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The University of Texas at El Paso

UTEP Border Region Modeling Project

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Downtown Parking Meter Demand in El Paso*

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Abstract
Prior research establishes that the price of parking in the city centre often impacts the decision to travel downtown and the mode of transportation utilized. Other factors that influence the decision to drive and park downtown have received less attention. This study uses time series data to analyse the demand for metered parking spaces in El Paso, Texas, USA. In addition to meter rates, the determinants of demand include personal income, gasoline prices, and the price of a substitute good, parking garage spaces. Because international bridges connect downtown El Paso to neighbouring Ciudad Juárez, Chihuahua, Mexico, the impacts of trans-boundary traffic flows, bridge tolls and other cross-border economic variables are also included as potential determinants of metered parking demand. Results indicate that parking meter rates, other transportation-related costs, and economic conditions in both countries affect meter use.

Keywords
Parking Meter Demand; Border Economics; Applied Econometrics

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F15, Economic Integration; M21, Business Economics; R41, Transportation Demand

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Introduction

The availability and cost of parking are important factors that help shape the trip-making decisions of consumers and commuters. The price of parking plays a major role in determining transportation choices – walk/bike, ride transit, carpool, drive alone. In addition to influencing modal choices, parking policies may also impact decisions regarding whether or not to travel downtown. Hu and Saleh (2005) show that costs associated with downtown parking can affect the willingness of shoppers to visit city centres. Furthermore, price differentials between parking garages and metered on-street parking spaces also influence drivers' behaviour by providing an incentive to cruise the downtown area in search of relatively cheap curb side parking spots. The latter behaviour, of course, contributes to traffic congestion (Arnott and Rowse, 2009).

This study analyses data on parking meter utilization for El Paso, Texas. Monthly parking meter data used for this analysis run from January 2001 to December 2012. Parking meters in El Paso have generated more than $14.3 million in revenue

since January 2001, averaging $99,406 per month. As in many other cities, parking meters in El Paso are concentrated in the central business district. Consumers consider meter rates in deciding whether to do business downtown or in suburban areas that typically have free parking. The connection between parking meter policies and the number of visits downtown is especially relevant to El Paso in light of recent efforts to attract more firms to the central business district (Mohl, 2013). Insight into the impacts of meter rates and other factors on parking demand may help inform downtown revitalization efforts in this city and others.

One feature of the El Paso central business district that must be taken into consideration in a study of this type is its proximity to an international border. Many businesses in El Paso serve customers from neighbouring Ciudad Juárez, Mexico (Fullerton, 2001; Coronado and Phillips, 2007). Because the greater downtown area includes many potential destinations for day visitors from Ciudad Juárez, economic conditions in Mexico and the costs of crossing the border likely affect parking meter utilization in that area. This study models downtown parking meter demand in El Paso taking into account potential border related effects on parking dynamics. The next section reviews the literature on parking and commuting behaviour. The following section provides details regarding the methodological approach employed to estimate a demand function for metered parking spaces. Subsequently, variables utilized in the analysis are defined and the data are described. Empirical results and policy implications are then presented, followed by a conclusion.

Literature Review

The literature regarding consumer and commuter reactions to parking rate increases dates back to at least 1977. Gillen (1977) uses binary logit analysis to examine modal switching in response to changes in parking costs in the Toronto central business district. Automobile trips are found to decline by 0.31% in response to a 1% increase in parking fees. Hensher and King (2001) examine the factors affecting modal choice for trips to the central business district of Sydney, Australia. The price of downtown parking is found to be among the most important of these factors. Estimates of the price sensitivity of parking demand generally range from inelastic to unitary elastic. In a study of San Francisco, Pierce and Shoup (2013) document that, on average, parking space occupancy drops by 0.40% when parking prices increase by 1%.

One strand of the transportation economics literature quantifies the extent to which employer-subsidized parking encourages commuters to drive alone to work. In an analysis of four case studies from Los Angeles and one from Ottawa, Canada, Willson and Shoup (1990) find that reducing or eliminating employer subsidies for parking provides commuters with an incentive to carpool or ride public transit rather than drive alone. The share of all commuters who drive alone declines from 66% when employers pay the cost of parking to 39% when the driver pays the cost. Willson (1992) provides further evidence that the price of parking affects commuting patterns. The estimated price elasticity of demand for solo-driving changes from -0.03 to -0.70 as the cost of parking increases from $0 to $6 per day.

In another study related to workplace parking subsidies, Miller and Everett (1982) document the consequences of increasing parking prices to about half the market rate ($10 to $32.50 per month) at federal government worksites in metropolitan Washington, DC. The share of employees commuting by automobile declined at 13 out of 15 worksites after the price increase. Shoup (1997) analyses the effects of a cashing-out program in which employees can choose between receiving free parking or receiving a cash payment equivalent to the value of parking. Solo-driver commuting decreased 17% after cashing-out programs went into effect for the eight firms under review. Car-pooling increased by 64% while the number of commuters using transit and the number that walk to work each increased by 50%.

Although higher parking prices may encourage some drivers to switch to different modes of transportation, others may simply elect to use cheaper parking sites located further from their destinations. In a study of the central business area of Athens, Greece, Tsamboulas (2001) analyses factors determining where drivers choose to park. The most significant determinants of location are the relative cost of parking at alternative sites and the relative walking time (to and from parking locations). Azari *et al*. (2013) examine the effects of charging a congestion fee for parking within a cordon zone that encompasses the central business district of Mashhad City, Iran. Results from a multinomial logit model indicate that if the cordon zone fee increases by 1% the demand for parking inside the cordon zone decreases by 1.145%, while demand for parking beyond the cordon area increases by 0.337%.

Some evidence suggests that the price sensitivity of parking demand depends, in part, on whether the trip is made for work-related reasons. Kelly and Clinch (2006) address this topic in a study of on-street parking behaviour in Dublin, Ireland. When the price of parking increases from £1.5 to £4 per hour, the probability of parking cessation is 20% lower for business users compared to non-business users. Consistent with these findings, Kelly and Clinch (2009) report that the price elasticity of parking demand is greater on Saturdays than on weekdays. In a study of trips to the central business district in Belgrade, Serbia, Simićević *et al*. (2012) report similar findings. For an increase in the cost of parking from an initial hourly maximum of RSD 35 to RSD 60, the parking price elasticities are -0.39 for work commutes to the central business area, -0.35 for other business-related trips downtown, -0.55 for recreational outings and -0.70 for shopping excursions.

As the preceding discussion illustrates, a large body of research has explored the relationship between parking prices and demand. In the study of parking space demand, it is also important to control for other explanatory factors in addition to parking prices. One of those additional factors is the price of gasoline (Hu and Saleh, 2005). Income is another key determinant of modal choice and parking decisions (Hensher and King, 2001; Azari *et al*., 2013). Further, various local and environmental factors affect parking choices (Hunt and Teply, 1993). For El Paso, an important local characteristic that may impact parking meter utilization is the cross-border flow of vehicle traffic into the downtown area. The next section presents the modelling framework used to estimate a parking space demand function for downtown El Paso. Several potential predictors of demand, representing economic conditions and the costs of driving and parking downtown, are considered for inclusion in the model.

Methodology

Economic theory suggests that, at a minimum, the demand for a good is affected by its price, the prices of substitute goods and income levels. The demand for metered parking spaces is likely to be affected not only by meter fees, but also by the charges associated with parking lots and garages. That is because those parking facilities typically serve as substitutes for metered curb side parking (Arnott and Rowse, 2009). The prices of metered and garage parking spaces influence whether downtown motorists choose on- or off-street parking options. Even before choosing where to park, consumers and commuters must decide whether to travel downtown by automobile at all. Fluctuations in El Paso area personal income are expected to impact the flow of vehicle traffic into the central business district, thus influencing the demand for parking (Azari *et al*., 2013). Costs associated with alternative modes of transportation, such as bus fares and gasoline prices, may also affect decisions regarding whether or not to drive downtown (Miller and Everett, 1982).

Economic conditions in Mexico and the costs associated with crossing the border are also likely to

affect the number of automobile trips to downtown El Paso and, consequently, the demand for parking in that area. That is because El Paso's central business district, which is located immediately adjacent to the international boundary, attracts a regular influx of cross-border shoppers and other visitors from Mexico. More than nine million northbound personal vehicle border crossings were recorded in 2012 (BTS, 2013). To control for the factors that influence Mexican motorists in deciding whether to visit El Paso's city centre, a set of cross-border variables is included in the demand equation.

A variety of factors impact the decision to drive across the international boundary to downtown El Paso. Employment levels in Ciudad Juárez and the real value of the peso have been shown to affect international bridge traffic (De Leon *et al*., 2009; Fullerton et al., 2013). Furthermore, Mexican drivers visiting El Paso may face additional travel costs beyond the standard expenditures on fuel and parking. These border-related travel costs include tolls for crossing the international bridges and the time costs imposed by bottlenecks at the ports of entry. Because time series data are not available for factors such as the intensity of security screening at ports of entry, the total number of personal vehicle border crossings into El Paso is included in the analysis to capture the effects of such factors on travel decisions. Variables that influence Mexican motorists' decisions regarding whether to cross the border into El Paso are also likely to exercise an indirect effect on parking demand.

In order to estimate demand for parking meter purchases in downtown El Paso, a linear transfer function is utilized. The implicit function is as follows:

$$MTR_t = \mathrm{f}(PR_{t-f}, SUB_{t-g}, GAS_{t-h}, INC_{t-i}, CEMP_{t-j}, XR_{t-k}, TOLL_{t-l}, XING_{t-m}) \quad (1)$$

where *MTR* represents parking meter purchases, *PR* is for the real parking meter fee, *SUB* is the real substitute price, *GAS* denotes the real price of gasoline, *INC* stands for real per capita personal income, *CEMP* is total formal-sector employment in the Mexican state of Chihuahua (which includes Ciudad Juárez), *XR* is the real peso/ dollar exchange rate, *TOLL* is the real average international bridge toll and *XING* represents personal vehicle border crossings. The subscripts represent temporal lags. In addition, both autoregressive (AR) and moving average (MA) parameters can be included in Equation 1 to account for systematic fluctuations in demand that are not explained by the right-hand-side variables (Pindyck and Rubinfeld, 1998). The independent variables are expected to have the marginal effects shown in Equation 2.

$$\frac{\partial MTR}{\partial PR} < 0,\ \frac{\partial MTR}{\partial GAS} < 0,\ \frac{\partial MTR}{\partial TOLL} < 0,\ \frac{\partial MTR}{\partial XR} < 0,$$

$$\frac{\partial MTR}{\partial SUB} > 0,\ \frac{\partial MTR}{\partial INC} > 0,\ \frac{\partial MTR}{\partial CEMP} > 0,\ \frac{\partial MTR}{\partial XING} > 0 \quad (2)$$

Parking meter purchases are expected to decline in response to increases in the real parking meter fee. Real gasoline prices and bridge tolls are secondary prices that drivers visiting central El Paso must incorporate into trip-making decisions. A rise in either of those prices is expected to reduce demand for automobile trips downtown, thereby curtailing parking meter purchases. Meter utilization is also expected to decrease in response to an increase in the real value of the dollar relative to the peso because that tends to deter Mexican shoppers from patronizing stores in El Paso. Higher parking garage fees are expected to induce additional demand for curb side parking spaces. Greater economic activity, whether locally or across the border, is likely to stimulate additional automobile trips to downtown El Paso and, thus, boost parking meter sales. Personal vehicle border crossings may have a positive partial effect on parking meter purchases if the other cross-border variables fail to capture all the factors that influence the decision to drive across the international boundary to downtown El Paso.

Data

In a departure from most prior parking meter studies, a fairly unique sample has been assembled for this effort and monthly-frequency time series data are employed in the empirical analysis. The sample period runs from January 2001 through December 2012. Parking meter purchase data for downtown El Paso are calculated by dividing monthly parking revenue by the nominal parking meter fee charged during that period. Data for monthly parking meter revenues and parking meter fees are from the City of El Paso International Bridges Department. The nominal parking meter fee divided by the Consumer Price Index (CPI) yields the real parking meter fee. The CPI is obtained from the Bureau of Labor Statistics (BLS, 2013).

Substitute parking price data are obtained using information from 15 parking lots and garages in downtown El Paso. The parking prices for the garages were provided by Diversified Parking of El Paso. Each garage has its own price schedule. Some garages have as many as five different prices depending on the length of time parked. For the sake of simplicity, the nominal substitute price is defined as the average price of parking at one of the 15 lots and garages for half an hour.

A composite gasoline price variable is developed by averaging El Paso and Ciudad Juárez gasoline prices. The El Paso gasoline price data are obtained from GasBuddy.com. Atkinson (2008) finds that such online data sources provide reliable information for approximating citywide average gasoline prices. The Ciudad Juárez data are from Mexico's national statistics agency (INEGI, 2013), and are converted into nominal dollars per gallon before averaging. The composite gasoline price is then converted into real terms using CPI. Real bus fares are estimated by dividing fare revenue over total ridership and CPI. Fare revenue data are from the City of El Paso Financial Services Department and ridership data are from the local mass transit agency, Sun Metro.

Per capita personal income for El Paso County is calculated by dividing personal income by population. Annual data for personal income and population are reported by the Bureau of Economic Analysis (BEA, 2013). Monthly personal income and population estimates are generated from annual data. In order to generate the monthly personal income observations, percentage growth of income, *r*, from one year to the next is calculated. The personal income value for 2001 is used for January 2001. Equation 3 is used to estimate monthly values.

$$INCOME_t = INCOME_{t-1} \times \left(1 + \frac{r}{100}\right)^{\frac{1}{12}} \quad (3)$$

The process is repeated through December 2012. Monthly population observations are derived using Equation 4,

$$POP_t = POP_0 \times e^{kt} \quad (4)$$

where POP_0 is the population for July of each year, *k* is the growth rate and *t* is the time period. Each annual population value becomes the July monthly value. The values of *t* begin at zero for July and increase by one as the month changes. The constant *k* is the natural logarithm of the ratio of population in year *t+1* and year *t* divided by 12. The process is repeated sequentially through December 2012.

Data on formal-sector employment in the state of Chihuahua are from the website of Mexico's national statistics agency (INEGI, 2013). The real exchange rate index is obtained from the University of Texas at El Paso Border Region Modeling Project. The real exchange rate index is calculated using Equation 5,

$$XR_t = XR_{t-1} \times (NX_t/NX_{t-1}) \times (USCPI_t/USCPI_{t-1}) / (MXCPI_t/MXCPI_{t-1}) \quad (5)$$

where *XR* is the real exchange rate index, *NX* is the nominal exchange rate, *USCPI* is the CPI of the United States, *MXCPI* is the CPI of Mexico and *t* is a time index. The nominal exchange rate and the CPI for Mexico are from the Federal Reserve Bank of St. Louis (FRB, 2013).

Toll data for northbound and southbound international bridge traffic are collected by the Border Region Modeling Project at the University of Texas at El Paso. The toll variable utilized in this analysis is the monthly average of northbound and southbound tolls for the international bridges that connect downtown El Paso to Ciudad Juárez. Since northbound tolls are reported in pesos, they are first divided by the nominal exchange rate before averaging (BM, 2013). Mean downtown bridge tolls are then transformed into real terms using the CPI. Personal vehicle border crossings are obtained from the Bureau of Transportation Statistics (BTS, 2013).

Descriptive statistics for the sample variables are reported in Table 1. To facilitate interpretation of the regression coefficients, the parking meter fee, substitute prices, gasoline prices and international bridge tolls are in 1982 – 1984 cents, while per capita personal income is in 1982 – 1984 dollars. International bridge crossings are recorded in thousands. The maximum value for this variable during the sample period, recorded in August 2001, was 1695692 vehicles. Passenger vehicle trips across the international boundary declined sharply in the wake of the 11 September 2001 terrorist attacks when border security intensified.

Table 1. Descriptive Statistics

Variable	Units	Mean	Median	SD	Minimum	Maximum
MTR	Meter purchases	195 706	195 952	32 819	124 292	273 575
PR	1982-84 cents	25.791	25.641	6.203	13.812	34.730
SUB	1982-84 cents	68.701	70.137	4.280	62.249	75.812
GAS	1982-84 cents	114.347	112.700	19.346	81.179	153.699
INC	1982-84 dollars	12,633	12,680	592	11,546	13,469
CEMP	Jobs (1000s)	649.355	646.837	30.727	587.157	711.034
XR	March 1997=100	94.285	93.588	6.255	81.917	115.098
TOLL	1982-84 cents	89.147	87.356	6.329	77.270	100.427
XING	Crossings (1000s)	1084.8	1107.2	224.8	688.9	1695.7

Figure 1 depicts parking meter rates and utilization. Two price shocks occurred during the course of the sample period. The first of these corresponds to an increase in nominal rates from ¢25 to ¢50 in October, 2002. Subsequently, in October, 2009, rates increased again, this time rising to ¢75. Both price hikes are followed by pronounced declines in demand, which is suggestive of an inverse relationship between these series. The analysis that follows will use econometric methods to quantify the relationship between the price and utilization of curb side parking in downtown El Paso controlling for a variety of other factors that influence demand.

found to have a statistically significant effect on parking demand and are therefore omitted from the final specification. The price of off-street parking and cross-border employment levels affect metered parking demand after a lag of 30 days and the impact of the real gasoline price occurs after a 60-day lag. All of the other explanatory variables have contemporaneous effects on demand. The signs for the estimated slope parameters are as hypothesized. Table 3 lists elasticities of demand, estimated by multiplying the coefficients in Table 2 by the ratio of the sample mean of each explanatory variable to the mean of MTR.

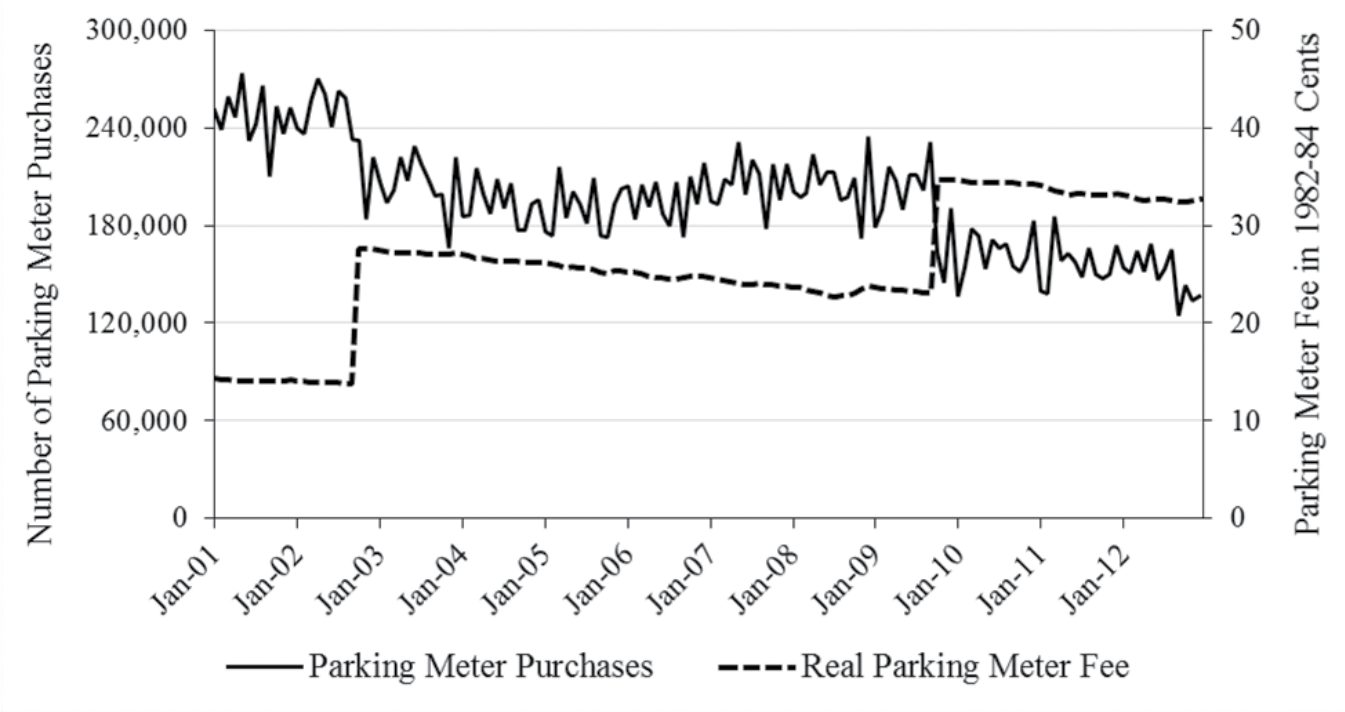

Figure 1. Parking Meter Rates and Utilization
Source: City of El Paso International Bridges Department

Empirical Analysis

Estimation results for the linear transfer function are summarized in Table 2. The data for the dependent variable and the eight independent variables have been first-differenced to ensure stationarity. Both AR and MA terms are included to correct for serial correlation. Bus fares are not

The coefficient on *PR* indicates that a one cent increase in the real parking meter fee reduces parking meter purchases by 3101 (Table 2). In proportional terms, this means that a 10% price hike lowers parking meter utilization by 4.1% (Table 3). This is similar to the average parking price elasticity of -0.40 obtained by Pierce and Shoup

(2013) for various districts of San Francisco. The responsiveness of parking behaviour to price signals in El Paso confirms City Council suggestions that parking meter fees can be used to partially help control traffic congestion in the downtown area (Ramirez, 2014).

of *SUB* is that off-street parking spaces may offer somewhat different amenities than on-street spaces and may, therefore, serve as imperfect substitutes. Azari *et al.* (2013) suggest that convenience may be a more important factor than price for motorists who choose off-street parking. The safety of the

Table 2. Estimation Results

Dependent Variable: MTR_t
Sample (adjusted): May 2001 – December 2012

Variable	Coefficient	Std. Error	*t*-Statistic
Constant	-322.657	1273.345	-0.253
PR_t	-3101.181	675.857	-4.589**
SUB_{t-1}	1135.854	961.609	1.181
GAS_{t-2}	-355.971	171.551	-2.075**
INC_t	28.103	13.342	2.106**
$CEMP_{t-1}$	277.948	162.728	1.708*
XR_t	-1107.825	384.190	-2.884**
$TOLL_t$	-1574.635	559.892	-2.812**
$XING_t$	74.324	18.600	3.996**
AR_{t-1}	-0.682	0.0653	-10.455**
MA_{t-9}	0.623	0.0676	9.206**

R-squared	0.602	Akaike criterion	22.223
Adjusted R-squared	0.571	Schwarz criterion	22.454
Log likelihood	-1544.599	Hannan-Quinn criterion	22.317
F-statistic	19.532**	Durbin-Watson statistic	2.256

Notes:
* $p < .10$, ** $p < .05$

The estimated elasticity of demand with respect to garage and parking lot fees is 0.40, confirming that parking meter purchases and parking lot or garage purchases are substitutes. The computed *t*-statistic for the substitute price coefficient shown in Table 2 does not, however, satisfy the 10-percent significance criterion. One factor that might contribute to this outcome is the relatively limited variation in *SUB* (see Table 1). Another possible explanation for the statistically insignificant effect

vehicle may also be relatively more important for those drivers. Conversely, a key advantage of curb side parking is its relatively low price, while a major disadvantage is the inconvenience of searching for an available spot and, sometimes, walking further to reach the final destination (Arnott and Rowse, 2009). Some individuals who typically choose metered on-street parking may regard public transit or free parking spaces further from downtown as better substitutes than parking garage spaces.

Table 3. Elasticity Estimates

PR	SUB	GAS	INC	CEMP	XR	TOLL	XING
-0.409	0.399	-0.208	1.814	0.922	-0.534	-0.717	0.412

Note:
Elasticities of demand with respect to the variables in the first row.

In addition to the price of parking, the price of gasoline is another important factor determining trip-making decisions. A real one cent increase in gasoline prices reduces parking meter sales by 356 after a two-month lag. The lagged response to changes in the price of gasoline may be due to the time required to make alternative transportation arrangements (Rose, 1986; Lane 2010). Although few other studies examine gasoline prices in relation to parking meter utilization, substantial research documents the impact of gasoline prices on vehicle traffic. In a survey of previous research, Goodwin (1992) reports an average elasticity of traffic levels with respect to petrol prices of -0.16 in the short run, which is close to the parking demand elasticity of -0.21 reported in Table 3. The results in Table 3 suggest that an increase in the price of gasoline would have a smaller impact on the number of automobiles parking in downtown El Paso than a proportionally equal increase in parking fees.

The estimated coefficient for per capita personal income is positive, which indicates that curb side parking spaces are a normal good. This is consistent with findings reported in several other parking studies (Willson, 1992; Hensher and King, 2001; Azari *et al*., 2013). For a 10% increase in income, parking meter purchases are expected to increase by 18.1%. One factor behind the relatively large magnitude of this elasticity estimate may be the relatively high concentration of entertainment venues and recreational destinations in the downtown area. Nelson (2001) finds that the income elasticity of demand for recreational goods and services is greater than one and, furthermore, that the income elasticity of transportation demand nationwide is 2.67. The latter figure is even higher than the estimate for El Paso. These factors, taken together, suggest that income fluctuations may have a disproportionately large effect on the decision to drive to the city centre and utilize curb side parking.

The coefficient for the real exchange rate index is negative. As defined, increases in the peso/dollar real exchange rate index occur whenever there is a decline in the purchasing power of the peso. Such occurrences generally lead to fewer north-of-the-river shopping trips by residents of Mexico (Patrick and Renforth, 1996). Lower volumes of cross-border traffic into El Paso translate, in turn, into lower rates of downtown parking meter utilization. Through similar channels, a rise in formal-sector employment in the state of Chihuahua is associated with increased parking meter purchases. This is consistent with prior research documenting a relationship between business cycles in Ciudad Juárez and the flow of automobiles crossing the international bridges into El Paso (Fullerton *et al*., 2013).

For Ciudad Juárez motorists, the cost of a day trip to downtown El Paso may not only include gasoline and parking expenses but also international bridge tolls (one bridge is not tolled). A 10% increase in real bridge tolls reduces parking meter sales by 7.2%. The fact that this cross-price elasticity estimate is negative indicates that international bridge crossing and curb side parking in downtown El Paso are complements. Finally, even after including the variables *XR*, *CEMP* and *TOLL* to capture the effects of economic factors

on cross-border trips to El Paso, personal vehicle international bridge crossings still exert a positive and statistically significant effect on parking meter purchases. This suggests that unobserved variables, such as delays at ports of entry, affect the decision of Ciudad Juárez residents to drive across the border and park in downtown El Paso. Other factors that might be reflected in the number of international bridge crossings include relative public safety conditions in the twin border cities (Fullerton and Walke, 2014).

The results documented above have implications for planners in both the public and private sectors. First, estimates of the price-responsiveness of curb side parking demand in downtown El Paso can help inform efforts to reduce traffic congestion in that area. Second, city government efforts to anticipate future parking meter revenues should take into account all of the relevant predictors of demand. These include the various costs incurred in driving to the central city and economic conditions on both sides of the border. Third, because the city government sets southbound bridge tolls, it has some ability to influence the decisions of consumers from Ciudad Juárez regarding travel to downtown El Paso.

Lastly, the results suggest that cross-border dynamics strongly affect curb side parking demand in El Paso. Factors that affect the decision to drive across the border and park in downtown El Paso are also likely to affect the profitability of area businesses. Customers from Mexico are critical to the vitality of the central business district and changes in variables like exchange rates and border crossing times can have profound effects on firms in the area (Valdez, 2008; Kolenc, 2010). This is especially relevant given current downtown revitalization efforts (Mohl, 2013). Such efforts should take account of both the importance of cross-border visitors and the factors that influence their trip-making decisions.

Conclusion

Using monthly-frequency time series data, this study examines the evolution of metered curb side parking demand in El Paso, Texas. As in previous research, an increase in the parking meter fee leads to a decrease in parking meter purchases. The own-price parameter estimate indicates that a real one cent increase in parking meter rates reduces the number of meter purchases by 3101. The inverse relationship suggests that increases in meter rates may help reduce congestion in the central business district. This analysis also finds that an increase in parking lot and garage prices will raise parking meter sales, suggesting that on- and off-street parking sites are substitutes.

Motorists consider other factors, in addition to parking fees, when deciding whether to visit downtown El Paso. The results suggest that gasoline prices and local income levels affect the decision to drive downtown and, hence, the volume of parking meter sales. Furthermore, a rise in international bridge tolls has a more substantial negative effect on curb side parking in El Paso than proportionally equal increases in either gasoline or parking prices. The importance of bridge tolls and other cross-border variables in explaining demand fluctuations highlights the vital economic role of day visitors from Ciudad Juárez who visit El Paso for shopping, entertainment, and job-related purposes. The relationship between border crossings and downtown parking is relevant to policy decisions regarding how best to facilitate commerce and mobility in the central city.

Some of the explanatory variables included in this study are likely relevant to on-street parking dynamics in many other urban areas. These indicators include off-street parking prices, gasoline prices, and regional income levels. Others, such as the real exchange rate, are included in the analysis due mainly to El Paso's location near an international boundary. However, parking demand in cities not located near a national border may be

affected by economic conditions in neighbouring cities just as parking dynamics in El Paso are influenced by conditions in Ciudad Juárez. Also, the relationship between bridge tolls and parking meter utilization may apply to interior cities in which the central business district is located near a tolled bridge. Future research on the demand for parking spaces that examines the unique features of other regional economies that are relevant to trip-making decisions would appear warranted.

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