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Estimating the travel and parking demand effects of employer-paid parking

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A multinomial logit model of downtown Los Angeles commuters is used to assess the effect of employer-paid parking on mode choice and parking demand. Employer-paid parking significantly increases the probability that an employee will drive to work alone. The best performing models predict that between 25 and 34 percent fewer automobiles are driven to work when workers have to pay to park, as compared to when they park free. This analysis provides support for the notion that public policies concerning traffic congestion, air pollution and energy use must address employer-paid parking.

1. Introduction

Most commuters in the United States park free at work.[1] Commuters generally do not consider the cost of parking in choosing their travel mode because their employers directly or indirectly subsidize parking. When commuters are shielded from the cost of parking they drive alone more frequently, frustrating public aims to reduce solo driving. This paper reports on a new multinomial logit model used to estimate the mode choice and parking demand effects of employer-paid parking.

Increased policy interest in parking subsidies has corresponded with the growing use of travel demand management techniques in transportation, air quality and energy plans.[2] In the last decade, the amount of empirical

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[1] Willson and Shoup (1990) review estimates of the extent of employer-paid parking. Overall, 90 percent of U.S. automobile commuters park free at work. Willson (1991) estimates that at least 47 percent of downtown Los Angeles office workers receive free parking.

[2] For example, numerous proposals are being considered in the U.S. to reform federal and state taxation policies that currently encourage employers to subsidize parking.

evidence provided by researchers has grown as well. Young et al. (1991) summarize recent research on parking, identifying mode choice models as one of four main modeling themes in parking. This research contributes to the evidence on the mode choice effects of parking price by focussing on employers' subsidization of employee parking.

Although numerous discrete choice models of mode choice are available, few are specified in a way that allows one to properly examine the effect of parking subsidies. Feeney (1989) reviews nineteen discrete choice models and finds support for the notion that parking subsidies are an important determinant of mode choice. However, he concludes that few models adequately address parking subsidies. Feeney recommends that models separate parking price from other running money costs and explicitly address excess time and search time related to parking. An example of research that specifically addresses parking subsidies is Gillen's (1977a, b) analysis of commuters in Ottawa and Toronto, Canada. Those models show that parking subsidies significantly increase solo driving.

The other source of information on commuters' responsiveness to parking policy is case studies that examine mode choice before and after subsidies are changed, or in comparable firms with differing subsidy policies. Shoup and Pickrell (1980) and Willson and Shoup (1990) summarize these case studies and find a consistent reduction in auto commuting when commuters have to pay for parking.

The analysis reported here uses a 1986 mode choice survey of downtown Los Angeles office workers and their employers. The survey, entitled *Los Angeles CBD Employee–Employer Baseline Travel Survey* (hereafter termed the 'Baseline Survey'), provides a matched sample of 5,060 employees and 118 employers. The survey includes cross-sectional data on mode choice, parking prices and parking subsidy policies. The primary purpose of the survey was to measure mode split in subareas of downtown Los Angeles. There are limitations in this analysis because the survey was not specifically designed for discrete choice modeling. Nonetheless, the survey provides a large cross-sectional data base that contains enough information to usefully examine the effect of parking subsidies.

The survey sample was developed using a stratified, multi-stage cluster sample. The sampling procedure used office space as a proxy for the population of office workers, and sampled the employer and up to 200 employees at the sampled location. Because the sampling procedure was not random, the consultant created weights to estimate the mode split of the population. These weights have the effect of increasing the representation of small employers and their employees. They are not used in estimating the logit model, because employer size characteristics are exogenous to mode choice. The weights are used in the predictions described later in the paper.

2. Downtown Los Angeles context

The Baseline Survey measured a 1986 mode split in downtown Los Angeles of 61 percent solo driver, 15 percent carpool, and 22 percent transit. ('Carpool' includes cars with a driver and one or more passengers, and vanpools.) This mode split translates to 66 cars per 100 employees being driven to work.[3] A further translation, taking into account worker density, absenteeism and parking occupancy factors, yields an employee *parking demand* estimate of 2.2 parking spaces per 1,000 square feet.[4]

This research also uses a 1986 survey of market parking prices at all 240 downtown Los Angeles parking facilities that are open to the public [Anil Verma Associates (1986)]. The average parking price in 1986 was $84 per month, or $3.87 per day.[5] The price of parking drops substantially with distance from the highest density core of downtown (between $100 and $175 per month in the core and between $20 and $100 per month in the periphery).

Parking conditions in downtown areas differ significantly from suburban areas. For example, downtown parking is more expensive, but offers cost/location tradeoffs not available in suburban areas. A market for parking usually exists, and employers can easily adjust the number of spaces they use by leasing the unneeded spaces or reducing the number of spaces they lease from the building owner or parking operator. Also, parking subsidies are not universal in downtown areas, so the behavior of those who pay for parking can be observed. Finally, a broad range of commute options exist. As a result of these differences, the results reported here may not be transferable to suburban areas.

3. The effect of parking subsidies

Disaggregate models of personal travel behavior are the most appropriate

[3]The *cars per 100 employees* measure is based on the number of solo drivers per 100 employees, plus the number of carpool/vanpool drivers per 100 employees. A mean carpool/vanpool size of 2.92 (derived from the Baseline Survey) is used to convert the carpool/vanpool mode share into the number of carpool/vanpool drivers.

[4]*Cars per 100 employees* is translated to *parking spaces per 1,000 square feet* using an employee density of 4.2 employees per 1,000 square feet, an employee absenteeism rate of 14 percent, and a peak parking occupancy factor of 94 percent [all derived from the Baseline Survey and a Wilbur Smith and Associates (1981) study of downtown Los Angeles parking]. For example, if there are 4.2 employees per 1,000 square feet, and 0.66 cars driven to work per employee, there are potentially 2.8 cars driven to work per 1,000 square feet. Not all of these drivers require a parking space at the peak accumulation period on a given day. So the 2.8 spaces per 1,000 square feet is multiplied by 0.86 (to account for employee absenteeism) and 0.94 (to account for the fact that not all employees who drive park during the peak parking occupancy period), yielding a demand of 2.2 spaces per 1,000 square feet.

[5]This average uses quoted monthly parking rates (and daily rates if a monthly rate was not quoted).

tool for examining the relationship between the after-subsidy price of parking and mode choice. Disaggregate models fully use individual-level data and are well-suited for policy analysis. Since the parking subsidy eligibility of employees varies within a given geographic area, zonal aggregate models cannot adequately analyze the effect of parking subsidies.

Disaggregate choice models are used when the decision-maker faces a choice of a set of alternatives that are finite, mutually exclusive and exhaustive. This analysis uses the most frequently used discrete choice model, the multinomial logit model, to provide comparability with other studies.

The choice set for this study is auto (solo driver), carpool, and transit. The sample for the logit analysis is drawn from the Baseline Survey, using responses from both the employer and employee questionnaires. Two subgroups of the employee sample are used – those who must pay the *market price* to park if they drive, and those who may *park free*. Accounting for missing data, 713 cases are available for analysis.

These subgroups of the sample are used because the parking subsidy eligibility of the rest of the sample cannot be reliably established. This is because (1) respondents who drove did not consistently interpret the question asking them about their parking cost, and (2) non-driver respondents did not report what parking would cost if they had chosen to drive. Consequently, *employers*' responses on parking subsidy policy are used to determine an employee's eligibility for a subsidy. To ensure accuracy, only those employers who offer a consistent 'free parking' or 'no subsidy' policy are included. The average market parking prices in seven subareas of downtown are used to estimate the price paid by those not eligible for a parking subsidy.[6] Comments are provided later in the paper concerning the limitations of this procedure.

Table 1 summarizes the mode choice of the full sample and logit sample. The different mode split of the 'free parking' and 'no subsidy' groups indicates that commuters are responsive to the after-subsidy price of parking. However, this comparison does not control for other factors that may explain the difference between the two groups, as does the logit analysis that follows. Table 1 also indicates that the majority of cases in the logit sample are those who park free. Among those who are not subsidized, the subarea average market parking price ranges between \$3.39 and \$5.58 per space per day. (The logit sample is drawn from areas of downtown having the higher than average parking prices.) Finally, the income data displayed in table 1 reveals that the income distribution is fairly consistent in the middle income groups. However, the logit sample has more respondents with incomes less than \$15,000 and fewer respondents with incomes greater than \$50,000.

[6]These subareas are used because they represent the highest level of detail available concerning the location of survey respondents.

Table 1
Mode, parking cost, and income characteristics.

	Full sample ($n=5{,}060$)	Logit sample ($n=713$)	Logit sample free parkers ($n=522$)	Logit sample pay to park ($n=191$)
Mode choice				
Drive alone	61%	64%	68%	54%
Carpool/vanpool	15%	17%	18%	13%
Transit	22%	18%	13%	32%
Cars/100 employees	66	70	74	58
Daily parking cost[a]				
Free parking	est. 47%	73%	100%	0%
\$0.01–\$2.00	N/A	0%	0%	0%
\$2.01–\$4.00	N/A	2%	0%	8%
\$4.01–\$6.00	N/A	25%	0%	92%
Household income (pre-tax)				
<\$15 K	5%	12%	10%	15%
\$15 K–\$24.9 K	18%	18%	19%	15%
\$25 K–\$50 K	41%	41%	44%	34%
>\$50 K	36%	29%	27%	36%

[a]Using subarea average market prices (see text).

The multinomial logit model estimates the probability of a commuter's choosing each model. That probability is expressed as

$$\text{Prob}[y_i=j]=\exp(\beta' x_{ij}) \Big/ \sum_k \exp(\beta' x_{ik}), \tag{1}$$

where $\text{Prob}[y_i=j]$ is the probability that individual i's choice (y) is mode j, $\exp(\cdot)$ is the exponential function, β' is a parameter vector, and (x_{ij}) is a vector of attributes for individual i and choice j.

Two kinds of parking variables are used to examine the mode choice effect of parking subsidies. The first is the 'free parking' dummy variable, which applies to the solo driver mode. It is set to '1' if parking is free, and '0' if no subsidy is available. The second variable, 'daily parking cost', indicates the subarea-average market parking price faced by those who are not eligible for a parking subsidy. Those entitled to free parking have a daily parking cost of \$0. The daily-parking-cost variables applies to both solo driver and carpool modes. The daily parking cost is divided by the average size of the carpool (2.92) to estimate the daily parking cost for each individual in a carpool.

Data are not available on the search time and walking time for parking.

Therefore, the subarea-average market prices for parking are used to measure the overall disincentive to driving represented by parking price (acknowledging that there may be different tradeoffs between cost and walking time that are not measured). The model predicts the mode choice of commuters given different assumptions about parking price, but cannot predict commuters' choice of parking location.

Running costs are separated from parking costs. They are based on automobile commuters' estimates of trip length times a 1986 per mile automobile running cost of $0.065 per mile.[7] Transit riders' running costs are the 1986 monthly pass fare, minus the employer's reported subsidy to transit passes.

The travel-time variables are based on respondents' total reported morning and afternoon door-to-door travel time. Reported travel times are averaged for each mode and zip code origin, and those averages are used as the travel-time variables. The Baseline Survey did not collect disaggregated travel-time components. Using a single measure of travel time is acceptable in this study because travel-time sensitivity is not the policy variable of interest. Separate travel-time coefficients are estimated for automobile and transit commuting, to allow for commuters' sensitivity to the larger proportion of out-of-vehicle time in the transit mode.

A number of additional mode-specific variables are used. Income, occupation, and vehicle availability are commonly used in other discrete choice models, and are intended to control for other factors that affect mode choice. Two additional employer policy variables are used: rideshare incentives and flextime programs. They are not commonly used in mode choice models, but usefully control for other employer policies that affect mode choice. Finally, certain other commonly used variables were not available in the data set, such as household size, or number of vehicles in the household. The mode-specific variables are described below.

Income Solo (Drivers): categorical data on pre-tax household income.
Occupation (Solo Drivers): Dummy variable: 1 = professional; 0 = non-professional. Professional includes 'Executive, Administrative and Managerial' and 'Professional Specialty' categories.
Vehicle Availability (Transit): Dummy variable: 1 = yes; 0 = no. This variable indicates whether a car was available for use in travelling to work on the day of the survey.
Rideshare Incentives (Carpool): Dummy variable: 1 = yes; 0 = no. This vari-

[7]Motor Vehicle Manufacturers Association of the U.S., Inc. (1989) *Facts and Figures*. Running costs include gas and oil, maintenance, and tires (equaling $0.065 in 1986). This measure was used because individual level running costs were not collected in the Baseline Survey. The use of a single per mile automobile running cost may decrease the accuracy of the running cost coefficient.

able measures whether the employer offers significant ridesharing incentives, such as ridematching or financial incentives.
Flextime Programs (Carpool): Dummy variable: 1 = yes; 0 = no. Flextime programs include a variety of circumstances in which employees are permitted to vary their work-start times.

4. Model results

Table 2 summarizes five model specifications. All models use the free parking dummy variable and/or the daily parking cost. They also include standard factors known to influence mode choice (e.g., travel time, non-parking running cost, income), as well as dummy variables representing other employer transportation policies.

Model 1 uses the free-parking dummy variable to examine the mode choice effect of parking subsidies. It produces the expected positive coefficient (1.4) on the free-parking dummy variable, and a high level of significance (t score of 6.9). The positive coefficient indicates that free parking significantly increases the probability of *solo driving*. The t tests for all variables except auto travel time are significant at a 95 percent confidence interval. The likelihood ratio index is 0.27, indicating a 27 percent improvement in the log likelihood over that when the coefficients are set at zero.

Model 1 was tested with alternative definitions of the free-parking dummy variable. When the free-parking dummy variable applied to both solo driver and carpool modes (instead of just the solo driver mode), the coefficient was slightly less significant and the likelihood ratio index was smaller. When separate free-parking dummy variables were created for the solo driver and carpool modes, the solo driver dummy was slightly more significant than Model 1, but the carpool dummy variable was not significant at a 95 percent confidence interval.

Table 2 also shows marginal values of time for each specification. They are based on the travel time and running cost coefficients (running cost is used because it appears in all models). The estimates for automobile commuting, which are lower than those usually found, may be inaccurate because the coefficient on automobile travel time is imprecisely estimated by the models.

Model 2 uses daily parking cost instead of the free parking dummy variable. The model produces a significant negative coefficient on the daily parking cost variable, indicating that as parking cost increases, the probability of using the *automobile mode* (solo driving and carpooling) decreases. As described previously, the daily parking price is assumed to be equally divided among carpool members, using an average carpool size of 2.92. The overall explanatory power of Model 2 is similar to Model 1.

Likelihood-ratio test statistics were computed for Model 2 to test the treatment of travel cost and travel time. The likelihood ratio test statistic for

Table 2
Estimated multinomial logit models of commuter mode choice (Mode 1 – Auto (solo driver); Mode 2 – Carpool; Mode 3 – (Transit).[a]

Independent variable (applicable mode in parenthesis)	Model 1	Model 2	Model 3	Model 4	Model 5
Free parking dummy (1)	1.45 (6.9)			1.48 (1.9)	
Daily parking cost, in cents (1–2)		−0.0029 (−6.7)		0.000070 (0.044)	−0.0029 (−5.9)
Daily parking cost/daily household income, both in cents (1–2)			−20.8 (−5.4)		
Daily running cost, in cents (1–3)	−0.0064 (−5.6)	−0.0062 (−5.5)		−0.0064 (−5.6)	−0.0061 (−5.1)
Daily running cost/daily household income, both in cents (1–3)			−38.7 (−3.7)		
Round-trip auto travel time, in minutes (1–2)	−0.0037 (−0.75)	−0.0042 (−0.87)	−0.0090 (−1.9)	−0.0037 (−0.75)	−0.0070 (−1.4)
Round-trip transit travel time, in minutes (3)	−0.029 (−5.9)	−0.029 (−5.9)	−0.025 (−5.4)	−0.029 (−5.8)	−0.026 (−4.7)
Annual pre-tax household income, in dollars (1)	0.000019 (5.1)	0.000020 (5.4)	0.0000061 (1.7)	0.000019 (5.0)	0.000014 (3.7)
Vehicle availability for the work trip dummy (3)					−3.1 (−10.8)
Employee occupation dummy (1)	0.62 (3.2)	0.58 (3.0)	0.39 (2.1)	0.62 (3.1)	0.51 (2.5)
Employer rideshare program dummy (2)	0.88 (3.8)	0.73 (3.2)	0.74 (3.3)	0.88 (3.6)	0.71 (3.1)
Flextime program dummy (2)	−1.1 (−4.9)	−0.87 (−4.0)	−0.73 (−3.4)	−1.1 (−4.4)	−0.91 (−4.1)
Auto constant dummy (1)	−3.2 (−6.2)	−1.7 (−3.8)	−0.78 (−1.9)	−3.2 (−3.6)	−3.3 (−6.0)
Carpool constant	−3.3 (−5.9)	−3.2 (−5.7)	−2.4 (−4.6)	−3.3 (−5.9)	−4.9 (−7.6)
Likelihood ratio index	0.27	0.27	0.25	0.27	0.36
Log likelihood at zero	−783.3	−783.3	−783.3	−783.3	−783.3
Log likelihood at convergence	−570.3	−572.2	−585.6	−570.3	−502.7
Marginal value of time for drivers[b]	$0.35	$0.41	$2.25[c]	$0.35	$0.69
Marginal value of time for transit[b]	$2.72	$2.81	$6.26[c]	$2.72	$2.56

[a] t score reported immediately beneath coefficient.
[b] In $ per hour, based on the coefficients of travel time and daily running costs.
[c] Using mean household income of $42,000 per year, converted to cents per day (260 days/year).

separate treatment of parking and running cost variables is 7.8. The likelihood-ratio test statistic for mode-specific treatment of travel time is 24.4. Both test statistics exceed the critical value of the chi-square distribution (1 degree of freedom) by a large margin, justifying the separate treatment of travel costs and travel time.

Model 3 divides parking and running costs by daily household income, under the hypothesis that sensitivity to travel cost declines as income increases. This specification does not perform as well as Model 2. The parking cost variable is less significant than Model 2 (−5.4 versus −6.7), and the log likelihood is larger (−585.6 versus −572.2). The household-income variable is no longer significant at a 95 percent confidence interval. This result does not offer support for the hypothesis that responsiveness to money travel cost varies inversely with income.

Model 4 uses both the free-parking dummy variable and the daily parking cost. This specification is tested to explore the hypothesis of a non-linear effect of parking price on mode choice, where commuters' responsiveness to receiving a subsidy differs from their responsiveness to parking price. The free-parking dummy coefficient is similar to Model 1, but is not statistically significant at a 95 percent confidence interval. The daily-parking-cost coefficient is completely insignificant. Therefore, support was not found for this test of non-linearity in commuters' response to parking subsidies and parking prices. Additional modeling using individual-level parking-price data could further explore this question.

An alternative model specification examines the effect of including vehicle availability as an independent variable. This formulation estimates mode choice conditional on vehicle availability, and therefore represents a short-run response to a change in daily parking cost. Model 5 (on table 2) is identical to Model 2 except that the vehicle-availability variable has been included. Vehicle availability is highly significant in Model 5, and the likelihood ratio index is significantly larger than the other models. The value and significance of the parking coefficient are largely unchanged. The difficulty with this model stems from the influence that mode choice, the dependent variable, has on vehicle availability. A more extensive data set would permit the development of a structured logit model of auto ownership and mode choice, as described in Train (1980).

Models 1 and 2 are the best-fitting long-run response models, and are used for subsequent predictions. Model 2 has greater appeal than Model 1 because it fully uses parking price information and accounts for the parking charges faced by carpool commuters. It confirms the hypothesis that commuters respond to parking charges by reducing automobile commuting. Although previous studies have found that responsiveness to parking price declines as income increases, this study finds a linear relationship between parking price and mode choice.

Table 3
Multinomial logit model predictions.

Daily parking cost	Mode share			Cars per 100 employees	Elasticity of demand for solo driving[a]	Elasticity of demand for auto commuting[a,b]	Cross-elasticity of demand for transit[a]
	Solo	Carpool	Transit				
Model 1 – Free parking dummy							
Free parking	72%	13%	15%	76			
Pay to park	41%	28%	31%	51	−0.27	−0.20	0.35
Model 2 – Daily parking cost							
$0	70%	15%	15%	75			
$1	66%	16%	18%	71	−0.03	−0.03	0.09
$2	61%	18%	22%	67	−0.12	−0.10	0.26
$3	55%	19%	26%	62	−0.23	−0.18	0.41
$4	50%	20%	30%	57	−0.36	−0.29	0.52
$5	45%	21%	34%	52	−0.51	−0.42	0.61
$6	39%	22%	38%	47	−0.70	−0.56	0.68

[a]Midpoint of $1 interval price.
[b]Based on total number of cars driven by solo drivers and carpoolers.

5. Predictions

Models 1 and 2 are used to predict mode choice by substituting policy-generated values (i.e., values chosen to test the effect of a change in policy) for the free-parking dummy variable and the daily parking-cost variable. The behavioral change of those currently receiving free parking is of primary interest, so the predictions use commuters in the logit sample who park free (521 cases). Mode choice probabilities are calculated for each case, and those probabilities are averaged to arrive at a predicted mode split. The weights created by the survey consultant are used in averaging the predictions.

Table 3 shows mode-split predictions for the free parking/pay-to-park scenario and a range of daily parking costs. The mode shares are also converted to the number of cars driven to work per 100 employees in the manner described previously. Mid-point elasticities for $1 increments in the daily parking cost are calculated, as well as cross elasticities of demand for transit.

Model 1 predicts a solo share of 72 percent when parking is free, versus 41 percent when commuters pay to park. This 43 percent decrease in solo driving is comparable to the sensitivity identified in previous studies [Shoup and Pickrell (1980)] and close to the average 40 percent decrease found in the case studies reviewed by Willson and Shoup (1990). Said another way, the effect of *offering* subsidies *increases* solo driving by 76 percent. Converting mode shares to cars per 100 employees, Model 1 predicts a 34 percent decrease in cars driven to work when commuters have to pay to park.

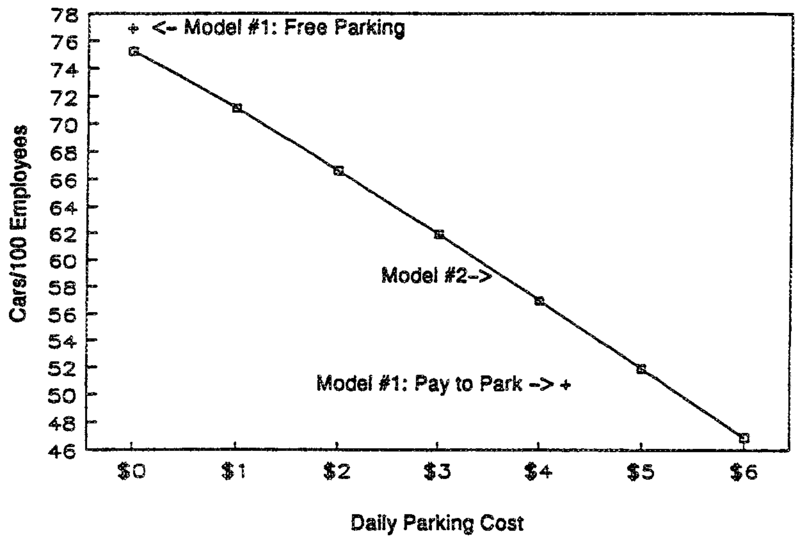

Fig. 1. Effect of parking cost on level of automobile commuting.

Model 2 predicts a smaller, but still substantial change in solo share: 70 percent at a zero price, and 49 percent at the average daily parking cost for the prediction sample ($4.15). The corresponding cars-per-100-employees measures are 75 at a zero price and 56 at $4.15, a 25 percent decrease. One reason Model 2 predicts a lower diversion from solo driving than Model 1 is that the free-parking dummy variable applies only to the solo driver mode, whereas the daily-parking cost applies to the solo driver and carpool modes. Therefore, Model 1 does not directly measure the effect of paying for parking on the carpool mode.

Fig. 1 graphically expresses the sensitivity of automobile commuting to daily parking cost using the cars-per-100-employees measure. The results show that those who park free would drive to work less often if they have to pay for their own parking. The magnitude of the change is large when compared to mode changes achieved by travel demand management programs that rely solely on incentives for carpooling and transit use.

Model 2 predicts that when commuters pay to park, transit ridership increases more than carpooling. Carpools still bear a parking cost, albeit divided among carpool members. However, another factor may be that cross-sectional data cannot adequately explain commuters' behavior if the decision-making environment being tested did not exist when the data set was collected. For example, under the current parking subsidy policy, most commuters have an incentive to drive alone, which reduces the size of the pool of potential carpool partners. If parking charges were common, a larger pool of potential carpoolers might exist, making it easier to find a compatible match, and thereby increasing the diversion to carpooling.

The models predict large increases in transit ridership when commuters pay to park, yielding cross-elasticities of transit demand of between 0.09 and 0.68. The strong sensitivity of transit ridership to parking subsidies is consistent with previous case studies of parking desubsidization in downtown Ottawa, Canada and Washington, DC. This is especially significant in downtown Los Angeles, because the rail transit system that is currently being constructed depends on high ridership for its economic viability.

To illustrate the parking-demand implications of parking subsidies, the predictions of cars per 100 employees are converted to predictions of parking spaces demanded per 1,000 square feet of office space. The conversion takes into account employee density, absenteeism, and parking occupancy factors, as noted earlier. The parking demand calculation that follows uses the Model 2 predictions. When parking is free, the mode share predictions translate to a parking demand of 2.5 spaces per 1,000 square feet. When those commuters pay average market prices ($4.15 per day), the mode share predictions translate to a parking demand of 1.9 spaces per 1,000 square feet.

The sensitivity of parking demand to the after-subsidy price of parking indicates that *parking requirements cannot be established without reference to employers' parking subsidy policies.* One would expect that employer parking subsidies would be a prominent issue in predicting parking demand and establishing parking requirements. Yet a recent guide to setting parking requirements [Weant and Levinson (1990)] fails to explicitly mention this factor.

6. Conclusion

This analysis shows that parking subsidies are an important determinant of commute mode choice. The best models presented here predict that in a large downtown area between 25 and 34 percent fewer cars would be driven to work if commuters had to pay to park, rather than park free. These powerful and widespread subsidies undermine public policies designed to increase ridesharing and transit use. Policy-makers and transportation modelers should recognize the significant role that employers' parking subsidies play in the travel choices.

Although the evidence assembled is quite compelling, some limitations exist because the data set does not provide as much information on commuters' parking choices as would be desirable. Better data on automobile ownership would permit the development of a structured model of auto ownership and mode choice. More extensive data would also facilitate the examination of commuters' tradeoffs between parking price and walking time. Finally, parking subsidies are not unique to the journey to work, so the effect of subsidies on other types of trips should be assessed.

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