

# Examining Shoppers' Stated Willingness to Pay for Parking at Suburban Malls

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**This research combines stated preference data with demographic, travel habit, and shopping behavior information to examine the willingness of suburban mall patrons to pay for surface parking. Bivariate correlations and multivariate regression models are used to identify the factors that predict the hourly parking fee breakpoint at which current drivers will change travel behavior and no longer drive to the mall. This research identifies household income, vehicle engine size, mall purchase amount, and the number of additional passengers in the car as positively correlated with the willingness to pay for parking. Age and grocery shopping are negatively correlated with a willingness to pay. Several parking policy options are presented, with particular concern for social equity impacts. This research broadens the research on parking policy to consider suburban venues and provides statistical information for municipalities and mall owners to craft effective and equitable parking policies.**

By definition, shopping centers provide on-site parking (1, 2). Abundant adjacent parking offers a level of convenience to consumers (3) that retailers, developers, and local authorities believe is critical to economic vitality (4). Such parking has typically been provided free at suburban malls. Even in the 1923 construction of the first suburban mall in North America, Country Club Plaza in Kansas City, Missouri, "free parking was not an afterthought; it was part of the original conception" (5).

Surface parking spaces, however, are a scarce commodity. Recently, some communities and suburban mall operators have begun to elicit the untapped value of surface parking (6). For example, in April 2006, Greater Vancouver, Canada, approved a tax on private, nonresidential parking spaces to fund regional transportation improvements (7), and, in June 2006, Brent Cross, perhaps England's most famous suburban shopping center, announced that it would institute a parking fee to deter nonshoppers from parking at the mall and to fund parking lot improvements (8).

This research statistically examines the stated willingness of shoppers to pay for surface parking at the four major suburban shopping centers in Prague, Czech Republic.

## LITERATURE REVIEW

Parking policy is a potent means to influence transportation behavior. Economic theory holds that parking fees raise the general costs of

automobile use and induce adaptive travel behaviors, such as switching to public transit modes. Parking studies typically use stated preference surveys to evaluate hypothetical parking policies for central business districts (CBDs). Such studies include those by Axhausen and Polak (9) of Karlsruhe, Germany, and of Birmingham, Sutton, and Coventry, United Kingdom; by Calthrop et al. (10) of Brussels, Belgium; by Shiftan and Burd-Eden (11) of Haifa, Israel; by Hensher and King (12) of Sydney, Australia; by Tsamboulas (13) of Athens; and by Shiftan and Golani (14) of Tel Aviv, Israel. To the best of the authors' knowledge, there have been no ex post facto validations of stated preference surveys of parking policy. The current study expands the focus of this research from downtown areas to consider the impact of parking restraints in suburban areas.

This study also emphasizes the factors that cause mode changes away from driving for shopping trip purposes. Axhausen and Polak (9) found the price elasticities of parking fees to be  $-0.141$ ,  $-0.663$ ,  $-0.384$ , and  $-0.218$  for shopping trips in Karlsruhe, Birmingham, Sutton, and Coventry, respectively. Hensher and King (12) found that shoppers were willing to park elsewhere in the CBD in response to parking restraints, but they were not willing to shift to the fringe of the CBD or to other modes. Shiftan and Burd-Eden (11) found that the propensity to change mode in response to parking restrictions for nonwork trips was positively related to household size, parking search time, and parking cost and negatively related to income and activity duration. Tsamboulas (13) found that among those who paid for parking hourly, and were therefore less likely to be commuters, this mode shift propensity was positively related to parking duration and the frequency of trips and negatively related to travel distance and engine size.

## METHODOLOGY

This research examines stated preference data on the willingness of current drivers to pay for surface parking at the four major suburban malls in Prague. Although there is a potential for bias with stated preference surveys, they do provide useful insights into predicting the likely behavioral responses to possible changes in policy. Descriptive statistics, bivariate correlations, and multivariate regression models were used to analyze the factors that affect the stated hourly parking fee at which suburban mall shoppers will shift their travel behavior away from driving.

Prague was chosen for this analysis for several reasons. First, it is at the leading edge of the trend in suburban shopping center development that has been sweeping central and eastern Europe. Lessons learned here are thus immediately relevant for shaping future retail land use development in the region. Second, because shopping centers are a very recent addition to the Prague landscape, with the first suburban shopping mall opening in 1997, it is believed that the associated travel behaviors are continuing to adapt and

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therefore are rather open to alternatives. Third, because Prague couples a high motorization rate with ample provision of public transit, there is a greater expected range of potential alternative travel behaviors. Finally, because Prague maintains a tradition of metropolitan planning, there is a greater likelihood of future regional policy coordination with regard to shopping mall development and parking policy.

### Survey

In fall 2001, once malls had become established, professional surveyors intercepted mall patrons during Thursday and Saturday peak shopping hours to request information on demographic characteristics, travel behaviors, and shopping activities (15). Those respondents who reported accessing the mall by automobile were asked an additional set of questions, including the hourly parking price that would cause them to change modes or not make the trip.

### Study Site

The shopping centers chosen for this survey are located at each of the four compass points on the Prague perimeter, as indicated in Figure 1, and are referred to here by those cardinal directions. All the malls are located at or near the intersection of a radial highway with the ring road that is being constructed in sections around the city. The East Mall and the West Mall are located at the ends of a subway line, and the North Mall is well served by the existing bus system and is the site of a

planned subway extension. The South Mall is located outside the municipal boundaries and has limited bus service.

The anchor store for each center is a hypermarket—a type of store, pioneered in Western Europe, that combines a supermarket with a discount retailer. For a store to qualify as a hypermarket, more than half the merchandise for sale must be nonfood items. The popularity of hypermarket shopping among residents of Prague has risen dramatically over the last several years (16).

The East Mall and the North Mall are traditional mall designs, in which the hypermarket is linked by a covered, climate-controlled gallery to a series of small specialty shops. The East Mall has an adjacent entertainment complex and the North Mall has adjacent sports facilities. The West Mall is a plaza design without a climate-controlled gallery. Here, the hypermarket is joined by an IKEA store and a major discount electronics and appliance firm as the major anchors. The South Mall is a series of big-box retailers located in adjacent parking lots. One of the three boxes surveyed is a small climate-controlled mall composed entirely of specialty retailers without any major anchor; another is a Makro, which specializes in bulk merchandising; and the last one is a large hypermarket within whose structure are several additional concessionaires.

### Study Sample

The current study is limited to those respondents who came to the mall for shopping purposes by private vehicle modes and stated a parking fee at which they would change mode away from driving. Of the 1,001 shoppers who reported driving to the mall, 38.9% did

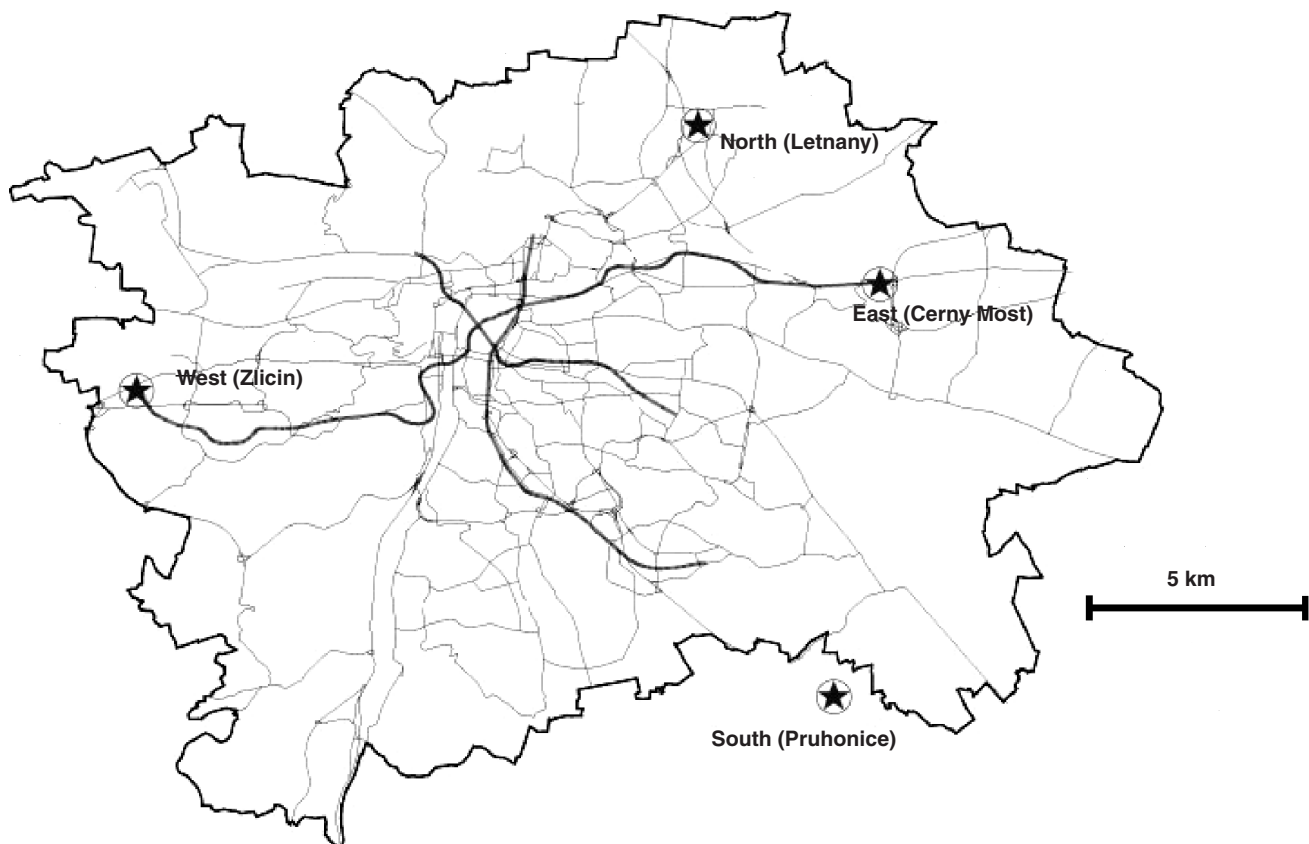


FIGURE 1 Map of Prague malls.

not answer the additional car-related questions. These cases were removed from the sample because of a lack of information. Of those who answered the car-related questions, 10.3% reported they would change travel behavior at an hourly parking fee of 0 Czech koruna (CZK). These cases were also removed from the study sample because of potential uncertainty about the intended meaning of this response. Another 0.6% reported they would change travel behavior at an hourly parking fee of 300 CZK or more. These cases were also removed from the study sample because of the likelihood of their being outliers—in fall 2001, 100 CZK was roughly equal to U.S.\$2.70. This paring of the full survey data set left a study sample of 498 cases.

## DESCRIPTIVE STATISTICS

### Demographic Characteristics

Table 1 presents the descriptive statistics on the study sample’s demographic characteristics. These traits include gender, household income, age, household size, and number of cars in the household.

The sample is divided evenly between men and women. The economic status of respondents skews slightly above average. The mean age is 38.3 years, the mean household size is 3.57 persons, and the mean number of cars per household is 1.37. These traits are consistent with expectations that a survey of people who drove to the mall is likely to emphasize wealthier, larger households in their prime earning and family rearing years.

### Travel Behavior Characteristics

Table 2 presents the descriptive statistics on the study sample’s travel behavior characteristics. These characteristics refer to the elements of the mall access and egress trips and include the day of the week, external trip chaining (i.e., if the mall trip is linked to other

trips), whether transit provides an alternative to driving, whether the mall trip origin began in Prague, drive time to the mall, monthly mall trip frequency, number of accompanying passengers in the car, vehicle engine size, and vehicle age.

The vast majority of all mall trips were primary (i.e., unlinked) trips and did not constitute external trip chains (17). Most trips originated from within the city of Prague, but a substantial minority came from elsewhere. The variations in access times and monthly trip frequencies accord with expectations derived from central place theory, which postulates an inverse relationship between travel time and trip frequency (18). Patrons at the durable-good-oriented West Mall reported the longest travel times, smallest trip frequencies, and highest car occupancies, whereas patrons at the small-good-and-grocery-oriented North Mall reported the opposite travel characteristics.

Engine size and vehicle age information provides insight into the ecological impacts of shopping travel to suburban malls. Engine size reflects the fuel necessary to power the vehicle and is an effective proxy for gauging related fuel consumption and greenhouse gas emissions. Mall patrons reported a mean engine volume of roughly 1,600 cm<sup>3</sup>, which, by North American standards, is rather compact. Vehicle age is also a proxy for criteria pollutants as the efficiency of catalytic converters degrades with age. Because catalytic converters became required in the Czech Republic in the 1994 model year, vehicle age is also a useful indicator of which cars have emission controls. Mall shoppers reported a mean vehicle age of 6.1 years, which in fall 2001 corresponds to the 1995 automobile model year.

### Shopping Behavior Characteristics

Table 3 presents the descriptive statistics on the study sample’s shopping behavior characteristics. These characteristics refer to the activities of the patrons at the mall and include primary shopping purpose (i.e., grocery or other purchases), internal trip chaining, whether

TABLE 1 Demographic Characteristics

Dummy variable	Categories	All Malls Combined		West Mall (Zlicin)		East Mall (Cerny Most)		North Mall (Letnany)		South Mall (Pruhonice)		
		%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	
Gender	Male (0)	50.1	248	48.7	76	50.8	32	71.6	53	43.1	87	
	Female (1)	49.9	247	51.3	80	49.2	31	28.4	21	56.9	115	
Ordinal variable	Rankings											
	Income	Below average (1)	9.8	48	7.2	11	12.7	8	12.3	9	10.0	20
		Average (2)	74.6	365	79.1	121	73.0	46	72.6	53	72.5	145
Above average (3)		15.5	76	13.7	21	14.3	9	15.1	11	17.5	35	
		Mean	<i>n</i>	Mean	<i>n</i>	Mean	<i>n</i>	Mean	<i>n</i>	Mean	<i>n</i>	
Interval variable	Measure											
	Age	Years	38.3	486	36.63	152	38.13	62	41.07	74	38.64	198
		Household size	Persons	3.57	497	3.57	156	3.76	63	3.58	74	3.50
Car ownership			Cars	1.37	487	1.43	156	1.36	61	1.47	73	1.28

NOTE: Numbers provided in parentheses refer to the nominal or ordinal coding of the variable in the statistical models. All percentages are column percentages.

TABLE 2 Travel Behavior Characteristics

Dummy variable	Categories	All Malls Combined		West Mall (Zlicin)		East Mall (Cerny Most)		North Mall (Letnany)		South Mall (Pruhonice)	
		%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
Day of week	Thursday (0)	56.8	283	37.2	58	100.0	63	94.6	70	44.9	92
	Saturday (1)	43.2	215	62.8	98	—	—	5.4	4	55.1	113
External trip chain	Primary trip (0)	83.1	403	83.2	129	80.7	46	86.5	64	82.4	164
	Linked trip (1)	16.9	82	16.8	26	19.3	11	13.5	10	17.6	35
Is transit an option?	No/don't know (0)	50.5	251	36.5	57	25.4	16	39.2	29	73.0	149
	Yes (1)	49.5	246	63.5	99	74.6	47	60.8	45	27.0	55
Trip origin in Prague	No (0)	37.3	186	44.9	70	36.5	23	36.5	27	32.2	66
	Yes (1)	62.7	312	55.1	86	63.5	40	63.5	47	67.8	139
Ordinal variable	Rankings										
Access time (in min)	0 to 15 (1)	33.7	167	28.8	45	51.6	32	47.3	35	27.0	55
	15 to 30 (2)	37.3	185	32.7	51	27.4	17	33.8	25	45.1	92
	30 to 45 (3)	15.1	75	15.4	24	11.3	7	13.5	10	16.7	34
	More than 45 (4)	13.9	69	23.1	36	9.7	6	5.4	4	11.3	23
		Mean	<i>n</i>	Mean	<i>n</i>	Mean	<i>n</i>	Mean	<i>n</i>	Mean	<i>n</i>
Interval variable	Measure										
Trip frequency	Trips per month	2.55	498	1.8	156	3.3	63	4.0	74	2.4	205
Passengers in car	Persons	1.37	433	1.7	155	—	—	1.1	74	1.2	204
Car engine size	Cubic centimeters	1,591	473	1,632	153	1,542	59	1,623	74	1,559	187
Vehicle age	Years	6.10	482	6.17	154	6.43	61	6.33	73	5.85	194

NOTE: Numbers provided in parentheses refer to the nominal or ordinal coding of the variable in the statistical models. All percentages are column percentages.

a car was needed to transport purchases, mall purchase amount, and mall activity duration.

Shopping behaviors reflect the nature of the different malls. The West Mall reported the lowest rate of grocery shopping (44.0%) and the North Mall reported the highest (86.5%), a fact reflected in the center's high rate of single-purpose trips (67.6%).

By contrast, the more distant South Mall reported the highest rate of multipurpose sojourns (68.8%). This research follows an earlier precedent (17) in referring to the latter trips as internal trip chains. Most patrons did not report requiring a car to transport their purchases and spent more than 1,000 CZK and more than 1 h at the mall.

TABLE 3 Shopping Behavior Characteristics

Dummy variable	Categories	All Malls Combined		West Mall (Zlicin)		East Mall (Cerny Most)		North Mall (Letnany)		South Mall (Pruhonice)	
		%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
Primary shopping purpose	Other shopping (0)	32.2	158	56.0	84	29.0	18	13.5	10	22.4	46
	Groceries (1)	67.8	333	44.0	66	71.0	44	86.5	64	77.6	159
Internal trip chaining	Single purpose (0)	46.0	229	49.4	77	60.3	38	67.6	50	31.2	64
	Multipurpose (1)	54.0	269	50.6	79	39.7	25	32.4	24	68.8	141
Need car for purchases	No (0)	67.6	336	66.0	103	9.5	6	55.4	41	91.2	186
	Yes (1)	32.4	161	34.0	53	90.5	57	44.6	33	8.8	18
Purchase amount dummy	<1,000 CKR (0)	30.2	150	31.2	48	42.9	27	60.8	45	14.6	30
	1,000+ CKR (1)	69.8	346	68.8	106	57.1	36	39.2	29	85.4	175
Ordinal variable	Rankings										
Mall stay (h)	0 to 1 (1)	38.0	189	29.5	46	46.0	29	60.8	45	33.8	69
	1 to 1.5 (2)	24.1	120	19.2	30	27.0	17	24.3	18	27.0	55
	1.5 to 2 (3)	18.5	92	25.0	39	11.1	7	5.4	4	20.6	42
	2+ (4)	19.3	96	26.3	41	15.9	10	9.5	7	18.6	38

NOTE: Numbers provided in parentheses refer to the nominal or ordinal coding of the variable in the statistical models. All percentages are column percentages.

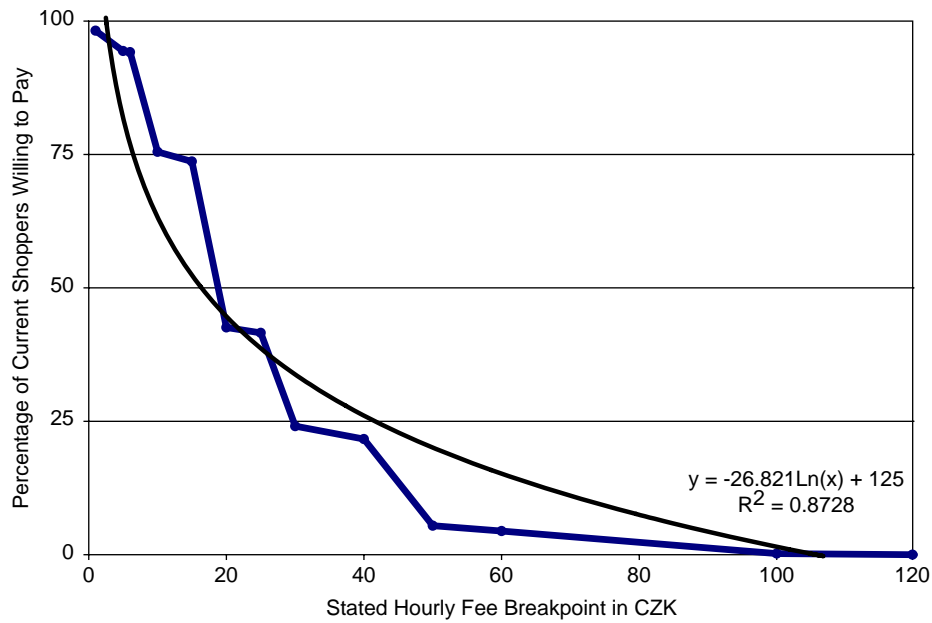


FIGURE 2 Cumulative demand curve and estimated trendline.

**Stated Hourly Parking Fee Data**

This study refers to the stated hourly parking fee that would trigger a mode change away from driving to the mall as the parking breakpoint. Figure 2 presents the cumulative demand function of these breakpoint values for the full (i.e., all malls combined) study sample as well as an estimated logarithmic trendline. Table 4 presents comparative information for the full and disaggregated (i.e., mall specific) study samples. The aggregate sample mean and median breakpoint are 28.2 and 20 CZK, respectively, although responses range from 1 to 120 CZK, with a standard deviation of 21.15 CZK.

**ANALYSIS 1. BIVARIATE CORRELATIONS**

The Pearson test of bivariate correlation was conducted for each of the explanatory variables and the stated breakpoint price.

**Demographic Characteristics**

It was hypothesized that income, household size, and car ownership would be positively related to the willingness to pay for parking because of a greater ability to pay and a more urgent need to shop for a large household. Age was assumed to be negatively related to parking fee breakpoint because of the reduced financial and increased time budgets of older people, which would discourage paying for parking and encourage shifting to transit modes. There was no clear consensus on whether gender would be related to willingness to pay.

Table 5 indicates that for the entire study sample only income and age demonstrated significant correlations with the willingness to pay for parking. Income was positively related and age was negatively related, as hypothesized. For the disaggregated sample, the parking breakpoint was significantly related to either income or age, but not both. The East Mall and the North Mall showed strong nega-

tive correlations with age, which most likely reflects their location, surrounded by high-density residences with strong transit access. There, older people appear to be more willing to change mode away from driving. The West Mall and the South Mall show moderate positive correlations with income, which most likely reflects their role as purely comparison shopping locales (19) that are isolated from surrounding residences. In the absence of a convenience shopping element, income becomes a more significant factor in determining the parking trigger price.

**Travel Behavior Characteristics**

It was hypothesized that shoppers would pay more for parking on Thursday evenings, when the mall stop was part of an external trip chain, and if the access time were longer because of time pressures on the shopping activity. Shoppers would also pay more if there were a number of other people in the car because of the convenience value and the higher alternative cost of other access modes. Willingness to pay for parking was also assumed to be positively related to engine size because this measure is an indicator of both wealth and the willingness to expend resources on driving. The willingness to pay for parking was thought to be negatively related to trip frequency because of the ability to cluster trips if the costs of a single trip went up, to the existence of a transit option that would provide an alternative mode to driving, and to the age of the vehicle because this measure is an indicator of both lower economic status and a reduced willingness to spend money on driving.

Table 5 indicates that for the entire study sample only the number of passengers in the car and the vehicle engine size demonstrated significant correlations with the willingness to pay for parking. Both were positively related to the willingness to pay for parking at the mall, as expected. Among the disaggregated data, the West Mall reflected the same findings as the overall sample and the North Mall and the South Mall shared the significant positive relation to vehi-



TABLE 4 Stated Hourly Parking Fee Data

Feature	Measure	All Malls Combined	West Mall (Zlicin)	East Mall (Cerny Most)	North Mall (Letnany)	South Mall (Pruhonice)
Sample cases	<i>N</i>	498	156	63	74	205
Central tendency <sup>a</sup>	Mean	28.2	30.2	32.9	22.7	27.3
	Median	20	20	20	20	20
	Mode	20	10	20	10	20
Dispersion <sup>a</sup>	SD	21.15	24.25	22.70	21.70	17.23
	Variance	447.52	588.05	515.09	470.91	296.93
	Min.	1	1	5	1	1
	Max.	120	100	100	100	120
Distribution	Skewness	1.803	1.412	1.613	2.023	2.442
	Kurtosis	3.831	1.915	2.645	4.569	8.363
Percentile <sup>a</sup>	5th	5	5	10	4	10
	10th	10	10	10	5	10
	15th	10	10	13	5	15
	20th	10	10	20	10	20
	25th	15	10	20	10	20
	30th	20	10	20	10	20
	35th	20	20	20	10	20
	40th	20	20	20	10	20
	45th	20	20	20	10	20
	50th	20	20	20	20	20
	55th	20	30	30	20	20
	60th	30	30	30	20	25
	65th	30	30	30	20	30
	70th	30	40	48	20	30
	75th	30	50	50	30	30
	80th	50	50	50	40	30
85th	50	50	50	50	50	
90th	50	50	50	50	50	
95th	60	100	100	63	50	

<sup>a</sup>Values are in CZK.

cle engine size. The East Mall showed no significant relationships to engine size and did not record the number of passengers in the car, but it did show the expected negative relationship to vehicle age. The South Mall also demonstrated a second positive relationship with mall access time and a negative relationship with the availability of transit, both as hypothesized. These additional relationships may reflect the mall's location farther from the core of Prague and with limited transit offerings. The driving costs to this mall would be larger, making the time there more valuable and the small number of people who are aware of the limited transit alternatives at the mall are likely to be transit users and willing to shift mode.

### Shopping Behavior Characteristics

It was hypothesized that shoppers who planned to spend more time or money at the mall or who were making an internal trip chain would be more likely to pay for parking as they were demonstrating a higher investment in their mall experience. Shoppers who needed a car to transport their purchases were also assumed to be willing to pay more for parking to enjoy the hauling benefit of their vehicle. It was not clear if grocery shopping would encourage paying for parking because a car would improve efficiency and convenience or if grocery shoppers would find such fees too onerous for regular household maintenance trips and shift to purchasing at local markets.

Table 5 indicates that, for the entire study sample, only primary shopping purpose (i.e., groceries or other purchases) and the mall

activity duration demonstrated significant correlations with the willingness to pay for parking. Mall activity duration is positively correlated with a willingness to pay for parking as expected. Grocery shopping is shown to be negatively correlated with a willingness to pay for parking, which suggests the potential for accessing alternatives without paying for parking is favored over the convenience of shopping at a hypermarket.

These correlations were not similarly revealed in the disaggregated data. The West Mall showed a similar negative correlation with grocery shopping, but no other location showed any statistically significant relationship with mall activity duration. No relationships between shopping behavior and the willingness to pay for parking were shown to be significant at the North Mall. The East Mall, contrary to expectation, demonstrated a negative relation to internal trip chaining in the shopping center. This finding may be interpreted to mean that multi-purpose trips to the mall reflect not the highly directed activities of the wealthy or time pressed, but rather the leisurely wanderings of those who use the shopping center as a source of diversion and are unwilling to pay a premium to park. The East Mall had recently opened an adjacent entertainment complex at the time of this survey and this finding may represent that new use of the mall. Finally, and also contrary to expectation, shoppers at the South Mall demonstrated a negative correlation between needing a car for their purchases and their willingness to pay for parking. This finding could be interpreted to suggest that the people who believe they must drive to transport their goods are the least willing to pay for parking and would rather drive elsewhere.

TABLE 5 Pearson Correlations with Hourly Parking Fee Breakpoint

Variable	All Malls Combined			West Mall (Zlicim)			East Mall (Cerny Most)			North Mall (Letmany)			South Mall (Pruhonice)		
	$\rho$	$p$	$n$	$\rho$	$p$	$n$	$\rho$	$p$	$n$	$\rho$	$p$	$n$	$\rho$	$p$	$n$
<b>Demographic</b>															
Gender	-0.029	0.520	495	0.011	0.890	156	-0.167	0.190	63	-0.045	0.701	74	-0.055	0.441	202
Income	<b>0.117</b>	<b>0.001</b>	<b>486</b>	<b>0.167</b>	<b>0.039</b>	<b>153</b>	0.037	0.774	63	0.006	0.957	73	<b>0.165</b>	<b>0.020</b>	<b>200</b>
Age	<b>-0.146</b>	<b>0.001</b>	<b>486</b>	-0.049	0.552	152	<b>-0.227</b>	<b>0.076</b>	<b>62</b>	<b>-0.322</b>	<b>0.005</b>	<b>74</b>	-0.092	0.197	198
Household size	0.004	0.921	497	-0.033	0.687	156	0.032	0.806	63	0.135	0.250	74	-0.040	0.567	204
Car ownership	0.060	0.183	487	0.068	0.402	156	0.174	0.180	61	0.044	0.714	73	0.029	0.684	197
Gender	-0.029	0.520	495	0.011	0.890	156	-0.167	0.190	63	-0.045	0.701	74	-0.055	0.441	202
<b>Travel behavior</b>															
Day of week	0.028	0.533	498	0.037	0.649	156	—	—	63	0.011	0.925	74	0.005	0.938	205
External trip chain	-0.029	0.523	485	-0.097	0.228	155	-0.180	0.181	57	0.007	0.956	74	0.072	0.315	199
Is transit an option?	-0.056	0.211	497	-0.113	0.160	156	0.042	0.746	63	-0.060	0.614	74	<b>-0.116</b>	<b>0.100</b>	<b>204</b>
Trip origin in Prague	-0.039	0.390	498	0.002	0.980	156	-0.101	0.429	63	-0.016	0.895	74	-0.051	0.464	205
Access time	0.069	0.123	496	-0.021	0.791	156	0.056	0.665	62	0.043	0.719	74	<b>0.178</b>	<b>0.011</b>	<b>204</b>
Mall trip frequency	-0.043	0.334	498	-0.121	0.133	156	-0.149	0.243	63	0.151	0.198	74	0.052	0.457	205
Passengers in car	<b>0.126</b>	<b>0.008</b>	<b>433</b>	<b>0.159</b>	<b>0.049</b>	<b>155</b>	—	—	—	-0.001	0.995	74	0.092	0.190	204
Engine size	<b>0.180</b>	<b>0.000</b>	<b>473</b>	<b>0.194</b>	<b>0.016</b>	<b>153</b>	0.113	0.393	59	<b>0.247</b>	<b>0.034</b>	74	<b>0.162</b>	<b>0.027</b>	<b>187</b>
Vehicle age	-0.044	0.341	482	-0.085	0.292	154	<b>-0.218</b>	<b>0.091</b>	<b>61</b>	0.056	0.635	73	0.016	0.829	205
<b>Shopping behavior</b>															
Primarily grocery trip	<b>-0.103</b>	<b>0.022</b>	<b>491</b>	<b>-0.221</b>	<b>0.007</b>	<b>150</b>	-0.058	0.653	62	0.041	0.728	74	0.047	0.505	205
Internal trip chaining	-0.032	0.471	498	-0.077	0.341	156	<b>-0.261</b>	<b>0.038</b>	<b>63</b>	0.119	0.311	74	0.037	0.596	205
Purchases require car	-0.007	0.873	497	-0.068	0.397	156	0.149	0.243	63	-0.025	0.835	74	<b>-0.123</b>	<b>0.079</b>	<b>204</b>
Mall purchase dummy	0.072	0.109	496	0.022	0.791	154	-0.004	0.975	63	0.182	0.121	74	0.091	0.194	205
Mall activity duration	<b>0.079</b>	<b>0.077</b>	<b>497</b>	0.078	0.331	156	-0.048	0.710	63	0.061	0.604	74	0.089	0.206	204

NOTE: Correlations significant at the 90% confidence interval are denoted by boldface.  $\rho$  = measure of correlation;  $p$  = measure of significance; and  $n$  = number of cases.

## ANALYSIS 2. LINEAR REGRESSION MODELS

Multivariate statistical models were made to analyze the aggregated survey data from all four malls as well as to analyze the disaggregated data from each mall independently. As indicated in Table 6, all the models are significant at the 99% confidence level, but the goodness-of-fit measures are low to moderate. The strength of these measures appears to be inversely related to the size of the sample.

### Aggregate Model

The aggregate model retains all the explanatory variables noted as significant in the correlation analysis except shopper age and mall activity duration. Grocery shopping and age appear to account for much of the same explanatory information because replacing one variable with the other in the model results in comparable predictive power and statistical significance, whereas incorporating both variables results in neither being a significant predictor. Of the two variables, the inclusion of grocery shopping over shopper age results in a better-fitting model. The explanatory power of mall activity duration is no longer significant in the presence of the other variables included in the model. In the absence of additional information, mall activity duration is a useful predictor but not in tandem with more specific data. The dummy variable for mall purchase amount, in contrast, gains unique explanatory power once other factors are accounted for and therefore enters the larger model. Finally, although not demonstrating statistically significant explanatory power, the dummy variable for the awareness of transit options improves the model's goodness of fit without degrading much from the significance of the remaining variables.

### Disaggregate Models

The model for the West Mall retained the same variables found to be significant in the correlation analysis. Here, the grocery shopping dummy garnered the most explanatory power as it distinguished food customers from those who were comparison shopping for the major durable goods.

The model for the East Mall demonstrated the strongest goodness of fit. It retained the variables identified in the bivariate analysis and added the need for a car to transport purchases as a positive factor, as initially hypothesized. The distinction between this finding and that noted previously at the South Mall may be due to shopping intention in that shoppers drive to the transit-accessible East Mall only if they need their car to transport goods and therefore are willing to pay to park. By contrast, everyone drives to the South Mall because there is little transit alternative and imposing a fee on those who believe they actually need their car is off-putting. External trip chaining also enters the model as a negative predictor. This finding appears to suggest that at the East Mall visitors link trips to save money and not merely time. Parking fees are therefore a deterrent instead of a trade-off. Finally, and perhaps most interesting, the model also adds gender as the most powerful explanatory factor. It appears that, in the model, once other factors are controlled for, gender stands out, showing that women are willing to pay less for parking.

The model for the North Mall retains the two variables of age and engine size noted in the correlation discussion and reveals internal trip chaining to offer significant predictive value. Interestingly, here, in contrast to the East Mall, internal trip chaining is a positive predictor of the willingness to pay for parking. It is possible that the patronage patterns of the North Mall are closer to those initially hypothesized,

which view multipurpose sojourns as a sign of valuing mall visits and thus being willing to pay to park. Last, as in the aggregate model, mall activity duration loses almost all unique predictive value when combined with other explanatory variables and is therefore dropped.

The model for the South Mall retains all the significantly correlated variables except awareness of transit as an option; however, income, although still included in the model, no longer is a statistically significant predictor of the willingness to pay for parking. Were the awareness of transit as an option to be retained, the overall goodness of model fit would be slightly improved, but in that case neither income nor awareness of transit as an option nor needing a car for purchases would be a statistically significant explanatory variable.

## CONCLUSIONS

This research examines the willingness to pay for surface parking at suburban shopping malls and the factors that contribute to variation in that willingness among individuals. The purpose of this research is to inform future policy to account for the costs of parking without deterring mall patronage. As such the results are quite useful for assisting both suburban shopping center owners and transportation planners with their considerations of parking policy. The findings are all significant and, although at a lower level of explanatory strength than expected, do suggest many useful policy recommendations for effective parking fee programs at suburban malls and beyond.

First, income is positively correlated with the willingness to pay for parking. Mall owners may choose to ignore equity considerations and apply undifferentiated parking fees because the people who have the most income and spend the most money at the mall are willing to pay for the privilege of parking. A more equitable and possibly more profitable policy might exploit the high correlation between engine size and willingness to pay to offer different tariff schedules based on the size of the car. This market segmentation approach sends better consumer price signals about the costs of driving in terms of the infrastructure required, the pollution emissions generated, and the energy consumed by larger vehicles.

Second, grocery shoppers are less willing to pay a parking fee than are shoppers of nonfood items. This distinction suggests that an effective parking policy might allow an initial grace period after which time the parking fee would commence. Such a policy, already practiced at many parking facilities, would enable time-conscious grocery shoppers to avoid the tariff, the burden of which would then fall on the comparison shoppers who are more willing to assume it.

Third, the willingness to pay is positively related to the number of passengers in the car. Mall owners may make greater efforts to market the family elements of a trip to a mall to encourage larger car occupancies and a greater willingness to pay for parking. The IKEA store at the West Mall, for example, offers an extensive play area for children as well as two family-friendly dining venues. Although these amenities are clearly aimed at bringing people into a specific store, they can benefit the mall as a whole.

Fourth, age is often negatively correlated with the willingness to pay for parking. Effective parking programs might provide senior citizen discounts or fee exemptions. This approach would shift the parking fee burden to the younger people with a greater willingness to pay for parking. An alternative approach may be for shopping centers and transit agencies to cooperate to promote public transportation alternatives for senior citizens. Through successful partnerships, malls could maintain their clientele and transit agencies could benefit from the system ridership, particularly as senior citizens tend to travel during the more valuable off-peak periods.



**TABLE 6 Multivariate Regression Models**

Variable	All Malls Combined			West Mall (Zlicin)			East Mall (Cerry Most)			North Mall (Letnany)			South Mall (Pruhonice)		
	$R^2$	$F$	$p$	$R^2$	$F$	$p$	$R^2$	$F$	$p$	$R^2$	$F$	$p$	$R^2$	$F$	$p$
Model score	0.094	6.796	0.000	0.120	4.708	0.001	0.409	5.537	0.000	0.210	6.199	0.001	0.097	4.764	0.001
	$\beta$	$t$	$p$	$\beta$	$t$	$p$	$\beta$	$t$	$p$	$\beta$	$t$	$p$	$\beta$	$t$	$p$
(Constant)	—	0.508	0.612	—	.037	0.970	—	-2.723	0.009	—	2.122	0.037	—	0.246	0.806
<b>Demographic</b>															
Income	0.091	1.828	0.068	0.169	2.078	0.040	-0.282	-2.478	0.017	-0.359	-3.346	0.001	0.106	1.422	0.157
Age							-0.435	-3.516	0.001						
Gender															
<b>Travel behavior</b>															
External trip chain							-0.313	-2.565	0.014						
Is transit an option?	-0.069	-1.387	0.166										0.215	2.998	0.003
Mall access time															
Passengers in car	0.112	2.225	0.027	0.138	1.671	0.097	—	—	—	0.284	2.654	0.010	0.126	1.704	0.090
Engine size	0.181	3.703	0.000	0.121	1.474	0.143									
Age of car							-0.324	2.770	0.008						
<b>Shopping behavior</b>															
Grocery trip	-0.088	-1.791	0.074	-0.175	-2.105	0.037									
Internal trip chaining							-0.283	-2.449	0.018	0.200	1.855	0.068			
Purchases require car							0.223	1.828	0.008				-0.124	-1.724	0.086
Mall purchase dummy	0.105	2.097	0.037												

$R^2$  = measure of goodness of model fit;  $F$  = statistic for testing model significance;  $p$  = that significance;  $\beta$  = weighted measure of predictive power; and  $t$  = score of the significance of the given predictor to the model.

Fifth, people report that they are willing to pay for parking even at suburban shopping malls. This finding dispels the long-held assumption that such parking needs to be free and demonstrates the potential for recapturing value that is currently lost to the market. This finding lends statistical support to policies, such as that in Vancouver, that seek to signal the social costs of parking more accurately by imposing a tax on nonresidential spaces.

Sixth, the findings suggest that the willingness-to-pay-for-parking demand curve, presented in Figure 2, is logarithmic with a price elasticity of demand that is inelastic for lower parking fees. Because the percentage change in the quantity of parking purchased is less than the percentage change in the parking fee levied, substantial parking revenues can be raised with little loss of patronage. Such revenues can be put to many related public and private uses, such as financing additional transit service and improving parking lot upkeep. A portion of these funds could also be allocated to compensate the former drivers who are unable to stay in the parking market. Such compensation could take several forms. One possibility that might appeal to a shopping center seeking to achieve a certain transit mode split, perhaps to avoid environmental impact fees, could be to reward patrons who come by transit with credits good for use in the mall. As transit operators increasingly switch to the use of smart cards, monitoring such movements will become increasingly simple.

Finally, this research affirms the need for planning to be tailored to local conditions. Even in the city of Prague, the explanatory factors for the willingness to pay for parking varied among the malls. There is much potential for future research to illuminate further the extent and nature of this variation.

## FUTURE RESEARCH

This study represents an early effort at measuring the willingness to pay for surface parking in suburban venues. As mall owners and municipalities seek to use parking policy as a means to manage traffic demand and raise revenues, much more work needs to be done. Integrated studies will be useful for linking parking policy directly to long-term planning objectives, such as reducing vehicle miles traveled or conforming to ambient air quality standards. Such work might be productively complemented by simulation studies that forecast the likely transportation, economic, and environmental impacts of future suburban parking policies.

These studies will need to increase the specificity of their inquiry from analysis of the parking fee breakpoint to predicting likely travel adaptations. Such thinking will need to be imported and incorporated into regional transportation demand models and metropolitan planning practice. Comparative and revealed preference work elsewhere will need to be pursued. Such efforts will refine the lessons gleaned from this study and test the validity of stated preference surveys for parking policy.

Research should be undertaken to assess the impact and, therefore, the role of parking policies among the suite of urban-planning strategies. Finally, it is critical that parking policies be increasingly explored in suburban settings to craft transportation demand management programs for a region and not just for the CBD.

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