New York politicians are concerned that the recently opened Brooklyn Barclays Centre, a sports arena with limited parking, might have negative consequences for residents parking (CBS New York, 2011).

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demand by shoppers and residents occurs at the same time. A recent poll for the West of Amsterdam indicates that 50% of households with a residential parking permit use the car at most one day per week (Trajan, 2009), suggesting that their cars remain parked for most of the time.

Residential parking permits are particularly distortionary if the parking supply is not fully elastic, because residents consume more on-street parking and shoppers consume less on-street parking than would be optimal. Knowledge of the parking supply function within shopping districts is then useful to derive the order of magnitude of the welfare effects of residential parking permits. In the current paper, we estimate the long-run (inverse) parking supply function using a dataset of about 300 of the largest shopping districts in the Netherlands, most of them (about 80%) being downtown shopping districts. Importantly, we employ a unique dataset with detailed information about street and garage capacity. Our main finding is that parking supply is quite elastic in downtown shopping districts, but possibly perfectly elastic in suburban and out-of-town shopping districts. This suggests that parking policies that provide parking permits to residents increase parking costs for nonresidents in downtown shopping districts, which has negative implications for welfare.[2] Our results suggest that the Dutch residential parking permits policy induces an annual welfare loss of about 100 to 140 million euro per year, which is about 15% of the parking supply costs in downtown shopping districts. 80 to 90% of this loss is borne by nonresidents.

The outline of the rest of the paper is as follows. In Section 2, we will discuss the main theoretical considerations to estimate the welfare losses of a residential parking permit policy. In Section 3, we discuss the institutional context and will focus on the empirical results. Section 4 discusses the welfare implications and Section 5 concludes.

2. Theory and welfare

2.1. Theoretical considerations

The welfare loss of a residential parking permit policy depends on the properties of the residents' and nonresidents' demand and supply functions. In the current paper, we will estimate the (inverse) supply function relevant to nonresidents. By making assumptions on the demand function we are able to determine the boundaries of the welfare loss.

There is a large empirical literature on parking demand.[3] However, as far as we know, there is only one empirical study about parking supply which does not apply to shopping districts.[4] Parking supply is likely perfectly price elastic in out-of-town shopping malls with large outdoor car parks (Hasker and Inci, 2011), but this is unlikely to be true for parking within mixed downtown shopping districts which combine street and garage parking places. When parking supply includes garage parking, it is unlikely that parking supply is perfectly elastic.[5] Note that it is a misconception that street parking is perfectly inelastic, even within historical city centers, because parking places may be converted into pedestrian areas or street lanes, which reduces traffic congestion (Arnott and Inci, 2006).

In order to identify the parking supply curve, we make a few strong assumptions. First of all, we assume that street and garage parking are perfect substitutes for nonresidents. Furthermore, we assume that parking suppliers are free to set parking prices and that they apply marginal cost pricing.

One may argue that street and garage parking are not perfect substitutes, for example because they are not at exactly the same location. This is consistent with Kobus et al. (2013), who show that drivers have a preference to park on-street. However, the average drivers' willingness to pay to park on-street is small and equal to only €0.25, so the perfect-substitution assumption is a reasonable approximation. Arguably, garage parking represents a safer place to park the car compared to on-street parking. So, drivers with more expensive cars might prefer off-street parking. As far as we are aware, this issue does not play a role in shopping districts particularly during shopping hours. When street and off-street parking are perfect substitutes (and freely compete with each other within a shopping district), then, despite any difference in construction costs, their prices are equal to each other (Calthrop and Proost, 2006). So, we will estimate the parking cost function ignoring the type of parking (garage or street parking) that is supplied.

There are many reasons to believe that the marginal cost pricing assumption does not hold. One fundamental criticism of the marginal cost pricing assumption is that local monopolistic behavior by commercial parking garages is likely present when local governments keep street prices low (Arnott, 2006; Arnott and Rowse, 2009a). As we shall see, the consequences for pricing of this behavior is not important in the Netherlands, because on-street and garage prices are roughly equal, and street parking is the dominant form, so as a simplifying assumption we believe that the marginal cost pricing assumption is reasonable.

Another criticism is that the presence of second-degree (nonlinear) price discrimination is strongly suggested by the well-known observation that parking usually occurs at a price discount for longer parking durations (National Parking Association, 2009).[6] Prices for short durations then exceed marginal costs, whereas prices for long durations equal marginal costs.[7] However, particularly when parking duration restrictions are applied, parking may be free for the first hour(s), the opposite may be true. Hence, to deal with second-degree price discrimination, we will use prices *per day* rather than per hour. There are however also other reasons to use prices per day. In particular, it does not require additional information about the average daily occupancy rate. As we lack this information, it makes more sense to focus on day prices. In the sensitivity analysis, we will show that using prices of the first hour parking generates almost identical results.

So, given the strong competition of suppliers within and, in particular, between shopping districts, the marginal cost pricing assumption seems reasonable.[8] However, differences between price and marginal costs are expected to exist, for example due to unexpected strong or weak demand. When these differences are random, we will still obtain consistent estimates of the inverse supply function. So, the marginal cost pricing assumption generates consistent estimates when parking is not systematically over- or undersupplied.

The welfare loss of a residential parking permit policy depends not only on the number of residential parking permits issued, but also on other local government policies, like the setting of on-street prices and the regulation of commercial parking prices. It is well known that setting the street prices far below garage prices will induce cruising

[2] In this paper, we ignore the effect of residential parking permits on car ownership. As the costs of car ownership decrease, car ownership and car use may increase, which may cause additional parking and traffic congestion problems.

[3] About 25 years ago, reviews by Feeney (1989) revealed 20 revealed parking demand studies. For more recent contributions, see for example, Kelly and Clinch (2006, 2009). Stated-preference studies are also common, see e.g. Axhausen and Polak (1991) and Hensher and King (2001).

[4] This study reports that the long-run supply function of employer-owned parking near office buildings is perfectly elastic (Van Ommeren and Wentink, 2012).

[5] Garage parking implies substantial fixed cost. In addition, marginal building costs for underground parking increase steeply with the number of parking levels. Arguably, there are constant returns to scale in terms of number of garages. So, in districts that contain *only* garage parking, parking supply may be perfectly elastic (see Arnott and Inci, 2006). These districts are rare in our dataset.

[6] The observation that prices vary within the day (e.g., night prices are often zero) is *not* evidence of third-degree price discrimination, because the daily parking supply costs are fixed.

[7] Local governments may set parking charges above marginal costs for shorter durations for a completely different reason: i.e. to charge for car congestion, (see Glazer and Niskanen, 1992).

[8] The empirical finding that shoppers' choice of parking is very price elastic for longer parking durations (Kobus et al., 2013) also suggests that monopolistic competition is not so much an issue when using parking prices for long durations.