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Curbside parking time limits

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ABSTRACT

Previous work in the economic theory of parking has treated parkers as homogeneous. In almost all policy contexts, however, heterogeneity among individuals matters not only quantitatively but also qualitatively. For example, providing both tolled and untolled alternatives allows those with high values of time to pay largely with money and those with low values of time to pay only with time. This paper extends the authors' (2009) integrated model of parking and traffic congestion in an isotropic downtown in steady state to treat heterogeneity in the value of time and parking duration. It develops the theory, and then presents an extended numerical example that applies the theory to several policy scenarios. With homogeneous individuals, underpricing curbside parking leads to wasteful cruising for parking. With heterogeneous individuals, however, curbside time limits can be used to ration out those with longer parking durations, so that cruising for parking is eliminated. With curbside parking time limits, underpricing curbside parking downtown may be a sound policy response to the free parking provided by suburban shopping centers.

1. Introduction

Pricing downtown curbside parking is being debated in both academic and policy circles. Current practice in most US cities is to apply a constant hourly meter rate during business hours. The meter rate may or may not vary by location and is typically set so that at least during peak hours excess demand for curbside parking exists, leading to considerable cruising for parking. Current practice has been strongly influenced by downtown merchant associations arguing that downtown parking should be subsidized to make downtown shopping competitive with suburban shopping centers, where free parking is typical (Jakle and Sculle, 2004, provides an informative history of parking and parking policy in US cities). Garage parking by downtown shoppers is subsidized through the validation[1] of garage parking, and curbside parking through its 'underpricing' (setting the meter rate below the level that clears the market for curbside parking). Opponents of underpricing curbside parking present two arguments against the practice. The first-best[2] argument, well presented in Shoup (2005), is that curbside parking should be 'cashed out' or priced to clear the market. Underpriced curbside parking is rationed via cruising for parking. The efficiency cost associated with this rationing mechanism is not only the value of time lost by cars cruising for parking, but also the value of time lost due to the increased traffic congestion caused by cruising for parking. Pricing curbside parking to clear the market not only eliminates this inefficiency, but also ensures that curbside parking spots go to those who value them the most. The second-best argument is that, even when subsidizing downtown shopping is desirable, attempting to achieve this

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[1] An individual parks in a parking garage and shops at a store. At the checkout, he presents his parking stub to the store clerk, who validates it. Upon exiting the garage, the individual presents his validated parking stub to the parking attendant, who waives part or all of the parking fee. The merchant then reimburses the garage for part or all of the waived portion of the parking fee.

[2] The terms "first best" and "second best" are explained in Section 2.

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Nomenclature

α	slope of the marginal parker locus $(\tilde{\lambda}/\tilde{\rho})$
γ	parameter of negative exponential visit time distribution
δ	driving distance
$\varepsilon(\rho)$	visit duration of the marginal parker with value of time ρ
λ	visit duration
$\bar{\lambda}$	mean visit duration of curbside parkers
$\tilde{\lambda}$	mean visit duration of marginal parkers
μ	mean of $\ln\rho$
θ	passenger car equivalent (in terms of effective density) of a car cruising for parking
ρ	value of time
$\bar{\rho}$	mean value of time of curbside parkers
$\tilde{\rho}$	value of time of marginal parker
$\bar{\tilde{\rho}}$	mean value of time of marginal parkers
$\xi(\alpha)$	intermediate function
σ	standard deviation of $\ln\rho$
τ	curbside maximum parking time limit
$\chi(\%)$	visit length of marginal parker with percentile value of time %
ψ	turnover rate of curbside parking
$\Lambda(\lambda')$	mean visit length for $\lambda \geqslant \lambda'$
$\Lambda(\lambda', \lambda'')$	mean visit length for $\lambda' \in (\lambda', \lambda'')$
Ω	effective jam density with no curbside parking
c	unit garage parking cost per unit time
f	curbside meter rate per unit time
$g(\rho,\lambda)$	joint p. d. f. of value of time and visit duration
$h(\lambda)$	p.d.f. of visit duration
$j(\rho)$	p.d.f. of value of time
t	travel time per mile
t_0	free flow travel time
v	velocity
$w(\rho;\alpha)$	p.d.f of value of time of curbside parkers
$x(\rho;\alpha)$	p.d.f. of value of time of marginal parkers
$y(\lambda;\alpha)$	p.d.f. of visit duration of curbside parkers
z	intermediate function
C	stock of cars cruising for parking per unit area-time
CP	cruising-for-parking costs per unit area-time
D	trip demand per unit area-time
$E_{x:y}$	elasticity of x with respect to y
$F(\%, \%')$	full price for the parker with the % percentile value of time and the %' percentile visit duration
$G(\rho,\lambda)$	c.d.f. of value of time and visit duration
GC	garage costs per unit area-time
$H(\lambda)$	c.d.f. of visit length
$J(\rho)$	c.d.f. of value of time

goal by underpricing curbside parking is dysfunctional since it does not in fact lower the full price of a downtown trip and may increase it. If there is only curbside parking, the full price of a downtown trip is unaffected by the underpricing of curbside parking since this price is determined by the intersection of the curbside parking capacity constraint and the demand curve. Underpricing curbside parking simply replaces the curbside parking fee revenue dollar for dollar with travel time costs (Arnott and Inci, 2006). If there is unsubsidized off-street parking in addition to curbside parking, the full price of *parking* is unaffected by the underpricing of curbside parking, while the full price of a downtown trip rises due to the increased traffic congestion caused by cars cruising for parking (Arnott and Rowse, 2009).

Arguments against underpricing curbside parking have been developed in the context of models with identical individuals. This paper makes the point that these arguments are significantly weakened when account is taken of driver heterogeneity. When drivers differ in visit duration, curbside parking limits reduce the demand for curbside parking, and can be set so as to eliminate the excess demand for curbside parking and the cruising for parking associated with it. Thus, supplementing the underpricing of curbside parking with appropriate curbside parking limits can achieve the goal of subsidizing