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The Political Economy of Pricing Car Access to Downtown Commercial Districts

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The Political Economy of Pricing Car Access to Downtown Commercial Districts

Abstract

We develop a positive theory of pricing car access (by parking fees or cordon tolls) to downtown commercial districts. The model accounts for the special interests of downtown retailers and competing superstores at the edge of the city, and studies how lobbying by both groups shapes the government's policy. We find that downtown retailers typically have steeper lobbying contribution schedules than superstores, which induces the government to underprice central roads and parking spaces. This result is strengthened if some consumers visit both downtown and edge-of-town retailers. The presence of an alternative travel mode (e.g. public transport) does not weaken downtown retailers' incentives to oppose car tariffs. Finally, extending the model to allow for lobbying by residents within the downtown retail district we find that residents may lobby for higher or lower parking fees, depending on their relative concern for the vitality of the central district. As a consequence, depending on parameter values, the outcome of lobbying may produce car fees below or above first-best levels. We argue that our results are in line with empirical observations.

JEL-Code: D720, H230, D430, R410.

Keywords: parking, road pricing, lobbying, retailers, superstores.

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1. Introduction

Basic economic theory suggests that governments should correct the externalities generated by automobile traffic, such as congestion and pollution. Economists therefore routinely advocate a more widespread use of road pricing on major highways and other main long-distance connections, and the use of cordon tolls and parking fees in central cities or within urban areas (see, among many others, Arnott, de Palma and Lindsey (1993), Small and Verhoef (2007)). However, governments often appear highly reluctant to act accordingly. Despite longstanding support by economists, some form of pricing has been implemented by only a handful of cities, including London, Stockholm, Milan and Singapore (Stockholm is by far the best documented case; see, e.g., Eliasson (2009)). Similarly, although parking fees are frequently used, they are often found to be too low relative to the socially optimal level (see Arnott (2011)). Not surprisingly, therefore, the economics literature has made a start investigating the reasons for this divergence between suggested policies by economists and actual policies implemented by political decision makers; early studies include, for example, Borck and Wrede (2005) and Brueckner and Selod (2006).

This paper focuses on an aspect of the discussion on pricing transport in central cities that has so far been largely ignored, viz., the role of organized special interest groups. In most cities, the area where traffic problems are most severe coincides, or at least partially overlaps, with the main commercial district. This is, therefore, the primary target for policies intended to discourage car use. Groups that are positively or negatively affected by such policies may have strong incentives to try to influence the government. For example, retailers may have a stake in the way in which local transport policies are administered. Indeed, though quantitative evidence is hard to obtain, there is plenty of anecdotal evidence suggesting that retailers have significant weight in shaping local traffic policy. This seems to be the case both for parking policies and for the potential introduction of cordon tolls. With respect to the former, Hunt (2007) finds in a stated-preference analysis that retailers in central Calgary consider an increase in parking fees of C\$1.00/h equivalent to a raise in rent of about C\$200 per month. More recently, Arnott (2011) argues that in the US parking policy is commonly the object of lobbying by retailers, whose main concern is losing customers to suburban-based competitors. The same seems to apply in Europe. For example, a report from the Federation of Small Businesses, which represents a large share of British single-unit, family-run businesses, clearly illustrates the issue when discussing parking policy in the British town of Harleston:

“In spring 2008 South Norfolk Council recommended that Harleston’s town centre car parks should introduce charges. The Federation of Small Businesses threw its weight behind a local resident campaign to urge the district authority to rethink the introduction of charges...When the case was made for the crucial relationship between parking policy and a successful town centre, South Norfolk Council decided to rethink the introduction of car park charges” (FSB (2008)).

A fairly analogous story can be told for various forms of urban road pricing: proposals for tolls have met retailers' opposition in several cities.¹ In Manchester, retailers formed the Greater Manchester Momentum Group to lobby against congestion pricing (ultimately abandoned in 2008).² In Milan, retailer associations and owners of private parking firms opposed the expansion of the Ecopass road pricing scheme in 2011. Furthermore, centrally-based shops were among the strongest opponents of road and/or parking pricing in other cities, such as San Francisco (Bent and Singa (2009)), London (Quddus *et al.* (2007)) and Montréal.³

Of course, policies intended to discourage car traffic do not affect all retailers in the same way. If a parking fee or a cordon toll increases the cost of shopping within the city's traditional commercial district, they also make it relatively more convenient to shop elsewhere (e.g. at "big-box" suburban stores).⁴ It is therefore interesting to study such pricing issues when the government can be lobbied by retailers located both within and outside the targeted area. Moreover, it may well be that not only retailers, but also local residents have strong opinions on pricing in commercial districts, and engage in lobbying activities. They may dislike car trips from outsiders, for instance because they compete with them for parking spaces. Indeed, in some cities, central residents have encouraged the government to raise fees on non-resident drivers. In other (usually smaller) cities, residents have shown concerns about the loss of vitality of the area they live in.⁵ If higher parking fees reduce the volume of non-resident shoppers, traditional retailers -- already exposed to competition from superstores -- may decide to abandon the local market. Residents may be in favor or against higher parking fees, depending on how strong this concern for a vital commercial district is.

The purpose of this paper is to propose a positive theory of cordon tolls or parking fees in commercial districts of cities. It accounts for the special interests of different types of retailers and

¹Some cities have pursued a more radical policy of pedestrianization of central retail areas (Still and Simmonds, 2000). This is also often opposed by retailers (Hass-Klau, 1993). While some evidence indicates that retailers' support tends to grow after implementation, it should be noted that this is at least in part due to self-selection, as firms less suited to pedestrianized areas (losers from the policy change) may exit the market and are, therefore, less represented.

² http://www.rochdaleonline.co.uk/Rochdale_News_Business_News_The_Greater_Manchester_Momentum_Group-Rochdale_Online.htm

³See http://milano.corriere.it/milano/notizie/cronaca/11_settembre_7/ecopass-fronda-commercianti-ticket-1901467512794.shtml and <http://ici.radio-canada.ca/regions/Montreal/2010/11/17/008-plateau-stationnement-commercants.shtml>

⁴ Scholars and commentators mention accessibility *by car* as one of the key competitive advantages of the latter firms, as opposed to less car-friendly traditional commercial districts. The importance of car accessibility is emphasized, in particular, in light of consumers' taste for one-stop shopping, which means purchases are likely to be made in volumes (see, e.g., Lagakos (2009)). See also the Portas Review (UK (2011)) for a non-technical discussion.

⁵ See, for example, "Residents lobby for neighborhood parking restrictions" (Chicagotribune.com, Retrieved June 2014). Some indirect evidence on the weight of central residents can be found in van Ommeren *et al.* (2011). They report a large difference between parking fees applied to residents and to outside visitors in central Amsterdam. By contrast, in the example of Harlestone mentioned above, the campaign against parking fees was backed by both retailers and local residents.

residents, focusing on the interplay between government objectives and lobbying activities in shaping the government's pricing policies. The basic ingredients of our baseline model are as follows. We consider a linear city with retail areas at the edges: a shopping street in the commercial center of the city is populated by traditional retailers (e.g. delis, grocery stores or convenience stores), and "big-box" superstores are located at the other edge. For reasons explained below, traditional retailers are price-taking firms with increasing marginal costs; superstores are instead price-setting firms with constant marginal costs. Consumers buy a homogeneous good in one of the two areas. Travel takes place by car and trips to the shopping street generate an external cost. Hence, the government should ideally regulate access to the downtown shopping area with a parking fee or a toll. However, this increases the relative cost of visiting the downtown shopping street, shifting consumer demand towards superstores.⁶ We embed this spatial model in a political economy framework à la Grossman and Helpman (1994) whereby both downtown and suburban retailers form lobbies to influence policymakers.

Our baseline model is used to show that, although only the small central city retailers lose as a consequence of high parking fees -- whereas the big superstores would actually gain --, lobbying by both types of retailers does bias the government against high parking fees (or cordon pricing) in the city's commercial district. Indeed, while we find that traditional shops strongly oppose such policies, we show that big-box retailers will typically have lower incentives to lobby in favor. The intuition relates to a stylized fact of the retail industry. Big-box firms dominate the market despite operating on thin margins.⁷ They are built to exploit economies of scale (and scope) and fiercely compete on prices (Foster et al. (2006)). Traditional retailers generally sell much smaller quantities, but with larger mark-ups. This implies that the value of attracting (or retaining) a customer is, at the margin, smaller for the latter type of retailers than for the former. Thus, one dollar "spent" on lobbying to alter travel costs produces a greater impact on profits of traditional retailers (taken together) than on superstores. The lobby representing traditional retailers is therefore willing to offer the government a "steeper" schedule of payments. Under plausible conditions, this results in lower-than-optimal parking prices in the commercial district.⁸ If the government is sufficiently

⁶ Evidence on the relation between shoppers' (car) travel costs and retailers' profits is to some extent mixed. Focusing on the Netherlands, Mingardo and van Meerkerk (2012) find a weak relation, while van der Waerden et al. (2009) find that parking tariffs significantly decrease consumer visits. Studies based on the US, Asia and Australia generally find a stronger link (see, e.g., Reimers (2013)). A possible reason for this discrepancy is that in Europe cars are generally a less important means of transport, especially in urban areas. As we show below, our results are robust to the presence of alternative travel modes.

⁷ According to data published by Sageworks, over the five years from 2007 to 2012, the average net profit margin for US supermarkets was below 2%, less than half of the corresponding figure for specialty food stores (see Forbes.com, "Supermarkets face tough choices if food costs rise", retrieved June 2014). A report by Statistics Canada puts the net operating margin of food and beverage stores at 7%, compared to 2% for supermarkets (see CCSA (2012)).

⁸ Another explanation could be that big-box retail chains are thriving businesses, thus less needful of government protection. However, this is contradicted by other evidence, e.g. on land-use regulation. There are several reports of

sensitive to lobbying contributions they can easily be zero.

We propose several extensions to the baseline model. First, we allow traditional retailers and superstores to sell differentiated goods. Consumers may shop at one location but are also allowed to visit both types of retailers so as to enjoy the whole variety on the market. We show that introducing the possibility of “multiple-stop shopping” further weakens the incentives of suburban large retailers to lobby for tighter traffic measures in the central shopping area. The result is that traffic is even more likely to be underpriced. Furthermore, we find that when some consumers visit both shopping areas, traditional downtown retailers that sell more differentiated goods are more likely to oppose higher parking fees. Second, we introduce an alternative travel mode (e.g. public transport) to the central shopping area and include modal choice decisions. Although this could weaken the link between profits of traditional retailers and the cost of reaching their premises by car we find that, unless all consumers who shop in the traditional retail district go by public transport, our baseline results do not fundamentally change.⁹ Third, we introduce the behavior of residents within the traditional retail district, and allow for an endogenous number of retailers in the central shopping area. On the one hand, scarce parking capacity may imply that residents dislike shoppers from outside. On the other hand, however, residents may be concerned about the loss of vitality of the area they live in, and they may view a decline in the number of available retailers as contributing to a less vital center.¹⁰ Parking fees may therefore produce a negative externality on residents of the shopping area. We show that, if exit of traditional retailers is not too strong a concern, residents lobby for higher parking fees on visitors. Otherwise, residents may in fact lobby, together with traditional retailers, for parking fee reductions. As a consequence, depending on parameter values, the outcome of lobbying may produce parking fees below or above first-best levels.

Finally, although rather informally, we discuss the implications of possible entry by additional superstores. This is relevant, because the big-box retail segment is characterized by significantly higher rates of (net) entry than the traditional retail segment (see Competition Commission (2008) for the UK and Foster et al. (2006) for the US). Moreover, new entrants in the big-box segment tend to be early adopters of cost-reducing innovations, such as ICT for sales and

lobbying by large retailers (for example supermarkets) to tighten planning rules in order to block entry of similar competitors. See, e.g. Friends of the Earth (2006).

⁹ Some studies actually find that the main source of revenue for shopping street retailers are customers who do not use cars (see, e.g., City of Copenhagen (2013)). This is not in contrast with our findings. As we show below, what matters is that the marginal customer, indifferent between shopping street and superstore, is a car driver.

¹⁰ See, for example, “Residents lobby for neighborhood parking restrictions” (Chicagotribune.com, Retrieved June 2014). Some indirect evidence of the weight of central residents can be found in van Ommeren et al. (2011). They report a large difference between parking fees applied to residents and to outside visitors in central Amsterdam. By contrast, in the example of Harlestone mentioned above, the campaign against parking fees was backed by both retailers and local residents.

inventory support (Basker (2006)). Consequently, incumbents (including both traditional retailers and superstores) have strong incentives to raise barriers to entry of an additional superstore. We argue that protecting the traditional commercial district, by encouraging the government to curb parking tariffs there, might be part of such strategy.

Related literature. This paper is related to several strands of literature. First, it contributes to the growing literature on the political economy of urban transportation. Recent studies have focused on the role of political and individual idiosyncratic uncertainty, land ownership arrangements, distributional issues, etc. (see, e.g. Borck and Wrede (2005, 2008), Brueckner and Selod (2006), De Borger and Proost (2012, 2013), Russo (2013)). Our paper instead focuses on the role of organized special interests. In this sense, it also fits in with the literature, initiated by Grossman and Helpman (1994), on lobbying by special interest groups so as to influence government policies. Much of this literature has studied lobbying by firms and how this affects competition. For example, Aghion and Schankerman (2004) propose a model of spatial competition between asymmetric firms that lobby the government on infrastructure provision. They show that, under some conditions, inefficient firms may block welfare-enhancing investment to protect their market power. More recently, Baldwin and Robert-Nicoud (2007) show that firms that operate in declining sectors, characterized by lower rates of entry, have stronger incentives to lobby for government protection.¹¹ Our paper differs in several respects, however. Policy in our model is not intended to enhance competition, but to correct a traffic externality. Moreover, we consider lobbying by two types of retailers that are affected asymmetrically, depending on their location. Finally, we analyze lobbying by both residents and retailers.

Our model is also related to recent studies of spatial competition between firms in separated market places. For example, Smith and Hay (2005) develop a model of one-stop shopping with two spatially separated marketplaces, assuming individual demand for variety is perfectly inelastic. More closely related in spirit is the recent paper by Uschev, Sloev and Thisse (2015); they explicitly study competition between small urban retailers and large suburban shopping malls, allowing for multi-stop shopping. Whereas they focus on questions related to the desirability of government regulation, we concentrate on what type of regulation to expect, given the lobbying incentives of the different stakeholders involved.

Finally, our analysis contributes to the recent literature on the economics of parking. A few studies focus on socially optimal pricing of parking in the presence of free on-street parking

¹¹ In a similar vein, Ghosh and Meagher (2014) study how market structure may affect majority voting on infrastructure provision.

(Calthrop and Proost (2006), Inci and Lindsey (2014)). Various other papers emphasize the role of cruising for on-street parking space in downtown areas and its impact on congestion (see, e.g., Glazer and Niskanen (1992), Arnott and Rowse (1999, 2009), Anderson and de Palma (2004), and Arnott and Inci (2006)). Some studies have also looked at different organizational structures to deal with downtown parking. For example, Shoup (2005) compares the establishment of pure residential parking areas with a parking policy that taxes outsiders while local residents park for free. More recently, Van Ommeren et al. (2011) emphasize the inefficiencies that can result from such a differentiated parking policy. They estimate a marginal willingness to pay for parking that exceeds the actual fee for a resident permit quite considerably, but it is lower than the parking fee that non-residents pay, implying an inefficient use of parking spaces. Furthermore, a few papers contribute to a better understanding of the relation between parking policies, shopping, and the economic vitality of urban centers. Hasker and Inci (2014) show that parking in suburban malls should be provided for free if consumers are risk averse, and they provide a rationale for minimum parking requirements. Molenda and Sieg (2013) model the trade-off between privileged parking for residents and economic vitality in terms of the product variety offered in a vibrant city district, showing under what conditions assigning on-street parking spaces to residents is a good policy. Hymel (2014) empirically studies the effect of on-street parking fees on retail sales in commercial districts.

The remainder of the paper is organized as follows. We present the baseline model in Section 2. The model is solved in Section 3. Section 4 contains a series of extensions. In Section 5 we discuss the implications of relaxing a few of the assumptions underlying our model. Finally, in Section 6 we summarize our conclusions.

2. The Model

In this section, we present the structure of the basic model. We consecutively discuss the spatial structure, our assumptions regarding traditional local stores and large superstores, consumer preferences and welfare, the objectives of the government, and the potential role of lobbying. Finally, the timing of events underlying our model is explained.

Spatial structure. We consider a linear city of unit length. The population has unit size and is composed of identical individuals uniformly distributed on the unit line. We denote by x the (exogenous) position of a consumer, with $x \sim U[0,1]$. The traditional commercial district (the city's "shopping street") is located in position 0, the city center. It is populated by many identical traditional retailers (e.g. delis, specialized food stores, convenience stores...), which we identify as

retailers of type A. At the edge of the city, in position 1, we have a “superstore” (a big-box establishment, e.g. a hypermarket), denoted B. Finally, there is an additional retail area O located outside the city, at a distance y from its edge. A consumer in position x has to travel $(I-x)$ units of distance to reach B and $(I-x+y)$ to reach O. Several superstores (identical to B) are available there. The spatial structure of the model is depicted in Figure 1.

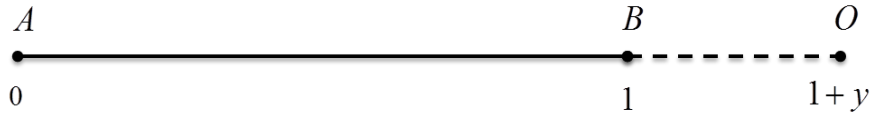


Figure 1: Spatial setup of the model

In the baseline version of the model, we assume all retailers sell the same good. This assumption is relaxed in Section 4 below.

Traditional retailers. Traditional (i.e. type-A) retailers are identical, price-taking firms. The number of traditional retailers is fixed¹², and normalized to one. Each of these firms is endowed with a decreasing returns technology described by the quadratic cost function

$$c_A = \frac{q_A^2}{2}, \quad (1)$$

where q_A is the quantity sold. The quadratic functional form greatly improves tractability, but is not essential for our results. Note that the assumption of decreasing returns may be justified in several ways: first, traditional retailers are primarily small ‘entrepreneurial’ firms: the owner’s labor is typically a crucial input that gets scarcer as the business increases in size. Second, space is a significant constraint in dense traditional retail areas, making expansion increasingly costly. Third, retailers in traditional commercial districts face increasingly high logistic costs (especially in comparison with suburban based big-box retailers). For example, it is harder to make use of large trucks for deliveries.

Denoting the price charged by a traditional retailer by p_A , and using (1), we can write profits of a type-A retailer as

$$\pi_A = p_A q_A - \frac{q_A^2}{2} \quad (2)$$

Superstores. Contrary to traditional retailers, superstores at the edge of (or outside) the city are built to exploit economies of scale and scope and have low, virtually constant marginal costs.

¹² This assumption is also relaxed in an extension discussed in Section 4 below.

Moreover, they face little of the space constraints faced by traditional retailers. We therefore assume that all superstores are endowed with a constant-returns technology with – for simplicity -- zero marginal cost (sunk costs are ignored). The profit of superstore B or O is therefore

$$\pi_j = p_j q_j, j = B, O.$$

Given its location, superstore B primarily serves consumers within the city, while superstores in O primarily serve consumers living elsewhere (which we do not explicitly model).¹³ Unlike traditional retailers, superstores are strategic, price-setting firms. This seems justified both by their dominant position in the market and by their restricted number. Not surprisingly, the price charged by superstore B will play a crucial role in the analysis. For simplicity, however, it is assumed that superstores in O charge an exogenous price normalized at zero, $p_o = 0$.¹⁴

Consumers. We assume all individuals in the city consume one unit of a homogeneous retail good. Of course, shopping implies a transport cost on top of the expenditures on the goods bought. We initially assume that all travel takes place by car (alternative travel modes, e.g. public transport, are considered in Section 4 below). A consumer located at position x obtains the following utility by buying at a store of type A in the shopping street

$$U(x, A) = V - p_A - \beta x - t. \quad (3)$$

In this expression, V is the gross utility of consuming the retail good, β is the cost of travel (per unit of distance) and $t \geq 0$ is a user fee charged by the local government to visitors of the central shopping street. This fee can be interpreted as a parking fee or a (cordon) toll that shoppers traveling to the central shopping street are required to pay. For conciseness, we will henceforth refer to t as a parking fee.

In an analogous way, a consumer located in position x and shopping at superstore B obtains utility

$$U(x, B) = V - p_B - \beta(1 - x). \quad (4)$$

Finally, the consumer may also shop at a superstore in O outside the urban area; this yields utility

$$U(x, O) = V - \beta(1 - x + y). \quad (5)$$

Comparing (4) and (5), conditional on shopping at a superstore, a consumer in location x will

¹³ In principle, a superstore in O might also serve consumers within the city. However, given the extra travel cost y , B could always undercut it, serving all consumers in the city that do not shop in the shopping street (this is indeed what happens in equilibrium, see below). By the same token, no consumer from outside the city would shop at B, since other superstores in O can be accessed without extra travel costs.

¹⁴ Note that the price $p_o = 0$ would in fact be the result of Bertrand price competition between superstores in O. A positive p_o would not change the analysis, as it would be equivalent to an increase in the extra travel cost βy to shop in O.

choose B if and only if the higher price paid at B falls short of the extra transport cost to shop in O outside the urban area (when indifferent, a consumer is assumed to always choose the closest outlet, i.e. B):

$$U(x, B) \geq U(x, O) \Leftrightarrow p_B \leq \beta y.$$

As will become clear shortly, no consumer in our city will choose to shop in O in equilibrium.

To compute demands, it is useful to identify the consumer who is indifferent between shopping in superstores and in the traditional commercial district. We denote her position \bar{x} . As illustrated on Figure 2, all consumers positioned to its left shop in A and all to its right shop in either B or O.



Figure 2: Consumer position and where to shop

Position \bar{x} is defined by $U(\bar{x}, A) = \max(U(\bar{x}, B); U(\bar{x}, O))$. Using (3), (4) and (5), we immediately find

$$\bar{x} = \frac{\min(p_B; \beta y) - p_A + \beta - t}{2\beta}. \quad (6)$$

Denote the demand (from consumers in the city) for shopping at a retailer in A, B or O by q_A , q_B and q_O , respectively. Given our assumptions, we then easily find the demands faced by the different retailers as follows:

$$q_A = \bar{x}, \quad (7)$$

$$\begin{aligned} q_B = 1 - \bar{x} = 1 - q_A \quad \text{and} \quad q_O = 0 \quad \text{if} \quad \min(p_B; \beta y) = p_B, \\ \text{or} \quad q_O = 1 - \bar{x} = 1 - q_A \quad \text{and} \quad q_B = 0 \quad \text{otherwise.} \end{aligned} \quad (8)$$

We assume the traditional shopping street is visited by at least one consumer (i.e. $q_A > 0$). This places a maximum cap on the parking fee t , see below.¹⁵

For future reference, it is useful to write aggregate consumer surplus associated with shopping. Assuming that parking revenues are lump-sum redistributed to consumers, it can be defined as

¹⁵ This assumption is not obvious in a dynamic setting, see Uschev *et al.* (2015). They show that entry of superstores may completely eliminate urban retailing of type A.

$$CS = \int_0^{\bar{x}} U(x; A) dx + \int_{\bar{x}}^1 U(x; B) dx + tq_A$$

Using the definitions of utility in (3), (4) and (5) together with demand specifications (7) and (8), this can be rewritten after straightforward algebra as follows

$$CS = V - \beta \frac{q_A^2}{2} - \beta(1 - q_A) + \beta \frac{(1 - q_A^2)}{2} - (p_A + t)q_A - \min(p_B; \beta y)(1 - q_A) + tq_A \quad (9)$$

Two remarks are in order before proceeding. First, although we interpret x and y as travel costs, it is possible -- as in standard models of product differentiation -- to interpret these parameters as capturing heterogeneous preferences for firms and/or heterogeneous product (or service) quality. In this vein, one could also interpret x as a consumer's intensity of preferences for shopping at traditional retailers versus superstores, and y as the quality advantage of superstore B compared to the other superstores O in the local market. Second, observe that the retail good can also be thought of as a basket of different goods purchased in fixed proportions. One could assume that each traditional retailer sells one such good (still operating as a price taker as there is a large number of traditional retailers per each good), whereas superstores sell instead the entire basket. If consumers are one-stop shoppers (i.e. only shop in one of the retail areas, for example because they are highly time-constrained), the analysis would be essentially unchanged. Nevertheless, for simplicity, our baseline model focuses on a single undifferentiated good. An extension where traditional retailers and superstores do not sell the same goods (and consumers may visit both retail areas) is discussed in Section 4 below.

Welfare. Each car trip to A produces an environmental damage (or external cost) $e > 0$, assumed constant. This may represent noise, pollution or the opportunity cost of space earmarked for parking. Assuming constant e means that we ignore congestion, but we only do so for simplicity. It could easily be added, but it would only complicate the analysis without changing the qualitative results. We discuss this assumption in more detail in Section 5.

We assume that e is ignored by individual consumers. As what matters are external cost differences, and external damage is generally less relevant in city outskirts than in the center, we disregard external costs for car trips to B.

Adding consumer surplus (9), retailer profits and external costs we obtain social welfare:

$$SW = CS + \sum_{i=A,B,O} \pi_i - eq_A.$$

Using (2) and (9) this can be rewritten, after straightforward simplifications, as:

$$SW = V - \beta \frac{q_A^2}{2} - \beta(1 - q_A) + \beta \frac{(1 - q_A^2)}{2} - \frac{q_A^2}{2} - eq_A - (1 - q_A)\beta y I_{p_B > \beta y} \quad (10)$$

In this expression, $I_{p_B > \beta y}$ is an indicator function taking value one if and only if $p_B > \beta y$ (which is necessary and sufficient for consumers who do not shop in the city center A to choose O rather than B).¹⁶

Government and lobbying. A city government controls the parking charge $t \geq 0$. We assume this is the only policy instrument. Our model of the political decision process follows the standard “Protection for Sale” framework originally proposed by Grossman and Helpman (1994). We do not explicitly model elections, but assume that politicians in office are subject to the influence of organized pressure groups. This comes in the form of (possibly implicit) promises to reward decision-makers, at some point in the future, for adopting policies which benefit group members. Examples of such rewards are contributions to electoral campaigns, in the form of monetary or in-kind transfers (e.g. logistic or administrative support). Furthermore, contributions may be indirectly made by helping the incumbent administration finance local public goods or services. In the extreme, contributions may be thought of as outright bribes.¹⁷ Politicians in office value contributions by lobbying organizations either because they can pocket them or because collected contributions increase the probability of being re-elected.

Of course, the probability of remaining in office may also depend on social welfare. Therefore, it is assumed that the objective of the government is to maximize a weighted sum of social welfare (10) and lobbying contributions L_i (to be described in more detail below):

$$W_G = \eta SW + (1 - \eta) \sum_{i=A,B} I_i L_i \quad (11)$$

In expression (11), $\eta \in [0,1]$ represents the (exogenous) degree of government “benevolence”: the larger it is, the more the government cares for social welfare and the less it values contributions by lobbies. Furthermore, I_i is an indicator function that takes value 1 if the government accepts contributions from group i ; it is zero otherwise. The idea is that, having observed L_i from each lobby i , the government decides whether or not to accept them. We assume for the moment that only retailers from A and B form a lobby.¹⁸ Obviously, in order to lobby the government it is necessary to form a lobbying outfit. In practice, doing so requires costly preliminary steps like opening offices,

¹⁶ Contrary to price p_B , the extra travel cost βy is a pure deadweight loss. Indeed, the socially optimal allocation we describe below is such that $q_O = 0$.

¹⁷ Bribes provided by a lobby may not be observable to other lobbies. However, since all lobbies commit to “truthful” contribution schedules (see below), each can correctly anticipate the behavior of the other in equilibrium.

¹⁸ Lobbying by local residents in the city center A is treated in an extension below. Lobbying by superstores in O is ignored as they primarily target consumers living elsewhere: the parking fee in the city center has a negligible impact on their profit. In fact, as will be shown below, in equilibrium it is independent of t .

developing a communication network among members and hiring support staff, lawyers and lobbyists, etc. However, we disregard this and simply assume lobbies exogenously exist.¹⁹

Consider the way in which contributions to the government are made. It is natural to expect a lobby's support to the government to be conditional on the policy implemented. Indeed, contributions L_i are functions of the parking charge t . In other words, they are *contribution schedules* $L_i(t)$ that lobbies commit to. Following Bernheim and Whinston (1986) and Grossman and Helpman (1994), it is also natural to expect $L_i(t)$ to be 'truthful', in the sense that the contribution and the lobby's objective function must vary with t in the same way. In particular, there is no loss of generality in restricting attention to so-called "*globally truthful contribution schedules*", which are equal to the industry/lobby's welfare minus a positive constant. Formally, we have

$$L_i(t) = \max(\pi_i(t) - \phi_i, 0) \quad \forall t \quad (12)$$

where the positive constant $\phi_i > 0$ represents the profit made by retailers i net of payments to the government (for more details see Grossman and Helpman (1994)). Note that ϕ_i does not depend on t .

In a "Protection for Sale" framework (with no lobby formation costs) a standard outcome is that, in equilibrium, the government accepts contributions from all lobbies. The reason is that promising a contribution such that the government accepts is always a (weakly) dominant strategy for all lobbies. To streamline the presentation, we will therefore assume that

$$I_i = 1 \quad i = A, B. \quad (13)$$

We show in Appendix 1 that there is no loss of generality in making this assumption.

Timing. The timing of events is as follows:

1. *Policy formation.* Lobbies $i=A, B$ commit simultaneously to a contribution schedule $L_i(t) \geq 0$ to the government, which then decides on the parking fee (or cordon toll) t .
2. *Utility and profit maximization.* Given t , firms and consumers make profit and utility maximizing decisions in the following order: (i) Superstore B decides on p_B , (ii) traditional retailers decide on q_A and (iii) consumers choose where to shop.

We focus on (pure strategy) Subgame-Perfect Nash Equilibria.

¹⁹ A possible justification is that retailer associations are already active in areas other than traffic policy that we do not explicitly take into account.

3. Solving the baseline version of the model

We solve the model by backward induction: we first analyze the decisions of firms and consumers conditional on the parking fee, next we study lobbying and the government's decision on how to set the fee.

3.1 Behavior of consumers and firms

Given the parking fee t , consumers maximize utility, generating demands as described in (7) and (8). Traditional retailers in A are price taking firms so that, in equilibrium, each sells a quantity q_A such that marginal cost is equal to price; hence, using (1), we have

$$p_A = q_A. \quad (14)$$

Replacing (14) in (7) and (8) and using (6), we can rewrite demands as follows:

$$q_A = \frac{\min(p_B; \beta y) + \beta - t}{2\beta + 1}, \quad (15)$$

$$q_B = \frac{\beta + 1 + t - p_B}{2\beta + 1} \quad q_O = 0 \quad \text{if } \min(p_B; \beta y) = p_B, \quad (16)$$

$$q_B = 0 \quad q_O = \frac{\beta + 1 + t - \beta t}{2\beta + 1} \quad \text{otherwise.}$$

Given the (residual) demand function in (16), how will the superstore B set its price? If the extra travel cost βy to the superstores at O is large, so that $(\min(p_B; \beta y) = p_B)$, then no city consumers will shop there and B would enjoy quite some market power. It would maximize its profits on all consumers not buying at traditional stores in A; this profit is given by $p_B \frac{\beta + 1 + t - p_B}{2\beta + 1}$. Unconstrained profit maximization yields $p_B = \frac{\beta + t + 1}{2}$ (it is easily checked that the second-order condition is satisfied). But, of course, p_B is bounded from above by the extra cost βy a consumer would have to sustain to buy the good at a superstore in O instead. If B charged $p_B > \beta y$, it would lose all customers to competing superstores in O. Therefore, we can view βy as capturing the strength of the competitive pressure superstore B is subject to. The smaller it is, the more intense such pressure and the lower the price that can be charged by B.

The above discussion establishes the price charged by B as

$$p_B = \min\left(\beta y; \frac{\beta + t + 1}{2}\right), \quad (17)$$

We will assume henceforth that $\beta y \leq \frac{\beta+t+1}{2}$. This is without loss of generality since, if the inequality were reversed, we would always have $p_B = \frac{\beta+t+1}{2}$ in equilibrium. We can thus write equilibrium demands, prices and profits (all conditional on t) as²⁰

$$p_A = \frac{\beta-t+\beta y}{2\beta+1} \quad p_B = \beta y, \quad (18)$$

$$q_A = \frac{\beta-t+\beta y}{2\beta+1} \quad q_B = \frac{\beta+t+1-\beta y}{2\beta+1} \quad q_O = 0, \quad (19)$$

$$\pi_A = \frac{1}{2} \left(\frac{\beta-t+\beta y}{2\beta+1} \right)^2 \quad \pi_B = \beta y \left(\frac{\beta+1+t-\beta y}{2\beta+1} \right). \quad (20)$$

Straightforward comparative statics suggest that a higher parking fee in the central shopping street penalizes traditional retailers, to the advantage of superstore B; it raises the cost of reaching the shopping street, shifting demand to B in the suburban retail area. We can therefore expect traditional retailers A to lobby against the parking fee. On the contrary, superstore B is expected to lobby for higher fees. The analysis that follows will confirm this intuition. However, what is crucial for the final outcome is the extent to which each lobby is willing to promise the government additional contributions for a marginal change in the parking fee (i.e. the ‘‘steepness’’ of the contribution schedule).

Before proceeding, it should be noted that we implicitly assumed that $q_A > 0$ for any t . Given (19), this implicitly imposes a maximum cap on the parking fee, viz.

$$0 \leq t < \beta + \beta y \equiv \bar{t}.$$

We will retain this assumption throughout the analysis. A higher fee would eliminate demand at A.

3.2 Lobbying and parking policy formation

Here we study the first stage of the game, where government and lobbies interact. However, before doing so it seems instructive to first describe the social optimum.

No-lobbying benchmark. To begin, suppose the government disregards lobbies’ contributions, i.e. $\eta = 1$ and $W_G = SW$ in (11). Thus, it simply maximizes SW with respect to t . To find the optimal allocation, we maximize (10) with respect to q_A and use (8). This yields

²⁰ The fact that $q_O = 0$ in equilibrium does not mean that superstores in O have zero demand. Recall that they primarily serve consumers outside the city, which we do not explicitly model.

$$q_A^* = \frac{\beta - e}{2\beta + 1} \quad q_B^* = \frac{\beta + e + 1}{2\beta + 1} \quad q_o^* = 0. \quad (21)$$

Comparing (21) and the equilibrium allocation in (19), we immediately find that a parking fee

$$t^* = e + \beta y \quad (22)$$

implements the optimum. The socially optimal fee t^* is equal to the external cost of car trips e plus the margin βy that superstore B charges. To see the intuition, note that there are two market failures: the external cost of car trips to the traditional shopping street, and the market power of superstore B. In general, solving two market failures would require two instruments; for instance, a parking fee could be combined with a linear subsidy (either directly to store B or to consumers that shop there). However, in the setting of our model, there is no loss of generality in restricting the set of government instruments to t . Our assumption that all consumers buy one unit of the retail good implies that the first best allocation can be implemented with any linear combination of t and a linear subsidy, including one that equals zero.

Policy in the presence of lobbying. Suppose now that the government cares for the support of lobbies, i.e. $\eta < 1$. From (20), we know that π_A and π_B are decreasing and increasing in t , respectively. It follows that superstore B will promise the government a contribution schedule $L_B(t)$ that increases in t ; the opposite holds for the schedule $L_A(t)$ proposed by the lobby representing traditional retailers.

Let t^e be the parking fee implemented in equilibrium. Since, by assumption, the government accepts all contributions, t^e maximizes

$$W_G = \eta SW + (1 - \eta) \sum_{i=A,B} (\pi_i - \phi_i). \quad (23)$$

The first-order condition (recall that ϕ_i , $i=A,B$ are constant) is

$$\frac{\partial W_G}{\partial t} = \eta \frac{\partial SW}{\partial t} + (1 - \eta) \left(\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t} \right) \leq 0, \quad (24)$$

where equality holds for any positive t^e .

To facilitate the interpretation we work out the first term on the right-hand side of (24). Note from (10) that (observe that $p_B = \beta y$ holds in equilibrium, so $I_{p_B > \beta y} = 0$ in expression (10)):

$$\frac{\partial SW}{\partial t} = [\beta - (2\beta + 1)q_A - e] \frac{\partial q_A}{\partial t}$$

Then use the demand function for q_A as given in (19) and the first-best parking fee defined by (22).

Denoting the equilibrium parking fee that results from maximizing (23) as t^e , we then obtain

$$\frac{\partial SW}{\partial t} = (t^e - t^*) \frac{\partial q_A}{\partial t}$$

Finally, substitute this result in (24) to find:

$$\frac{\partial W_G}{\partial t} = \eta (t^e - t^*) \frac{\partial q_A}{\partial t} + (1 - \eta) \left(\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t} \right) \leq 0. \quad (25)$$

Expression (25) has a very intuitive interpretation. It suggests that the relation between the equilibrium parking fee t^e and the optimal fee t^* depends on (i) the extent to which the government cares for social welfare η , and (ii) the sign of $\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t}$, i.e., on how total profits made by lobbies (and, hence, their contributions to the government) vary with t . Intuitively, the more politicians value the support of lobbies (i.e. the smaller is η), the more they are willing to deviate from the welfare-maximizing policy. The sign of $\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t}$ then determines the direction in which the deviation takes place. Of course, when interpreting (25) we should take into account that the sign of $\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t}$ itself depends on the value of t at which it is evaluated, see below.

The crucial role of $\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t}$ can be understood in two different ways. First, making use of (18), (19) and (20), we easily show

$$\frac{\partial \pi_A}{\partial t} = -\frac{p_A}{2\beta + 1} \quad \text{and} \quad \frac{\partial \pi_B}{\partial t} = \frac{p_B}{2\beta + 1}. \quad (26)$$

Hence, the sign of $\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t}$ depends on the difference between the equilibrium price set by traditional retailers p_A and by the superstore p_B . It will be negative if retailers at A sell at higher prices than the superstore at B. Second, for a better understanding of the results that follow, it is useful to take the interpretation one further step. Define the per unit profit margin by retailers of type i in equilibrium, i.e., the difference between price and average variable cost AVC_i . Specifically, define

$$M_i \equiv p_i - AVC_i \quad i = A, B.$$

Since $AVC_A = \frac{q_A}{2}$ (from (1)) and $p_A = q_A = \frac{\beta + \beta y - t}{(2\beta + 1)}$ (from (18) and (19)), we have

$$M_A = \frac{\beta - t + \beta y}{2(2\beta + 1)}. \quad (27)$$

Similarly, since $AVC_B = 0$ and $p_B = \beta y$, it follows that

$$M_B = p_B = \beta y. \quad (28)$$

Using (27) and (28) in (26) we can therefore write

$$\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t} > 0 \Leftrightarrow M_B > 2M_A. \quad (29)$$

Interpretation is as follows. When the per-unit profit margin of retailers A in the central shopping street is sufficiently large relative to that of superstore B (specifically, $M_B > 2M_A$), then raising the parking fee will reduce profits of traditional retailers less than that it increases profits at the superstore. In that case B's incentive to lobby for a marginal increase in t is weaker than the incentive of traditional retailers to lobby against it. An analogous but opposite argument can be developed in the case the profit margin at A is much smaller.

Of course, as we anticipated earlier, the sign of $\frac{\partial \pi_A}{\partial t} + \frac{\partial \pi_B}{\partial t}$ depends on t since the profit margin of traditional retailers M_A decreases with the parking fee. Hence, intuitive as this may be, (29) is not enough to establish whether t^e is above, equal to, or below t^* . However, what can be shown is that this is determined by the relative per unit margins of stores in A and B when evaluated at the socially optimal fee. More precisely, in Appendix 2 we show the following Proposition.

PROPOSITION 1: Lobbying and equilibrium parking fees

- a. **The equilibrium parking fee is below the socially optimal level if and only if the per-unit profit margin of superstore B is sufficiently smaller than that of traditional retailers. More precisely,**

$$t^e < t^* \Leftrightarrow M_B < 2M_A(t^*) \Leftrightarrow \beta y < \frac{\beta - e}{2\beta + 1}$$

where $M_A(t^*)$ is the per unit profit margin of retailers A evaluated at the socially optimal parking fee.

- b. **If the condition $\beta y < \frac{\beta - e}{2\beta + 1}$ holds, the equilibrium parking fee is lower the more the government is sensitive to lobbying contributions. If the government is sufficiently sensitive to lobbying contributions (more specifically, when $\eta \leq \frac{1}{2(1+\beta)}$ holds) the parking fee is zero.**
- c. **The equilibrium parking fee may be larger than the socially optimal level if the per-unit profit margin of superstore B is sufficiently high compared to that of traditional retailers.**

The intuition is as follows. Lobbying on the parking fee is a way of altering the relative transport cost between the central and suburban retail areas and, hence, a way of changing relative demands. Moreover, the lower the margin a retailer applies to the goods it sells, the lower a retailer's gains from attracting (or retaining) one more customer. Therefore, if the superstore's margin is low enough, traditional retailers will lobby with greater intensity, and they favor low parking charges. Consequently, the government deviates from the welfare maximizing policy by setting the parking fee below t^* . The extent of this deviation will be smaller when the external cost is high, and when the travel cost to the outside shopping area O is large. Moreover, it depends on how much lobbying contributions matter in the government's objective function. Indeed, we find that when $\frac{\beta - e}{2\beta + 1} > \beta y$ and the government is sufficiently sensitive to lobbying contributions (i.e.

$\eta \leq \frac{1}{2(1 + \beta)}$), the parking fee implemented is actually zero.²¹

A stylized fact of the retail industry is that a few large retail establishments (the superstores of our model) dominate local markets despite operating on thin margins. Traditional downtown retailers generally operate on larger per-unit mark-ups, selling much smaller quantities than their big-box counterparts. Our findings suggest that this has implications for parking fees (or cordon tolls) in commercial districts. If the superstore's margin is small compared to that of traditional retailers (as seems to be the case in reality), a dollar paid to the government to "buy" a marginal change in the parking fee produces a bigger change in profits for the latter than for the former. Thus, traditional retailers (as a whole) are willing to offer the government a "steeper" schedule of payments, resulting in a parking fee that is below the socially optimal level. In fact, if the government is sufficiently sensitive to lobbying contributions, there might be no fee implemented at all. By contrast, when superstore B is able to charge a large enough margin, its incentive to lobby for a high parking fee is strong. As a result, the fee can then be equal to or higher than the optimal level.

²¹ Recall that t^* accounts not only for the external cost e of car trips, but also for the market power of superstore B. Hence, the fact the parking fee is below the first-best level does not necessarily imply that it is also below e . It is easy to show, in accordance with Proposition 1.b, that it will be when the government's sensitivity to lobbying contributions is high enough.

4. Extending the baseline model

In this section we discuss several extensions of our baseline model to see how robust the finding of Proposition 1 is with respect to the underlying assumptions. We consecutively allow for differentiated products, multiple transport modes to access the city, and lobbying by residents; finally, we discuss the role of entry treats of additional superstores in the urban area.

4.1 Differentiated goods in the two marketplaces

The baseline model assumes that traditional retailers in the shopping street and suburban superstores sell the same product. In practice, however, different (though possibly overlapping) sets of goods may be sold in the retail areas A and B. For instance, consumers may do their basic grocery shopping at a superstore and then buy special delicacies in a traditional shop. Or they may do their shopping in the suburban retail area and visit the central city shopping district to eat out or go to a movie. We extend the model to include such possibilities.

Setup. We retain the setup of the baseline model of Section 2, except that we assume that traditional retailers in the shopping street and superstores sell differentiated goods.²² More precisely, we consider three retail goods: T, S and C. Goods T and S can only be acquired from traditional retailers and from superstores, respectively; good C is instead available at both types of outlets.

To simplify the analysis, we impose some extra structure on the problem. First, we assume that each traditional retailer at A sells only one type of good: either it sells C or it sells T, but not both. We denote the first type of retailers by subscript ‘ A,C ’ and the second by subscript ‘ A,T ’. There is a mass of size one of each type of traditional retailers and, as before, they are perfectly competitive. The profit function of a traditional retailer is

$$\pi_{A,k} = p_{A,k} q_{A,k} - \frac{q_{A,k}^2}{2}, \quad k = T, C \quad (30)$$

where $p_{A,T}$ ($p_{A,C}$) is the price of good T (respectively C) at traditional retailers in A, and $q_{A,T}$ ($q_{A,C}$) are the corresponding quantities.

Second, superstores are multi-product firms: each sells both C and S. We retain the assumption of constant marginal costs for superstores (set to zero for simplicity). We denote by $p_{B,S}$ ($p_{B,C}$) the price of good S (respectively C) at superstore B. As in the baseline model, we assume $p_{O,S} = p_{O,C} = 0$ at out of town superstores.

²² Most of the literature on spatial competition with multi-product firms considers either homogeneous or fully differentiated goods (see, e.g., Uschev et al. (2015), Smith et al. (2006)). A recent exception is Brandao et al. (2014). See Choi (2010) for a model of spatial competition by single-product firms with multi-homing consumers.

Third, consumers may decide to shop only in the shopping street, only at suburban superstores (these two cases amount to one-stop shopping), or they may shop at both locations on one shopping trip (multiple-stop shopping). The advantage of this latter option is that shopping in both places allows to consume the entire variety of goods available on the market. The drawback is of course the additional travel cost that has to be incurred.

Fourth, to keep things simple we assume that all consumers buy the “common” good C (either in one marketplace or the other) but that, if they visit a particular market place (retail area A or the superstore B) they always buy the good which is specific to that area. For example, if a consumer visits only the central shopping area A, she buys good C and good T (which is specific to retailers at A). If she visits only area B, she buys good C and good S (only available in area B). If the consumer visits both marketplaces, we assume she will buy both T and S; she will also buy good C, though only where it is cheaper. We will return to this last point below.

Market equilibrium. Suppose a consumer located in position x visits only the downtown shopping street. This produces the following utility

$$U(x, A) = V_T + V_C - p_{A,T} - p_{A,C} - \beta x - t,$$

where V_T and V_C are the gross utilities of consuming good T and C, respectively. Similarly, a consumer shopping exclusively at superstore B gets utility

$$U(x, B) = V_S + V_C - p_{B,S} - p_{B,C} - \beta(1-x).$$

As in the baseline model, a consumer will prefer B over O if and only if $p_{B,S} + p_{B,C} \leq \beta y$ holds. To avoid repetition, we anticipate that this condition is satisfied (we show below that this is true in equilibrium). Hence, as in the baseline model, all consumers of the city that shop at a superstore choose B rather than O.

Finally, the utility obtained by a consumer located at x and shopping in both retail areas A and B depends on where she buys good C. If she buys it at superstore B, her utility is

$$V_T + V_S + V_C - p_{A,T} - p_{B,S} - p_{B,C} - \beta - t$$

If, instead, she buys good C at a traditional retailer, she has utility

$$V_T + V_S + V_C - p_{A,T} - p_{B,S} - p_{A,C} - \beta - t.$$

Direct comparison shows that, conditionally on visiting both retail areas, the consumer will buy good C at the superstore B if and only if

$$p_{B,C} \leq p_{A,C}.$$

Although the qualitative results of this section do not depend on this condition, we focus, for brevity, on the case where good C is indeed cheaper at superstores than at traditional retailers. This

is probably the most likely scenario in reality. We will nonetheless discuss the results in the opposite case at the end of this section.

As in the baseline model, we implicitly assume that the gross utility V_C is always large enough that all consumers buy one unit of this good, irrespectively of prices and travel costs. We also assume that $V_S \geq p_{B,S}$ and $V_T \geq p_{A,T}$, which are sufficient to ensure that, conditionally on visiting a marketplace, consumers buy the good that is only available there.

Using the above utility definitions, we can identify the individual \bar{x} who is indifferent between visiting only the traditional shopping street and both retail areas:

$$\bar{x} = \frac{\beta + p_{B,C} - p_{A,C} - (V_S - p_{B,S})}{\beta}. \quad (31)$$

Analogously, the individual in $\bar{\bar{x}}$, indifferent between visiting only B and visiting both areas, is found as

$$\bar{\bar{x}} = \frac{V_T - p_{A,T} - t}{\beta}. \quad (32)$$

We illustrate the spatial setting with multiple-stop shopping in Figure 3 below. The intuition underlying the figure is simple: conditional on shopping in one area, the extra cost of visiting an additional one is larger the closer the consumer's position to the edges A and B. As a result, consumers located close to the edges are less likely to engage in multiple-stop shopping than those located towards the middle.

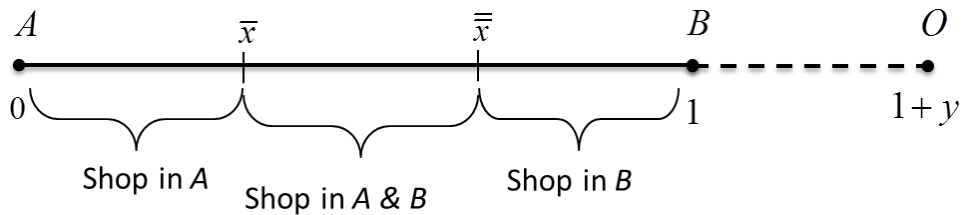


Figure 3: equilibrium with differentiated goods and multiple-stop shopping

Turning to the analysis of the respective demands, we begin with the traditional retail stores in A that sell good T. Their demand is given by all consumers who visit the shopping street (irrespectively of whether they also visit the superstore). As for traditional retailers in A that sell good C, they only serve consumers that exclusively visit the shopping street, since all those who visit B buy good C there. Finally, superstore B sells goods C and S to all consumers that visit the suburban area (recall that we are assuming $p_{B,C} \leq p_{A,C}$). Given these insights, it is easily shown in

Appendix 3 that the various demands can be written as

$$\begin{aligned}
q_T = \bar{x} &= \frac{V_T - t}{\beta + 1} \\
q_{A,C} = \bar{x} &= \frac{\beta + \beta y - V_S}{\beta + 1} \\
q_{B,C} = q_{B,S} &= 1 - \bar{x} = \frac{1 + V_S - \beta y}{\beta + 1}
\end{aligned} \tag{33}$$

Equilibrium prices and profits are given by (see Appendix 3):

$$p_{A,C} = \frac{\beta + \beta y - V_S}{\beta + 1} \quad p_{A,T} = \frac{V_T - t}{\beta + 1} \quad p_{B,S} + p_{B,C} = \beta y, \tag{34}$$

$$\pi_{A,C} = \frac{1}{2} \left(\frac{\beta + \beta y - V_S}{\beta + 1} \right)^2 \quad \pi_{A,T} = \frac{1}{2} \left(\frac{V_T - t}{\beta + 1} \right)^2 \quad \pi_B = \beta y \frac{1 + V_S - \beta y}{\beta + 1}. \tag{35}$$

At this point it is important to note from (33) and (35) that (i) demand and profits of the superstore in B are independent of the parking fee t , and (ii) the same goes for traditional retailers selling good C. Indeed, the marginal consumer \bar{x} is indifferent between shopping only at the traditional shopping street and shopping at both retail areas. Hence, the parking fee t does not affect her decision. In contrast, aggregate profits of traditional retailers selling good T are decreasing in t , as in the baseline model. This is because a marginal increase in t does not leave the marginal consumer \bar{x} indifferent, but reduces the relative utility of shopping in the central commercial district.

These observations have two important implications. First, in Appendix 3 it is shown that they yield a socially optimal parking fee equal to marginal external cost

$$t^* = e.$$

To understand this note that, as in the baseline model, superstore B charges a price above marginal cost, so that there are two market failures: traffic externalities in the shopping street and the market power of superstore B. To implement the social optimum, the government needs two instruments; it should combine a parking fee equal to marginal external cost with an additional instrument specifically targeted to market power, such as a subsidy to consumers shopping in B. As such instrument is not available in our model, a welfare-maximizing government can do no better than setting $t = e$. There is no reason to deviate from this fee because, unlike in the baseline model, demand for B is independent of t , so that the parking fee has no effect on the second market failure (market power). But note that the absence of a second instrument implies that $t^* = e$ is only a

necessary, not a sufficient condition to implement the socially optimal allocation.²³

Second, turn to the implications for the lobbying outcomes and the equilibrium parking fee. From (35), we immediately conclude that, since their profit is strictly decreasing in t , traditional retailers selling good T will lobby for reducing the parking fee. But, by contrast, no lobbying contributions will come from retailers B and O, since their profit is independent of t . It is therefore easy to see that, unless the government is completely insensitive to lobbying (i.e. $\eta = 1$), it will implement a parking fee which is below the social optimum. We summarize as follows.

PROPOSITION 2: Assume traditional retailers in the shopping street and superstores do not sell the same goods and that some consumers engage in multiple-stop shopping. The equilibrium parking fee is such that $t < t^* = e$.

The intuition is that when (some) consumers visit both types of retailers, the cost of traveling to the shopping street does not directly affect the demand for superstore B. The marginal consumer (indifferent between visiting B or not) visits the shopping street anyway. Hence, the parking fee has no impact on her decision whether also to shop at B. Consequently, while traditional retailers have a strong interest in making sure the government sets the parking fee as low as possible, the superstore has nothing to gain from preventing such outcome.

It is also worth noting that the presence of multiple-stop shoppers implies that not all traditional retailers will be equally sensitive to changes in parking fees. Indeed, (35) suggests that, while those that sell the “specific” good T are penalized by a higher t , those that sell good C, which consumers can also buy at superstores, are unaffected. Therefore, when some consumers visit both shopping areas, traditional retailers that sell more differentiated goods are more likely to oppose higher parking fees. This is to some extent counterintuitive, as one would expect retailers that are more exposed to competition from superstores to be more active in seeking protection from the government.

Finally, remember that we made our argument assuming that $p_{B,C} \leq p_{A,C}$. Suppose the opposite holds. In that case, consumers that visit both the shopping street and the superstore buy good C from traditional retailers at A. Nonetheless, demand for superstore B would still be independent of the parking fee t , for the same reasons as before. It follows that the result of Proposition 2 would not change. However, in one respect the implications do differ: it can be shown

²³ In other words, setting $t = e$ implements a constrained optimum, where the government cannot use any other instrument than t . Note however that, even if the government could provide a subsidy to B, it would still be optimal to have $t = e$. The reason is that demand for B does not depend on t , while the number of individuals visiting the traditional commercial district does not depend on the price set by B.

that traditional retailers selling good C would be negatively affected by the parking fee and would therefore oppose it, contrary to what they would do in the case $p_{B,C} \leq p_{A,C}$.

4.2 Public Transport Access to the Central Shopping Street

We have so far assumed that the shopping street is accessible only by car. Of course, alternative means of transport may be available, such as public transportation, biking or walking. If consumers respond to an increase in the cost of using cars by switching to another mode, one might intuitively expect that centrally-based retailers A will suffer less from high parking charges and, thus, have less incentives to lobby. However, as we will show below, firms only care for the effects of the parking fee to the extent that it affects incentives for the marginal consumer, i.e., the person indifferent between shopping at superstore B or in a traditional shop A. The validity of the reasoning above therefore depends on whether or not she is a car user.

Setup. We retain the same setup as in the baseline model, except that we allow consumers that shop in the downtown shopping street to choose between two transportation modes: cars and public transport (or biking or walking). Utility of shopping in B is as in the baseline model; we assume that shopping in the suburban retail area requires a car. Hence, (4) and (5) still apply.

Consider a person located at x and shopping in A. For car users, utility is specified in the same way as in the previous section. Denoting this utility as $U(x, A, C)$ we have:

$$U(x, A, C) = V - p_A - \beta x - t$$

For a consumer shopping in A but using public transport, we specify utility as

$$U(x, A, P) = V - p_A - (\beta + z)x$$

Using public transport avoids the parking fee, but it raises the “variable” (i.e. distance-based) travel cost; this is captured by $z > 0$. The rationale is that car travel entails smaller time costs (accounting for both in- and out-of-vehicle costs). Moreover, using cars for shop-related travel may be more convenient (e.g., in the case of bulky goods), and the relative cost of using public transport is likely to increase with distance. Of course, one could interpret $(\beta + z)$ as the fare plus time cost. We assume public transport generates zero external cost.

It is easy to see that there exists a threshold x^P such that, conditionally on shopping in A, a consumer for which $x \leq x^P$ uses public transport, whereas people for which $x > x^P$ go by car. Comparing utilities, the threshold x^P is given by

$$x^P = \frac{t}{z}.$$

The higher the parking fee charged to car users or the lower the extra cost of public transport z , the

greater the distance from A of the consumer indifferent between the two modes (again, conditionally on shopping in A).

Given our assumptions, among A's consumer base in equilibrium, there will always be at least one consumer using public transportation (i.e. the consumer(s) in position 0), while there may or may not be car users. This depends on the comparison between x^P and \bar{x} . The latter is defined analogous to the previous section. It is the consumer going by car that is indifferent between shopping in A and in B:

$$U(\bar{x}, A, C) = U(\bar{x}, B) \Rightarrow \bar{x} = \frac{\beta y - p_A + \beta - t}{2\beta}. \quad (36)$$

Note that we are implicitly anticipating that $p_B = \beta y$, which is true in equilibrium (as in the baseline model, see (17) above); hence, $q_0 = 0$. Comparing (36) with (6) it is clear that the marginal consumer is exactly the same as in the baseline model (as long as she uses the car).

Given this information, we can describe the spatial pattern of where people shop and what mode they use. Two situations have to be distinguished.

- (i) First, if $x^P \leq \bar{x}$, all consumers located at x such that $x \leq x^P$ will shop in A and use public transport, and all consumers for which $x^P < x \leq \bar{x}$ go shopping in A by car; all other consumers will shop in superstore B (by car). This is graphically illustrated on the upper panel of Figure 4.
- (ii) Second, if $x^P > \bar{x}$, there will be no shoppers in A traveling by car. Either people go to the central shopping street by public transport or they take their car to the superstore B. In this case, the position of the marginal consumer (denoted \bar{x}^P), indifferent between shopping in A and B, will be such that

$$U(\bar{x}^P, A, P) = U(\bar{x}^P, B) \Rightarrow \bar{x}^P = \frac{\beta - p_A + \beta y}{2\beta + z}. \quad (37)$$

All consumers such that $x \leq \bar{x}^P$ will therefore shop in A using public transport, while the others shop in B using cars. An illustration of this case is given in the lower panel of Figure 4.

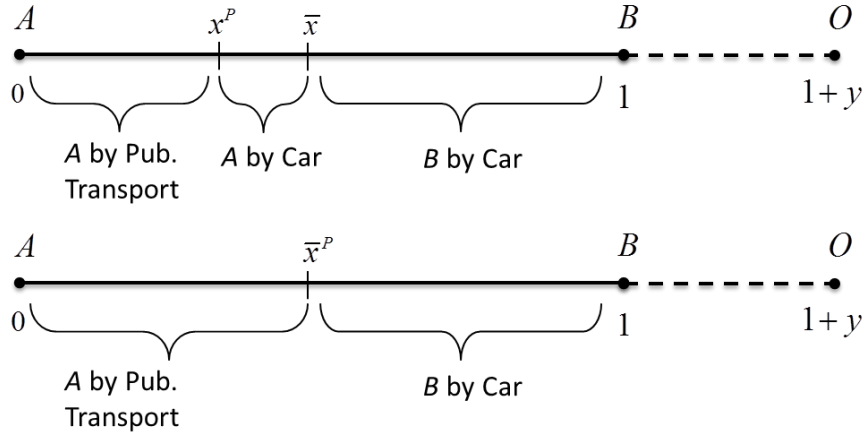


Figure 4: equilibria with public transportation. In the upper panel $x^P \leq \bar{x}$; in the lower panel $x^P > \bar{x}$.

Market equilibrium. To describe the market equilibrium, conditional on a parking fee t , it is necessary to distinguish the two cases depicted on Figure 4.

First, take the case illustrated on the upper panel: the marginal consumer goes shopping in A by car (hence, $x^P < \bar{x}$). Remember that the marginal consumer \bar{x} is exactly the same as in the baseline model. We can therefore follow the same steps described in Section 3 (starting from expressions (7)) to arrive at the same equilibrium quantities, prices and profits, as given by (18) - (20). Note however that, taking into account equilibrium prices (18), the condition $x^P \leq \bar{x}$ imposes an upper bound (which we denote t^P) on the parking fee. Specifically, $x^P < \bar{x}$ holds if and only if

$$\frac{\beta y + \beta - t}{2\beta + 1} > \frac{t}{z} \Leftrightarrow t < t^P \equiv \frac{(\beta y + \beta)z}{2\beta + 1 + z}. \quad (38)$$

Quite intuitively, only when the parking fee is below some upper bound will consumers visit the shopping street by car. When t exceeds this upper bound, which we denote t^P , all central-city shoppers use public transport. It is easily verified that the upper bound increases with the cost of using public transport z .

Second, suppose we have $x^P \geq \bar{x}$ or, equivalently, a fee $t \geq t^P$ (lower panel of Figure 4). All shoppers in the shopping street go there by public transport, so the marginal consumer is given by \bar{x}^P , as defined in (37). Using $q_A = 1 - q_B = \bar{x}^P$ and expression (37), and following the same steps as in Section 3, we find the following equilibrium prices, quantities and profits:

$$q_A = \frac{\beta + \beta y}{2\beta + z + 1} \quad q_B = \frac{1 + \beta + z - \beta y}{2\beta + z + 1} \quad q_O = 0 \quad (39)$$

$$p_A = \frac{\beta + \beta y}{2\beta + z + 1} \quad p_B = \beta y \quad (40)$$

$$\pi_A = \frac{1}{2} \left(\frac{\beta + \beta y}{2\beta + z + 1} \right)^2 \quad \pi_B = \beta y \frac{1 + \beta + z - \beta y}{2\beta + z + 1} \quad (41)$$

It follows that quantities and prices are independent of t as long as $t \geq t^P$. The intuition is straightforward: consumers completely avoid the fee when it is very large, either by using public transport or by shopping in the suburban area. Of course, the relative cost of using public transport for visiting retailers A, captured by z , does matter: it reduces demand at A and raises demand at superstore B.

Equilibrium policy and lobbying. The above insights allow us to describe the different equilibria that may result from the interaction between the government and lobbying retailers. However, before doing so, let us consider the socially optimal parking fee in the setting of this subsection. It is easy to understand that the socially optimal fee is given by

$$t^* = \min(e + \beta y, t^P)$$

To see this, we distinguish two cases, which we illustrate in Figure 5. If $e + \beta y < t^P$ (left panel of Figure 5), the socially optimal fee equals $(e + \beta y)$. This follows from the fact that $t = e + \beta y$ solves the unconstrained welfare maximization problem (10), see expression (22). Indeed, when $t < t^P$, prices and quantities (and, hence, welfare) are as in the baseline model. However, if $e + \beta y \geq t^P$, $t = t^P$ maximizes social welfare (see the right panel of Figure 5). This is because welfare increases with t as long as $t < t^P$, given that $t^P \leq e + \beta y$, but remains flat when $t \geq t^P$. Of course, all fees such that $t \geq t^P$ yield the same level of welfare. Hence, all are weakly optimal in case $e + \beta y \geq t^P$. For simplicity, we assume that when indifferent between several fees, the government always chooses the lowest one. A similar argument shows that when we account for lobbying an equilibrium fee t^e such that $t^e > t^P$ can be ruled out. Indeed, retailers' profits (and, hence, contributions) do not vary with t as long as it is above t^P . It follows that fees such that $t^e > t^P$ must be (weakly) dominated from the government's perspective.

Observe that the condition $e + \beta y < t^P$ implies a sufficiently high cost of public transport: using the definition of t^P it requires:

$$z > (e + \beta y) \frac{2\beta + 1}{\beta - e}. \quad (42)$$

This makes sense: a high cost of public transport means that, in the socially optimal allocation, at least some shoppers at A travel by car.

Turn now to the possible equilibria. First, suppose $e + \beta y < t^P$. The cost of using public

transport is high enough so that, despite the externality produced by cars, it is socially optimal to have some shoppers drive to A. The welfare-maximizing fee is $t^* = e + \beta y$. The results are then essentially the same as in Proposition 1 (except, of course, that the parking fee is bounded by t^P). The parking fee t^e can be above or below the socially optimal level, depending on unit margins of retailers A and B and the government's sensitivity to lobbying contributions. Second, suppose that (42) does not hold, i.e., $e + \beta y \geq t^P$. The cost of using public transport is so low that it is socially optimal that all shoppers in A use public transport. The socially optimal parking fee then equals t^P . Given that $t^e \leq t^P$, we necessarily have $t^e \leq t^P = t^*$.

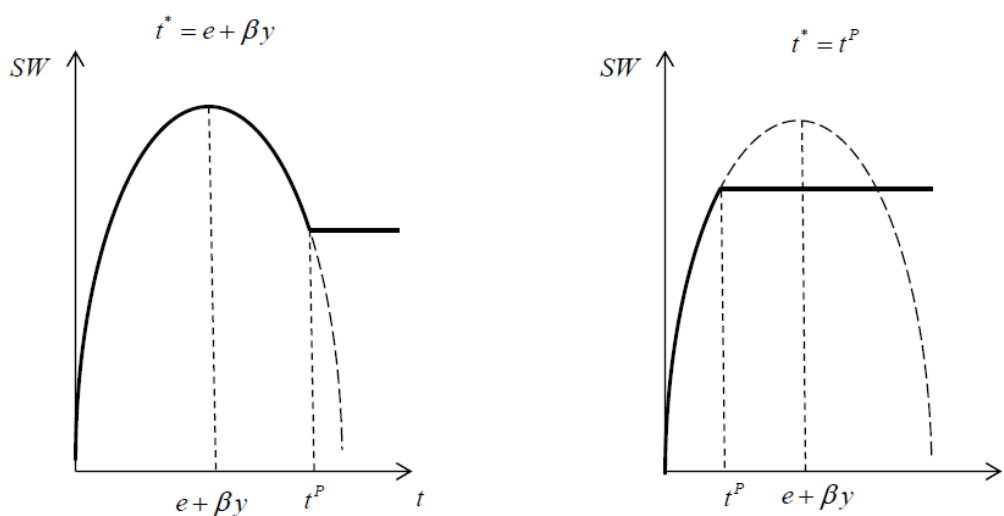


Figure 5: Social welfare (solid line) as a function of t in case $e + \beta y < t^P$ (left panel) and $e + \beta y \geq t^P$ (right panel).

Summarizing the discussion, we can clearly conclude that the equilibrium parking fee cannot be larger than the socially optimal level. We have the following Proposition.

PROPOSITION 3: Suppose the traditional shopping street can be accessed either by car or by public transport:

- a. If the user cost of public transport is sufficiently high (in the sense that (42) holds), the results of Proposition 1 do not change. The parking fee may be above or below the socially optimal level.
- b. If the user cost of public transport is sufficiently low (in the sense that (42) does not hold), the socially optimal fee is the lowest fee that guarantees that all shoppers in the downtown commercial district go there by public transport. The equilibrium fee cannot exceed the socially optimal level.

4.3 Lobbying by central city residents

It has been argued in the literature (see, for example, Arnott (2011), Sieg and Molinda (2013)) that local residents within (or in the proximity of) commercial districts may also have incentives to try to influence the government's decisions on local parking fees t . In this section we allow lobbying by central city residents. To specifically focus on the role of residents and the trade-offs they face with respect to parking fees, we will simplify the analysis in other respects. This will be explained in more detail below.

Setup. We assume there is a number of residents of the central shopping area A (positioned at $x=0$); their number is denoted N_R . They suffer some disutility $r > 0$ (assumed constant) from each car trip to the shopping street by a non-resident. For example, we can think of r as being the consequence of scarce parking capacity. Residents care for the availability of parking spaces in the proximity of their home: they can park for free, but they have to compete for limited space with shoppers from outside. Hence, they suffer a disutility which is increasing in the number of parking spaces occupied by visitors. With a fixed supply of parking spaces, a higher parking fee on visitors has an effect similar to that of a larger share of parking spaces reserved to residents.²⁴

The disutility due to visitors of the shopping area is only part of the story, of course. There are also obvious benefits of having shops in the central residential area. Residents in the proximity of shopping streets also care for the vitality of the area they live in. The number of traditional shops in A can be interpreted as a good proxy for this vitality. For instance, the presence of retailers raises the value of houses located in the same neighborhood, which benefits homeowners. Furthermore, vacant shopping spaces are often associated with blight and urban decay, producing a negative externality on local residents.

For the above reasons, we assume the utility of a local resident is

$$U^R = vN_A - rQ_A \quad (43)$$

where $v > 0$ and constant, and $N_A \in [0,1]$ is the number of active traditional retailers. Note that, for simplicity, we disregard consumption of the retail good by local residents themselves and thus ignore the surplus they may obtain from shopping (we discuss this assumption further below); we only capture the disutility residents suffer from the total number of outside visitors. Under our assumptions, the number of visitors equals the aggregate quantity sold in the central shopping street A. This is denoted Q_A . The utility of a non-resident shopper is unchanged with respect to the

²⁴ There are of course other reasons why local residents may dislike car trips from outside visitors, such as noise and pollution.

previous sections, i.e., it is as described in (3), (4) and (5).

Of course, if N_A were constant, local residents would simply want to reduce the number of external visitors as much as possible, having extreme incentives to lobby for high parking fees. We will therefore treat N_A as endogenous. We assume that there is an opportunity cost c of operating a shop in area A, which is distributed uniformly across the population of traditional retailers, i.e., $c \sim U[0,1]$. This opportunity cost may be justified as follows. First, as many traditional retailers are entrepreneurial or family-run businesses, c may capture the quality of alternative job opportunities for the tenant: for instance, the older and less skilled she is, the lower the likelihood of finding alternative occupations that provide a comparable income. Second, c may capture the land rent paid to landowners, which may vary even within the central shopping street, depending on the specific location of the shop.

Given the above discussion, conditional on a given opportunity cost and a given number of shops, the profit of a retailer in area A can be written as

$$\pi_A(N_A, c) = \max \left(p_A \frac{Q_A}{N_A} - \frac{1}{2} \left(\frac{Q_A}{N_A} \right)^2 - c; 0 \right). \quad (44)$$

Observe that, for given c , $\pi_A(N_A, c)$ is decreasing in N_A . Obviously, a shop characterized by opportunity cost c will be active if and only if the gross operating profit is non-negative, i.e.

$$p_A \frac{Q_A}{N_A} - \frac{1}{2} \left(\frac{Q_A}{N_A} \right)^2 - c \geq 0. \text{ Thus, denoting the opportunity cost of the 'marginal' retailer by } \bar{c} \text{ (i.e.,}$$

this is the cost of the retailer that is indifferent between being and not being active in equilibrium), the number of shops N_A is such that

$$p_A \frac{Q_A}{N_A} - \frac{1}{2} \left(\frac{Q_A}{N_A} \right)^2 = \bar{c}. \quad (45)$$

Our assumption of a uniform cost distribution $c \sim U[0,1]$ then immediately implies that the number of active retailers (whose opportunity cost is equal or smaller than \bar{c}) equals \bar{c} . We have

$$N_A = \bar{c} \quad (46)$$

Finally, for simplicity, we will assume throughout this section that $y = 0$. Hence, from (17), $p_B = \pi_B = 0, \forall t$. This implies that, as in the baseline model, no consumer in the city shops in O. Furthermore, it implies that no superstore lobbies the government, as their profit is independent of t . Therefore, only two lobbies need to be taken into account: traditional retailers (A) and local

residents (R).

Aggregating consumer surplus (given in (9)), the utility of residents, retailer profits and external costs we obtain the following social welfare function (note that we have used (46))

$$SW = CS + N_R U^R - eQ_A + \int_0^{N_A} \pi_A(N_A, c) dc + \sum_{i=B,0} \pi_i$$

After straightforward simplifications, this can be rewritten as:²⁵

$$SW = V - \beta \frac{Q_A^2}{2} - \beta(1 - Q_A) + \beta \frac{(1 - Q_A^2)}{2} - (e + rN_R)Q_A + vN_R N_A - \frac{1}{2} \frac{Q_A^2}{N_A} - \frac{N_A^2}{2}. \quad (47)$$

Market equilibrium. The equilibrium condition that price equals marginal cost implies $p_A = \frac{Q_A}{N_A}$.

Recalling that $p_B = 0$, the equilibrium prices, quantities and profits – as functions of the parking fee and the number of retailers in A -- are easily obtained as:

$$Q_A = \frac{(\beta - t)N_A}{2\beta N_A + 1} \quad Q_B = \frac{1 + (\beta + t)N_A}{2\beta N_A + 1} \quad (48)$$

$$p_A = \frac{\beta - t}{2\beta N_A + 1} \quad p_B = 0 \quad (49)$$

$$\pi_A(N_A, c) = \max\left(\frac{1}{2}\left(\frac{Q_A}{N_A}\right)^2 - c; 0\right) \quad \pi_B = 0 \quad (50)$$

Before proceeding to the analysis of government policy, let us establish some intermediate results (for a formal proof see Appendix 4) that will be useful later on. First, a higher parking fee reduces the number of retailers in equilibrium. We find

$$\frac{\partial N_A}{\partial t} = -\frac{p_A N_A}{\frac{Q_A}{N_A} \left(\frac{p_A}{N_A} \frac{2\beta}{2\beta N_A + 1} \right) + 1} < 0 \quad (51)$$

Second, the total profit made by traditional retailers A is strictly decreasing in the parking fee as well. We have

$$\frac{d \int_0^{N_A} \pi_A(N_A, c) dc}{dt} = \frac{\partial p_A}{\partial t} Q_A \frac{\frac{\partial p_A}{\partial t}}{\frac{\partial p_A}{\partial t} - \frac{N_A}{Q_A}} < 0 \quad (52)$$

Hence, as in previous sections, traditional retailers will lobby against the fee. Third, it is useful to

²⁵ It can be verified that SW is a concave function of t .

explicitly establish the trade-off faced by a resident of the central shopping area. Differentiating her utility U^R as given in (43) with respect to the parking fee t gives, after simple derivations

$$\frac{\partial U^R}{\partial t} = v \frac{\partial N_A}{\partial t} - r \frac{dQ_A}{dt} = v \frac{\partial N_A}{\partial t} + r \left(\frac{N_A}{2\beta N_A + 1} \right) \left[\frac{Q_A}{(N_A)^2} \frac{\partial N_A}{\partial t} - 1 \right]$$

Not surprisingly, the sign of this effect is theoretically ambiguous: residents like high parking fees on outside visitors, but they do like local shops to stay (and this is an incentive to keep parking fees low). Using (51), the previous expression can be rearranged to obtain that

$$\frac{\partial U^R}{\partial t} < 0 \Leftrightarrow \frac{v}{r} > \left(\frac{N_A}{2\beta N_A + 1} \right) \left(\frac{Q_A}{N_A^2} - \frac{1}{\frac{\partial N_A}{\partial t}} \right) \quad (53)$$

The utility of central residents is decreasing in the parking fee if the value attached to the vitality of the central city (captured by the presence of many traditional retailers) is large enough. By contrast, it is increasing in the parking fee if the external cost of car trips by visitors r is large. It can be verified that the right hand side of (53) is decreasing in t . This implies that if (53) is satisfied for $t=0$, local residents' utility will be decreasing for any value of t . Hence

$$\frac{v}{r} > \left(\frac{N_A}{2\beta N_A + 1} \right) \left(\frac{Q_A}{N_A^2} - \frac{1}{\frac{\partial N_A}{\partial t}} \right) \Bigg|_{t=0} \Rightarrow \frac{\partial U^R}{\partial t} < 0, \forall t. \quad (54)$$

This is a sufficient condition for local residents to lobby against the parking fee. If (54) does not hold, residents may lobby either in favor or against the parking fee. Intuitively, this will depend on the relative magnitude of v and r .

The social optimum. To find the socially optimal parking fee we maximize (47) with respect to Q_A and compare the result to the market equilibrium described in (48). We find that the optimal parking fee t^* satisfies

$$(t^* - e - rN_R) \frac{dQ_A}{dt} + vN_R \frac{\partial N_A}{\partial t} = 0. \quad (55)$$

Given that $\frac{dQ_A}{dt}$ and $\frac{\partial N_A}{\partial t}$ are quite complex functions of t , working out (55) in more detail does not lead to extra insights. However, it is easily seen that the optimal parking fee should not only account for the direct externalities (e, r) produced by car trips by outside visitors, but also for the indirect externality due to the value that residents attach to the presence of traditional shops in the proximity of their home (v) .

Note that, unlike in the baseline model of Section 3, suburban superstores have no market

power by assumption. Hence, the parking fee should only be designed with the objective of making visitors internalize the external costs and benefits of driving to the traditional retail area.

Lobbying. Consider lobbying and how the parking fee t is determined. The contribution schedules of the two lobbies $i=A,R$ (retailers at A and local residents) are

$$L_A(t) = \max(\pi_A(t) - \phi_A, 0) \quad L_R(t) = \max(U^R(t) - \phi_R, 0) \quad \forall t$$

As before, the objective function of the government is

$$W_G = \eta SW + (1-\eta) \sum_{i=A,R} I_i L_i$$

Without loss of generality, we will again let all contributions be accepted in equilibrium. The first order condition of the government's optimization problem can be rewritten, using similar methods as before, to show that the resulting equilibrium parking fee t^e satisfies

$$\frac{\partial W_G}{\partial t} = \eta \left((t^e - e - rN_R) \frac{dQ_A}{dt} + vN_R \frac{\partial N_A}{\partial t} \right) + (1-\eta) \left(\frac{d\pi_A}{dt} + \frac{\partial U^R}{\partial t} \right) \leq 0. \quad (56)$$

Expression (56) suggests that the comparison between t^e and the socially optimal fee t^* hinges on the sign of $\frac{d\pi_A}{dt} + \frac{\partial U^R}{\partial t}$, the net effect of a marginal increase in the fee on retailer profits and utility of residents of the commercial district. As the sign of this term depends on t itself it is hard to establish in general. We can nonetheless provide some interesting insights.

First, suppose that (54) holds: in other words, local residents always dislike the parking fee.

This is a sufficient condition for $\frac{d\pi_A}{dt} + \frac{\partial U^R}{\partial t}$ to be negative (for any value of t) so that (56) necessarily implies an equilibrium parking fee below the optimum: $t^e < t^*$. If local residents attach a high value to the vitality of the area where they reside in and want therefore to preserve traditional retailers there, they will oppose parking fees for outside visitors, so that their interests coincide with those of the retailers themselves. This convergence of different special interests leads the government to implement a parking fee that is below the social optimum.

Of course, if local residents attach a high value to the disutility imposed by outside visitors, it may dominate their desire to keep many local shops. Then, (54) does not hold. In equilibrium residents may lobby for the parking fee (if $\frac{\partial U^R}{\partial t} > 0$) or against it (if $\frac{\partial U^R}{\partial t} < 0$). While it is not easy to provide clean analytical conditions for either case, it is intuitive that the former will take place if

r is large enough. By contrast, local retailers will always want the fee to be small (since $\frac{d\pi_A}{dt} < 0$)²⁶.

We can therefore establish the following proposition

PROPOSITION 4: Suppose residents care about the vitality of the central shopping district but also suffer disutility from outside visitors.

- a. If preference for vitality is sufficiently strong relative to the disutility of searching for parking spaces (so that (54) holds), the equilibrium is such that both central retailers and residents lobby against the parking fee. As a result, the fee is strictly below the socially optimal level.**
- b. If preference for vitality is relatively weak (so that (54) does not hold), residents may lobby in favor of parking fees (and will do so if the disutility of searching for parking is large) or against them, while retailers will always lobby against. The parking fee may be below or above the optimal level, depending on the strength of the preference for vitality, the disutility experienced due to outside shoppers, and the impact of the fee on retailer profits.**

Residents in the central shopping district face a trade-off: increasing parking fees for outside visitors frees up parking spaces but also reduces business opportunities for traditional shops. As a result, the latter may decide to abandon the central retail area, reducing its attractiveness as a residential location as well. Thus, central residents may oppose parking fees in order to protect local retailers. This is conceivably more likely in relatively small cities, where the number of outside visitors is limited and, therefore, so is the number of retailers. Exit of traditional shops may then quickly lead to an impoverished and blighted shopping street. Furthermore, local residents are probably less likely to face problems with congestion of parking than in large cities. In our model, this would be captured by a small r and a high v . This makes the outcome described in Proposition 4a more likely. Indeed, as some of the examples reported in the introduction suggest, in small cities residents often do take sides with local retailers in opposing parking fees.

Things are probably different in larger cities, where the risk of exit of traditional retailers is likely to be smaller, given the greater number of visitors. Moreover, central shopping streets of large cities are more dynamic. Hence, exit of some traditional retailers probably has a smaller impact on

²⁶ Further analysis of the term $\left(\frac{d\pi_A}{dt} + \frac{\partial U^R}{\partial t} \right)$ using earlier results did not produce extra insights. The bottom line is

simply that the outcome depends on the strength of (i) residents' disutility associated with more visitors of the local shopping area in A, (ii) residents concern for the attractiveness of the local shopping street and (iii) the impact of higher parking fees on retailer profits and the number of retailers. .

residents' utility (i.e. small v). In contrast, space constraints are likely to be more severe, together with availability of reserved parking spaces for residents (high r). As a result, residents may support increasing parking fees on outside visitors. Van Ommeren *et al.* (2011, 2014) document some indirect evidence of this phenomenon for large shopping districts in the Netherlands, where residents pay significantly smaller parking fees than outside visitors.

Of course, our model is very simple and may not capture all the aspects that determine local residents' support, or lack thereof, for parking fees (or road pricing). It seems however that more elaborate and realistic frameworks would not yield very different qualitative results. For instance, we have ignored the surplus local residents may derive from shopping in the neighborhood they live in. In our model, if local residents were shoppers like the remainder of the population, they would patronize the shopping street. This would increase their distaste for a higher parking fee, especially if it brings a reduction in the number of shops (and, hence, reduces competition). Furthermore, suppose traditional retailers sold different goods and store location were endogenous. The parking fee may then induce certain types of traditional retailers to cease operation in the shopping street, either moving to the suburban retail area or simply exiting the local market (see, e.g., Uschev *et al.* (2015)). This would penalize centrally located consumers, who would either have to cease consuming goods sold by those who moved out, or travel all the way to B in order to purchase them. As in our simple framework, therefore, exit of retailers from the traditional shopping street may reduce residents' support for tighter parking policy.

4.4 Threat of superstore entry

Finally, we reconsider our baseline model under the threat of entry of additional superstores in the city (i.e. in the same location as B or closer to the city center). This is a relevant scenario since, in reality, the big-box segment of the retail industry is characterized by rates of (net) entry that are non-negligible, and typically higher than the traditional retail segment (see Competition Commission (2008) for the UK and Foster *et al.* (2006) for the US). Quite intuitively, entry of a new superstore in (or in the proximity of) the city is a threat for incumbent retailers. It is therefore interesting to consider how it may affect their incentives to lobby on the parking fee. For the sake of brevity, we will not provide a formal treatment of this issue. Nonetheless, the argument is rather intuitive and it would be rather easy to extend the formal model to obtain the results we now describe.

We have argued in Proposition 1 that when competitive pressure forces a superstore to keep margins low, its incentive to support higher parking prices in the traditional shopping street is weak. However, even if competition from incumbents is lax, the mere threat of entry by a similar

competitor may be enough to discourage a superstore from supporting parking fees in the central area. Suppose an additional superstore may decide to enter the market. Suppose also that it has some competitive advantage with respect to B (e.g. a more convenient location, some cost advantage or greater product quality or variety).²⁷ As we have seen in the baseline model, equilibrium demand for B increases with the parking fee. As a result, the higher such fee, the greater the market share potentially available to the new entrant. Thus, raising the parking fee in the shopping street practically reduces barriers to entry for the new superstore (that will enter only if profits are higher than entry costs). Consequently, lobbying for the parking fee may be counterproductive for incumbents.

Summing up, all incumbent retailers have an interest in keeping a new superstore out of the local market. If entry is a relevant threat, incumbent superstores may deliberately choose not to oppose underpricing of parking spaces in the shopping street, even though they would if no such threat existed. They may thus prefer to let the government “protect” the shopping street (where less powerful rivals are located), for fear of entry of a much more threatening competitor.²⁸ As long as the entry costs are not too large and externalities produced by automobile travel significant, the resulting parking fee may well be below the socially optimal level.

5. Discussion: the role of some key assumptions

Of course, we made some strong assumptions to derive our results, and it is useful to briefly reflect on how robust our findings are when some of these were relaxed. For example, we have ignored congestion. However, adding it to the model would not change the main results. Indeed, as long as the fee increases the generalized cost of travel to the shopping street, traditional retailers would still dislike it. Note that this is partly due to our assumption that consumers buy an exogenous quantity per visit. In a more elaborate model, one could allow consumers to choose not only where to shop, but also how much time to spend shopping per visit. Assuming purchases increase at a decreasing rate with time per visit, and there is congestion of parking spaces, retailers may prefer a positive parking fee (proportional to length of stay) to no fee at all, in order to raise customer turnover. However, it is not a priori clear that they would not want a fee lower than the socially optimal level.²⁹ Furthermore, the effect of the parking fee on profits conceivably depends

²⁷ New entrants in the big-box segment are often adopters of cost-reducing innovations, such as ICT sales and inventory support (Basker, 2006).

²⁸ In a model of oligopolistic competition with horizontally differentiated products, Ashiya (2000) provides a similar argument.

²⁹ After all, as the evidence provided in the introduction suggests, retailers' opposition to parking charges and road tolls is very common. It is possible that downtown retailers' associations systematically fail to properly understand the link between reduced parking fees and increased congestion, and therefore oppose fees even when they would benefit from them. Albeit plausible, we have not found evidence supporting this hypothesis.

on the degree of saturation of parking spaces. Evidence provided by Hymel (2014) suggests that even for very high levels of saturation, parking meter rates do not increase turnover and actually reduce profits for nearby retailers at lower (though still large) saturation levels. Finally, recall that the car user fee in our model can also be interpreted as a cordon toll, which affects trip costs independently of duration. As such, the cordon toll should have little effect on customer turnover, but is likely to increase the (generalized) cost of travel to the central retail district, thereby reducing retailer profits.

We also ignored the distinction between curbside and garage parking. Implicitly, our model assumes that the government controls the price of all parking spaces in the commercial district. Of course, one may consider the possibility that the government controls only on-street parking, while garages set prices independently. However, Calthrop and Proost (2006) show that, as long as on- and off-street parking are perfect substitutes, in the competitive equilibrium prices are the same for both parking modes.³⁰ Furthermore, many countries regulate pricing by parking garages in commercial districts, at least when their market power is large. Hence, our assumption can be considered a reasonable first-order approximation.

6. Concluding remarks

This paper has studied local government decisions on parking fees or cordon tolls in central cities when special interest groups lobby in favor or against such charges. We considered a linear city with retail areas at the edges: a central city shopping street populated by traditional retailers (e.g. delis, grocery stores or convenience stores) and a suburban shopping area where “big-box” superstores are located. The baseline model assumed that consumers buy a homogeneous commodity. Shopping in either location requires some travel; all transport is by car, and car use generates an external cost. Central city parking fees increase the relative cost of visiting the central shopping street, shifting consumer demand towards superstores. Both central city and suburban retailers form lobbies to influence policymakers, promising payments in exchange for a more favorable parking policy. The baseline model is further extended to allow for heterogeneous goods offered by different types of stores and the possibility to access the central city shopping area by public transport as well as by car. Moreover, another extension studies the implications of potential lobbying by local residents that suffer from too many outside visitors but do care about local shops to preserve the vitality of the city.

The baseline model explains how lobbying by retailers may lead governments to price central roads and parking spaces less than welfare maximization would require. Although in our

³⁰ Kobus *et al.* (2013) find that drivers have a preference for parking on-street, but this is quite weak: the willingness-to-pay to park on-street is 0.25 euros per trip.

model only the smallest retailers stand to lose (while the superstores actually gain from central city parking fees), we find that that traditional shops strongly oppose such policies, whereas big-box retailers have lower incentive to lobby in favor. We argue that stylized facts of the retail industry imply that traditional retailers are willing to offer the government a “steeper” lobbying contribution schedule than lobbies representing large superstores. This results in lower-than-optimal car use charges in the central commercial district.

If there is product differentiation in the sense that traditional retailers and superstores do not sell the same goods and consumers may visit both types of retailers to enjoy the whole variety on the market, we find that “multiple-stop shopping” further weakens the incentives of suburban retailers to lobby for tighter traffic measures in the central city. Consequently, the result is that traffic externalities are even more underpriced and the parking fee is too low from a social perspective.

Of course, the presence of alternative travel modes (e.g. public transport) to the central shopping area could, at least in principle, weaken the link between profits of traditional retailers and the cost of reaching their premises by car. However, we show that so long as in equilibrium at least some shoppers go to the central commercial district by car, our baseline results do not change.

We further allow lobbying by local residents near the central shopping area. These people may dislike car trips from outsiders, for instance because they compete with them for parking spaces. Indeed, in some cities, central residents have encouraged the government to raise fees on non-resident drivers. However, in other (usually small) cities, residents have shown concerns about the loss of vitality of the area they live in. If higher parking fees reduce the volume of non-resident shoppers, traditional retailers, already exposed to competition from superstores, may decide to abandon the local market. This produces a negative externality on residents of the shopping street. For instance, vacant commercial space is a source of blight and urban decay. We show that, if exit of traditional retailers is not a strong concern, residents lobby for higher parking fees intended for visitors. Otherwise, residents may in fact lobby, together with traditional retailers, for parking fee reductions. Depending on the strengths of the various effects fees may be above or below first best levels.

An important final remark is in order. Although we focused on local transportation in commercial districts, it should be noted that the analysis may have more general applicability. As mentioned previously, the setup of our model can be interpreted as one of imperfect competition among vertically and horizontally differentiated firms. We have shown that firms in the least productive and profitable market segment are willing to lobby for protection with greater intensity than firms in the more productive and competitive market segment. Our results can therefore contribute to explain the well-documented tendency by governments to provide protection primarily

to less productive firms, i.e. the so-called “Losers’ Paradox” (Baldwin and Robert-Nicoud (2007)). It should be noted, though, that the fact that a certain market segment is in decline is, by itself, not enough to make it more willing to pay to obtain government protection. Rather, our results suggests that the structural factors that determine the relative disadvantage of firms within some market segment (such as their cost structure) may also be the source of their greater willingness to seek government protection.

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Appendix 1: Proof that there is no loss of generality in assuming all groups lobby

Suppose there are two lobbies, A and B, and that the government accepts contributions only from one of them (say, A). The fee that would be implemented, denoted t^A , maximizes

$$W_G^A = \eta SW + (1-\eta)L_A, \quad \text{where } L_i = \pi_i(t) - \phi_i.$$

This implies that, evaluated at t^A , $\frac{\partial W_G^A}{\partial t} = 0$ (we here assume interior solutions, but the argument would be similar with corner solutions).

Consider then the decision by the B-lobby on whether or not to provide positive contributions to the government (given what other lobbies do). Except in the special case where π_B is already maximized at t^A , a positive change in the B's profits can be achieved by marginally changing t .³¹ If B pays a positive contribution and the government accepts, the fee (denoted t^{AB}) maximizes

$$W_G^{AB} = \eta SW + (1-\eta) \sum_{i=A,B} L_i$$

It therefore satisfies $\frac{\partial W_G^{AB}}{\partial t} = 0$ so that, starting at t^{AB} , a marginal change in t decreases W_G^A by just as much as it increases π_B . Moreover, starting from any $t \in [t^A; t^{AB})$, a marginal change in t would decrease W_G^A by strictly less than it increases π_B . Hence, as we move from t^A to t^{AB} , the change in W_G^A is smaller (in absolute value) than the change in π_B . This implies that the B-lobby always finds it profitable to have the government move from t^A to t^{AB} : the contribution paid in equilibrium (i.e. $\pi_B(t^{AB}) - \phi_B$) -- needed to have the government be indifferent between t^A and t^{AB} (given all other contributions) -- is not larger than the corresponding increase in profits $\pi_B(t^{AB}) - \pi_B(t^A)$.

With a similar reasoning, it can be shown that when no lobbies provide payments to the government, at least one of them is better off providing a positive contribution. As a result, we always have an equilibrium in which the government receives contributions from all lobbies.

³¹ In this special case, one can simply assume that the government accepts a zero contribution from the B lobby. This is without loss of generality since, obviously, the tax implemented would be the same whether the contribution is accepted or not.

Appendix 2. Proof of Proposition 1

Rewriting $\frac{\partial \pi_A}{\partial t}$ and $\frac{\partial \pi_B}{\partial t}$ using (20), and noting that $t^* = e + \beta y$, we can reformulate the first order condition (25) after simple algebra as

$$(1 - 2\eta(\beta + 1))t^e + \eta(2\beta + 1)(e + \beta y) - (1 - \eta)\beta(1 - 2\beta y) \leq 0. \quad (\text{A2.1})$$

In this expression, t^e is the equilibrium parking fee. Assuming an interior solution we obtain, after simple rearrangements

$$t^e = (e + \beta y) \frac{\eta(2\beta + 1)}{2\eta(\beta + 1) - 1} - \frac{(1 - \eta)\beta(1 - 2\beta y)}{2\eta(\beta + 1) - 1}. \quad (\text{A2.2})$$

It is easy to show that the second order condition requires $2\eta(\beta + 1) - 1 > 0$. To see this, differentiate the left hand side of (25) with respect to t , use (20) and work out to find

$$\frac{\partial^2 W_G}{\partial t^2} = \eta \frac{\partial q_A}{\partial t} + (1 - \eta) \left(\frac{\partial q_A}{\partial t} \right)^2 = -\eta \frac{1}{2\beta + 1} + (1 - \eta) \left(\frac{1}{2\beta + 1} \right)^2.$$

Straightforward algebra then shows

$$\frac{\partial^2 W_G}{\partial t^2} < 0 \Leftrightarrow 2\eta(\beta + 1) - 1 > 0 \quad \forall t \quad (\text{A2.3})$$

Unless otherwise noted, we assume that this condition holds, so that the objective function is concave in t and the solution in (A2.2) is a maximum.

Comparing (A2.2) to $t^* = e + \beta y$, we have after some rearrangements that:

$$t^e < t^{FB} \text{ if and only if } \beta y < \frac{\beta - e}{2\beta + 1}.$$

Using (27)-(28) this boils down to a comparison of the per unit profit margin evaluated at the socially optimal parking fee:

$$\beta y < \frac{\beta - e}{2\beta + 1} \Leftrightarrow M_B < 2M_A(t^{FB}).$$

By analogy we have

$$t^e \geq t^* \text{ if and only if } \beta y \geq \frac{\beta - e}{2\beta + 1} \Leftrightarrow M_B \geq 2M_A(t^*).$$

To study how the equilibrium tax that follows from the interaction of lobbying and government objectives, we apply the implicit function theorem to the first order condition of its optimization problem, and we use (10), (19) and (22). We find

$$\frac{\partial t^e}{\partial \eta} = - \frac{\left(-\frac{1}{2\beta + 1} \right) \left((t - e - \beta y) - \left(\frac{\beta + \beta y - t}{2\beta + 1} - \beta y \right) \right)}{\frac{\partial^2 W_G}{\partial t^2}}$$

Since the denominator is negative by the second order condition, this implies

$$\frac{\partial t^e}{\partial \eta} > 0 \Leftrightarrow \frac{\beta + \beta y - t^e}{2\beta + 1} > t^e - e. \quad (\text{A2.4})$$

It is easily verified that -- when $\beta y < \frac{\beta - e}{2\beta + 1}$ so that $t^e < t^*$ (as shown above) -- the latter condition is always satisfied. Hence, when the equilibrium parking fee is below first-best, it is increasing in η . In other words, the fee declines when the government cares relatively more for lobbying contributions and less for social welfare.

Finally, we should consider the possibility of corner solutions. Suppose the objective function W_G is everywhere not concave (i.e. either linear or convex) in t , so that the second order condition for a maximum at the interior solution does not hold (so $2\eta(\beta + 1) - 1 > 0$ does not hold, see (A2.3)). Since we assumed that the objective function is everywhere continuous and differentiable in t , the maximization problem must have a corner solution, i.e., the optimal parking fee is either zero or it equals the maximum bound \bar{t} ; we have either $t^e = 0$ or $t^e = \bar{t}$.

To find out which is optimal we need to compare the objective function at these values (denoted $W_{G,t=0}$ and $W_{G,t=\bar{t}}$, respectively). First, substituting $t = 0$ in (25) we have, using (19) and rearranging

$$\begin{aligned} W_{G,t=0} = & \eta \left(V + \frac{\beta}{2} - \left(\frac{\beta + \beta y}{2\beta + 1} \right) \left(e + \left(\beta + \frac{1}{2} \right) \left(\frac{\beta + \beta y}{2\beta + 1} \right) - \beta \left(\frac{\beta + 1 - \beta y}{2\beta + 1} \right) \right) \right) + \\ & + (1 - \eta) \left(\frac{1}{2} \left(\frac{\beta + \beta y}{2\beta + 1} \right)^2 + \beta y \left(\frac{\beta + 1 - \beta y}{2\beta + 1} \right) \right) \end{aligned} \quad (\text{A2.5})$$

Second, replacing $t = \bar{t}$ in (25) we get

$$W_{G,t=\bar{t}} = \eta \left(V - \frac{\beta}{2} \right) + (1 - \eta) \beta y. \quad (\text{A2.6})$$

Note that (A2.5) and (A2.6) are both linear functions of η , so that $(W_{G,t=0} - W_{G,t=\bar{t}})$ is linear in η .

Hence, if we can show that, for the case where $\beta y < \frac{\beta - e}{2\beta + 1}$, $(W_{G,t=0} - W_{G,t=\bar{t}})$ is positive both for

$\eta = 0$ and for $\eta = \frac{1}{2(1 + \beta)}$ (so $2\eta(\beta + 1) - 1 = 0$), we can conclude that it is everywhere positive

when $\eta \leq \frac{1}{2(1 + \beta)}$ and $\beta y < \frac{\beta - e}{2\beta + 1}$ hold. As a result, $t^e = 0$ must be the solution.

To show the above statement, first note that when $\eta = 0$ we have

$$W_{G,t=0} - W_{G,t=i} = \left(\frac{1}{2} \left(\frac{\beta + \beta y}{2\beta + 1} \right)^2 + \beta y \left(\frac{\beta + 1 - \beta y}{2\beta + 1} \right) \right) - \beta y$$

After some rearrangements, it can be shown that, if $\beta y < \frac{\beta - e}{2\beta + 1}$, this is positive. Second, consider

$\eta = \frac{1}{2(1+\beta)}$. From (A2.3), $\frac{\partial^2 W_G}{\partial t^2} = 0$, $\forall t$. That is, W_G is linear in t . Moreover, if $\beta y < \frac{\beta - e}{2\beta + 1}$ and

$\eta = \frac{1}{2(1+\beta)}$, (A2.1) is negative; hence, W_G is strictly decreasing in t . It follows that $W_{G,t=0} > W_{G,t=i}$

holds when $\eta = \frac{1}{2(1+\beta)}$.

The implication is that $t^e = 0$ when $\beta y < \frac{\beta - e}{2\beta + 1}$ and $\eta \leq \frac{1}{2(1+\beta)}$ hold. In words, the

parking fee will be zero ($t = 0$) if the government is sufficiently sensitive to lobbying contributions.

Appendix 3: Heterogeneous goods

In this appendix, we briefly analyze the case of heterogeneous goods considered in Section 4.1. We first derive equilibrium demands, prices and profits, next we study the social optimum.

Equilibrium demands, prices and profits

The description of the demand structure implies that the various demands can be written as

$$\begin{aligned} q_T = \bar{x} &= \frac{V_A - p_A - t}{\beta} \\ q_{A,C} = \bar{x} &= \frac{\beta + p_{B,C} - p_{A,C} - (V_S - p_{B,S})}{\beta} \\ q_{B,C} = q_{B,S} &= 1 - \bar{x} = \frac{(V_S - p_{B,S}) + p_{A,C} - p_{B,C}}{\beta} \end{aligned} \tag{A3.1}$$

Since traditional retailers are price-taking firms, in equilibrium we further have

$$p_{A,k} = q_{A,k} \quad k = T, C. \tag{A3.2}$$

Hence, we can rewrite (A3.1) as

$$\begin{aligned}
q_T = \bar{x} &= \frac{V_A - t}{\beta + 1} \\
q_{A,C} = \bar{x} &= \frac{\beta + p_{B,C} - (V_S - p_{B,S})}{\beta + 1} \\
q_{B,C} = q_{B,S} &= 1 - \bar{x} = \frac{1 + V_S - p_{B,S} - p_{B,C}}{\beta + 1}
\end{aligned} \tag{A3.3}$$

As in the baseline model, it can easily be argued that, due to the presence of competition in O, profit-maximization by superstore B implies

$$p_{B,S} + p_{B,C} = \min(\beta y; \frac{1 + V_S}{2}),$$

where $p_{B,S} + p_{B,C} = \frac{1 + V_S}{2}$ maximizes B's profit in the absence of competition from O; this profit amounts to $(p_{B,S} + p_{B,C}) \left(\frac{1 + V_S - p_{B,S} - p_{B,C}}{\beta + 1} \right)$. We assume, without loss of generality, that

$$\min(\beta y; \frac{1 + V_S}{2}) = \beta y \Rightarrow p_{B,S} + p_{B,C} = \beta y \tag{A3.4}$$

Using this in (A3.3), we obtain the equilibrium quantities (conditional on the parking fee t)

$$\begin{aligned}
q_T = \bar{x} &= \frac{V_T - t}{\beta + 1} \\
q_{A,C} = \bar{x} &= \frac{\beta + \beta y - V_S}{\beta + 1} \\
q_{B,C} = q_{B,S} &= 1 - \bar{x} = \frac{1 + V_S - \beta y}{\beta + 1}
\end{aligned} \tag{A3.5}$$

Finally, using (A3.2) and (A3.5), equilibrium prices and profits are

$$p_{A,C} = \frac{\beta + \beta y - V_S}{\beta + 1} \quad p_{A,T} = \frac{V_T - t}{\beta + 1} \quad p_{B,S} + p_{B,C} = \beta y, \tag{A3.6}$$

$$\pi_{A,C} = \frac{1}{2} \left(\frac{\beta + \beta y - V_S}{\beta + 1} \right)^2 \quad \pi_{A,T} = \frac{1}{2} \left(\frac{V_T - t}{\beta + 1} \right)^2 \quad \pi_B = \beta y \frac{1 + V_S - \beta y}{\beta + 1}. \tag{A3.7}$$

Derivation of the social optimum

Before proceeding, we have to point out that the equilibrium described in (A3.5)-(A3.6)-(A3.7) exists only if parameters of the model satisfy some consistency conditions. First, recall that we assumed above that $p_{B,C} \leq p_{A,C}$ and $V_S \geq p_{B,S}$. Hence, we need

$$p_{B,C} \leq \frac{\beta + \beta y - V_S}{\beta + 1} \quad p_{B,S} \leq V_S$$

Second, consistency requires that $q_T \geq q_{A,C}$. That is

$$\beta + \beta y + t \leq V_T + V_S$$

Since $t \in [0, \bar{t}]$, with $\bar{t} = \beta + \beta y$, the above holds for all feasible values of t if and only if

$$2(\beta + \beta y) \leq V_T + V_S.$$

Finally, we require that $0 < q_T$ for any $t \in [0, \bar{t}]$ and that $1 > q_T$ for any $t \in [e, \bar{t}]$. The first of these conditions simply means that demand in the shopping street is positive for all values of the parking fee. The second one requires that when the parking fee is equal (or higher) than the external cost of car trips e , some consumers do not visit the shopping street. If it did not hold, a parking fee equal to e would be ineffective in discouraging travel there, i.e. it would just be a transfer from drivers to the government. These conditions hold if and only if

$$\beta + \beta y < V_T < \beta + 1 + e$$

Using previous results, we can summarize the consistency conditions in³²

$$\max(\beta + \beta y; 2(\beta + \beta y) - V_S) < V_T < \beta + 1 + e.$$

Turning to the derivation of the social optimum first observe that, using the fact that $q_T = \bar{x}$, $q_{A,C} = \bar{x}$ and $q_{B,C} = q_{B,S} = 1 - \bar{x}$, the social welfare function can be written as

$$\begin{aligned} SW &= \int_0^{\bar{x}} U(x; A) dx + \int_{\bar{x}}^1 U(x; AB) dx + \int_{\bar{x}}^1 U(x; B) dx + \sum_{i=A,B} \pi_i - e\bar{x} + t\bar{x} = \\ &= V_T \bar{x} + V_S (1 - \bar{x}) + V_C - \beta \frac{\bar{x}^2}{2} - \beta (1 - \bar{x}) + \beta \left(\frac{1 - \bar{x}^2}{2} \right) - \frac{\bar{x}^2}{2} - \frac{\bar{x}^2}{2} - e\bar{x} \end{aligned}$$

Maximizing social welfare then implies, after simple algebra, that

$$\begin{aligned} \bar{x} = q_T &= \frac{V_T - e}{\beta + 1} \\ \bar{x} = q_{A,C} &= \frac{\beta - V_S}{\beta + 1} \\ 1 - \bar{x} = q_{B,C} = q_{B,S} &= \frac{1 + V_S}{\beta + 1} \end{aligned} \quad (A3.8)$$

Comparing (A3.8) with (A3.5), and noting that equilibrium quantities $q_{A,C}$, $q_{B,C}$, and $q_{B,S}$ are unaffected by t , we see that the optimal parking fee is

³² Note that $q_{A,C} > 0$ if and only if $\beta + \beta y > V_S$. However, this is not strictly necessary for our argument: if it does not hold, we have corner solutions (that we have implicitly disregarded so far): $\bar{x} = q_{A,C} = 0$ and $q_{B,C} = q_{B,S} = 1$. In words, all consumers visit the superstore to buy C and S, some visit the shopping street to buy T and none buys C in the shopping street. This would not change the qualitative results of Section 4.2.

$$t^* = e.$$

Observe that this is not enough to make equilibrium and (first-best) optimum coincide. However, given that by assumption t is the only instrument at the government's disposal, social welfare cannot be higher than when $t = e$.

Appendix 4: Lobbying by residents: proof of some intermediate results

To arrive at (51), note that $N_A = \bar{c}$, $p_A = \frac{Q_A}{N_A}$ and expression (45) jointly imply that the equation

$$\frac{1}{2} \left(\frac{Q_A}{N_A} \right)^2 = N_A$$

implicitly defines the number of active traditional retailers N_A . Applying the implicit function theorem, we then immediately have (51).

To arrive at (52), note that from (50) and (46), total profit is given by

$$\int_0^{N_A} \pi_A(N_A, c) dc = N_A \frac{1}{2} \left(\frac{Q_A}{N_A} \right)^2 - \frac{N_A^2}{2}.$$

Totally differentiating this expression we have

$$\frac{d \int_0^{N_A} \pi_A(N_A, c) dc}{dt} = \int_0^{N_A} \frac{\partial \pi_A(N_A, c)}{\partial t} dc + \int_0^{N_A} \frac{\partial \pi_A(N_A, c)}{\partial N_A} dc \frac{\partial N_A}{\partial t}$$

Working out, we arrive at (52).