

Who Benefits from Tax-Advantaged Employee Benefits?: Evidence from University Parking*

Michael D. Grubb[†] and Paul Oyer[‡]

September 2, 2009

Abstract

We use university parking permits to study how employers and workers split the value of employee benefit tax subsidies. Starting in 1998, the IRS allowed employees to pay for parking passes with pre-tax income. This subsidized the parking pass purchases of faculty and staff, but did not affect students. We show that the typical university raised faculty and staff parking rates by 12%-14% extra when it implemented a pre-tax payment system. Some universities offer student-only rates, which did not increase significantly. However, at most universities, the 12%-14% faculty and staff price increase applied equally to students not affected by the tax change. We conclude that university employees captured much of the new tax benefit, that faculty and staff that purchase permits benefited relative to those that do not purchase permits, and that students at universities that do not offer student-only rates (over half our sample of universities) that purchase permits were made strictly worse off relative to those that do not buy permits. We discuss what these results suggest about universities' objectives in setting their parking prices and about the demand for university parking.

*We thank many university parking office employees for providing data from their schools and Tavneet Suri for comments. Grubb thanks SIEPR's Taube Scholarship Fund Fellowship and the State Farm Companies Doctoral Award for financial support.

[†]Massachusetts Institute of Technology, Sloan School of Management. mgrubb@mit.edu.

[‡]Stanford University Graduate School of Business and NBER. pauloyer@stanford.edu.

1 Introduction

Firms provide a variety of benefits to their employees. In addition to the often-studied examples of health insurance and pensions, many employers also provide meals, product discounts, and numerous other benefits. There are several motivations for firms to provide these benefits, but one important consideration in almost all benefits decisions is taxes.¹ Firms and employees can save on taxes if the firm provides a benefit to the employee and the employee is not required to report the value of the benefit as income. In this paper, we use prices of parking passes at universities to investigate how the benefits of these tax advantages get split between firms and employees.

If the labor market were perfectly competitive and either tastes for the benefit were homogeneous or firms could adjust individuals' compensation such that each person "paid" for the amount of the benefit she consumed, then employees would capture none of the tax advantages of workplace benefits. In fact, if the product market were also competitive, consumers would capture the benefit. But if employee valuations of the benefit differ, and the firm cannot perfectly price discriminate between employees, then some of the value of the tax advantage will be distributed unequally among employees rather than being captured by the firm or consumers.

We show that, at least in the case of university parking, employees capture a substantial share of the tax advantages of benefits. We focus on an IRS tax code revision implemented in 1998. This change allowed employers to set up payroll deduction schemes so that employees could pay for parking with pre-tax dollars whereas parking was previously paid out of after-tax income. For example, if a university charged \$100 for a parking pass and an employee had a marginal tax rate of 25%, holding wages and parking prices fixed, the tax change saved the employee \$25 at government expense. However, by increasing the parking price 33% to \$133, the university captures the entire tax benefit, saving \$33 at government expense. The government loses revenue no matter who captures the benefit, as discussed in Office of Management and Budget (2008), which estimates that the exclusion for reimbursed employee parking expenses will generate a \$3.07 billion revenue loss in 2009. This is one of the largest revenue losses for Internal Revenue Code (IRC) Section 132 fringe benefits (Gazur 2006).

¹See Oyer (2008) for a discussion of the factors that lead firms to offer employee benefits and Marino and Zbojnik (2008) for a discussion of optimal pricing of employee benefits.

Our empirical analysis studies parking rates at twenty-two universities. Some of these schools sell the same passes to students that they sell to faculty and staff while others sell faculty/staff passes and student passes separately. This allows us to compare rate increases for staff and faculty who are directly affected by the tax change to rate increases for students who are not directly affected by the tax change. On its own, this comparison does not identify the effect of the tax change on faculty and staff parking rates because it is inappropriate to assume a priori that there is no effect on student-only rates. If schools are price discriminating, and costs are linear, we would expect that they will raise prices on faculty and staff permits after the tax change but not on student permits. However, if costs are convex (as Shoup (2005) suggests) profit maximizing parking departments would be expected to raise student rates as well. (We discuss possible parking department objectives in Section 4.) Our main empirical results identify the effect of the tax change by assuming the time trend in individual parking prices is linear. That is, we assume the time trend in parking prices is linear but this trend rate can differ across schools and, for a given school, across different types of parking passes.²

We draw three primary conclusions from our empirical results. First, the tax change led universities to raise faculty and staff parking prices, but schools let employees who buy parking passes capture a significant share of the tax advantage. While parking rates go up as the tax advantage becomes available, the increases are on the order of only 12-14%. This leaves most faculty and staff that buy parking passes after the change better off than before the change. Second, there is no evidence that the tax change led universities to alter student-only rates. Therefore, at half the universities in our sample, students were protected from price increases because the school offered student-only rates or did not have student parking at all. Finally, at the other 50% of universities in our sample (where students pay the same rates as faculty and staff), student price increases were the same as those for faculty and staff. At these schools, faculty and staff permit purchases impose a pecuniary externality on students by driving up student permit prices.

We must qualify our results given some important data limitations. We do not observe how wages change when parking prices change. We cannot say for sure that universities

²Our results are similar when we relax the linear time trend assumption and identify the effect of the tax change using variation across schools in when the pre-tax parking plan is adopted. However, this relies on the tenuous assumption that timing of adoption is exogenous.

do not capture some of the benefits of the tax law through lower wages.³ Also, we do not observe how tuition rates or spending on student services change when parking prices change. We cannot be sure that students facing higher parking prices are not compensated through lower tuition or improved campus services. However, we believe it is safe to conclude that employees captured a considerable amount of the value of the parking law change, that faculty and staff that buy parking passes benefited relative to those that do not buy parking passes, and that, at universities with uniform pricing, the tax law change made students that buy parking passes worse off relative to those that do not.

Our results relate to numerous prior papers in public finance that have studied how the rents from government subsidies and tax policies get split and how those policies can affect parties they were not meant to affect. Poterba (1984), for example, shows that the mortgage interest deduction lowers the cost of home ownership and that this is especially true when inflation is high. As a result, periods of high inflation, even holding the tax rate constant, may lead to increases in the owner-occupied housing stock. Susin (2002) also looks at the housing market, though he focuses on the effects of government vouchers on the rental housing market. He finds that vouchers increase prices for low income renters and, therefore, are costly to those who are not eligible for government vouchers. This combination of results mirrors the effects of the parking tax change that we find on faculty and students. Goolsbee (1998a) finds that increases in government R&D spending have little effect on actual R&D output because scientists capture most of the additional spending in higher salaries. Both Susin (2002) and Goolsbee (1998a) argue that inelasticity in the relevant markets drives the effects. Berger (1993) also finds that some of the benefits of government R&D subsidies accrue to providers of R&D inputs. Goolsbee (1998b) shows that the U.S. investment tax credit had the unintended effect of increasing the price of capital goods, at least in the short term, as producers extracted some of the value of tax subsidies until supply could respond. Andreoni and Payne (2003) find that government donations to charities do not all get used for their intended purposes because the charities respond by reducing other fund-raising efforts.

³However, in all our correspondence with university parking officials, we never heard any suggestion that parking prices affect wages. Also, we have yet to find a university employee that knew the parking rates and policies at their school before accepting a job. This suggests that universities cannot take the value of the tax benefit out of wages without making their employment offers look less attractive.

The 12-14% increase in university parking prices following the tax law change is smaller than might be expected. Any employees with marginal tax rates of 13% or higher are better off, which includes most faculty and staff. For instance, a 14% price increase captures only 30% of the tax benefit to an employee with a marginal tax rate of 40%. Low-paid university employees, with marginal tax rates 12% or lower, will of course be worse off. Given heterogeneous tax rates and parking values among its employees and an inability to perfectly price discriminate, no university could be expected to extract all value from the tax benefit. Nevertheless, it seems likely that universities could have extracted more value through a larger price increase. Unfortunately, we have very little information on parking quantity, so we cannot say for sure that universities are not in fact capturing some of the value through higher quantity.

After laying out our empirical findings in Section 3, we consider various explanations in Section 4. We focus on three main possibilities – highly elastic parking demand, a significant “salience” problem, and the possibility that university parking departments employ average cost pricing policies. While there are demand functions that can reconcile our empirical results with university parking departments acting to maximize profits, we argue that this is unlikely. Salience is a possible contributing factor, though we would expect universities to counter this with aggressive marketing campaigns. Finally, though it is hard to reconcile with a standard economic model of universities maximizing profits or social welfare, the patterns we see are consistent with university parking departments practicing average cost pricing, as Shoup (2005) suggests.⁴

⁴Our paper adds to the small set of economic studies of parking. Shoup (2005) provides interesting institutional details on university parking systems, with a focus on UCLA. Arbatskay, Mukhopadhaya and Rasmusen (2006) use a parking lot as an example of how rents get distributed when agents fight for access to an underpriced good. They argue that welfare will be higher if parking lots are built larger than mean demand. Fisman and Miguel (2007) use diplomats’ parking tickets as an indication of social norms in the diplomats’ countries.

2 University Parking Pass Background

2.1 1998 Tax Code Change

Many American universities sell parking permits to faculty, staff, and students. Before 1998 employees had to pay for these permits with “after-tax income.”⁵ However, ever since passage of the Taxpayer Relief Act of 1997 (TRA-97), universities can deduct the price of parking permits from employees’ income. Employees then pay taxes based on their gross wages minus the parking permit price. TRA-97, which added the parking benefit, and the Transportation Equity Act for the 21st Century (TEA-21) Section 9010(a), which applied to other transit benefits such as commuter vans and mass transit passes, revised IRC Section 132(f) effective January 1, 1998. IRC 132(f) defines “qualified transportation fringe” benefits provided by an employer to an employee that are excluded from taxable income, and hence free from federal, social security, and (in most cases) state taxes. There are limits on how much can be deducted (\$120 per month for mass transit passes and \$230 for parking in 2009), but these limits are not relevant for our sample.

In order to allow employees to take advantage of Section 132(f), universities had to first make some changes in their payroll systems to allow for proper pre-tax deductions of parking pass (or mass transit pass) fees.⁶ As we show below, most schools we sampled introduced pre-tax parking for the 1998-1999 or 1999-2000 academic years. It is hard to say exactly how much tax revenue is lost by the exclusion of parking passes from income because we do not have an estimate of parking costs at facilities owned by employers. However, employee parking expenses in general lower tax revenue substantially. The Office of Management and Budget (2008) estimates that the exclusion for reimbursed employee parking expenses will generate a \$3.07 billion revenue loss in 2009, which is one of the largest revenue losses for IRC Section 132 fringe benefits (Gazur 2006). Mass transit pass exclusions lead to an estimated

⁵In fact, in 1985 a district court ruled against Marquette University’s refund claim for employment taxes paid on the value of employee parking paid for via salary deduction in tax years 1973-1978 (Gazur 2006).

⁶The change in the tax code also insured that employer contributions to parking expenses did not have to be declared as income. So, if a university leased a parking spot for \$100 per month and sold a pass to an employee for \$60 per month, the employee would not have to pay taxes on the \$40 subsidy or the \$60 he spent on the pass. We do not know of any schools in our sample where this subsidy was relevant, however, because the universities generally own their parking facilities.

loss of \$0.47 billion.⁷

2.2 Supply and Demand of University Parking

Figure 1 provides an example of the change in price and quantity of university parking passes before and after the 1998 tax code change. The University of Washington (UW) in Seattle provides unusually detailed transportation benefits pricing and usage data on their website (see <http://www.washington.edu/commuterservices/programs/upass/reports.php>).⁸ UW is in a central urban area known for traffic problems and congestion, so the school is unlikely to be typical. However, it does provide a useful example at a school where managing transportation is important and appears to be taken quite seriously. The figure shows that, from 1996 to 2005, the number of permits sold trended down slowly but steadily for both staff and students. On a percentage basis, the decrease was sharper for student permits. Faculty/staff permit sales were about five times that of students in 1996 and over eight times as large in 2005. We do not have quantity data for many of the schools in our sample. Note that such data would not be as useful as we would like, even if we had it, because sometimes parking passes are rationed. We do not know if this was the case at UW.

UW sells monthly parking permits to students, faculty, and staff. The price is the same for each of these groups. The figure shows the nominal monthly cost of this permit from 1996 through 2005. Pass prices increased at an average annual rate of 7%. The increases were somewhat higher in the years after the introduction of the pre-tax plan (about 10% in 2000, 2001, and 2002). The graph also shows how much a faculty member with a 25% marginal tax rate would have to earn in order to buy the monthly pass.⁹ The cost to this person of the pass dropped significantly with the introduction of the pre-tax plan, while the cost to students never decreased.

Figure 2 shows similar data for one of the few other schools for which we have both price and quantity data. This university, which we will call “School 2”, sells a premium pass to

⁷See Office of Management and Budget (2008) Table 19-1, page 290.

⁸All our UW data was gathered from public sources. Because we gathered data from the other schools without explicit permission to share it, we do not use the names of other schools.

⁹We believe that most parkers at universities in our sample will have had a marginal tax rate of at least 23.65% in 1998. This corresponds to the 15% federal tax bracket, the employee portion of payroll taxes, and a 1% state income tax. Many faculty or staff will have had higher marginal tax rates.

University of Washington Parking Price and Quantity

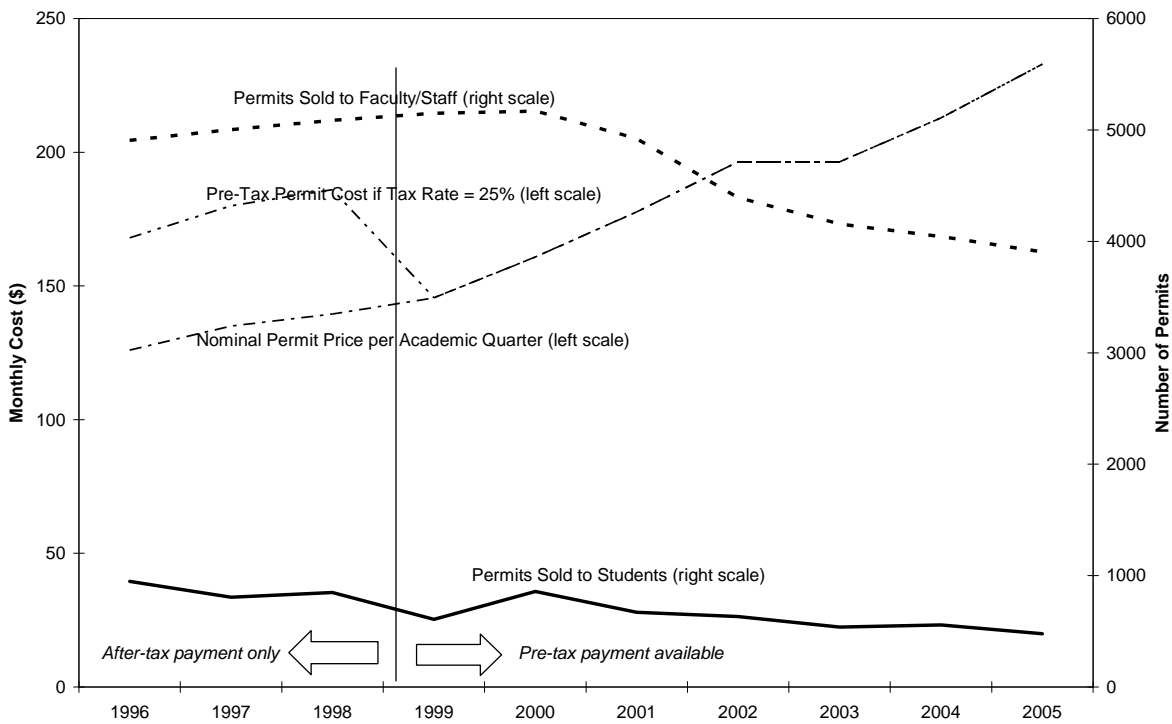


Figure 1: All data from University of Washington website. Permits are available to faculty, staff, and students and all groups pay the same price. The vertical line marks the date the University of Washington made pre-tax payment available to faculty and staff.

faculty and staff only and standard pass to faculty, staff, and students. All purchasers of standard passes pay the same cash price, but, ever since 1998, faculty and staff have been able to pay for their parking passes with pre-tax dollars. The prices of both types of passes have increased slowly but steadily. The premium pass price has increased at a 6% annual rate while the standard pass has increased 3.5%. This university is more suburban than UW, which may explain why student parking demand is higher.¹⁰ More students than employees buy permits at this university. Faculty and staff permit sales took a one-time drop in 1999

¹⁰We have pass quantity information for two other schools. The first university, like School 2, is in a suburban location. A little over half of sales at this school are to faculty and staff. The second university, like UW, is in an urban location. A little over 90% of sales at this school are to faculty and staff.

School 2 Parking Price and Quantity

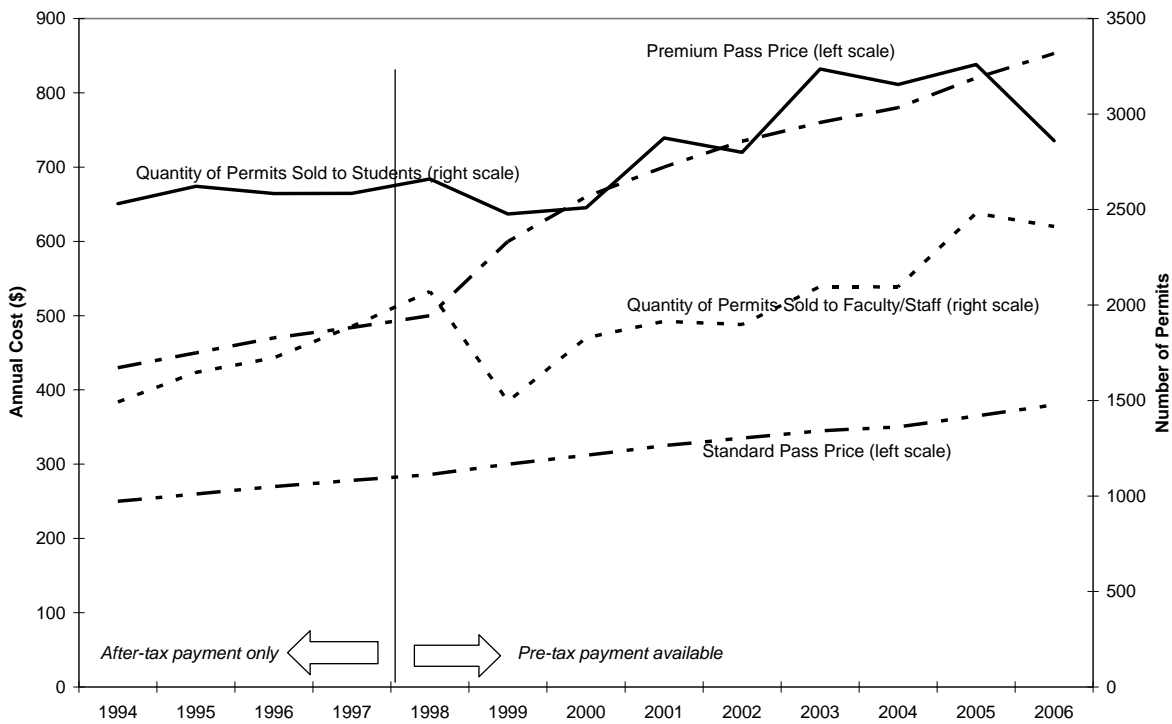


Figure 2: The school has two rates: Standard permits are available to faculty, staff, and students for the same standard permit price. Premium permits are only available to faculty and staff.

for reasons that we do not know.¹¹ The graphs of both UW and School 2 suggest that the change in the tax code may have had some effect on parking pass prices given slightly greater price increases after the new tax plans were enacted, but the effects do not appear to be large.

¹¹Based on Figure 2, one possible interpretation of the 1999 drop in faculty/staff permit sales is that the premium pass increase was more salient than the (economically larger) tax benefit and hence demand for premium permits fell. (See discussion of salience effects in Section 4.) In fact this is unlikely since faculty/staff standard permit sales fall as fast as premium permit sales in 1999. Another possible explanation is coincidental supply reduction due to new building construction on existing surface commuter lots.

3 Empirical Analysis

3.1 Data

We gathered historical data for the academic years from 1990-1991 through 2006-2007 from the parking offices at universities. We sent emails, asking for historical parking rates and the date the university implemented a pre-tax payroll deduction parking plan, to the parking offices at all schools in the Pacific 10, Big 10, Ivy League, the University of California system, and the top 25 “National Universities” on the *US News and World Report* list of America’s Best Colleges for 2007 (released in the Fall of 2006.) We received usable information from twenty-two universities covering one hundred and nine different parking passes. This represents a response rate of approximately 50%. A few of the non-respondents indicated that they had tried, but failed, to find historical information. Others simply ignored our request and follow-up. We believe that the variation in response was due to historical accident as to who kept data and random differences in parking office helpfulness. In order to implement a pre-tax payroll deduction parking plan, a university needs to make some adjustments to its payroll systems. Eight of the twenty-two schools implemented this plan for the 1998-1999 academic year, seven did so the following year, three did so in 2000-2001, and the remaining four did so over the following four academic years 2001-2005.

The number of different passes varies across universities. For instance, School 3 offers two passes: premium passes to faculty and staff only and standard passes to faculty, staff, and students. In contrast, School 4 offers four passes: both high and low quality premium passes available to faculty and staff only, as well as both high and low quality standard passes available to faculty, staff, and students. When estimating the average response of faculty and staff rates or faculty, staff, and student rates to the tax change, there is no reason to weight School 4 twice as heavily as School 3 simply because School 4 price discriminates more finely. To weight schools equally, we first average pass prices at the school level by eligibility group. For instance, for School 4 we calculate an average price for the two faculty/staff only passes, and a second average price for the two faculty/staff/student passes. Not all parking passes were offered in all years and not all schools could provide complete historical data for all passes.¹² Hence we have forty one averaged pass groups and a total of 568 pass/year

¹²We exclude select passes from three schools that drop or add parking passes during the sample period,

observations. Fourteen schools offer faculty and staff only passes (195 pass years), fifteen schools offer passes available to faculty, staff, and students (207 pass years), nine schools offer student only passes (118 pass years), and three schools offer visitor passes (48 pass years).

Table 1 summarizes the prices of the passes. All prices have been converted to annual real (\$2000) amounts and represent the price charged by the parking office. The amount an employee has to earn to purchase the pass may differ with whether the tax change has been put in place, but the prices analyzed here and throughout the paper are the amount the university receives (or withholds) from the employee. The average pass sells for \$475, but there is considerable variation. Eleven percent of pass/years are priced under \$100 and eight percent are priced above \$1,000. Prices are higher for passes that are limited to faculty and staff or to students because the universities that have offerings for a specific population are often in areas where land is expensive (such as Berkeley and Los Angeles.)

3.2 Difference in Differences Estimates

Our empirical analysis addresses two questions. First, to what extent did universities extract the surplus created through the transportation tax code change by increasing the parking prices they charge to employees? Second, did universities limit price increases to the population that could benefit from the tax change (that is, faculty and staff) or were students affected as well?

The right two columns of Table 1 provide some simple analysis to address these questions. The next to last column in the table shows the average price increase from one year prior to pre-tax payment plan implementation ($t = -1$) until four years after implementation ($t = 4$) for all parking passes and each of the four types of passes. We find that the real price of the average pass increases by 39% in this five-year period. The average one-year price increase in the sample is 4.1%, suggesting that the expected five-year price change is about 22% for the sample as a whole. The average of 39% for one year prior to implementation until four years after suggests that universities did increase parking pass prices as they implemented pre-tax plans.

There is no evidence to suggest that faculty and staff price increases around the pre-tax payment plan implementation were greater than the increases in prices of passes that were

since these product changes would appear to be price changes in the calculated averages.

less affected by the tax change. In fact, passes available only to faculty and staff had the lowest rate of price increase in this period surrounding the implementation of the new tax law. Student-only passes increased less than passes that can be bought by students and employees, but more than the prices of employee-only passes. The visitor sample, though small, had the greatest increase of all despite purchasers gaining no tax advantages. None of these differences in average price increases are statistically significant.

Figures 3 and 4 show the progression of real parking prices relative to the date each university implemented the pre-tax payroll deduction parking plan (normalized to date zero) for three of the four types of passes in Table 1. Visitor passes are excluded because the sample size is so small. Figure 3 shows the average real price increase for each group. The graph shows a marked but small peak in price increases following pre-tax payment plan implementation. However, there also appears to be an unexplained earlier peak roughly six years prior to implementation. Figure 4 shows the average annual real price for each of the four groups. To keep the sample consistent, the graph is limited to those passes for which we have data for each year from four years prior to implementation to five years after implementation. This limits the sample to fourteen out of twenty two schools, ten offering faculty/staff-only passes, eight offering passes to both faculty, staff, and students, and four offering student-only passes. The graph shows a small but noticeable increase in the price trends of all three pass types following implementation.

3.3 Regressions

The visual evidence in Figures 3 and 4 and the simple difference-in-difference calculations in Table 1 do not suggest that universities extracted the surplus created by the 1998 tax law change, nor that prices went up more for those that could claim the tax benefit than for those that could not. In this section, we do a more formal analysis looking at parking price changes at the exact time each school adopted a pre-tax parking pass plan.

We run regressions of the form

$$p_{it} = \delta_i + \theta_i t + \beta z_{it} + \varepsilon_{it} \tag{1}$$

where p_{it} is the log of the price of (averaged) parking pass i in academic year t , δ_i is a fixed effect for pass i , θ_i is a pass-specific linear time trend, and ε is a random error term. The

	# Passes	Average Price		$(t+4) - (t-1)$	Diff-in-Diff
		All Years	$t-1$		
All Passes	41 (29)	\$475 (446)	\$488 (338)	\$664 (564)	39% (42%)
Faculty/Staff Only	14 (11)	\$469 (278)	\$473 (245)	\$587 (302)	33% (41%)
Faculty/Student	15 (10)	\$316 (233)	\$367 (232)	\$476 (318)	39% (40%)
Student Only	9 (5)	\$336 (225)	\$338 (232)	\$471 (340)	36% (17%)
Visitor/Meter	3 (3)	\$1,522 (660)	\$1,202 (237)	\$1,895 (859)	64% (90%)

Table 1: Summary Statistics. Pass prices converted to annual real (\$2000) units. Average price in the "All Years" column uses the full sample of averaged passes. For the rest of the table, the sample is restricted to those average passes for which we have data both one year prior to implementation and 4 years after. Numbers in parentheses are the sample size in the "# Passes" column, standard errors in the final column, and standard deviations in other columns.

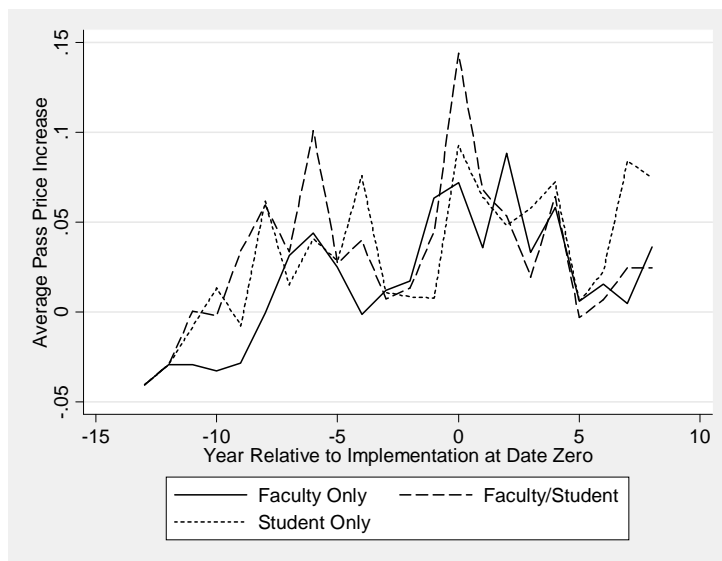


Figure 3: Average Real Price Increase. Displays the average annual price increase for each of the four types of parking permits.

variable of interest is z_{it} , which is an indicator variable that takes the value one if the school has implemented a pre-tax parking payment plan as of year t .¹³ The coefficient β indicates the percentage increase in the pass price after the plan is adopted relative to before the plan is adopted, controlling for a pass-specific linear time trend across plans.

Identification of β relies on the assumption that in the absence of the tax law change, pass-specific price trends would have been linear. We also run (unreported) regressions with qualitatively similar results that relax the linearity assumption by replacing $\theta_i t$ with a full set of year dummies γ_t . When we do this, we are identifying β using variation across schools in when they implement a pre-tax parking plan. But then interpreting our results as causal would force us to rely on the assumption that variation in price trends across schools, controlling for year, is not correlated with implementation dates. Unfortunately this may not be a valid assumption. Pre-1998, prices were increasing significantly faster for schools that adopt pre-tax payments in 1999 than those that adopt in 1998. As a result, we favor

¹³As noted in Section 3.1, we think it appropriate to weight by universities rather than by parking pass so that simply offering a wider variety of passes does not let a school unduly influence our analysis. Therefore, for purposes of the regressions, a “pass” is actually the average price of all passes of a certain class (either faculty/staff only, faculty/staff/student, student only, or visitor) at a given school.

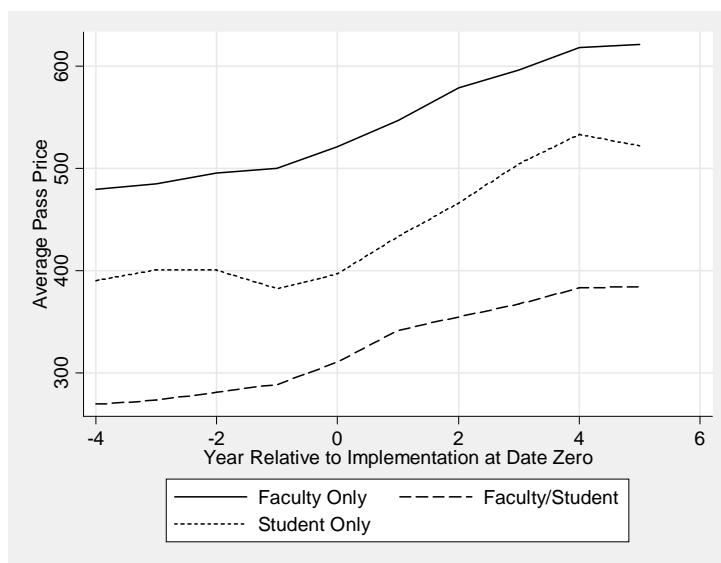


Figure 4: Average Real Pass Price. Displays the average annualized price (in \$2000) of each type of pass for all passes where the price is available for each year from four years prior to implementation to five years after implementation.

the specification above which, although linear, controls for pass-specific time trends. Other observed characteristics, including within-school price volatility and the fraction of urban versus rural schools, are similar across early and late adopters, although schools that adopt in 1998 appear to price discriminate more coarsely (with an average of 3.4 passes) than 1999 adopters (an average of 4.8 passes).

Table 2 contains regression results. Column 1 shows that the baseline estimate of β when fitting equation (1) is a highly statistically significant 0.116, indicating that schools raised parking prices about 12% upon implementing a pre-tax payment plan. This specification does not distinguish between student and faculty/staff price increases and so far we have no reason to think students will not have to pay the same rate increases as faculty and staff without the offsetting tax advantage. As mentioned earlier, if costs of providing parking are convex (as Shoup (2005) suggests) then it is purely an empirical question how much student prices will change relative to faculty/staff prices. Columns 2-5 run the specification in equation (1) separately for each of the four permit types. Columns 2 and 3 estimate that passes purchased by faculty and staff increased in price by 11-15%. In contrast, column 4 estimates that the effect of the tax law is only 3% for student permits, and statistically

indistinguishable from zero.

The finding that the estimated effect of the tax law is smallest for student-only permits could be due to the fact that schools that offer student-only permits are also schools that respond to the tax law change less aggressively across the board. In Column 6, we therefore change the specification in equation (1) slightly to

$$p_{it} = \delta_i + \theta_i t + \beta_j z_{it} + \gamma(z_{it} * f_i) + \varepsilon_{it} \quad (2)$$

where β_j is a coefficient specific to school j that sells parking pass i , and f_i is an indicator variable that takes the value one if parking plan i is only available to faculty and staff. The coefficient γ can be interpreted as the additional percentage change in parking prices after pre-tax plans are implemented for employee-only parking passes, relative to student-only passes. To make sure we compare passes rather than schools when we estimate γ , we want to focus on within-school differences between faculty/staff price increases and other permit price increases. So we estimate a vector of school specific coefficients (β_j) of the tax-advantage variable (z_{it}) when we estimate (2). Column 6 coefficients indicate a statistically significant 9% larger price adjustment for employees who can take advantage of the tax change relative to students who cannot. Column 7 runs a similar specification, but simultaneously compares faculty-only, faculty/student, and visitor price increases to student-only price increases.¹⁴ Including all types of passes in one regression leads to the same conclusion: price adjustments for passes purchased by employees are significantly higher than those for student-only permits.

An increase in parking price of 12-14% is not very large for many employees. Anyone whose marginal tax rate is 13% or higher is better off, which will include most university faculty and staff. More specifically, consider a person with a marginal tax rate of 40% who is paying \$500/year (a little above the sample average) for a parking pass before the tax change.¹⁵ That person had to earn \$833, pre-tax, to pay for the parking pass. If the school raises the cost of the pass by 14%, to \$570, the person has to earn \$263 less to pay for the pass

¹⁴Grouping student-only and visitor/meter passes together pushes point estimates of γ for faculty-only and faculty/student passes closer to zero.

¹⁵As an example of a university employee with a 40% marginal tax rate, consider the average non-tenure track lecturer at Yale in 1998 earning \$47,288 (Waters 2001). Filing single, she would be in the 28% federal bracket, 5% Connecticut bracket, for a total marginal tax rate of 40.65% with payroll taxes.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
β : Tax-Advantage Dummy	0.1161*** (0.0382)	0.1138* (0.0567)	0.1456** (0.0581)	0.0278 (0.0816)	0.2142 (0.2609)	n/a	n/a
γ : Tax-Adv*Faculty ONLY						0.0894** (0.0339)	0.1398*** (0.0335) 0.1344***
γ : Tax-Adv*Faculty/Student							(0.0360)
γ : Tax-Adv*Visitor/Meter							0.3064* (0.1726)
Sample	All	Faculty Only	Faculty/Students	Students Only	Visitor/Meter	Faculty Only & Student Only	All
R^2	0.9880	0.9879	0.9879	0.9800	0.8589	0.9897	0.9910
N (Number Pass Groups)	568 (41)	195 (14)	207 (15)	118 (9)	48 (3)	313 (23)	568 (41)
Significance level:	* 10%, ** 5%, *** 1%						

Table 2: Effect of Tax Rule Change on Parking Prices. Coefficients are based on OLS regressions where the dependent variable is the log of the real price of a parking pass in an academic year between 1990-1991 and 2006-2007. Sample consists of 41 different averaged parking passes at 22 universities. "Tax Advantage" is an indicator variable that takes the value of one if the school has implemented a program to allow faculty and staff to pay for parking with pre-tax income. "Faculty ONLY" is an indicator variable that takes the value of one if the parking pass is only available to faculty and staff. "Faculty/Student" is an indicator variable that takes the value of one if the pass is available to faculty, staff, and students. "Visitor/Meter" is an indicator variable that takes the value of one if the pass is a daily or hourly pass available to everyone. Each specification includes pass-specific fixed effects and linear time trends. Specifications 6 and 7 also include interactions between the Tax Advantage indicator and indicators for each school. Student Only passes are the omitted group in specifications 6 and 7. Standard errors (in parentheses) are adjusted for any correlation within parking pass.

and enjoys an additional \$158 of after-tax income. The school captures only 30% of the \$228 tax reduction. Low-paid university employees, with marginal tax rates 12% or lower will of course be worse off. For example, an employee with zero marginal income tax, and 7.6% marginal Social Security and Medicare tax who buys a \$100 pass that increases to \$114 pays \$9 less in taxes, but \$14 more to the university so loses \$5. Many students are shielded from similar losses by the availability of student-only passes that did not significantly increase in price. However, students at half the universities in our sample did not have the option of paying a student-only rate and faced the same price increases as faculty and staff. Excluding unobserved changes in tuition and student services, the students at these schools were clearly made worse off by the tax change.

In unreported analyses, we did several robustness checks and looked at factors that might explain variation in university parking prices. We did not find that being a public university made a difference, for example. Also, we found that our conclusions are basically unchanged when using school-specific linear time-trends (rather than pass-specific trends). Our analysis so far has assumed that any price effects of the pre-tax plans started at the same time as the plan. However, there could be some delay in the price effect if, for example, a school set its prices and then decided to quickly implement a tax-free plan so that employees could capture the benefits of the plan immediately. We reran the regressions dropping the first year of each school's pre-tax plan, but found it did not materially affect our results. Finally, we used a more conservative approach of clustering the standard errors at the school, rather than parking pass, level. This did not affect any of our conclusions, either.

Our identification strategy implicitly assumes that there was no change in the environment that affected parking prices and was correlated with the implementation of parking permit pre-tax payment plans. However, in response to the tax law changes made in TRA-97 and TEA-21, many universities in our sample introduced pre-tax payment plans for mass transit passes at the same time as for parking permits. If mass transit is a close substitute for parking, the reduction in after-tax mass transit prices could have limited university parking departments' ability to raise parking prices. This would imply that our estimates underestimate the effect of the change in tax treatment for parking passes. We find this unlikely however, because the effect of the tax change is nearly identical in urban and rural sub-samples. If the mass transit pre-tax payment plan were limiting parking permit price increases, we would expect to see a larger price increase on rural campuses which have limited

access to mass transit.¹⁶

4 Interpretation

The regression results lead to several conclusions and speculations. First, as noted above, the price changes made by these schools after the tax law change leave significant surplus to those buying parking permits. The increases in parking permit rates are much lower than the tax benefits to many employees. Universities could be extracting some of this surplus back in the form of lower wages, but it is hard to see why they would adjust the wage rather than the permit price. In any case, making the reasonable assumption that universities did not change the salaries of those who buy parking permits relative to those that did not as a result of the tax change, we can at least conclude that the tax law change gave some amount of surplus to faculty and staff that buy parking passes relative to those that do not.

Our second conclusion is that students lost surplus as a result of the tax change.¹⁷ While students at those universities that price discriminate by offering student-only passes were not affected, students at half the schools in our sample were hurt by the fact that their schools did not target the price changes to those parties that stood to benefit from the tax changes. Facing price increases, students could have bought cheaper (and, therefore, more remote) passes or found alternative transportation. But given they were now choosing an alternative from an inferior set of choices, they were clearly worse off.

Third, we are struck by the apparent limitations on price discrimination of university parking permits. While some universities have a wide range of permit options, others have very few choices. We found no evidence of additional permit choices being offered when the tax law was changed. While tax rates are likely to be quite variable for different parkers at a university, we see no differential price treatment based on how the tax benefits affected individuals. Universities could have added more variation in the prices, either based directly on income or other variables (such as demand for premium parking) that are likely to be

¹⁶Note that we expect that the increased availability of parking provided by competitive third parties in urban settings would reinforce rather than mask this effect. The presence of close substitutes should make residual parking demand more elastic, and hence reduce optimal price increases.

¹⁷Again, there could have been offsetting differences in terms of tuition or stipends. But, at the least, students who bought permits lost surplus relative to those that do not.

correlated with marginal tax rates. In this case, they might have been able to increase prices in line with employee tax rates and employees may have sorted themselves accordingly. This appears to be how investors segment into taxable and tax-free bonds, where the differences in yields imply investors with tax rates of 25% or more choose tax-free bonds (see Green (1993)).

We can only speculate as to why university parking prices reacted the way they did to the tax law change. We discuss three specific explanations for the patterns in the data: (1) Parking departments maximize profits and elasticity of demand is high. (2) Parking departments maximize profits but the tax law change had low salience. (3) Parking departments practice average cost pricing. We favor the latter two explanations over the first because we do not believe parking demand is sufficiently elastic to support the first explanation (although we have only anecdotal evidence for this).

(1) Profit maximization and high elasticity: Suppose a university finds that employees' decisions to take or keep a job are not based on parking pass prices, and directs its parking department to maximize parking profits in order to maximize the financial resources available for pursuing the university's educational objectives. In this case, a 12-14% faculty and staff price increase is only consistent with profit maximization if faculty and staff parking pass sales increase substantially.

If all parkers have a marginal tax rate of at least τ , then the university always has the option of increasing employee permit prices by $\frac{1}{1-\tau}$ after the tax law change. This increases revenues from employees who bought before the tax law change by $\frac{1}{1-\tau}$, and could increase permit sales to employees with marginal tax rates above τ . This is true even if non-university owned garages supply parking competitively near campus, since universities need not establish pre-tax payment plans for these garages. The optimal employee permit price increase could be either higher or lower than $\frac{1}{1-\tau}$.¹⁸ However, a smaller price increase can only be optimal if employee parking demand is sufficiently elastic that total employee permit revenues still increase by at least $\frac{1}{1-\tau}$. In particular, it can be shown that if the university finds it optimal to increase nominal employee parking prices by a factor of $\alpha \leq \frac{1}{1-\tau}$, then employee permit sales must increase by a factor of at least $(\frac{1}{1-\tau} \frac{1}{\alpha})$.¹⁹ For instance, if the

¹⁸All that can be said without more information about demand is that the optimal price increase is no higher than one over one minus the highest marginal tax rate.

¹⁹Denote the initial employee price P_0 . Absent a student market, an employee price αP_0 which is less than

minimum tax rate is 25%, then a nominal employee-permit price increase of 10% after the tax law change is only consistent with profit maximization if employee-permit sales increase by at least 21%. Although we have quantity time series data for only three schools, we have no evidence that parking demand spiked after the tax law change. This indicates to us that elasticity is not high enough to justify such small price increases. (In fact, faculty and staff permit sales fell at School 2, as seen in Figure 2, despite a drop in after-tax permit prices following the tax law change.)

In summary, our empirical findings can be reconciled with a model of very highly elastic university parking. However, while we are not able to estimate parking elasticity carefully, the indications that we do have suggest that very high elasticity is unlikely to explain our results.

(2) Profit maximization and low salience: Another possible explanation of the seemingly small price reaction to the parking tax benefits is limited salience of the change. If buyers of permits do not realize that their employer adopted a pre-tax plan, then they will overestimate the effective price of permits. Thus a low salience of the tax-deduction will lead to fewer sales and smaller price increases than would otherwise be expected. Finkelstein (2009) and Chetty, Looney and Kroft (2009) show that reducing the salience of a tax (rather than a tax deduction) leads to higher prices and demand. Finkelstein (2009) shows that highway toll rates increase in response to a decrease in tax salience brought on by the implementation of electronic toll collection. Chetty et al. (2009) show that consumer demand is higher if pre-tax prices are posted than when posted prices include tax, even if the end price is exactly the same. In these contexts, sellers of a product had an incentive to hide a tax from consumers in order to keep demand high.

In the parking context, salience would have the opposite effect on prices and sales because the salience problem is related to a tax *deduction* rather than to a tax. Given the sometimes large amount of revenue available from increasing parking fees, universities have strong incentives to raise the salience of the tax law change. They might engage in marketing campaigns to communicate the value of this benefit if they felt salience was inhibiting their ability to raise prices. Universities in our sample typically highlight the option of using

$\frac{1}{1-\tau}P_0$ leads to weakly higher sales and costs than a price equal to $\frac{1}{1-\tau}P_0$. Hence to be more profitable it must yield higher revenues: $\alpha P_0 Q(\alpha P_0) \geq \frac{1}{1-\tau}P_0 Q(\frac{1}{1-\tau}P_0)$. This implies: $\frac{Q(\alpha P_0)}{Q(P_0)} \geq \frac{1}{1-\tau} \frac{1}{\alpha} \frac{Q(\frac{1}{1-\tau}P_0)}{Q(P_0)} \geq \frac{1}{1-\tau} \frac{1}{\alpha}$. A similar argument shows the same result in the presence of a student market.

payroll deduction, which usually only requires checking a box, but do not highlight the tax advantage that goes with this. It seems quite possible that limited salience is at least a contributing factor to universities' limited price response to the parking tax change, but we cannot assess the exact degree to which salience of the parking tax change affects pricing.

(3) Average cost pricing: The fact that universities left so much of the value of the tax change to employees is consistent with the use of “average cost pricing” policies. Though it is difficult to generate an economic model that justifies this practice, many university parking offices operate under the stated goal of breaking even.²⁰ Shoup (2005) focuses on UCLA's implementation of average cost pricing for parking. We have spoken with administrators in other parking offices that use a similar approach and other schools suggest they use this method in the literature on their websites. The basic idea of average cost pricing is that the transportation office is told to set fees for parking (and, in some cases, other transportation services such as shuttle bus rides) so as to cover the costs of providing parking spaces and other transportation. Some schools attempt to recover the costs of capital while others price so as to merely break even in terms of operating expenses.

If a school is using average cost pricing for parking, then the tax law change should have little immediate effect on permit prices. However, given a substantial reduction in effective parking prices for at least some university employees, demand will increase after the tax law change. As Shoup (2005) discusses, the marginal price to build a parking space is typically far higher than the average cost of existing space, so prices would likely have to go up to sustain the average cost pricing scheme.²¹ Therefore, we would expect universities that use average cost pricing for parking to leave their parking prices unchanged, or increase them slightly, after the tax law change.²² This pattern appears consistent with our empirical results.

Another feature of university parking that is consistent with average cost pricing is the

²⁰The unofficial goal may be empire building, in the sense of maximizing permits sold or spaces managed, subject to a university imposed constraint that the parking office not lose money. A parking department with only one permit price would then charge average cost. However, this objective will lead parking departments that can set multiple permit prices to price discriminate to extract money from high value parkers to subsidize the cost of parking to low-value parkers not only below marginal cost, but below average cost as well.

²¹Average costs that include administrative costs could still fall if fixed administrative costs are large enough.

²²A slight increase is expected if either the increase in demand is not very large, or the difference between marginal cost and average cost is not very large.

fact that price discrimination policies are quite rigid. That is, almost no schools added additional types of parking permits or separated faculty/staff and student passes when both populations were eligible to purchase them. So the fact that, at many schools, students and faculty were not differentially affected by the tax change could be driven by budget balanced pricing policies, as parking offices may be indifferent to where the necessary revenue comes from.

5 Conclusions

According to the Office of Management and Budget (2008), the United States will forgo \$3.07 billion in 2009 tax revenues due to pre-tax employee parking programs made possible by TRA-97. One possible motivation for this national expense is to remove an incentive for employers to avoid paying taxes by providing employees with free parking. By removing such an incentive, the change in tax law could have increased effective parking prices, and reduced inefficiently high parking and related traffic congestion. Our results suggest that this was not the outcome in university parking lots. We find that nominal university parking rates go up only 12-14% as the tax advantage becomes available, so effective parking prices fall for employees with marginal tax rates above 13%. Although we cannot be definitive without quantity or wage data, under the reasonable assumption that wages were unaffected by the change in tax code and that employee parking is relatively inelastic, these moderate price increases imply that universities capture only a small portion of the tax benefit. Instead, because price increases are often across the board, the primary beneficiaries are faculty and staff who buy permits and have high marginal tax rates, while many students who buy permits are actually worse off. Our findings suggest that, if parking prices maximize university profit, parking demand must be highly elastic or the tax law changes must have very low salience with employees. The results are generally consistent with the claim by Shoup (2005), and many parking departments themselves, that university parking departments use average cost pricing.

References

- Andreoni, James and A. Abigail Payne**, “Do Government Grants to Private Charities Crowd Out Giving or Fund-raising?,” *The American Economic Review*, 2003, *93*, 792–812.
- Arbatskay, Maria, Kaushik Mukhopadhyaya, and Eric Rasmusen**, “The Parking Lot Problem,” 2006. Emory University Working Paper.
- Berger, Philip G.**, “Explicit and Implicit Tax Effects of the R&D Tax Credit,” *Journal of Accounting Research*, 1993, *31*, 141–171.
- Chetty, Raj, Adam Looney, and Kory Kroft**, “Salience and Taxation: Theory and Evidence,” *American Economic Review*, 2009. Forthcoming.
- Finkelstein, Amy**, “E-ZTax: Tax Salience and Tax Rates,” *Quarterly Journal of Economics*, 2009, *124*. Forthcoming.
- Fisman, Raymond and Edward Miguel**, “Corruption, Norms, and Legal Enforcement: Evidence from Diplomatic Parking Tickets,” *Journal of Political Economy*, 2007, *115*, 1020–1048.
- Gazur, Wayne M.**, “Assessing Internal Revenue Code 132 After Twenty Years,” *Virginia Tax Review*, 2006, *25*, 977–1046.
- Goolsbee, Austan**, “Does Government R&D Policy Mainly Benefit Scientists and Engineers?,” *American Economic Review*, 1998, *88*, 298–302.
- , “Investment Tax Incentives, Prices, and the Supply of Capital Goods,” *Quarterly Journal of Economics*, 1998, *113*, 121–148.
- Green, Richard C.**, “A Simple Model of the Taxable and Tax-Exempt Yield Curves,” *Review of Financial Studies*, 1993, *6*, 233–264.
- Marino, Anthony M. and Jan Zabojnik**, “A Rent Extraction View of Employee Discounts and Pricing,” *Journal of Labor Economics*, 2008, *26*, 485–518.
- Office of Management and Budget**, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2009*, Washington: US Government Printing Office, 2008.
- Oyer, Paul**, “Salary or Benefits?,” *Research in Labor Economics*, 2008, *28*, 429–467.
- Poterba, James M.**, “Tax Subsidies to Owner-Occupied Housing: An Asset-Market Approach,” *Quarterly Journal of Economics*, 1984, *99*, 729–752.

Shoup, Donald, “Parking on a Smart Campus,” in Daniel Mitchell, ed., *California Policy Options 2005*, Los Angeles: UCLA School of Public Affairs, 2005.

Susin, Scott, “Rent Vouchers and the Price of Low-Income Housing,” *Journal of Public Economics*, 2002, 83, 109–152.

Waters, Beverly, *A Yale Book of Numbers 1976-2000*, New Haven, CT: Yale Office of Institutional Research, 2001.