

# Fare-Free Public Transit at Universities

## An Evaluation

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& Donald Shoup*

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Over the past decade, federal, state, and local government financial assistance to public transit has increased, but the share of commuters who use public transit has declined. The transit share for commuting fell from 5.3 percent in 1990 to 4.7 percent in 2000. Transit now serves less than 2 percent of all trips, and passengers occupy only 27 percent of the seats available on public transit buses.<sup>1</sup> At the same time, auto use is increasing, and American motor vehicles now consume one-eighth of the world's total oil production.<sup>2</sup>

But there is also some good news. A small but growing number of transit agencies and universities have joined forces to offer a new program that provides fare-free transit for more than a million people. This program is generically known as Unlimited Access, and it has spread rapidly during the past decade.<sup>3</sup> Unlimited Access programs do not provide free transit; instead, they are a new way to pay for transit. The university pays the transit agency, and all eligible members of the university community ride free.

The rapid spread of Unlimited Access suggests that it meets a market test: universities are willing to pay for it. Nevertheless, there have been few evaluations of its performance. This article evaluates the Unlimited Access program at the University of California, Los Angeles (UCLA), called BruinGO (the Bruin is UCLA's mascot), and it builds on our previous survey of the Unlimited Access programs at thirty-five American universities (Brown, Hess, and Shoup 2001). UCLA's pilot program was designed to evaluate the effects of introducing fare-free transit at UCLA, and it is offered with one of the three transit agencies that serve UCLA but not with the other two agencies. This experimental design allows us to compare the travel behavior of the faculty, staff, and students who live inside the area served by BruinGO and those who live outside it, both before and after BruinGO began.

### ► BruinGO

UCLA is located on the west side of Los Angeles. Three major transit agencies serve the campus, but BruinGO includes only the Santa Monica Municipal Bus Lines (the Blue Bus), which serves all of Santa Monica, California, and much of West Los Angeles (see

### Abstract

Universities and public transit agencies in the United States have together invented an arrangement—called Unlimited Access—that provides fare-free transit service for all students (and, on some campuses, faculty and staff as well). Unlimited Access is not free transit but is instead a new way to pay for it. The university pays the transit agency for all rides taken by eligible members of the campus community. This article evaluates the results of the Unlimited Access program at the University of California, Los Angeles (UCLA). Bus ridership for commuting to campus increased by 56 percent during BruinGO's first year, and solo driving fell by 20 percent. Because these startling results were achieved in a city famous for its addiction to cars, they suggest that Unlimited Access can succeed almost anywhere.

**Keywords:** *public transit; fare-free transit; bus ridership; universities; BruinGO*

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Figure 1). Five of the Blue Bus's thirteen lines come directly to UCLA. Students, staff, and faculty swipe their university ID card through an electronic reader when they board any Blue Bus, and the university pays the fare of 45¢ per ride. The total fare payment for the eight-month pilot program (October 2000 to June 2001) was \$640,000 for 62,700 eligible riders (36,900 students and 26,800 staff and faculty), or \$1.27 per person per month.<sup>4</sup>

BruinGO ridership during the pilot program was 1.4 million rides, or 6 percent of the 23 million rides made on the Blue Bus in 2000. Because fare-free transit was offered to only a small percentage of all Blue Bus riders, overcrowding did not become a problem.

This sets BruinGO apart from traditional proposals to make transit free for *all* riders. If a transit agency offers free rides to everyone, total ridership can increase substantially. Beyond the resulting overcrowding, the agency loses all its existing fare revenue from current riders and receives no revenue from the new ones. With BruinGO, the Blue Bus continues to receive all the revenue from its current riders *and* gains additional revenue from the new riders. From the transit agency's point of view, the main effect of BruinGO is that UCLA pays the fares for its own riders, so the transit agency loses nothing from the program.

Because BruinGO includes only the Blue Bus, it is a natural experiment. UCLA faculty, staff, and students who live outside the Blue Bus service area are not offered an equivalent program, and they therefore serve as a control group for our analysis. We can estimate BruinGO's effects on travel choices by comparing the commuting behavior of those who live *inside* and *outside* the Blue Bus service area. For our analysis, we define the Blue Bus service area as all of the ZIP codes that include a Blue Bus route to UCLA. About 35 percent of all faculty and staff and 46 percent of students live inside the Blue Bus service area.<sup>5</sup>

## ► Evaluation Method

UCLA conducted transportation surveys of employees (faculty and staff) and of students before BruinGO began and again after it had operated for six months.<sup>6</sup> Because the respondents provided their addresses, they can be divided into two subgroups: (1) those who live *inside* the Blue Bus service



Figure 1. Map of Blue Bus service area.

area, who serve as the experimental group, and (2) those who live *outside*, who serve as the control group.<sup>7</sup> We can therefore compare the commute mode shares before and with BruinGO, as well as between the experimental group and the control group.

BruinGO's effects can be estimated three ways. For the high estimate, we assume that BruinGO caused all the mode changes for commuting to campus after the Blue Bus became free. For the medium estimate, we assume that BruinGO caused only the mode changes by those who live inside the Blue Bus service area. For the low estimate, we assume that the mode changes made by those who live outside the Blue Bus service area would have occurred inside it even if BruinGO had not been in place, and we therefore subtract them from the mode changes inside the service area to calculate the changes caused only by BruinGO.

The "medium" and "low" estimates are both conservative. By focusing only on those who live inside the Blue Bus service area, these estimates ignore mode changes made by those commuters who drive from outside the Blue Bus service area for part of their trip, park off campus, and ride the Blue Bus for the rest of their commute (an informal park-and-ride arrangement). For the medium estimate, we simply ignore these new riders. For the low estimate, we penalize BruinGO by subtracting them from the medium estimate.<sup>8</sup>

High	Medium	Low
BruinGO caused all mode share changes	BruinGO caused all mode share changes inside the Blue Bus service area	BruinGO caused all mode share changes inside the Blue Bus service area, less what occurred outside

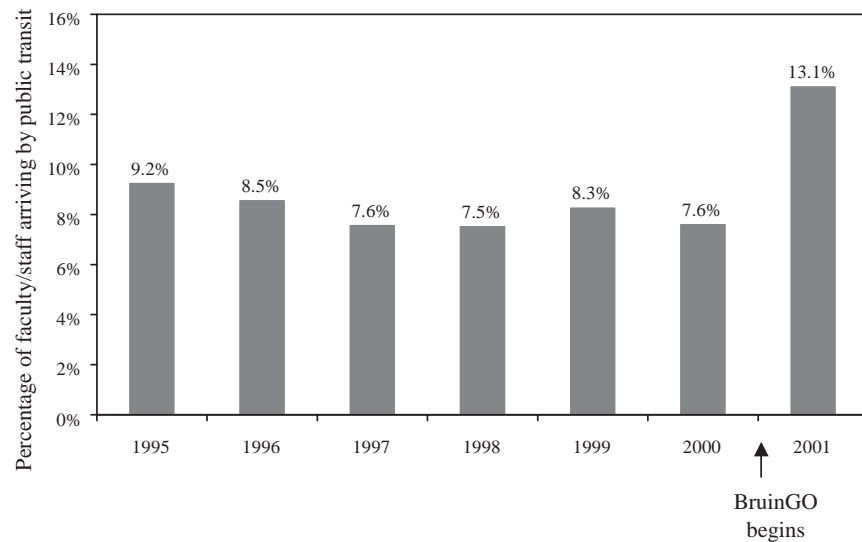
Some of these new “outside” riders, however, were riding the Blue Bus. A survey of BruinGO commuters found that 20 percent of them park on the street near a bus stop and then take the Blue Bus the rest of the way to campus.<sup>9</sup> The survey also found that 16 percent of BruinGO commuters live outside the Blue Bus service area.<sup>10</sup> For our low estimate of BruinGO’s effects, we thus include 16 percent of Blue Bus riders in the control group (those who live outside the Blue Bus service area) and therefore subtract some new riders from the test group (those who live inside the Blue Bus service area) when we should be adding them. Our low estimate of BruinGO’s effects is therefore extremely conservative.

UCLA set three goals for BruinGO: (1) increase bus ridership to campus, (2) reduce vehicle trips to campus, and (3) reduce parking demand on campus.<sup>11</sup> We examine whether BruinGO met these goals for two groups: employees (faculty and staff) and students.

### ► How Did BruinGO Affect Faculty/Staff Commuting?

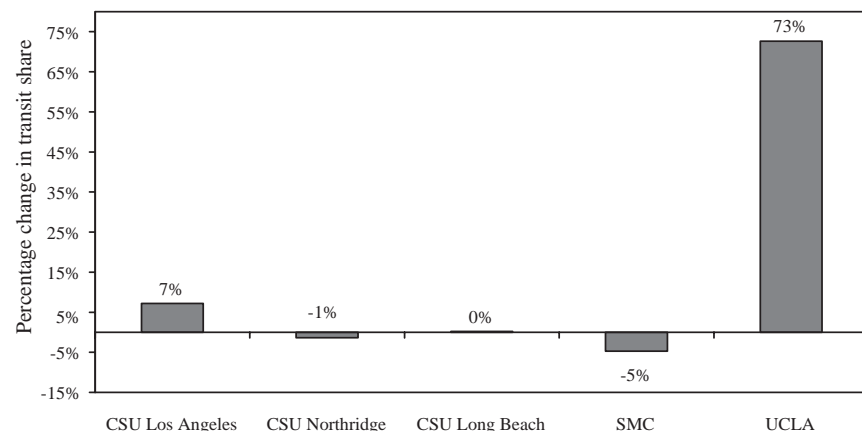
Southern California has the worst air quality in the nation, and as part of its air quality management plan, the South Coast Air Quality Management District requires employers of 250 or more employees to reduce their employees’ vehicle commuting to work. To fulfill this requirement, employers conduct annual surveys of their employees’ commute choices and report the results in a standard format, similar to an income tax return.<sup>12</sup> We can use these surveys to examine how BruinGO changed faculty/staff commuting behavior.

Figure 2 shows the recent history of faculty/staff bus ridership. Between 1995 and 2000, the bus share for faculty/staff commuting declined in every year but one, and it fell from 9.2 percent in 1995 to 7.6 percent in 2000. In contrast, the share of *all* faculty and staff (both inside and outside the Blue Bus service area) who commute by bus jumped from 7.6



**Figure 2.** Share of UCLA faculty and staff commuting by bus (1995-2001).

Sources: UCLA Transportation Services (1995-2001). Employee Commute Reduction Program plans submitted to the South Coast Air Quality Management District.



**Figure 3.** Change in faculty/staff transit share at five universities in Southern California (2000-2001).

Source: Employee Commute Reduction Program plans submitted by each university to the South Coast Air Quality Management District.

Note: UCLA = University of California, Los Angeles; CSU = California State University; SMC = Santa Monica College.

percent in 2000 to 13.1 percent in 2001—a 73 percent increase in just one year.<sup>13</sup>

Do regional factors (such as gasoline prices) explain the large increase in bus ridership to UCLA between 2000 and 2001? Bus ridership was relatively unchanged at four nearby universities, while it increased substantially at UCLA (see Figure 3).<sup>14</sup> The decline in bus ridership at Santa Monica College, a 29,000-student community college located in the center of the Blue Bus service area, is particularly striking. These

**Table 1.**  
**Effects of BruinGO on commute mode shares (in percentages).**

	Outside Blue Bus Service Area					Inside Blue Bus Service Area					
Mode	Before	With		Percentage		Before	With	Percentage Change			
(1)	BruinGO	BruinGO	Change	Change		BruinGO	BruinGO	Change	Medium	Low	
	(2)	(3)	(4) = (3) – (2)	(5) = (4)/(2)		(6)	(7)	(8) = (7) – (6)	(9) = (8)/(6)	(10) = (9) – (5)	
Faculty and staff											
Bus	7	8	0	6		9	20	11	134	128	****
Drive alone	69	68	–1	–1		46	42	–4	–9	–8	*
Carpool	15	14	–1	–8		13	9	–4	–28	–20	***
Vanpool	5	7	1	25		3	0	–2	–85	–100	
Bike	1	0	0	–33		4	3	0	–8	25	
Walk	2	3	1	43		26	25	–1	–5	–48	
Students											
Bus	11	14	3	30	**	17	24	7	43	13	***
Drive alone	64	59	–5	–8	***	17	12	–6	–33	–26	***
Carpool	15	11	–4	–24	***	5	4	–1	–16	9	
Bike	1	1	0	43		5	3	–2	–42	–85	
Walk	4	5	2	38	***	43	45	1	3	–35	

Note: Percentages may not add to 100 percent because of rounding.

Source: The data are taken from the spring 2000 and spring 2001 Student Transportation and Employee Commute Reduction Program Plan surveys conducted by UCLA Transportation Services.

\*Changes in Columns 4 and 8 are significantly different from zero at 10 percent.

\*\*Changes in Columns 4 and 8 are significantly different from zero at 5 percent.

\*\*\*Changes in Columns 4 and 8 are significantly different from zero at 1 percent.

\*\*\*\*Changes in Columns 4 and 8 are significantly different from zero at 0.01 percent.

comparisons suggest that BruinGO caused the large increase in bus ridership at UCLA.

Because the bus share for commuting to UCLA increased by 5.5 percentage points between 2000 and 2001, and because 21,149 employees reported to work during the survey period in 2001, there were about 1,163 new bus riders to campus in 2001 ( $21,149 \times 5.5$  percent). This is the high estimate of BruinGO's effects: it attributes all of the new bus riders to BruinGO. This is unlikely to be the case because ridership to campus on non-Blue Bus lines may also have increased. To be conservative, we will not consider this high estimate further. For the medium and low estimates of BruinGO's effects, we will examine only the increase in ridership *inside* the Blue Bus service area.

For UCLA faculty/staff commuters who live inside the Blue Bus service area, the bus mode share rose from 8.6 percent before BruinGO began to 20.1 percent afterward (see Table 1). The total number of faculty/staff bus riders increased by 134 percent after BruinGO began ( $11.5 \div 8.6$ ). Fifty-seven percent of all bus riders after BruinGO began were new riders ( $11.5 \div 20.1$ ). This is our medium estimate of BruinGO's effects.

*Faculty/Staff Bus Share for Commuting (in percentages).*

	Blue Bus Service Area	
	Inside	Outside
Before BruinGO	8.6	7.2
With BruinGO	20.1	7.6
Difference	11.5	0.4
Percentage change	134	6

Source: Crain & Associates (2002, Tables 3 and 4).

One commuter rode the bus for every 5 solo drivers before BruinGO began, and this ratio rose to 1 bus rider for every 2 solo drivers with BruinGO.<sup>15</sup> For every 100 commuters who live inside the Blue Bus service area, 11 began to ride the bus after BruinGO began; 4 of these 11 switched from solo driving, 4 from carpools, 2 from vanpools, and 1 from biking or walking. The net result was a large shift from private vehicles to public transit for commuting to campus: 37 percent of the new bus riders were former solo drivers, and the number of solo drivers fell by 9 percent. In contrast, the mode shares for faculty and staff who live outside the Blue Bus service area remained within 1 percentage point of their 2000 values, and no change

was statistically significant. This dramatic difference between the “inside” and “outside” results suggests that almost all the changes inside the Blue Bus service area were due to BruinGO.

Although the mode share changes for those who live outside the Blue Bus service area were statistically insignificant, we can subtract these small “outside” changes from the “inside” changes to develop a conservative estimate of BruinGO’s effects. Doing so produces our low estimate that BruinGO increased faculty/staff bus ridership by 128 percent and reduced solo driving by 8 percent.<sup>16</sup>

The startling 134 percent increase in UCLA employees’ transit ridership after BruinGO began has significant implications for the broader concept of Eco Pass programs that allow any employer located within a transit agency’s service area to purchase fare-free transit for all its employees at a bulk rate. Only six U.S. transit agencies (Dallas, Denver, Portland, Salt Lake City, San Jose, and Seattle) now offer Eco Pass programs, and the potential market for employer-based programs is much greater than for universities. The large increase in transit ridership at UCLA shows that Eco Passes have great potential to change commuters’ travel habits.

### ► How Did BruinGO Affect Student Commuting?

UCLA Transportation Services surveyed students about their commuting choices in May 2000 (before BruinGO began) and again in May 2001, after BruinGO had operated for seven months. We can compare the results to estimate how BruinGO changed students’ commuting behavior. Inside the Blue Bus service area, the bus share rose from 17 percent to 24 percent, while the drive-alone share fell from 17 percent to 12 percent. For every 100 students who live inside the Blue Bus service area, 7 began to ride the bus and 2 began to walk, 5 switched from solo driving, 2 switched from bicycles, and 1 switched from carpools. The net result was a shift from private vehicles to public transit and walking. In 2001, 29 percent of student riders were new riders, and 71 percent of these new riders were former solo drivers. The number of student bus riders increased 43 percent, and the number of solo drivers fell 33 percent.<sup>17</sup> This is our medium estimate of BruinGO’s effects. In 2000, there was 1 bus rider for every solo driver, and in 2001, there were 2 bus riders for every solo driver within the Blue Bus service area.

Some of the mode changes by students who live inside the Blue Bus service area might have occurred without BruinGO. The mode shares for students who live outside the Blue Bus service area also changed, and we subtract these “outside”

changes from the “inside” changes to develop a low estimate similar to our low estimate for faculty and staff. Our low estimate is that BruinGO increased student bus ridership inside the Blue Bus service area by 13 percent and reduced student solo driving by 26 percent (see Table 1).<sup>18</sup>

### ► Fare Elasticities

Large increases in bus ridership and decreases in solo driving were also found at other universities that offer Unlimited Access programs. In his study of transportation on university campuses, James Miller (2001) found that the first-year ridership increases at universities with Unlimited Access programs ranged from 50 percent at the University of Florida to 200 percent at the University of Colorado at Boulder. James Meyer and Edward Beimborn (1998) found that when the University of Wisconsin–Milwaukee began its program in 1994, the number of students who commuted to campus by bus increased by 117 percent, and the number who drove alone fell by 24 percent. The results at UCLA are remarkably similar to what happened at the University of Washington, which is very similar to UCLA in its urban location, size, and range of functions. Michael Williams and Kathleen Petrait (1993, Figure 2) found that when Washington began its U-Pass program in 1991, the number of commuters who rode the bus to campus increased by 57 percent, and the number who drove alone fell by 30 percent. At UCLA, our medium estimate is that the number of bus riders increased by 56 percent, and the number of solo drivers fell by 20 percent (see Table 2).<sup>19</sup>

We can use the ridership increases at UCLA to estimate the fare elasticity of demand for transit commuting. Among those who live inside the Blue Bus service area, the medium estimate of the fare elasticity of transit demand is  $-0.28$ .<sup>20</sup> A 10 percent reduction in the fare will increase bus ridership by 2.8 percent. The lower initial bus share for faculty/staff commuters before BruinGO began may help explain their higher fare elasticity.

We can also use these data to calculate the cross-elasticity between the transit fare and the number of solo drivers to campus. Our medium estimate is that the cross-elasticity is 0.1.<sup>21</sup> A 10 percent reduction in the transit fare will reduce the number of solo-driver trips by 1 percent. This cross-elasticity may seem low, but it leads to a large decrease in the number of solo drivers because both the fare reduction and the initial number of solo-driver trips are large.

These results are for BruinGO’s first year. During its second year (2001–2002), BruinGO ridership increased by 27 percent.<sup>22</sup> This large second-year ridership increase echoes the experiences at other universities with Unlimited Access

programs. At the University of California, Davis, for example, transit ridership increased by 10 percent per year during the decade following the creation of its program in 1990 (Brown, Hess, and Shoup 2001).

Three factors associated with Unlimited Access programs explain these long-term ridership increases: service improvements, greater familiarity with the transit system, and changes in residential choices.

First, the transit agencies receive more revenue as ridership increases, and they can improve their service to campus. The more convenient and reliable service then attracts more riders than would be expected from the fare reduction alone. The added demand and fare revenue created by BruinGO allowed the Blue Bus to schedule 16 new buses on two of its lines to campus, while the new riders on the three other lines were carried with the existing capacity. With the added service, 304 scheduled Blue Buses arrive at UCLA every weekday.<sup>23</sup>

Second, because BruinGO provides everyone with a transit pass, more people have an incentive to learn about transit service—where buses go, how often, and how late. Most travelers know little about the modes they do not use, and public transit is not a part of most people's mental maps. As people become more familiar with the transit system, however, they begin to use it for trips they previously believed it would not serve.

Third, and perhaps most important over the long term, students adjust their housing choices to take advantage of fare-free transit. Advertisements for student apartments now often emphasize "Blue Bus accessibility" as a selling point. As the share of students with easy access to public transit grows, ridership does too.

In summary, the ridership increases associated with Unlimited Access programs are not one-shot occurrences but rather the beginning of a long-term trend. BruinGO has fundamentally shifted the way many UCLA students, staff, and faculty view public transportation.

### ► How Did BruinGO Affect Parking Demand?

Before BruinGO began, 3,400 faculty and staff and 3,000 students drove to campus alone from within the Blue Bus service area. With BruinGO, 3,100 faculty and staff and 2,000 students drove to campus alone. Therefore, more than 1,000 commuters stopped driving to campus alone after BruinGO

**Table 2.**  
**Effects of BruinGO on commuting from inside the Blue Bus service area.**

	<i>Medium Estimate</i>			<i>Low Estimate</i>		
	<i>Percentage Change</i>	<i>Fare Elasticity</i>	<i>Number Change</i>	<i>Percentage Change</i>	<i>Fare Elasticity</i>	<i>Number Change</i>
Faculty/staff bus riders	+134	-0.67	+854	+128	-0.64	+818
Student bus riders	+43	-0.22	+1,248	+13	-0.07	+384
Total bus riders	+56	-0.28	+2,102	+33	-0.17	+1,202
Faculty/staff solo drivers	-9	+0.05	-304	-8	+0.04	-260
Student solo drivers	-33	+0.17	-992	-26	+0.15	-760
Total solo drivers	-20	+0.10	-1,296	-16	+0.08	-1,020

began (see Table 2). The campus parking spaces these former solo drivers had occupied became available for daily visitors or other students without permits.

UCLA's wait list for parking permits confirms that BruinGO reduced campus parking demand. Students who apply for but do not receive a parking permit live in a kind of automotive purgatory, and UCLA considers the wait list an indicator of the "unmet need" for campus parking, even if a student lives only a block from campus. The wait list of "unparked" students declined from 3,969 in the fall quarter of 1999 (before BruinGO began) to 2,637 in the fall quarter of 2000 (during BruinGO's first year). Therefore, 1,332 students left the parking wait list after BruinGO began. Some of these students may have received a permit given up by a new bus rider, and others may have decided not to apply for a permit because of BruinGO.

### ► BruinGO Also Serves Many Noncommute Trips

Our evaluation has focused on commute trips, but students, staff, and faculty also use BruinGO for many noncommute trips. For example, staff and faculty ride the Blue Bus to off-campus work sites, an option that is especially useful for the many vanpool commuters who do not have a car available during the day. Even for those who do have cars available, riding the bus saves parking and unparking time at both ends of a trip, and for short trips, this can make the bus faster than driving. As part of the pilot program evaluation, UCLA Transportation Services requested comments on BruinGO from the university community. More than 2,500 students, staff, and faculty responded, and we can look at their own words to see why they ride the Blue Bus for university business trips:<sup>24</sup>

My job requires a lot of travel around campus and Westwood in general. Since the BruinGO program started, my job has been made easier.



When I travel between offices, taking the Blue Bus for free saves my time and UCLA's time.

I use the Blue Bus for meetings in the Wilshire Center at least three days a week. BruinGO saves a lot of time since I don't have to find parking and also saves UCLA money because I don't need validation. Not to mention the Wilshire traffic!!

Students also use BruinGO for many noncommute trips. Students reported that they rode free to the Getty Museum, their internships, volunteer work, the beach, or anywhere else they want to go. Whole classes take the bus to museums or public meetings. Again, comments sent to UCLA Transportation Services explain how BruinGO gives students access to many valuable social, educational, and job opportunities in Los Angeles:

I am more likely to attend cultural events, concerts, and club meetings since I know that transportation will be so easy. BruinGO allows me to get much more out of my education besides simply taking classes.

I feel like the whole city is laid out before me. I use my Bruin Card to go to my internship at Loyola Marymount University.

As a teaching assistant, I believe that expanding learning outside the classroom (to museums) has always been a worthwhile experience. Now, with BruinGO, it is a great deal easier for students to expand their horizons beyond campus and Westwood.

As an international student at UCLA, I have found it extremely reassuring and welcoming to be able to negotiate the landscape of Los Angeles with the help of BruinGO. I arrived in L.A. without a car, and BruinGO facilitated the process of getting to know the city and the UCLA campus.

These comments by students, staff, and faculty show that BruinGO does much more than change the way they commute to campus. It helps students become more engaged with the city, and it helps staff and faculty be more productive in their work.

### ► Measuring the Costs and Benefits of BruinGO

BruinGO increased transit ridership, reduced solo driving, and caused more than 1,000 solo drivers to give up their parking spaces. Are these benefits sufficient to justify BruinGO's cost? Some costs and benefits accrue to the university, some to the transit agency, and some to society as a whole. We have estimated BruinGO's costs and benefits from the perspective of the campus community because this is the population being asked to decide whether to continue the program.<sup>25</sup> We allocated the costs and benefits among four groups within the

campus community: students, faculty and staff, university departments, and campus visitors.

### The Costs of BruinGO

BruinGO is funded entirely from parking revenue, which is derived from both daily parking fees and the sale of monthly parking permits. Of the total parking revenue, students pay 17 percent, faculty and staff pay 25 percent, university departments pay 4 percent (for university guests), and campus visitors pay 54 percent.<sup>26</sup> We multiply these percentages times BruinGO's \$810,000 total cost to allocate this cost, and the top panel of Table 3 shows the distribution.<sup>27</sup>

### The Benefits of BruinGO

BruinGO provides many benefits to the campus community, but some are difficult to quantify. For example, BruinGO helps the university recruit and retain employees and students, and it enhances the educational experience of students by providing access to local cultural sites. But BruinGO also provides two benefits that we *can* quantify: reduced fare payments for riders and reduced parking demand.

#### *Reduced Fare Payments*

BruinGO subsidizes individual riders, not the Blue Bus. The university pays the Blue Bus for each BruinGO ride, but students, staff, and faculty receive all the money.<sup>28</sup> Riders do not reach into their own pocket to pay the fare when they board the bus, but into the university's pocket. For those who were riding the bus before BruinGO began, the fare subsidy is a transfer payment to students, staff, and faculty because it replaces expenditures they would have made without the program. These existing riders made 909,000 rides using BruinGO, and we valued their fare reduction benefit at 45¢ per ride.<sup>29</sup> The riders' benefit for the existing rides is thus \$409,000 (909,000 rides  $\times$  45¢ per ride). For the new bus rides induced by BruinGO, the value to the riders is presumably less than 45¢ a ride because they were unwilling to pay the fare before the program began. If we assume that the demand curve is linear (as shown in Figure 4), the value to riders is the area under the demand curve (the consumer surplus) for the 512,000 new rides, and the average value (to the rider) per ride is half the fare payment, or 22.5¢ per ride. The total value of the new rides is therefore \$115,000 (512,000 rides  $\times$  22.5¢ per ride).<sup>30</sup> The combined fare reduction benefit (increase in

consumer surplus) for the existing and new riders is worth \$524,000 (\$409,000 + \$115,000). Because students made 73 percent of the BruinGO rides, while faculty and staff made 27 percent, we allocate 73 percent of the fare reduction benefit to students and 27 percent to faculty and staff.

Because we count UCLA's fare payment to the Blue Bus as a cost, we must also count the fare savings for UCLA's riders as a benefit. Most of the university's spending for BruinGO becomes direct financial aid for students. Money not spent on bus fares can be put toward books and other expenses, so UCLA's dollars get used twice: first for transportation and second for student aid. Students sent many comments to UCLA Transportation Services describing this benefit:

I love the BruinGO program. I have like 700 bucks total . . . no kidding, and the BruinGO program is like my lifeline.

I save about \$10 weekly, getting back and forth from school. Forty dollars a month buys a lot of groceries.

I know \$1 a day doesn't seem like a lot, but being able to ride free means I can spend the \$25 I save per month on other things . . . like schoolbooks.

A survey of student BruinGO riders in April 2002 found that 76 percent of them received financial aid from the university, so the fare subsidy effectively increases UCLA's financial aid packages.<sup>31</sup> Some riders also save far more than their bus fares. The survey found that 56 percent of riders own a car. When asked why they did not drive to campus, most of them said that they did not receive a parking permit or that a permit costs too much, but several volunteered that another person in the household had the car. One said, "BruinGO is our second car." If BruinGO convinces a family that they can live with only one car, the money saved by forgoing a second car can amount to several thousand dollars a year for fuel, maintenance, insurance, parking, and other ownership costs.

#### *Reduced Parking Demand*

BruinGO riders save money, but they are also led, as if by an invisible hand, to promote another goal: reduce parking

**Table 3.**  
**Measured annual costs and benefits of BruinGO.**

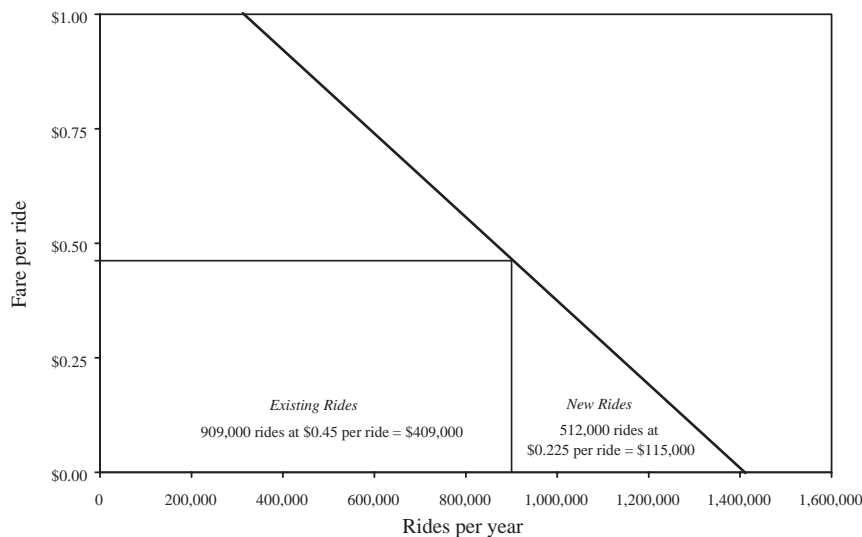
	<i>Students</i>	<i>Faculty and Staff</i>	<i>University Departments</i>	<i>Campus Visitors</i>	<i>Total</i>	<i>Percentage Share</i>
Distribution of costs						
BruinGO rides	\$108,800	\$160,000	\$25,600	\$345,600	\$640,000	79
BruinGO administration	\$28,900	\$42,500	\$6,800	\$91,800	\$170,000	21
Total cost	\$137,700	\$202,500	\$32,400	\$437,400	\$810,000	100
Percentage of total cost	17	25	4	54	100	
Distribution of benefits						
Reduced fare payments	\$399,000	\$125,000			\$524,000	16
Reduced parking demand	\$463,000	\$682,000	\$109,000	\$1,472,000	\$2,726,000	84
Total benefits	\$862,000	\$807,000	\$109,000	\$1,472,000	\$3,250,000	100
Percentage of total benefits	27	25	3	45	100	
Comparing the benefits and costs: benefit-cost measure						
Net benefits (benefits – costs)	\$724,000	\$605,000	\$77,000	\$1,035,000	\$2,440,000	
Benefit/cost ratio	6.3	4.0	3.4	3.4	4.0	

demand. The fare for a bus ride to campus is far less than the cost of building a parking space on campus, and avoiding the expense of new parking spaces is one of BruinGO's major benefits. BruinGO allows the university to satisfy its transportation demand with a smaller parking supply.

More than 1,000 former solo drivers who began to ride the bus after BruinGO began vacated the parking spaces they previously occupied, and these spaces are made available to new users. For these new users, the parking spaces vacated by former solo drivers are perfect substitutes for newly constructed spaces. We can therefore value the benefit of reducing parking demand by comparing it with the cost of increasing the parking supply. A new 1,500-space parking structure built on campus cost \$47.3 million, or \$31,500 per space (Office of the President 2001). Because UCLA is willing to pay \$31,500 per new parking space, we can use this figure to represent the value to UCLA of making another space available. BruinGO "buys back" parking spaces from existing users, as opposed to building new spaces. Since BruinGO reduced the demand for parking by at least 1,020 spaces, the reduction in parking demand is worth \$32.1 million (1,020 spaces × \$31,500 per space; see Table 2).

The debt service of \$2,414 per space per year for the capital borrowed to finance the parking structure shows the annual value of the one-time capital cost of a new parking space. When





**Figure 4.** Benefit of fare savings for BruinGO.

the operating cost is added, the annual capital and operating cost per new parking space is \$2,673 per year (or \$223 per month).<sup>32</sup> At this rate, the annual cost of 1,020 new parking spaces is \$2.7 million (1,020 spaces  $\times$  \$2,673 per space). Because UCLA is willing to pay \$2.7 million per year to increase the campus parking supply by 1,020 new parking spaces, we assume that reducing campus parking demand by 1,020 spaces is also worth \$2.7 million per year. UCLA increases parking fees to finance new campus parking spaces, and we therefore allocate the avoided cost of new spaces in proportion to the sources of campus parking revenue (see Table 3).

Even those who pay for parking receive a net benefit from BruinGO because it avoids the high cost of increasing the parking supply. Drivers enjoy the financial benefit of reduced parking demand in the form of lower parking fees. This benefit is worth \$2.7 million, while BruinGO cost \$810,000. Therefore, the benefit-cost ratio for drivers who pay to park is 3.4 to 1 (\$2.7 million  $\div$  \$810,000). Because BruinGO is financed entirely by parking fees, drivers pay for bus riders, but *both* drivers and bus riders are better off.

Many students, staff, and faculty members wrote to UCLA Transportation Services to report that BruinGO reduced their demand for parking:

I LOVE the BruinGO system. I gave up my parking permit because of it.

Because of BruinGO, I have mothballed my car and take the bus to school every day, so BruinGO has been a tremendous benefit to me (and has stopped me from applying for a parking permit).

I never plan to apply for a parking permit again.

New drivers who were formerly wait-listed for a parking permit and campus visitors who are able to park more easily do not realize that they also benefit from BruinGO, although they park in spaces vacated by former drivers.

By reducing the demand for parking, BruinGO reduces the demand for building new parking structures on campus, makes parking more affordable and available for those who must commute to campus by car, and allows the university to use land for purposes other than parking. By making more parking spaces available for visitors, BruinGO also allows more members of the Los Angeles community to take advantage of the campus's cultural and educational resources and helps

counter UCLA's image as an ivory tower with parking as its moat.

#### *Benefits to the Blue Bus*

The Blue Bus expected BruinGO to increase transit ridership, which it does. BruinGO also provides an unexpected benefit. Blue Bus drivers report that swiping the university ID cards is faster than paying the fare with coins and that it reduces boarding times. To test this effect, we observed Blue Bus boardings outbound from the main UCLA terminal in August and September 2001 *without* swipecards (when BruinGO was suspended for the summer break) and again in October 2001 *with* swipecards (during BruinGO's second year of operation). The average boarding time per passenger fell by 1 second when swipecards were used (see Figure 5).

Time savings translate into financial savings. Since 1.4 million BruinGO boardings were made using swipecards during the first year, the Blue Bus saved 339 vehicle operating hours. At an average cost of \$67 per vehicle hour, this amounts to a savings of \$26,000 a year. In addition to this operating cost saving, all Blue Bus passengers benefit from the reduced travel time that results from faster boardings.

#### *External Benefits*

Beyond its benefits to UCLA and the Blue Bus, BruinGO also produces benefits to all of Los Angeles. If BruinGO

reduces future parking construction and diverts trips from cars to public transportation, it reduces vehicle trips and vehicle emissions. This is an important by-product of fare-free transit because Los Angeles has the worst traffic congestion and air pollution in the United States. We have not attempted to put a dollar value on the social benefits of reduced traffic congestion and air pollution, but we can suggest their magnitude by comparing BruinGO with the alternative strategy of building new parking structures. The Environmental Impact Report (EIR) for UCLA's new 1,500-space, \$47 million parking structure shows that it will generate 1.5 million additional vehicle trips to and from UCLA every year. A parking structure does not, by itself, generate vehicle trips; rather, where there is a shortage of parking, a new parking structure will enable more vehicle trips. According to the EIR, these additional vehicle trips will exhaust 87 tons of carbon dioxide, 9 tons of nitrogen oxide, 14 tons of reactive organic gases, and 7 tons of particulates into the region's air every year.<sup>33</sup> By reducing the demand for vehicle trips, BruinGO can create substantial environmental benefits for the entire region.

### Comparing the Benefits and Costs of BruinGO

We can now compare the measured benefits and costs of BruinGO. BruinGO's benefit/cost ratio exceeds 1.0 for every group considered. The students' exceptionally high benefit/cost ratio of 6.3 to 1 helps explain the many enthusiastic comments that students have sent to UCLA Transportation Services about BruinGO:

BruinGO is one of the smartest things UCLA has done in years. With this program, I feel UCLA is finally showing it cares for students.

I am a first-year graduate student and I do not have the words to adequately describe how wonderful it is to have a free transportation system available to me.

BruinGO makes me feel proud to be a Bruin.

The bottom panel of Table 3 shows that BruinGO's measured benefits are \$3.3 million a year (for fare savings and

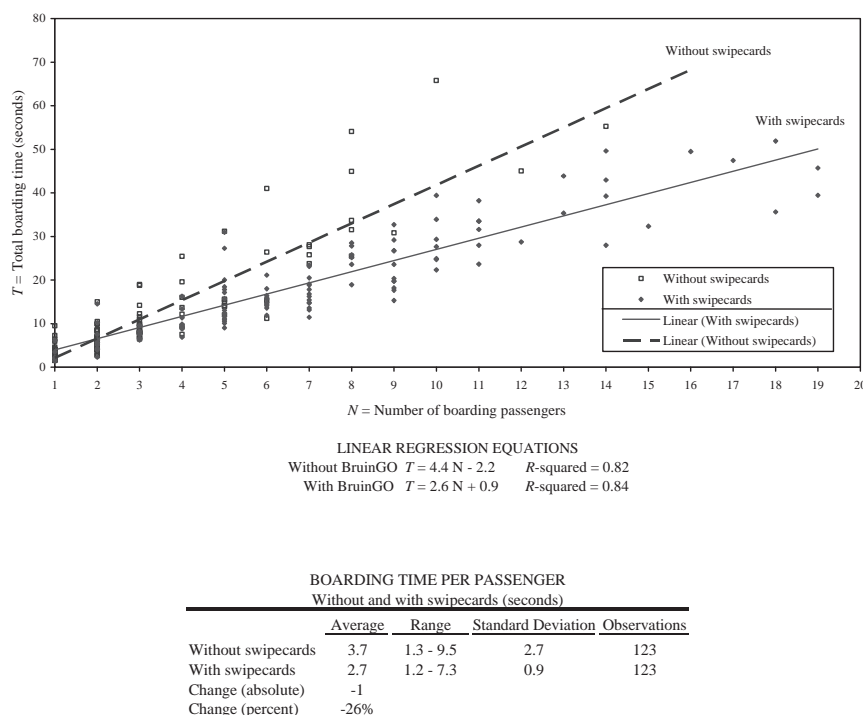


Figure 5. Boarding time as a function of the number of boarding passengers (without and with swipecards).

reduced parking demand), and its costs are \$810,000 a year (for fare payments and administration). Even when the unmeasured benefits are neglected, the net benefit is \$2.4 million a year, and the overall benefit/cost ratio is 4 to 1.

### ► Difficulty in Predicting Ridership and Cost

The pilot program for BruinGO proved to be a success. But because Unlimited Access is a novel concept, many people have difficulty understanding how it will work, and predicting the ridership and cost is difficult. We can show this difficulty by comparing the predictions made before BruinGO began with the results observed during the pilot program in 2000-2001 (see Table 4).

In 1998, UCLA hired a transportation consultant to predict the ridership and cost of a transit pass program for faculty and staff. The consultant predicted that fare-free transit for faculty and staff would cost \$170,000 per month (exclusive of administrative costs). BruinGO's actual cost for faculty and staff amounted to only \$19,200 per month in 2000-2001, or 11 percent of the predicted cost.<sup>34</sup>

Why did the consultant overestimate BruinGO's cost? The main reason seems to be a misunderstanding of how a

**Table 4.**  
**Predicted and realized results of a**  
**transit pass program for faculty and staff.**

	<i>Consultant Prediction (1)</i>	<i>BruinGO Result (2)</i>	<i>Result as Percentage of Prediction (3) = (2)/(1)</i>
Fare subsidy (per month)	\$170,000	\$19,200	11
Transit ridership increase (riders per day)	315	818	260
Reduction in parking demand (spaces per day)	150	260	173

Source: Consultant's predictions are from Crain & Associates (1998). Results are taken from the low estimates discussed earlier.

university transit pass program works. The consultant assumed that UCLA would buy a regular transit pass (at a cost of \$42 per month) for all employees who do not have a UCLA parking permit. The consultant also assumed that most employees who receive these transit passes would not use them. This misunderstanding helps to explain why the consultant overestimated BruinGO's actual cost by 885 percent. Although BruinGO gives free transit to everyone at UCLA (not just to those without a parking permit), it costs 89 percent less than the consultant predicted.<sup>35</sup>

The consultant also predicted that fare-free transit would attract only 315 new faculty/staff riders, but BruinGO attracted at least 800 new riders, or more than 260 percent of what was predicted.<sup>36</sup> What explains this error? The consultant assumed that the fare elasticity of demand for transit ridership would be only  $-0.18$ , which is extremely low. In reality, the fare elasticity for faculty and staff turned out to be between  $-0.67$  and  $-0.64$ , more than three times greater.<sup>37</sup> The consultant also used the *point* elasticity rather than the *arc* elasticity that economists recommend for predicting the effects of large fare changes (in this case, a 100 percent reduction); this arithmetic error reduced the predicted ridership by another 50 percent.

These difficulties in predicting the effects of BruinGO show the value of UCLA's decision to offer a pilot program. UCLA, the Big Blue Bus, and the riders themselves could not fully understand how a transit pass program works without the actual trial run. BruinGO's high ridership and low cost are a welcome departure from many transportation investments that attract fewer riders and cost more than consultants predict.

## ► Conclusion

The substantial mode shifts caused by BruinGO refute the common assumption that fare-free transit cannot entice

commuters from their cars. Transit ridership for commuting to campus increased by 56 percent during BruinGO's first year, and solo driving fell by 20 percent. Because these startling results were achieved in a city famous for its addiction to cars, they suggest that Unlimited Access can work almost anywhere.

If Unlimited Access can produce so many benefits for students, universities, and transit agencies at such a low cost, why don't more universities offer it? More universities *are* offering it every year, and it is also spreading to other settings. Six transit agencies in the United States offer Eco Pass programs that allow all employers to purchase transit passes for all their employees at a heavily discounted fare. A few transit agencies have even taken the idea beyond the workplace. In Seattle, the transit system has arranged for game tickets to serve as transit passes on game days at the University of Washington football stadium. In Silicon Valley, the transit system allows residential developments to buy Eco Passes for all residents.

Unlimited Access programs contribute to so many important planning goals: transportation demand management, smart growth, transit-oriented development, energy conservation, clean air, and sustainable cities. Few transportation planning reforms produce such large benefits at such low cost and have so much potential for growth.

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## ► Notes

1. The transit mode share data come from the 1990 and 2000 U.S. census, available at <http://www.census.gov>. We calculated the average bus occupancy using data from the National Transit Database. In 2000, transit patrons traveled 18.8 billion passenger miles by bus, and transit agencies provided 1.7 billion vehicle revenue miles of service. Dividing the 18.8 billion passenger miles by the 1.7 billion vehicle revenue miles gives an average bus occupancy of 10.7 passenger miles per bus mile ( $18.8 \div 1.7 = 10.7$ ). Dividing the average bus occupancy of 10.7 passengers by the average bus capacity of forty seats gives an average bus occupancy of 27 percent ( $10.7 \div 40 = 27$  percent). See U.S. Federal Transit Administration (2001).

2. Transportation accounted for 66.4 percent of U.S. oil consumption in 1996, and highway transportation accounted for 78.3 percent of U.S. oil consumption for transportation. Therefore, highway transportation accounted for 52 percent of U.S. oil con-

sumption ( $66.4 \times 78.3$  percent). The United States also consumed 25.7 percent of the world's oil production in 1996. Therefore, highway transportation in the United States consumed 13.4 percent (slightly more than an eighth) of the world's total oil production ( $52 \times 25.7$  percent). Highway transportation refers to travel by cars, trucks, motorcycles, and buses. See Stacy Davis (2000, Tables 1.3, 2.10, and 2.7) for the data on energy consumption in the United States.

3. Universities have given their programs a variety of names, such as BruinGO, ClassPass, SuperTicket, and U-Pass. We refer to these programs collectively as Unlimited Access. See Brown, Hess, and Shoup (2001) for a survey of thirty-five Unlimited Access programs. There were more than sixty programs by 2002.

4. BruinGO was launched as an eight-month pilot program. UCLA paid \$640,000 for student, staff, and faculty rides and spent an additional \$170,000 in administrative and marketing expenses, for a total cost of \$810,000. BruinGO is funded entirely from parking revenue, which is derived from both daily parking fees and the sale of monthly parking permits. UCLA and the Blue Bus renewed the program for the 2001-2002 and 2002-2003 school years.

5. The Blue Bus service area is defined as the ZIP codes that include the five Blue Bus lines that serve UCLA: 90024, 90025, 90034, 90035, 90049, 90064, 90066, 90291, 90401, 90402, 90403, 90404, and 90405. Crain and Associates (2002, 21) report that 7,424 of the 21,149 employees (35 percent) surveyed in 2001 live inside the Blue Bus service area. Boyd et al. (2002) report that 17,102 of the 36,084 students (44 percent) live inside the Blue Bus service area.

6. There were 4,565 faculty, staff, and student respondents in 2000 and 3,614 in 2001.

7. Crain and Associates (2002, Tables 3 and 4) report the separated results for faculty and staff, while Boyd et al. (2002) report the results for students.

8. The medium and low estimates are also conservative because, over time, people may relocate their residences to take advantage of BruinGO. Students are often new to the community, and they move often, so they can easily adjust their housing locations in response to the free public transit.

9. Santa Monica Municipal Bus Lines (2002, Table 5-1). The sample size was 763 BruinGO riders.

10. Santa Monica Municipal Bus Lines (2002, Table 3-1). Some commuters who live inside the Blue Bus service area probably park and ride because, although they live in a ZIP code served by the Blue Bus, they do not live within walking distance of a bus stop.

11. UCLA Transportation Services Advisory Board (1999) reports BruinGO's goals.

12. The South Coast Air Quality Management District (SCAQMD) requires employers of 250 or more employees to conduct employee travel surveys during the four-hour peak arrival period of 6 A.M. to 10 A.M. from Monday to Friday. UCLA had 27,644 employees who reported to work between 6 A.M. and 10 A.M. in 2001, and 77 percent of them, or 21,419 employees, commuted to campus on an average day. The text of the SCAQMD's regulation is available online at <http://www.aqmd.gov/trans/doc/rule/index.html>.

13. UCLA's Employee Commute Reduction Program Plans show that the share of UCLA employees who commute by public transit rose from 7.6 percent in 2000 to 13.1 percent in 2001, a 5.5 percentage point increase. The number of daily transit trips increased from 1,625 before BruinGO (2000) to 2,805 with BruinGO (2001), an increase of 1,180 daily transit trips. This is a 73 percent increase in transit ridership in one year. Campus parking

fees increased by 11 percent in July 2000, and this may have contributed to the increase in transit ridership to campus in 2001. But the prices of campus parking permits also increased by between 22 and 66 percent in 1991, while transit ridership fell by 1 percent the following year. Also, the prices for permits increased by 10 percent in 1995, while transit ridership fell by 7 percent in the next year. Therefore, the 11 percent increase in parking fees in 2000 is unlikely to have caused the 73 percent increase in transit ridership in 2001.

14. The four universities are as follows: California State University, Los Angeles; California State University, Northridge; California State University, Long Beach; and Santa Monica College.

15. The ratio of bus riders to solo drivers rose from 9 percent/46 percent before BruinGO to 20 percent/42 percent with it.

16. An example shows how we calculated the low estimate. Consider the case of faculty/staff bus ridership. The employee survey shows there were 638 faculty/staff bus riders before BruinGO and 1,492 with BruinGO, an increase of 854 riders, or 134 percent. There was a 6 percent increase in faculty/staff bus riders outside the Blue Bus service area. We might expect that bus ridership inside the Blue Bus service area would have increased 6 percent without BruinGO; this would have resulted in approximately 35 new bus riders ( $638 \times 6 \text{ percent} = 35$ ). Thus, we assume that BruinGO is responsible for 818 new riders ( $854 - 35 = 818$ ), or a 128 percent increase in bus ridership ( $818 \div 638$ ). By contrast, the high estimate discussed earlier showed that overall bus ridership to campus increased by 1,163 new riders in 2001.

17. Parking permit holders also use BruinGO. UCLA Transportation Services surveyed a random sample of 2,473 parking permit holders during February 2002 to learn about their BruinGO use. The survey found that 9.6 percent of all parking permit holders used BruinGO for commuting to or from campus during the previous week, and they used BruinGO for an average of 4.0 one-way commute trips per week. Among permit holders who live within any ZIP code served by the Blue Bus, 18.7 percent rode the bus to or from campus during the previous week, and they made an average of 3.8 trips per week.

18. The bus share for students who live outside the Blue Bus service area rose from 11 percent to 14 percent, the drive-alone share fell from 64 percent to 59 percent, and the carpool share fell from 15 percent to 11 percent. The large increase in bus ridership could be a function of students' propensity to park off campus and ride the Blue Bus the rest of the way to campus. The large increases in walking and bicycling are probably a function of the small sample size.

19. We combined the student data with the faculty/staff data to calculate these numbers. The combined survey and swipe data show there were 909,000 bus riders per year before and 1.4 million bus riders per year after BruinGO, an increase of 56 percent. The survey data also show there were 6,369 solo drivers per day before and 5,072 solo drivers per day after BruinGO, a decrease of 20 percent. The change in the number of travelers by each mode is calculated by multiplying the change in mode shares after BruinGO began by the number of commuters who live in the Blue Bus Service area: 7,424 faculty/staff and 17,102 students.

20. Elasticity measures the percentage change in ridership divided by the percentage change in fare. When fare changes are large, as with BruinGO, the preferred measure of elasticity of demand is the logarithmic arc elasticity. But the logarithmic arc elasticity is undefined when the fare is reduced to zero. Therefore, the fare elasticities for BruinGO are calculated as the linear arc elasticity, or "midpoint" elasticity, which approximates the average



elasticity between two points along a demand curve. To calculate the midpoint elasticity, the percentage change in fare is defined as the absolute change in fare divided by the average of the two fares between which elasticity is measured. Similarly, the percentage change in ridership is defined as the absolute change in ridership divided by the average of the two riderships between which elasticity is measured. See Samuelson and Nordhaus (1989, 425) for an explanation of the midpoint formula.

21. The cross-elasticity is the percentage change in drive-alone vehicle trips divided by the percentage change in transit fare, again calculated as the arc elasticity. The cross-elasticity is positive because public transit and solo driving are substitutes.

22. The number of rides increased from 1,383,479 in the first year to 1,750,640 in the second year (communication from UCLA Transportation Services, 27 November 2002). This shows that the one-year fare elasticities reported in the text underestimate BruinGO's longer run effects.

23. Additional unscheduled "booster" buses are also run during peak hours and days when overcrowding would otherwise occur. These booster buses are deleted during university holidays, when demand is low. The first scheduled bus arrives on campus at 5:53 A.M., and the last one leaves at 12:08 A.M. The route structure and timetables for the Blue Bus are available online at <http://www.bigbluebus.com/home/index.asp>.

24. The comments on this and the following page are taken from a survey of UCLA students, staff, and faculty. The comments are available at <http://www.spsr.ucla.edu/its/bruingo.pdf>.

25. The program clearly provides net benefits to the transit agency, or it would not participate. BruinGO also produces significant benefits for the Los Angeles community because it reduces solo driving to UCLA and, in turn, reduces traffic congestion and vehicle emissions.

26. UCLA Transportation Services provided the data on the shares of total permit revenue paid by faculty, staff, and students and on the shares of total daily sales revenue paid by faculty, staff, students, university departments, and visitors. Many visitors attend athletic events, concerts, lectures, theatrical performances, and other events on campus. Because they pay for parking by the hour or day, visitors account for a disproportionate share of total parking revenue.

27. This cost includes \$640,000 for BruinGO rides and \$170,000 for administration and marketing.

28. For financing BruinGO, both the administrative cost (\$170,000) and the fare payments (\$640,000) are the same: UCLA must cover both. But for evaluating BruinGO, these two costs are utterly different. The administrative costs represent a consumption of resources (mainly UCLA staff time), while the fare payments represent an income transfer to students, staff, and faculty.

29. Most riders paid the cash fare of 50¢ per ride before BruinGO began, so valuing the existing riders' fare reduction benefit at UCLA's price of 45¢ per ride is a conservative estimate of BruinGO's benefit to the existing riders. UCLA paid the Blue Bus for 1.4 million BruinGO rides. According to the swipe data, students made 73 percent of the rides (1.4 million  $\times$  73 percent = 1,038,222 rides), and faculty and staff made 27 percent (1.4 million  $\times$  27 percent = 384,000 rides). The swipe data do not allow us to break these numbers down into new and existing rides, but the transportation surveys do. The student survey showed that the bus mode share for those who live inside the Blue Bus service area was 17 percent before and 24 percent after BruinGO. Therefore, those who rode the bus before BruinGO made 71 percent (17  $\div$  24) of student rides, and new riders made 29 percent (7  $\div$  24). Existing

student riders thus made 737,138 rides (1,038,222 rides  $\times$  71 percent), and new student riders made 301,084 rides (1,038,222 rides  $\times$  29 percent). The faculty/staff survey showed that the bus mode share for those who live inside the Blue Bus service area was 9 percent before and 20 percent after BruinGO. Therefore, those who rode the bus before BruinGO made 45 percent (9  $\div$  20) of faculty/staff rides, and new riders made 55 percent (11  $\div$  20). Existing faculty/staff riders thus made 172,800 rides (384,000 rides  $\times$  45 percent), and new faculty/staff riders made 211,200 rides (384,000 rides  $\times$  55 percent). Existing riders made a total of 909,938 rides (737,138 + 172,800), and new riders made a total of 512,284 (301,084 + 211,200) rides.

30. This area under the demand curve for the new rides is the consumer surplus enjoyed by the riders (Friedman 2002, 202).

31. From a parking-centered view of BruinGO, the fare payments are money down the drain (because in this view, BruinGO's only purpose is to reduce parking demand). From a broader university-centered point of view, however, the spending for bus fares becomes additional income for students, staff, and faculty.

32. The structure cost \$47 million for 1,500 spaces, or \$31,500 per space. UCLA borrowed the money to finance the structure at 6.125 percent for 27 years and incurred an annual debt service of \$2,414 per debt-financed space. When the annual operating cost of \$259 per space is included, the annual total cost per debt-financed space is \$2,673, or \$223 per space per month. This high cost of structured parking is not unique to UCLA. The Parking and Transit Services (1998) department at the University of Colorado, Boulder, reports that the estimated debt service for a new parking structure on campus is \$227 per month for each parking space added by the structure.

33. Intramural Field Parking Structure Final Environmental Report, May 2001, Vol. I, Table IV.I-4. The Environmental Impact Report (EIR) reports the vehicle trips and emissions per day. To obtain the annual values, we multiplied the daily values by the number of weekdays per year (excluding all trips on the weekends).

34. UCLA's fare subsidy was \$640,000 for nine months (see Table 3), and faculty/staff accounted for 27 percent of all BruinGO rides, so the fare subsidy for faculty/staff was \$19,200 per month (\$640,000  $\times$  0.27  $\div$  9).

35. BruinGO offers free transit only to Blue Bus riders, while the consultant estimated the cost of transit passes for all bus lines to campus. Nevertheless, the Blue Bus carries most of the transit riders to UCLA, and extending it to the other lines would not greatly increase the cost. BruinGO offers free transit to all of UCLA's 31,000 employees, not merely to those without a parking permit, so it is far more generous to faculty and staff than what the consultant proposed. UCLA is also undercharged for BruinGO because some riders report that the bus drivers sometimes allow UCLA riders to board without swiping their BruinCards. A more accurate record of the boardings would therefore increase UCLA's cost for BruinGO.

36. See Crain and Associates (1998, 47) for the consultant's prediction.

37. See Crain and Associates (1998, 47).

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