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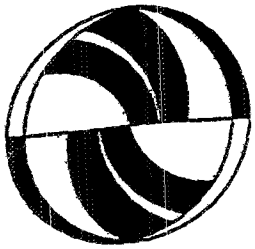

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Unlimited Access

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Abstract. Universities and public transit agencies have together invented an arrangement – called Unlimited Access – that provides fare-free transit service for over 825,000 people The university typically pays the transit agency an annual lump sum based on expected student ridership, and students simply show their university identification to board the bus This paper reports the results of a survey of Unlimited Access programs at 35 universities University officials report that Unlimited Access reduces parking demand, increases students' access to the campus, helps to recruit and retain students, and reduces the cost of attending college Transit agencies report that Unlimited Access increases ridership, fills empty seats, improves transit service, and reduces the operating cost per rider Increases in student transit ridership ranged from 71 percent to 200 percent during the first year of Unlimited Access, and growth in subsequent years ranged from 2 percent to 10 percent per year The universities' average cost for Unlimited Access is $30 per student per year

Introduction

Public transit carried only 1 8 percent of total trips in the US in 1995, down from 2 6 percent in 1977.[1] Total public transit ridership in the entire US is now lower than in some cities in other countries For example, Mexico City's transit system carries 60 percent more riders than all the transit systems in the US combined [2] Passengers occupy only 27 percent of the seats available on public transit buses, and this low seat-occupancy drives up the subsidy per passenger.[3] The US has the highest subsidy per passenger among countries in North America and Europe, yet the lowest share of all trips made by public transit.[4]

Nevertheless, there is some good news In partnership with universities, a few US transit agencies have developed an innovative program that provides fare-free transit for over 825,000 people, increases ridership, and pays for itself Universities and transit agencies have given this fare reform a variety of names – such as Unlimited Access, UPass, ClassPass, and SuperTicket – which we will refer to collectively as Unlimited Access.

We have surveyed 35 university transit-pass programs that meet the fol-

lowing definition: *Unlimited Access gives all students the right to ride public transit without paying a fare.*[5] We found that Unlimited Access substantially increases student transit ridership, improves transit agency performance, and enhances student mobility – all at low cost. The universities' average cost for Unlimited Access is $30 per student per year. Increases in student transit ridership range from 71 percent to 200 percent in the first year of Unlimited Access.

How does Unlimited Access work?

In an Unlimited Access program, a local public transit agency provides fare-free transit service for students. The university typically pays the transit agency an annual lump sum based on expected student ridership, and students simply show their university identification to board the bus. Unlimited Access thus transforms student identification cards into public transit passes. For every student on any day, a bus ride to campus (or anywhere else) is free.

Shadow fares

Unlimited Access is not free transit. With an Unlimited Access program, a university pays a "shadow fare" to a transit agency on behalf of students who ride the bus. This arrangement resembles the "shadow tolls" that some European countries use to finance highways built by the private sector.[6] With shadow-toll finance, the government pays tolls to the highway owner on behalf of the highway users. With Unlimited Access, the university pays a shadow fare to the transit agency on behalf of student riders. By virtue of the shadow-fare arrangement, students are able to ride free, universities obtain the benefits of fare-free public transit for students, and transit agencies gain a new source of revenue.

The survey

We conducted telephone interviews with university administrators, transit officials, and representatives of campus student organizations at the 35 universities that offer Unlimited Access. We asked them how much the programs cost, how the programs were financed, who was eligible to ride, how the programs changed student travel behavior, and whether or not they would recommend Unlimited Access to other universities and/or transit agencies.

Table 1 shows how much each university pays for Unlimited Access.[7] For example, consider the University of California, Santa Barbara (in the middle

of Table 1) The university's average cost of $23 per student per year is the university's annual payment to the transit agency divided by the number of students eligible to ride free ($400,200 – 17,400). The average ridership of 34 rides per student per year is the total number of rides per year divided by the number of students (584,800 ÷ 17,400). The average cost of 68¢ per ride is the university's annual payment to the transit agency divided by the number of rides per year ($400,200 ÷ 584,800); this is the shadow fare that the university pays the transit agency on behalf of the student rider. The final row shows that the average cost of Unlimited Access at the 35 universities is $30 per student per year, the average transit ridership is 50 rides per student per year, and the average cost of transit service is 61¢ per ride.

A university's total cost of providing Unlimited Access depends on the total number of rides its students take and how much the university pays the transit agency per ride. Table 1 shows that the university's cost per student is $5 per year at UC San Diego and $99 per year at UC Santa Cruz. Most of the variation in *annual cost per student* is explained by variation in the number of *rides per student*, not in the *cost per ride*.[8] The number of rides per student at Santa Cruz (103 per year) is nearly 13 times that at San Diego (8 per year), but the cost per ride at Santa Cruz (96¢) is only 1 6 times that at San Diego (60¢). The annual cost per student is higher at UC Santa Cruz mainly because Santa Cruz students ride transit far more often [9]

The diversity of locations where universities offer Unlimited Access – from small towns to large cities – indicates that it can work almost anywhere (see Figure 1) [10] Some programs have been in place for decades (UC San Diego, UMass) while others have been in operation for only a year or two (Ohio State, UNC-Wilmington). The universities range in size from 4,500 students (Edmonds Community College) to 49,000 students (University of Texas) In total the 35 Unlimited Access programs serve 825,000 eligible riders.

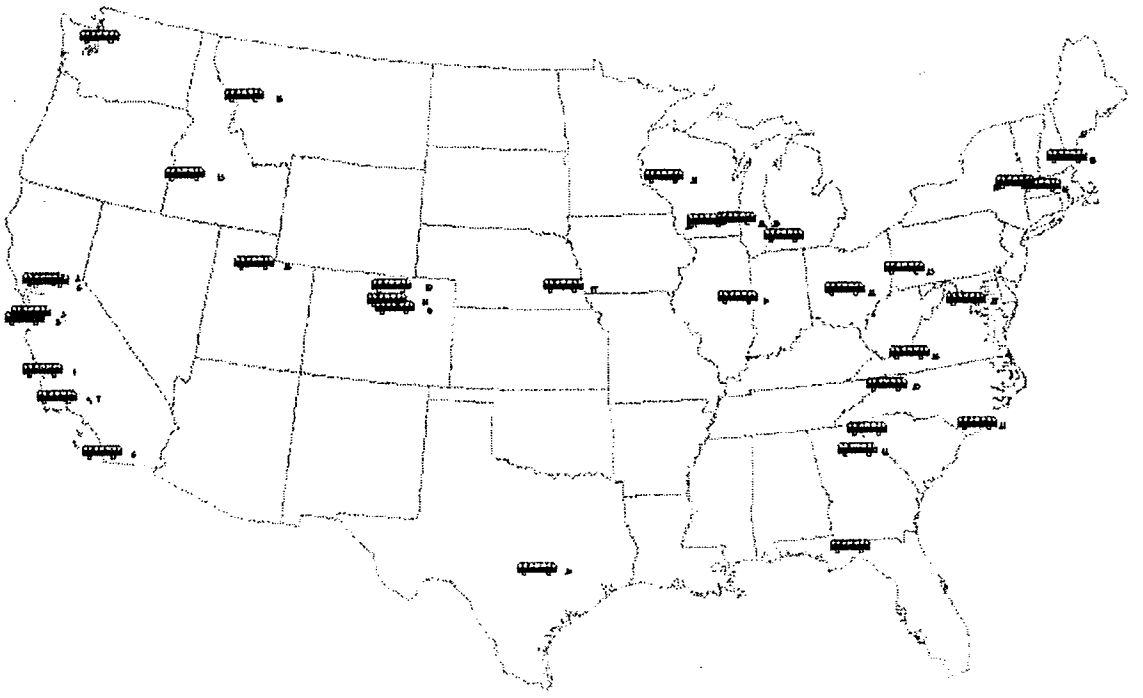
Why do universities offer Unlimited Access?

When we asked campus officials why their universities offer Unlimited Access, they typically said that it (1) reduces the demand for parking, (2) increases students' access to housing and employment, (3) helps universities recruit and retain students, (4) reduces the cost of attending college, and (5) increases transportation equity. We discuss these benefits below. When we asked transit officials why their agencies chose to participate, they said that Unlimited Access (1) increases transit ridership, (2) provides guaranteed revenue, and (3) improves overall transit service. We will discuss these benefits in a later section.

Table 1 Unlimited Access at thirty-five universities, 1997–1998

Universities	Who is eligible to ride free?	Number eligible to ride free (1)	Annual cost 1997–1998 (2)	Annual number of rides (3)	Annual cost per eligible person (4)=(2)/(1)	Annual student fee (5)	Annual no of rides per eligible person (6)=(3)/(1)	Cost per ride (7)=(2)/(3)	Year Unlimited Access began (8)
University of Florida	Students	48,000	$180,000	947,700	$4	$5	20	$0 19	1997
University of California San Diego	Students, faculty, staff, emeritus	35,200	$177,700	296,600	$5	$0	8	$0 60	1969
University of Montana	Students, faculty, staff	14,000	$83,600	947,700	$6	$0	14	$0 44	1991
Boise State University, ID	Students, faculty, staff	18,100	$160,000	175,000	$9	$0	10	$0 91	1992
University of Georgia at Athens	Students	30,000	$275,000	600,000	$9	$11	20	$0 46	1977
Cal Poly State University, San Luis Obispo	Students, faculty, staff, emeritus	17,500	$169,000	531,700	$10	$0	30	$0 32	1985
Clemson University	Students, faculty, staff	21,000	$200,000	412,568	$10	$0	20	$0 48	1996
University of New Hampshire – Durham	Students	10,000	$95,000	140,400	$10	$10	14	$0 68	1985
Cal State University, Sacramento	Students	27,000	$300,000	597,700	$11	$15	22	$0 50	1992
University of Nebraska – Lincoln	Students, faculty, staff	26,000	$290,000	476,500	$11	$0	18	$0 61	1994
University of North Carolina-Wilmington	Students, faculty, staff	11,000	$120,000		$11	$0			1997
University of Wisconsin at Eau Claire	Students, faculty, staff	11,600	$125,000	195,700	$11	$0	17	$0 64	1997
George Mason University, VA	Students, faculty, staff	20,000	$300,000		$15	$0			1996
Rensselaer Polytechnic Institute, NY	Students, faculty, staff	10,000	$148,000		$15	$0			1997
Appalachian State University, NC	Students, faculty, staff	13,200	$251,000	361,800	$19	$19	27	$0 69	1980
Colorado State University	Students	20,000	$375,400	462,900	$19	$24	23	$0 81	1975

Univ of Pittsburgh, PA	Students, faculty, staff	31,200	$650,000	1,536,900	$21	$74	49	$0 42	1995
University of California, Santa Barbara	**Students**	**17,400**	**$400,200**	**584,800**	**$23**	**$23**	**34**	**$0.68**	**1986**
Santa Barbara City College, CA	Students	12,000	$277,000	525,500	$23	$26	44	$0 53	1995
University of Massachusetts at Amherst	Students, faculty, staff	39,000	$972,300	807,500	$25	$24	21	$1 20	1969
Ohio State University	Students	48,300	$1,400,000		$29	$27			1997
University of Wisconsin at Madison	Students	39,000	$1,200,000	1,653,000	$31	$36	42	$0 73	1996
University of Utah	Students, faculty, staff	25,000	$850,000	700,000	$34	$0	28	$1.21	1992
Virginia Polytechnic Institute & State U	Students, faculty, staff	32,000	$1,100,000	1,400,000	$34	$33	44	$0 79	1983
Auraria High Education Center (UC Denver)	Students	31,500	$1,204,000	1,965,000	$38	$33	62	$0 61	1994
Univ of California, Davis	Students	18,500	$719,000	2,021,900	$39	$39	109	$0 36	1990
San Jose State Univ , CA	Students	25,500	$1,020,000	1,150,300	$40	$40	45	$0 89	1993
University of Colorado at Boulder	Students	24,500	$1,000,000	1,500,000	$41	$38	61	$0 67	1991
Western Michigan Univ	Students	26,000	$1,100,000	314,000	$42		12	$3 50	1997
Edmonds Community College, WA	Students	4,500	$193,300	363,000	$43	$60	12	$0.53	1996
Marquette University, WI	Students	6,700	$400,000		$60	$62			1995
University of Wisconsin at Milwaukee	Students	20,200	$1,247,400	2,300,000	$62	$60	114	$0 54	1994
University of Illinois at Urbana-Champaign	Students	30,400	$2,200,000	5,800,000	$72	$50	191	$0 38	1989
University of Texas at Austin	Students	49,000	$4,300,000	7,400,000	$88	$90	151	$0 58	1988
University of California, Santa Cruz	Students, faculty, staff	12,220	$1,203,800	1,253,000	$99	$83	103	$0 96	1972
	Average	23,586	$705,334	1,222,119	$30	–	50	$0 61	–
	Median	21,000	$375,400	598,850	$23	$24	28	$0 61	1992



California
1. California Polytechnic State University, San Luis, Obispo
2. California State University, Sacramento
3. San Jose State University
4. Santa Barbara City College
5. University of California, Davis
6. University of California, San Diego
7. University of California, Santa Barbara
8. University of California, Santa Cruz

Colorado
9. Auraria Higher Education Center (UC Denver)
10. Colorado State University, Fort Collins
11. University of Colorado, Boulder

Florida
12. University of Florida

Georgia
13. University of Georgia, Athens

Idaho
14. Boise State University

Illinois
15. University of Illinois, Urbana-Champaign

Massachusetts
16. University of Massachusetts, Amherst

Michigan
17. Western Michigan University

Montana
18. University of Montana, Missoula

Nebraska
19. University of Nebraska, Lincoln

New Hampshire
20. University of New Hampshire, Durham

New York
21. Rensselaer Polytechnic Institute, Troy

North Carolina
22. Appalachian State University, Boone
23. University of North Carolina, Wilmington

Ohio
24. Ohio State University, Columbus

Pennsylvania
25. University of Pittsburgh

South Carolina
26. Clemson University

Texas
27. University of Texas at Austin

Utah
28. University of Utah, Salt Lake City

Virginia
29. Virginia Polytechnic Institute, Blacksburg
30. George Mason University, Falls Church

Washington
31. Edmonds Community College

Wisconsin
32. Marquette University, Milwaukee
33. University of Wisconsin, Eau Claire
34. University of Wisconsin, Madison
35. University of Wisconsin, Milwaukee

Figure 1. Unlimited Access at United States universities.

Reduce parking demand

> "The philosophy behind starting our program in 1989 was a cost-avoidance measure to keep from building more campus parking."
>
> University of Illinois at Urbana-Champaign

> "The bus program has reduced parking demand by about 750 spaces, and has reduced political pressure to expand the parking supply."
>
> University of Colorado at Boulder

Unlimited Access encourages some students to shift from cars to public transit for their trips to campus, and officials at most campuses report that their primary reason for offering Unlimited Access was to reduce the demand for parking and avoid the expense of providing new parking spaces. As an example of the cost of campus parking, UCLA's debt service for the capital borrowed to build its most recent parking structure is $150 per space per month for 27.5 years, and the cost of a permit to park in the structure is only $43 per month.[11] In this case, paying the fare for a student who rides the bus to campus can cost far less than subsidizing the parking for a student who drives to campus

Not all new transit riders are former automobile drivers, because some students will switch from bicycling or walking to riding transit Many students will also use transit for trips other than commuting to campus, so the increased transit ridership does not translate directly into reduced parking demand on campus Quantifying how Unlimited Access reduces parking demand is difficult, and only a few universities attempted it At Pittsburgh, campus officials estimated that parking demand declined by between 250 and 400 spaces. At Boulder, officials estimated that parking demand declined by about 750 spaces At Urbana-Champaign, 1,000 parking spaces have been eliminated on campus as a result of Unlimited Access, and $5 million worth of new parking garage construction has been postponed. The University of Wisconsin at Eau Claire sold 24 percent fewer parking permits to students after Unlimited Access began.

Unlimited Access also reduces vehicle travel and vehicle emissions In an evaluation of the transit program at the UW-Milwaukee, Meyer and Beimborn (1998) found that the share of trips to campus by automobile fell from 54 percent to 40 percent during the first year of the program. Vehicle trips to campus declined by 221,000 per year, and vehicle miles traveled (VMT) to campus declined by approximately five million VMT per year [12]

Increase students' access

> "Students love the program. It gives them tremendous freedom at an acceptable cost." Marquette University

> "Students can live in better neighborhoods and get free rides to the university. They can also get to movies, shows, sports, and shopping." University of Pittsburgh

Unlimited Access increases students' access to the campus and to a variety of social, cultural, educational, and recreational opportunities throughout the region. For example, Pittsburgh's Port Authority Transit added a "cultural shuttle bus" that gives students access to museums and theaters.[13] Several officials report that the programs offered students access to less expensive housing in better neighborhoods. They note that increased mobility also gives students greater access to jobs, internships, and volunteer opportunities.

A few officials also mention the greater safety of public transit when compared to walking or bicycling at night or in bad weather. For example, the Milwaukee County Transit System offers expanded evening bus service as part of the UPASS program at the University of Wisconsin. An important safety benefit cited in the early years of the transit programs was to reduce hitchhiking

Recruit and retain students

> "We advertise the pre-paid transit program during student recruitment open houses." University of Wisconsin-Milwaukee

> "The transit pass program is very popular, especially among students and environmentally conscious groups on campus." University of California, San Diego

Campus officials report that Unlimited Access helps to recruit and retain students because it provides increased mobility at low cost. In a survey at the University of Wisconsin-Milwaukee, 15 percent of students said that the transit program had a major effect on their decision to continue attending the university, and another 21 percent said that it had a minor effect (Meyer & Beimborn 1998. 13). Students who drove to campus reported that it was easier to find parking on and off campus after Unlimited Access began [14]

When potential students think of transportation at some universities, their only image is of a notorious parking problem Bob Hope once said, "It takes four years to get through UCLA, or five if you park in Lot 32." In allocating parking permits, many universities give a low priority to first-year students – the very students they are trying to attract Unlimited Access, however,

attracts students who do not own cars, prefer not to drive, or think that fare-free transit reduces their cost of living Unlimited Access also attracts "green" students because it shows that the university supports alternatives to driving, and it also makes parking easier for other students who do drive to campus

Reduce the cost of attending college

> "With the transit pass program, we feel we are serving the needs of students who come to the university without a car, including low-income and international students." Virginia Polytechnic Institute and State University

> "Transit pass programs aid low-income students by providing affordable transportation." Milwaukee County Transit System

Transportation is a major component of the cost of attending college. For example, Table 2 shows the 1996–1997 financial aid budgets for undergraduates at UCLA These budgets represent a typical student's annual expenses, and they form the basis of the financial aid packages the university offers Students who live off campus spend 13 percent of their budget on transportation if they live independently, and 24 percent if they live with their parents. Students who live in their parents' homes spend more for transportation than they do for anything else except university fees These budgets suggest that if a transit pass program enables a student to get around without a car, it can reduce the cost of attending college by $2,000 a year Some students may be able to spend less time working to support their cars and more time to pursue their studies Although students pay for Unlimited Access at 23 of the 35 universities, the median fee – $24 per student per year – is small in relation

Table 2 Financial aid budgets for UCLA undergraduates, 1996–97

Cost	On-campus housing	Off-campus housing	
		Independent	Parents' home
Books and supplies	$930	$930	$930
Living	$6,490	$7,101	$1,812
Personal	$1,201	$954	$1,836
Transportation	**$172**	**$2,007**	**$2,777**
Fees	$4,050	$4,050	$4,050
Total cost	$12,843	$15,042	$11,405
Transportation as % of total cost	**1%**	**13%**	**24%**

Source "Report on the University of California 1996–97 Cost of Attendance survey, Appendix J " Office of President, University of California, Oakland, 1997

to the potential savings. Students who take advantage of the opportunity to live without a car can graduate from college burdened with significantly less debt. If a transit program reduces the financial aid needs of some students, a university's financial aid budget can also serve more students.

Increase transportation equity

> "Our program treats everyone fairly. Every student is assessed the same fee, every student receives the same transportation service, and every student is eligible to board any bus without paying a fare using their BluGold card."
> University of Wisconsin at Eau Claire

> "All students are provided with an alternative to the expense and additional responsibilities associated with auto ownership."
> Milwaukee County Transit System

Universities typically lead society in advocating equity, but university parking policies often create invidious distinctions among administrators, faculty, staff, and students. In academia, you are not what you drive but where you park With 175 different kinds of parking permits, UCLA's parking hierarchy makes the *Titanic* look like a one-class ship.

University transportation policies also create inequities among students who travel to campus by different modes Under-priced parking subsidizes students who drive to campus, but students who walk, bike, or ride transit to campus rarely receive any subsidy.[15] In contrast, Unlimited Access gives all students the same access to fare-free public transportation

What explains the large increases in transit ridership?

Unlimited Access can greatly increase transit ridership. Table 3 shows the increases in student ridership during the first year of Unlimited Access at the five universities that collected ridership data before the program began [16] The first-year ridership increases range from 71 percent to 200 percent. Annual ridership increases in subsequent years range from 2 percent to 10 percent per year. For example, ridership at UC Davis increased by 79 percent during the first year and continued to increase at a rate of 10 percent per year over the next five years. Ridership at UI Urbana-Champaign, increased by 193 percent during the first year and has continued to increase at a rate of 8 percent per year over the next eight years.

Six factors associated with Unlimited Access help to explain the large ridership increases in the first year, and the continuing ridership increases in subsequent years. These factors are. (1) reduced fares, (2) improved service,

Table 3 Unlimited Access increases students ridership

University	Year began	First-year increase in student ridership			Subsequent growth rate (%/year)
		Before	After	Change	
California State University, Sacramento	1992	315,000	537,700	+71%	+2%
University of California, Davis	1990	587,000	1,054,000	+79%	+10%
University of Wisconsin, Madison	1996	812,000	1,653,000	+104%	*
University of Illinois, Urbana Champaign	1989	1,058,000	3,102,000	+193%	+8%
University of Colorado, Boulder	1990	300,000	900,000	+200%	+8%

* Subsequent growth rate is not available because the program started in 1996

(3) mental maps, (4) residential relocation, (5) reduced automobile ownership, and (6) travelling together.

Reduced fares

Part of the ridership increase can be attributed to the fare reduction By reducing the fare to zero, the programs encourage students to ride more frequently simply to take advantage of the financial savings Research into the fare elasticity of transit ridership reveals a range of elasticity estimates, the most frequently cited of which is the Simpson-Curtin rule of –0.33. If all of the ridership increases were attributed solely to the free fares, the fare elasticities of the five universities cited in Table 3 would range from –0.26 to –0.50.

Improved service

Many transit agencies also improve their service to support their new Unlimited Access programs. These service improvements make public transit more convenient and more reliable for the users and thus attract more student riders than would be expected from the fare reduction alone Kalamazoo Transit added ten new buses to its fleet to provide new service for Western Michigan University Milwaukee County Transit System added new evening services as part of its programs with Marquette University and the University of Wisconsin-Milwaukee. The higher level of service in turn increased ridership by students and by passengers who pay the full fare. This finding is

consistent with Mohring's (1972) hypothesis that if increases in transit demand lead to more frequent service, the more frequent service then attracts more riders.

Mental maps

Because Unlimited Access automatically provides transit passes to everyone, students have a reason to learn where the buses can take them.[17] As students become more familiar with transit, they begin to use it for trips they previously believed it would not serve.[18]

The faculty may also find unexpected uses for transit. For example, several universities report that professors take their classes on more field trips to attend public hearings or visit art galleries, museums, and historic sites because travel by public transit is cheaper and easier than chartering a van or a bus.

Reduced automobile ownership

Unlimited Access enables some students to avoid the high cost of owning and maintaining a car. If some students choose not to buy a car, the reduced automobile ownership can further increase transit ridership, because students without cars are more likely to ride transit than students with cars For example, the 1995 Nationwide Personal Transportation Survey found that households without cars made 19 percent of all their trips by public transit, while households with one car made only 2.8 percent of all their trips by transit (Pucher et al. 1998· 19).

Residential relocation

Students are often new to the community and move frequently, so they can easily adjust their housing location in response to free public transit. For example, officials at the University of Pittsburgh report that the transit program has allowed students to move away from the residential districts adjacent to campus and into outlying areas that have better housing and lower rents.

University housing offices typically post maps of transit routes and the adjacent housing. If students respond to Unlimited Access by moving near transit lines, ridership will continue to increase. Students with Unlimited Access but without cars can also more easily live in older buildings and neighborhoods where a scarcity of parking deters other potential residents Living in transit-accessible neighborhoods also enables students to use public transit for non-commute trips, and this may further increase student transit ridership.

Fellow travelers

Beyond the previous five factors, Unlimited Access may encourage larger groups of students to ride the bus. We can examine this issue by comparing the relative costs of travel by car and bus.

Carpoolers share the cost of gasoline and parking, and the per-person cost of travel therefore decreases as the size of the carpool increases. In contrast, those who travel together by public transit do not share the cost of a single transit fare. Each person pays his or her own fare, and when a group of friends travel together by public transit their per-person cost does *not* decrease as the size of the group increases. This pattern of cost sharing among carpoolers but not among transit riders suggests that groups will naturally gravitate toward cars.

Unlimited Access reduces the pull toward cars Because it automatically gives a transit pass to every student, all students implicitly understand that transit is free not only for individuals but also for groups who want to go somewhere together. With no need to discuss the financial cost, any group of students can casually board any bus that will take them where they want to go. Some students may also believe that traveling together on a bus is safer and more enjoyable than traveling alone Because of this group behavior, a transit pass is worth more to students if everyone they know also has a transit pass.

Table 4 Unlimited Access (UA) reduces the pull toward cars

Assumptions	
Trip distance	5 miles
Travel time by car	10 minutes @ 30 mph
Travel time by bus	30 minutes @ 10 mph
Time difference	20 minutes (1/3 hour)
Parking cost	$6
Bus fare	$1

Number in group	Cost per person			Money savings for travel by bus			
	Car	Bus		Per person		Per person per hour	
		No UA	UA	No UA	UA	No UA	UA
(1)	(2)	(3)	(4)	(5)=(2)–(3)	(6)=(2)–(4)	(7)=3×(5)	(8)=3×(6)
1	$6 00	$1	$0	**$5.00**	**$6.00**	**$15.00**	**$18.00**
2	$3 00	$1	$0	$2 00	$3 00	$6 00	$9 00
3	**$2.00**	**$1**	$0	**$1.00**	**$2.00**	**$3.00**	**$6.00**
4	$1 50	$1	$0	$0 50	$1 50	$1 50	$4 50
5	$1 20	$1	$0	$0 20	$1 20	$0 60	$3 60
6	$1 00	$1	$0	$0 00	$1 00	$0 00	$3 00

To show this fellow-traveler effect, we can consider the decision whether to travel by car or ride the bus for a short roundtrip journey (see Table 4). Suppose the cost of parking at your destination is $6 and the roundtrip bus fare is $1 [19] Travel time is 10 minutes by car and 30 minutes by bus. *Without* Unlimited Access, a solo driver will pay $5 more than a bus rider, but will save 20 minutes (one-third of an hour) of travel time, so driving will cost $15 per hour of travel time saved Solo travelers should therefore drive a car if they are willing to pay more than $15 per hour to save travel time, and ride the bus if they are unwilling to pay $15 per hour to save travel time. *With* Unlimited Access, a solo driver will pay $6 more than a bus rider, so driving a car will cost $18 per hour of travel time saved.

Larger groups of travelers save less money per person when they ride the bus.[20] Column 1 of Table 4 shows the number of travelers in the group. Column 2 shows the parking cost per person in the group; the larger the group who share a car, the lower the parking charge per person Columns 3 and 4 show the bus fare per person in the group *Without* Unlimited Access the bus always costs $1 per person, and *with* Unlimited Access the bus is always free Columns 5 and 6 show how much money the bus ride saves without and with Unlimited Access. For example, if three people travel together, the parking cost is $2 per person ($6 ÷ 3 persons) and riding the bus costs $1 per person, so riding the bus saves $1 per person *without* Unlimited Access and $2 per person *with* it.

Figure 2 shows how group size and the value of travel time affect travel choices (from Columns 7 and 8 in Table 4) First, consider the lower curve,

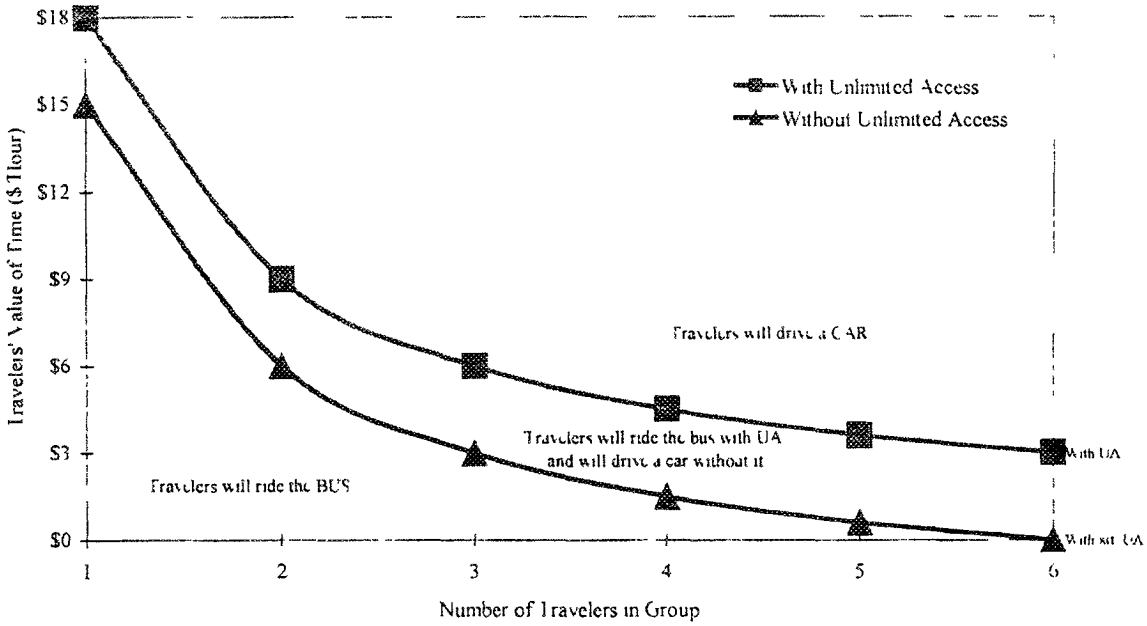


Figure 2 Unlimited Access shifts the bus-car frontier

which shows the savings per hour spent on the bus *without* Unlimited Access (from Column 7 in Table 4). We can call this curve the "bus-car frontier." The bus-car frontier divides those who will ride the bus from those who will drive a car. Travelers above the bus-car frontier will drive a car because they are willing to spend the extra money to reduce the time cost of travel. Travelers below the bus-car frontier will ride the bus because they are willing to spend the extra time to reduce the money cost of travel.

For example, *without* Unlimited Access, solo travelers will ride the bus if they value time savings at less than $15 per hour, and will drive a car if they value time savings at more than $15 per hour. A group of three travelers, however, will ride the bus only if they each value travel time savings at less than $3 per hour, and share a car if they value time savings at more than $3 per hour Groups whose size and value of time lie below the bus-car frontier will take the bus, while groups whose size and value of time lie above the frontier will share a car [21] Travelers do not precisely calculate these money and time costs, of course, but they do balance these two costs when making travel decisions.

Next, consider the upper curve in Figure 2, which shows how Unlimited Access shifts the bus-car frontier up and to the right (from Column 8 in Table 4). This shift will draw onto the bus some travelers who would otherwise drive As before, groups whose size and value of time lie above the bus-car frontier will share a car while groups whose size and value of time lie below the frontier will take the bus But now, *with* Unlimited Access, groups whose size and value of time lie between the upper and lower curves will also take the bus Solo travelers will ride the bus if they value time savings at up to $18 per hour, while groups of three travelers will ride the bus if they each value time savings at up to $6 per hour.[22] Unlimited Access shifts travelers from private cars to public transit in this band between the two curves.

For combinations of group size and value of time below the lower curve, Unlimited Access saves travelers the bus fares they would otherwise have paid. For combinations of group size and value of time above the upper curve, Unlimited Access does not affect travelers But between the two curves, Unlimited Access has a pivotal effect on mode choice, especially for larger groups of travelers. For example, consider a group of travelers who each value time savings at $3 per hour. *Without* Unlimited Access, only groups of up to three people will ride the bus. *With* Unlimited Access, groups of up to six people will ride the bus.

In summary, rational collective choice (not an oxymoron in this case) helps to explain why Unlimited Access produces large increases in transit ridership. Unlimited Access draws onto public transit travelers who place a higher value on time savings, and makes it more likely that larger groups will ride transit.

What explains the low cost of Unlimited Access?

Unlimited Access provides fare-free transit for all students at low cost. Table 1 shows that the universities' average cost of Unlimited Access is 61¢ per ride and $30 per person per year. Buying transit service at the pass rate and using excess transit capacity explain the low cost *per ride*. Avoiding the problem of "adverse selection" explains the low cost *per person*. Together, these factors explain why Unlimited Access costs much less than buying conventional transit passes for all students.

Buying at the pass rate

Universities achieve a low cost per ride by purchasing transit service for all students at the pass rate, which is usually much lower than the regular cash fare per ride. For example, the cash fare on the Los Angeles County Metropolitan Transportation Authority (MTA) is $1.35 per ride, and the price of a monthly transit pass is $42 Because passholders make an average of 109 rides per month, the MTA's pass rate is only 41¢ per ride ($42 – 109).[23] Unlimited Access achieves the low pass rate per ride for all students

Transit agencies can offer a low price per ride because the bulk purchase by a university reduces the transaction costs of selling transit passes. A transit agency saves the administrative expense of printing and selling many individual transit passes every month, and can pass these savings on to the university. Using the university identification card as a transit pass also eliminates many small cash transactions and saves time when boarding

Using excess transit capacity

The transit programs also achieve a low cost per ride if they attract students who ride at off-peak hours and on routes that have excess capacity.[24] The Chicago Transit Authority (1999) found that 69 percent of all student transit rides were made during off-peak hours while only 52 percent of all transit rides were made during off-peak hours The University of Colorado at Boulder reports that most students travel at off-peak hours and fill empty seats. Similarly, San Diego Transit reports that its program with UC San Diego fills unused bus capacity. Students may take advantage of unused transit capacity in some unusual ways. For example, Rosenbloom (1998) says of the Unlimited Access program at the University of Illinois: "Weather has a differential effect on ridership; in bad weather, ridership on the community services goes down because most trips are discretionary; however, university ridership goes up in bad weather because the trips are not discretionary and people unable to drive, walk, or bike also use the bus."[25] If students ride

existing transit routes at times when non-student demand is low, the savings can be passed on to the university. Because the community has already paid to provide the transit service, Unlimited Access is a good bargain if students fill seats that would otherwise remain empty.

Avoiding adverse selection

Conventional transit passes suffer from adverse selection. Originated in the context of insurance coverage, the term "adverse selection" describes the tendency for persons with a greater potential for loss to purchase more insurance. This tendency leads to higher loss payments, and then to higher insurance premiums for everyone who is insured

Similarly, adverse selection increases the cost of conventional transit passes sold to the public Frequent transit riders are more likely to buy monthly passes, so transit agencies must price these passes on the assumption that most passholders are frequent riders Because transit agencies must price their passes high enough to cover the cost of serving frequent riders, occasional riders will not buy them.

Table 5 shows the coverage options available in university transit programs – opting in, opting out, or universal coverage.[26] UC Irvine allows students to opt into the transit program The University of Washington automatically enrolls students in the transit program, but they can opt out. The University

Table 5 Coverage options

	Partial coverage		Universal coverage
	Opt in	Opt out	Cannot opt out
	University of California, Irvine	University of Washington, Seattle	University of Colorado, Boulder
How program works	The university buys bus passes from the Orange County Transit Authority for $33 50 per month and sells the passes to students for $13 per month	Students, faculty, and staff are automatically enrolled but can opt out and not pay the fee Students pay $28 per quarter and faculty and staff pay $37 50 per quarter	Students are automatically enrolled and cannot opt out Students pay a mandatory transit fee of $19 52 per semester
Percent who participate	1% of students	74% of students, faculty, staff	100% of students
University's cost per participant	$246 per year	$130 per year	$41 per year

of Colorado automatically enrolls students in the program, and they cannot opt out.

The universities' annual cost per participant ranges from $246 at UC Irvine to $41 at the University of Colorado. Partial-coverage programs are necessarily priced higher because of adverse selection – students who ride frequently will participate in the program and thus will increase the cost per person. The cost per person is lowest at the University of Colorado because universal coverage avoids the problem of adverse selection.

As explained earlier, the benefits of a transit pass to an individual are greater if everyone he or she knows also has a transit pass. This benefit of universal coverage helps to explain why many students who will not buy a conventional transit pass will vote for a mandatory transportation fee to finance a transit program, as shown by the high approval rates in student referenda (Figure 3).

Who pays for Unlimited Access?

Both universities and students benefit from Unlimited Access, so it seems appropriate for both to share the cost Nevertheless, 23 of the 35 universities finance their programs primarily through student fees, which range from $5 to $90 per student per year with a median of $24.[27] Where universities do pay for all or part of the cost, they typically use parking revenues One possible

In February 1997 students voted 4 to 1 in favor of a transit pass program, and the program began operating in April of the same year	Ohio State University
The student body reaffirmed their support by voting 15 to 1 in April 1997 to raise student fees to enhance the transit pass program	University of Colorado at Boulder
In Spring 1996 student voters approved, with 84 percent of the votes cast in support, continuing the transit pass program	University of California, Santa Barbara
When our program was established in 1983, it was approved by 85 percent of student voters	Virginia Polytechnic Institute and State University
The transit-pass program originally passed with an approval vote of 58 percent, two reapproval votes in subsequent years have seen it pass by 68 percent and 78 percent	San Jose State University
Pitt students voted an overwhelming 93 percent Yes to increase student fees to fund their unlimited access program	University of Pittsburgh
Ninety-four percent of the University of Wisconsin at Milwaukee student body approved a student fee to fund unlimited access in a student referendum	University of Wisconsin at Milwaukee

Figure 3 Approval rates in student referenda

reason why more universities do not pay for Unlimited Access is that the campus parking authorities do not want to pay for a free alternative to what they sell to students.

When students do pay for Unlimited Access, the non-riding students must subsidize those who ride, but students must approve this arrangement in a referendum.[28] Most referenda include sunset clauses requiring periodic re-approval. The university referenda to approve Unlimited Access resemble municipal ballot measures in which a majority approves sales taxes to finance public transit that only a minority rides. The high approval rates in the university referenda suggest that most students who vote believe the programs' benefits outweigh their costs.[29] The yes votes typically increase in subsequent referenda as students get to know the programs. These recurring referenda give transit agencies a continuing incentive to improve service to the students who pay the cost.

How does Unlimited Access affect transit agency performance?

Unlimited Access is a good bargain for universities, but is it also a good bargain for transit agencies? To examine how Unlimited Access affects the *transit agencies'* costs, and whether it increases *total* transit ridership, we obtained data on the transit agencies' performance measures from reports that the agencies file annually with the US Department of Transportation.[30] We then examined the transit agencies' total ridership, riders per bus, cost per rider, vehicle miles of service, operating subsidy per rider, and total operating subsidy. Table 6 shows the data we obtained for 13 programs, and Figure 4 summarizes the results.[31]

Increased total ridership

The first panel of Figure 4 shows the annual rate of change in the transit agencies' total ridership in the two years *before* and *after* each agency began to offer Unlimited Access. On average, total ridership was increasing 1.3 percent per year in the two years before Unlimited Access began, and it increased 8.9 percent per year in the following two years. This difference represents a 7.6 percentage-point improvement in the rate of change in the transit agencies' total ridership after Unlimited Access began.[32] This improvement is the difference between what *did happen* in the two years after Unlimited Access when compared with what *would have happened* if the trend in the two years before Unlimited Access had continued.

Do factors other than Unlimited Access explain the increases in ridership at the transit agencies that adopted Unlimited Access? National trends do

Table 6 Annual rate of change in transit agency performance indicators in the two years before and the two years after the Unlimited Access began (% per year)

Transit agency	Year program began	Total ridership			Riders per bus			Vehicle miles of service			Operating cost per ride			Operating subsidy per ride			Total operating subsudy		
		Before (1)	After (2)	Diff (3)= (2)–(1)	Before (4)	After (5)	Diff (6)= (4)–(5)	Before (7)	After (8)	Diff (9)= (7)–(8)	Before (10)	After (11)	Diff (12)= (10)–(11)	Before (13)	After (14)	Diff (15)= (13)–(14)	Before (16)	After (17)	Diff (18)= (16)–(17)
Santa Barbara MTD (UC Santa Barbara)	1986	–4	6	10	3	–9	–12	3	2	–1	12	–4	–16	13	–10	–23	8	–5	–13
Champaign-Urbana MTD (UI Urbana-Champaign)	1989	–2	76	78	–3	37	40	0	15	15	5	–28	–33	7	–32	–39	4	13	9
Denver RTD (UC Boulder)	1991	2	3	1	–3	4	7	2	7	5	5	2	–3	7	4	–3	9	6	–1
Santa Clara Valley TA (San Jose State Univ)	1993	0	–7	–7	1	–4	–5	–4	–2	2	4	3	–1	6	4	–2	5	–3	–8
Boise Urban Stages (Univ of Idaho)	1992	5	17	12	2	–2	–4	0	13	13	–5	0	5	2	3	1	6	20	14
Utah Transit Authority) (Univ of Utah)	1992	7	–5	–12	–7	- 10	–3	4	2	–2	–1	13	13	8	6	–2	5	8	4
Denver RTD (Aurarıa Center)	1994	5	3	–2	4	–3	–7	4	4	0	–1	4	5	–2	5	7	4	9	5

Milwaukee County Transit (UW Milwaukee)	1994	−2	4	6	5	3	−2	−1	−1	0	8	−2	−10	9	−4	−13	7	−1	−8
Milwaukee County Transit (Marquette University)	1995	2	11	9	−1	12	13	−1	1	2	6	1	−5	3	−10	−13	6	0	−6
Port Authority Transit (Univ of Pittsburgh)	1995	−2	−1	1	−7	−3	4	−5	0	5	2	3	1	14	−6	−20	12	−7	−19
Santa Barbara MTD (SB City College)	1995	6	1	−5	−5	4	9	1	3	2	0	−3	−3	1	−5	−6	6	−4	−10
Madison Metro (UW Madison)	1996	1	6	5	0	9	9	2	−1	−3	5	−2	−7	0	3	3	1	8	7
Sacramento RTD (California State U Sacramento)	1996	−1	2	3	8	5	−3	−1	3	4	7	−6	−13	1	−2	−3	5	5	0
Average (unweighted)		1 3	8 9	7 6	−0 2	3 3	3 5	0 3	3 5	3 2	3 6	−1 5	−5 1	5 3	−3 4	−8 7	6	3 9	−2 1
Average (weighted)		1 3	2 7	1 4	−0 8	1 3	2 1	−0 2	1 6	1 8	3 7	2 0	−1 7	6	−0 9	−6 9	6 7	1 9	−4 8

Note Columns 1, 4, 7, 10, 13 and 16 refer to the annual rate of change over the two years *before* Unlimited Access began Columns 2, 5, 8, 11, 14 and 17 refer to the annual rate of change over the two years *after* Unlimited Access began Columns 3, 6, 9, 12, 15 and 18 refer to the *difference* between the before and after trends, as measured in percentage points

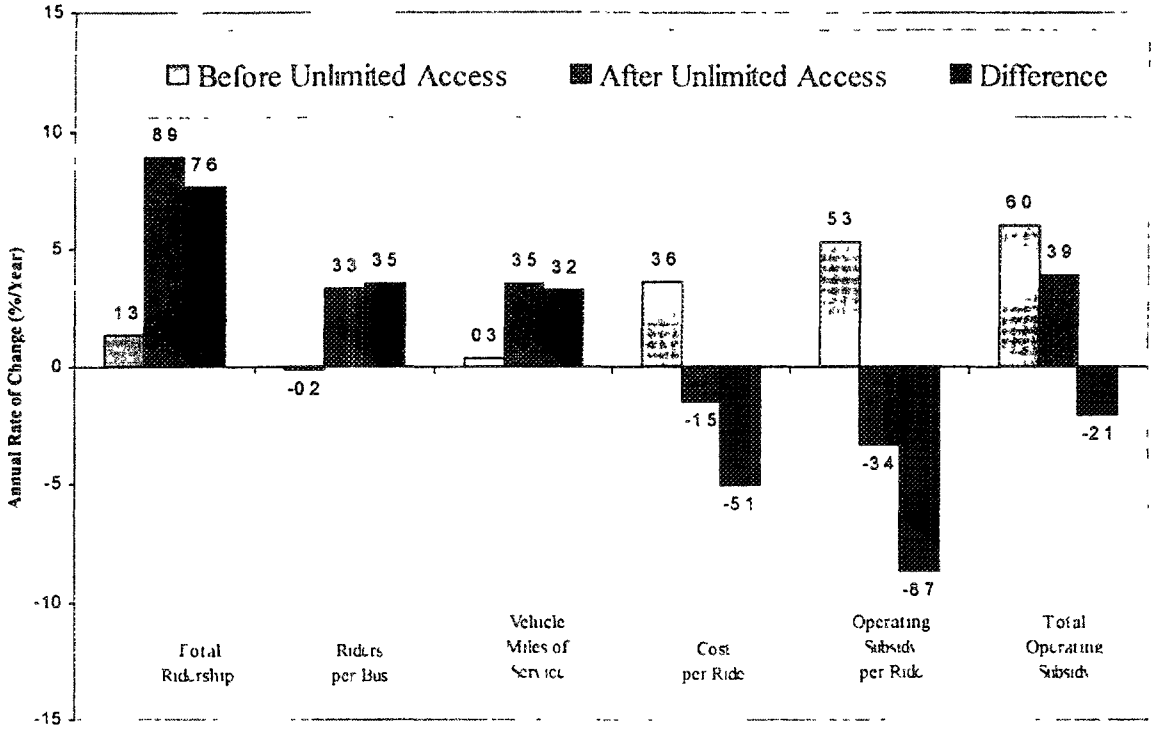


Figure 4 Average annual rate of change in transit agency performance indicators in the two years before and the two years after Unlimited Access began

not explain these increases because total bus transit ridership in the United States has declined since 1984 [33] Total ridership was falling in 5 of the 13 cases before Unlimited Access began, and in 4 of these cases ridership increased afterward. The trend in total ridership improved in 8 of the 13 cases after Unlimited Access began. This suggests that Unlimited Access increases the transit agencies' total ridership.

More riders per bus

Transit agencies report that the additional student riders fill unused capacity on existing bus service. The marginal cost of serving additional riders is low because many student trips are made during off-peak hours. To measure the utilization of bus service, we calculated the number of riders per bus. The second panel of Figure 4 shows that the number of riders per bus was decreasing at an average rate of 0.2 percent per year in the two years before Unlimited Access. In the two years after Unlimited Access, the number of riders per bus increased at an average rate of 3.3 percent per year. This difference represents a 3.5 percentage-point improvement in the trend of bus occupancy [34]

Added vehicle miles of service

Transit officials reported that Unlimited Access has improved the quality and increased the quantity of transit service to universities in several ways. more frequent buses, more routes, and service that extends later at night and on weekends. Transit agencies can afford to improve service to the campus because they carry more riders and earn more revenue. All transit riders – not just students – benefit from the improved service. For example, the Central Ohio Transit Authority reports that the transit program at Ohio State University has improved service quality and that this improvement has significantly increased the number of riders who pay the full fare.

To measure changes in service, we examined the annual rate of change in *vehicle miles of service* in the two years before and after each agency began to offer Unlimited Access The third panel of Figure 4 shows the results. On average, vehicle miles were increasing 0.3 percent per year in the two years before Unlimited Access began, and they increased 3 5 percent per year in the two years afterward. This difference represents a 3.2 percentage-point improvement in the trend of the transit agencies' vehicle miles of service.[35]

Reduced operating cost per ride

The fourth panel of Figure 4 shows the annual rate of change in the transit agencies' *operating cost per ride* in the two years before and after each agency began to offer Unlimited Access. On average, the cost per rider was increasing 3 6 percent per year in the two years before Unlimited Access, and it decreased 1.5 percent per year in the two years afterward. This difference represents a 5.1 percentage-point improvement in the trend of the transit agencies' cost per rider.[36]

Reduced operating subsidy per ride

The fifth panel of Figure 4 shows the annual rate of change in the transit agencies' *operating subsidy per ride* in the two years before and after each agency began to offer Unlimited Access. On average, the operating subsidy per ride was increasing 5.3 percent per year in the two years before Unlimited Access, and it decreased 3.4 percent per year in the two years afterward. This difference represents an 8.7 percentage-point improvement in the trend of the transit agencies' operating subsidies per ride.[37]

Reduced total operating subsidy

Will Unlimited Access increase or decrease a transit agency's need for public subsidy? If a transit agency's operating subsidy *per ride* declines after Unlimited Access begins, this decline may be explained by an increase in ridership rather than a decrease in the total operating subsidy. The final panel of the figure shows the transit agencies' annual rate of change in *total operating subsidy* in the two years before and after each agency began to offer Unlimited Access. On average, total operating subsidy was increasing 6 percent per year in the two years before Unlimited Access, and the rate of increase slowed to 3.9 percent per year in the two years afterward. This difference represents a 2.1 percentage-point improvement in the trend of the transit agencies' total subsidy [38]

Summary of changes in performance measures

The first three panels of Table 6 and Figure 4 suggest that Unlimited Access improves transit performance: it increases total transit ridership, fills empty seats, and improves transit service. The last three panels suggest that Unlimited Access reduces transit cost. It reduces the operating cost per ride, reduces the operating subsidy per ride, and reduces total operating subsidies Because the sample of transit agencies is small, the individual changes in the six performance measures are not statistically significant at the 95-percent confidence level Nevertheless, all changes in the six performance measures exhibit a consistent pattern of improvement.

Evidence from top-ranked transit systems

Other evidence suggests that Unlimited Access improves transit agency performance In a 1999 ranking of public transit agencies in the US, three of the five top-ranked systems have Unlimited Access programs – Champaign-Urbana, Santa Barbara, and Milwaukee; the latter two agencies each have Unlimited Access agreements with two universities.[39] Unlimited Access accounts for 61 percent of all transit rides in Champaign-Urbana, 16 percent of all transit rides in Santa Barbara, and 3 percent of all transit rides in Milwaukee.[40]

Does Unlimited Access help to explain the excellent performance at these three transit agencies? To answer this question, Figure 5 shows two important performance measures – total ridership and operating subsidy per ride – for the three transit systems since 1980 [41] In each case, the total ridership increased and the operating subsidy per ride decreased after Unlimited Access

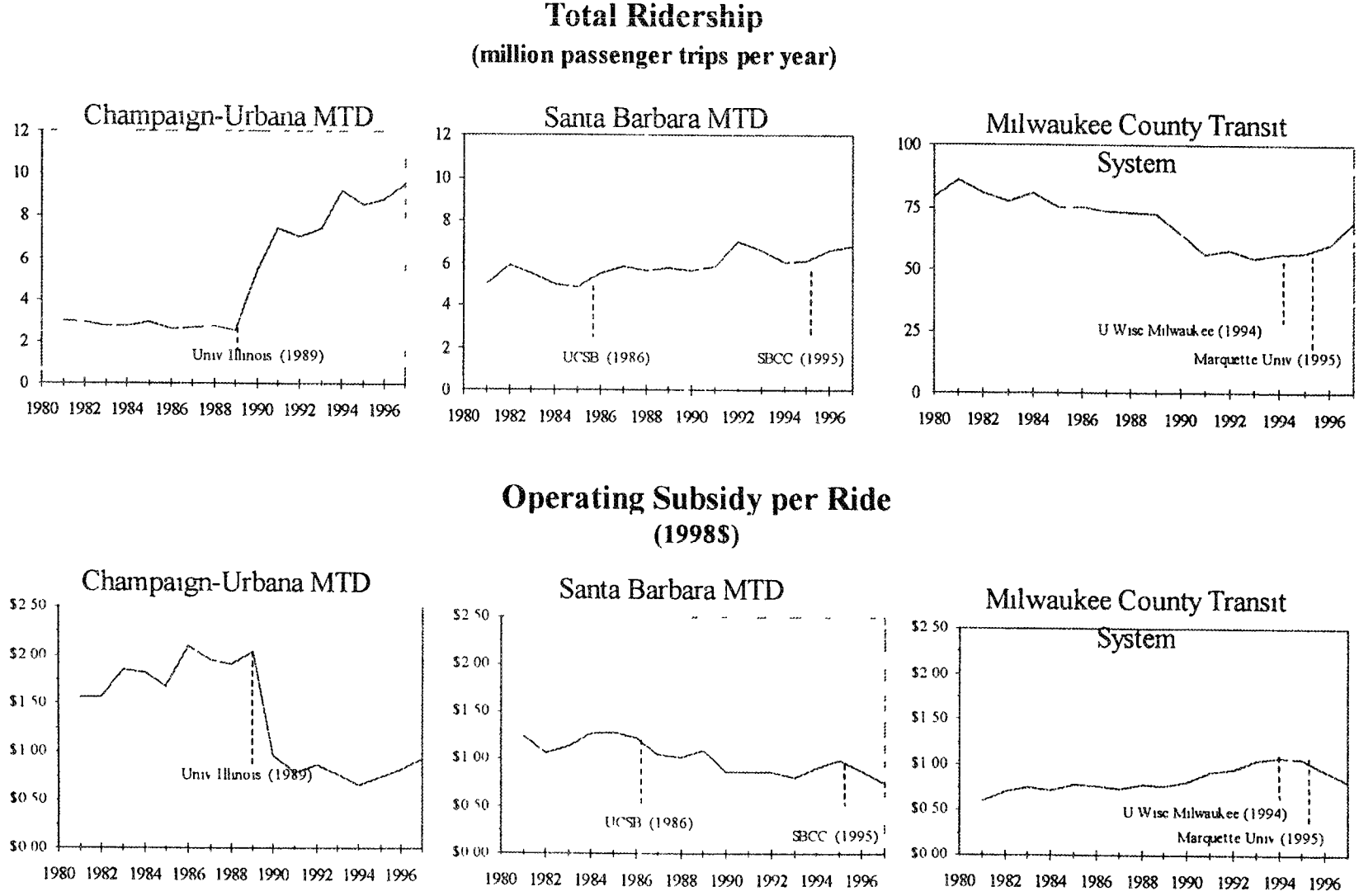


Figure 5 Total ridership and operating subsidy per ride before and after Unlimited Access began at three transit agencies

began. This result suggests that Unlimited Access helps to explain the excellent performance of these three transit systems.

Why don't more universities offer Unlimited Access?

If Unlimited Access produces so many benefits for students, universities, and transit agencies at such low cost, why don't more universities offer Unlimited Access? We offer three possible answers to this question.

More universities are offering Unlimited Access

Our survey included only 35 universities because these were the only programs in place during the 1997–1998 school year with sufficient data available to conduct our analyses. Since conducting our original survey, we have found that many more universities have started Unlimited Access programs For example, the University of California at Berkeley, UCLA, and more than 20 colleges and universities in the Chicago area have recently begun to offer Unlimited Access.[42]

Many universities and transit agencies have not heard of Unlimited Access

Although the first Unlimited Access program began at UC San Diego over thirty years ago, many university and transit officials have not heard of – or do not understand – the idea [43] Table 1 shows that more than half of the programs in our survey began in the 1990s

One possible reason for the general lack of knowledge among university and transit officials may be their lack of entrepreneurial drive. For example, in a survey of transit agencies that had agreements with universities, Smith (1986 6, 15) found that:

> A surprising number of respondents simply indicated that they had not considered the possibility of entering into such a relationship before Equally surprising was the number of responses which demonstrated a complacency towards the status quo. No aggressive marketing effort seems to have been initiated with respect to [university transit-pass programs]. There seemed to be more emphasis on system operation rather than aggressive system marketing . . All of these relationships are nontraditional in that they are departures from the traditional fixed route scheduled service normally provided. These relationships normally do not develop by themselves They are pursued, developed, and sought out by aggressive entrepreneurial managers [44]

In another survey twelve years later, Rosenbloom (1998) identified university students, faculty, and staff as an important market for transit, but she also found that most transit systems had not yet tapped the university market.[45]

Unlimited Access has high start-up costs

Start-up costs may discourage universities and transit agencies when they have no guarantee that a program will actually be established – let alone meet their long-term goals. University and transit officials interviewed for our study both reported having to overcome formidable barriers when starting an Unlimited Access program.[46] The rewards, however, can be enormous. No university has terminated a program, and some university administrators told us that Unlimited Access was one of the greatest success stories on their campus.

Conclusion: A promising innovation with great potential

Few transportation reforms increase mobility *and* reduce vehicle trips Unlimited Access increases mobility by giving students free access to public transportation, and it reduces vehicle trips by shifting some travelers from cars to public transportation

Unlimited Access produces many benefits for universities, transit agencies, and society. For universities, it can reduce parking demand, increase students' mobility, and reduce the cost of attending college For transit agencies, it can increase total ridership, fill empty seats, and reduce the cost per ride. For society, it can improve transit service, reduce traffic congestion, and improve air quality. And all these benefits come at a low cost – only $30 per student per year.

Unlimited Access is a creative, inexpensive way to take advantage of the excess capacity on public transit Nearly three-fourths of all seats on American public transit are now empty, and transit agencies have found a group eager to buy this excess capacity – university students Unlimited Access programs serve only 6 percent of the 14 million students enrolled in American universities, so the opportunity for growth is enormous Unlimited Access is a promising innovation with great potential.

Epilogue: Two logical extensions

Eco Passes

Several transit agencies have extended the shadow-fare arrangement beyond the university setting. For example, the Denver Regional Transportation District and the Santa Clara Valley Transportation Authority (in California's Silicon Valley) offer employers the option to buy "Eco Passes" that enable their employees to ride free on all local transit lines. The unique feature of Eco Passes is that employers purchase them for *all* employees whether or not the employees ride transit. Transit agencies can therefore price the Eco Passes – like Unlimited Access – according to their probability of use. For example, the Santa Clara Valley Transportation Authority's price for its Eco Pass ($10 to $80 per employee per year) is only 2 to 19 percent of the price for its conventional transit pass ($420 per year).

Eco Pass programs offer significant advantages for transit agencies that have excess capacity. Eco Passes increase transit ridership because they reduce the price of transit for all enrolled commuters to zero, and employers pay for the new riders No public subsidy is needed to cover these riders if they use existing transit capacity, and the added fare revenue should reduce the overall need for public subsidy

Eco Passes also offer significant advantages for employers who offer free parking to all commuters, because those who shift from driving to transit will reduce the demand for employer-paid parking spaces A survey of Silicon Valley commuters whose employers offer Eco Passes found that the solo-driver share fell from 76 percent before the passes were offered to 60 percent afterward. The transit mode share for commuting increased from 11 percent to 27 percent. These mode shifts reduced commuter parking demand by approximately 19 percent [47]

Given the high cost of constructing parking spaces in the Silicon Valley, each $1 per year spent to buy Eco Passes can save between $23 and $333 on the capital cost of required parking spaces (Shoup 1999). Eco Passes also reduce parking operation and maintenance costs because fewer spaces are required. The low cost of reducing parking demand compared with the high cost of increasing the parking supply suggests that Eco Passes are a cost-effective fringe benefit. As a way to subsidize commuting, Eco Passes are much cheaper than free parking

Eco Passes are just one of many possible variations on the idea of Unlimited Access Transit agencies are also developing transit-pass arrangements for hotels, conferences, apartment buildings, and stadiums

Finally, Unlimited Access can complement other parking policy reforms. For example, universities typically sell parking permits for the quarter, semester, or year. Students thus pay a fixed cost for the parking permit and a zero marginal cost for parking on each trip. This arrangement increases the demand for parking once students have bought their permits The zero marginal cost of parking encourages excessive use of scarce parking spaces, increases the "need" for parking, and leads to shortages that generate demands for more campus parking.

Some universities have reversed this relationship between the fixed and the marginal costs of parking by using debit cards for parking. Students use debit cards to pay for parking on every trip, and they pay only for the exact parking time they use – no more, no less This marginal-cost-but-no-fixed-cost arrangement gives everyone an incentive to consider the alternatives to solo driving for every trip. Students can always save on parking by carpooling, riding transit, bicycling, or walking.

Adopting debit cards for parking *and* Unlimited Access for transit will change the price of travel in two important ways First, replacing parking permits with debit cards will shift the price of parking to a marginal cost with no fixed cost. Second, Unlimited Access will shift the price of riding the bus to a fixed cost with no marginal cost These price reforms will make it cheaper for students to drive to campus when they carpool, or intend to stay for only a short time, and will encourage students to ride the bus when they want to stay on campus all day. Debit cards for parking *and* Unlimited Access for transit will together have a much greater impact on travel behavior than will either one acting alone because in combination they will turn transportation prices upside-down

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Notes

1 See Hu and Young (1999) for additional information about transit's declining share of total travel In 1995 about 87 percent of all travel in the United States was by automobile (Pisarski 1996)

2 See Wendell Cox Consultancy (1999) and Bushell and Pattison (1998) for transit ridership in major cities and countries Several cities have more transit ridership than the United States as a whole For example, Tokyo's transit system carries 2 4 times the ridership of all the transit systems in the United States combined

3 See Bureau of Transportation Statistics (1998 23) for data on the number of transit passengers. See Federal Transit Administration (1998) for data on annual passenger miles and annual vehicle revenue miles for public transit systems in the US Dividing the 17 5 billion passenger miles traveled on bus transit in 1997 by the 1 6 billion vehicle revenue miles of service on bus transit gives an average occupancy of 10 9 passenger miles per bus mile (17 5 – 1 6 = 10 9 passengers per bus) Dividing the average bus occupancy of 10 6 passengers by the average bus capacity of 40 seats gives an average seat occupancy of 27 percent (10 6 – 40 = 27%) That is, if all passengers are seated during their trips, only 27 percent of bus seats are occupied This calculation overestimates the number of bus seats that are occupied because some passengers stand rather than sit The 1995 Nationwide Personal Transportation Survey asked respondents who rode the bus whether they (1) sat only, (2) stood only, or (3) some of both The survey revealed that 65 percent of bus passengers sat for the entire trip, 10 percent stood for the entire trip, and 25 percent both sat and stood, thus, 35 percent of bus riders stood for at least part of their trip Because we assumed that all bus riders were seated during their trips when we estimated that 27 percent of bus seats are occupied, we have overestimated the average seat occupancy of a bus Therefore, *at least* 73 percent of bus seats are empty Winston and Shirley (1998 26) calculated a much lower average load factor for bus transit, 14 3 percent

4. The US subsidy per passenger trip is more than twice the average subsidy per passenger trip for the eleven other countries, and it is 18 percent higher than the subsidy per passenger trip for Sweden, which has the second highest subsidy See Pucher (1988) for international comparisons of transit subsidies and transit mode shares

5 We believe that our survey includes all transit pass programs that meet our definition of Unlimited Access and operated during the 1997–1998 school year The survey does not include universities that provide only campus shuttle-bus operations, or that sell transit passes to students at a discounted price We first obtained a list of universities with Unlimited Access programs from the University and Community Transportation Association (UCTA) After interviewing the members, we asked them if they knew of other universities and transit agencies that participated in similar programs (a snowball sample) During our survey, we learned about several other Unlimited Access programs that began operation after our study year (the 1997–1998 school year) and are too new to evaluate For example, twelve colleges and universities in Chicago have Unlimited Access programs with the Chicago Transit Authority

6 See *FHWA's Innovative Finance Quarterly* Vol 4, No 2 at http //www fhwa dot gov/innovativefinance/ifq42 htm for a discussion of shadow tolls

7 All data in Table 1 refer to the 1997–1998 school year The universities are ordered in the table by their programs' annual cost per person The university's annual cost of the program is its total payment to the transit operator All universities, except the University of California, San Diego and the University of Pittsburgh, provided free, unlimited rides throughout the jurisdiction of the transit agency, which is usually the surrounding county In 1999, the University of Pittsburgh began to offer unlimited rides throughout the county, which resulted in large gains in ridership and a decrease in cost per ride The university transit ridership increased from 1 5 million rides in 1997 to 6 million rides in 1999 and the university's cost fell from 68¢ per ride in 1997 to 29¢ per ride in 1999

8 The r^2 statistic for the correlation between the cost per student and the number of rides

per student is 0 81 The r^2 statistic for the correlation between the cost per student and the cost per ride is only 0 16

9 The difference in ridership is explained in part by convenience in service UC Santa Cruz is at the center of the bus network and buses travel through campus, while at UC San Diego students can only ride for free within a two-mile radius of campus

10 Smith (1986) found that only 8 percent of all transit systems have no university, college, junior college, or technical school within their area of operation

11 UCLA raised the price of all parking on campus to make up the difference

12 The reduction in vehicle travel reduced the vehicle emissions per day for commuting by 244 pounds of volatile organic compounds, 264 pounds of nitrogen oxides, and 1,662 pounds of carbon monoxide

13 The cultural shuttle bus is supported by the City of Pittsburgh, the Cultural Trust of Pittsburgh, and the attractions themselves All three entities recognized that the transit pass program provided an opportunity to enhance Pittsburgh students' accessibility to cultural institutions

14 In the survey, 23 percent of students who normally drive to campus reported that finding on-campus parking was easier after the transit program was implemented while another 14 percent reported that finding off-campus parking was easier (Meyer & Beimborn 1998 12) After Unlimited Access begins, it is easier to find parking only if fewer cars are driven to campus

15 Under-priced in this context means there is excess demand for permits at the price charged

16 Only five of the surveyed universities collected detailed before-and-after ridership data

17 While investigating the potential for an Unlimited Access program at UCLA, everyone was surprised to find that 1,100 buses arrive at UCLA every day Between 5 am and 8 pm, an average of more than one bus per minute arrives at UCLA Fifty thousand seated passengers per day could travel to UCLA on the existing bus service The information "buzz" caused by a transit program can imprint the transit system on students' mental maps, and the increased knowledge about transit service helps to explain the large increases in transit ridership

18 Knoxville Area Transit provides free transit passes to all freshmen and first-year students at the University of Tennessee at Knoxville Although this arrangement provides Unlimited Access to only a subset of the student population, ridership has increased because students receive a free orientation to transit during their first semester in Knoxville

19 In this example, the $6 for parking is the only cost of travel by car Although some drivers may perceive the operating cost of driving to be zero, most universities do charge for parking on campus If drivers also perceive an operating cost of driving, the $6 parking cost in this example can be interpreted as the total money cost of travel by car

20 In Table 4, the money savings of travel by bus is the same as the added money cost of travel by car Columns 5–8 report the difference in the money cost of travel by the two modes

21. This analysis assumes that the choice between bus and car depends only on the size of the group traveling together and the value of their time, and that travelers place the same value on their time spent in travel by bus and car Other factors such as convenience, comfort, and reliability also affect mode choice If the disutility of time spent on a bus were greater than the disutility of time spent in a car, the bus-car frontier would shift down and to the left Nevertheless, the smaller the group and the lower their value of time, the more likely they are to ride the bus, the larger the group and the higher their value of time, the more likely they are to share a car

22 Unlimited Access always saves a bus rider $1 per trip, and the bus ride always adds 1/3 hour to each traveler's travel time Travelers always save $3 more per hour spent on the bus with Unlimited Access than without it (the difference between Columns 7 and 8 is always $3 per hour)

23 The pass rate is reported in an MTA document entitled "MTA Average Pass Usage, Fiscal Year 1997 "

24 Garrett, Iseki, and Taylor (2000 4) conclude that "it costs significantly more per unit of output to provide service in the peak periods than in the off-peak " They found that the cost (capital and operating) to provide transit service in Los Angeles in the peak period (6 00 am–9 00 am and 3 00 pm–6 00 pm) is 36 percent higher than in the base period The base period includes all non-peak service – midday, evening, and owl periods

25 See Rosenbloom's study of innovative transit concepts (1998)

26 We show the University of California, Irvine and the University of Washington for the sake of comparison Neither is included in our survey because they do not meet the definition of an Unlimited Access program

27 Note that students pay no fee for 12 out of the 35 Unlimited Access programs Students pay a fee equal to the university's cost of operating 5 programs Students pay less than the university's cost for 8 programs, and the university may make up the difference with parking revenue or other administrative funds Students pay more than the university's cost in another 10 cases, the university may keep part of the student fee as an administrative charge, or the student fee may fund other campus transportation services besides Unlimited Access

28 Students who drive may vote in favor of a transit pass program because it makes more parking spaces available on campus by encouraging some drivers to take the bus instead In special cases, exempting students from the fee can also accommodate this objection For example, Ohio State University annually exempts approximately 100 students who are studying overseas

29 Another explanation for the high approval rate in student referenda is that students who ride transit turn out in larger numbers

30 Due to data limitations, we have not separated the effects of Unlimited Access from those of other factors such as population shifts, economic conditions, and changes in the nature of the transit services provided that might also affect ridership levels and overall transit agency performance The data in Tables 1 and 3 refer to the *universities'* costs, and to the resulting increases in *student* transit ridership We obtained the data for the transit agencies from the annual Section 15 reports they file with the US Department of Transportation The 13 programs were the only ones for which we could locate data before and after Unlimited Access began The remaining transit agencies did not file Section 15 reports or the programs were either too new or too old to permit the necessary data collection Although Section 15 data was available for the University of Montana/Missoula MTD and University of Nebraska/StarTran Unlimited Access programs, they were not included in Table 6 because both systems' services were restructured and fares were increased during the period of study The cost per rider is the operating expense per rider, and the vehicle-miles-of-service measure refers to vehicle revenue miles of service The number of riders per bus is calculated by dividing the annual passenger miles by the annual vehicle revenue miles

31 In Table 6, the performance statistics consider motor bus transit only The percentages reported in Table 6 refer to the annual averages over the two years before and after each transit agency began to offer Unlimited Access, except in the case of Madison Metro where data for only one "after" year were available This analytical method yields a conservative estimate of the effect of Unlimited Access because the university programs start at the beginning of the school year while the performance measures refer to end-of-calendar-year totals Three transit agencies are listed in the table twice because they participate in programs with more than one university The average figures in the last two rows refer to the unweighted and weighted averages for the 13 programs, for the weighted averages, the transit agencies have been weighted by the total bus transit ridership during the year that Unlimited Access began Both weighted and unweighted average performance characteristics are reported at the bottom of the table for the 13 programs Unlimited Access has a smaller effect on a larger transit system Therefore, Unlimited Access has a smaller effect on the performance characteristic averages for the 13 programs when the average is weighted by the system's total ridership

32 The *differences* reported in Table 6, Figure 4, and the text refer to the percentage-point

differences between the trends in the two years before and the two years after Unlimited Access began For example, total transit ridership increased an average 1.3 percent per year in the two years before and an average 8 9 percent per year in the two years after Unlimited Access began – a 7 6 percentage point difference The percentage point differences should not be misinterpreted as stating, for example, that Unlimited Access caused a 7 6-percent increase in total transit ridership

33 Ridership data were taken from the Federal Transit Administration's Section 15 National Transit Database Additional transit agencies report Section 15 data each year as they become eligible for federal funding, so the falling ridership occurs despite an increasing number of transit systems Section 15 reporting began in 1980

34 The transit agencies' number of riders per bus was decreasing in 6 of the 13 cases before Unlimited Access began The number of riders per bus increased in 4 of these cases after Unlimited Access began, and the rate of decrease slowed in another case

35 The vehicle miles of service were decreasing in 5 of the 13 cases before Unlimited Access began The vehicle miles of service increased in 2 of these 5 cases, and the rate of decrease slowed in the other 3 cases The trend in vehicle miles of service improved in 8 out of 13 cases

36 The transit agencies' cost per ride was increasing in 9 of the 13 cases before Unlimited Access began The cost per ride fell in 5 of these 9 cases afterward, and the rate of increase slowed in 3 other cases The trend in the cost per ride improved in 9 out of 13 cases

37 The operating subsidy per ride was increasing in 12 out of 13 cases before Unlimited Access, and in 7 of these cases it fell afterward The trend in operating subsidy per ride improved in 10 of the 13 cases after Unlimited Access began

38 Total operating subsidy was increasing in all 13 cases before Unlimited Access and in 5 of these cases it fell afterward In 2 other cases, the rate of increase in transit subsidies slowed after Unlimited Access began As measured by the trend in the transit agencies' total operating subsidy, this result suggests that Unlimited Access reduced the need for additional operating subsidies

39 See Hartgen and Kinnamon (1999) The Center for Interdisciplinary Studies at the University of North Carolina at Charlotte ranked the overall performance of transit systems in the United States The study analyzed transit service levels, operating costs fares, subsidies, and ridership for 137 of the nation's largest urban transit systems Each system's rank was determined by comparing its performance against national averages on 12 different measures Five measures of resources (vehicles, population base, fare revenue, non-fare revenue, and coverage area) were normalized and compared with seven measures of results (operating expense per mile and per hour, operating costs per passenger and per passenger mile, vehicle miles and hours of service provided, and ridership) The statistics were developed from nationally reported Section 15 data Systems were then ranked according to overall performance against US averages, weighting each statistic equally See Hartgen and Collins (1996) for a discussion of the controversy surrounding the comparison of the performance of different transit systems using Section 15 data

40 Unlimited Access ridership shares are calculated by dividing the number of Unlimited Access rides for the 1997–1998 school year (as reported by the universities) by the total number of unlinked rides on bus transit for 1998 from the National Transit Database Section 15 Reports

41 Performance characteristics are computed using Section 15 data from the National Transit Database The data starts in 1980 (the first section 15 reporting year) and ends in 1997, which is the most recent year for which data are available

42 See http //www transitchicago com/welcome/initiatives html#c for a description of The Chicago Transit Authority's U-Pass program and a listing of participating colleges and universities

43 The first meeting of the Transportation and University Communities Association (TUCA), a new organization sponsored by the American Public Transit Association, took place in