Operational and Revenue Implications of Implementing Employer-Based Transit Pass Program

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Findings are presented of a comprehensive evaluation that was made of an employer-based monthly transit pass program instituted in Jacksonville, Florida. The purpose of the demonstration, which was funded through the Service and Methods Demonstration Program of the Urban Mass Transportation Administration, was to assess the impacts that result when transit passes are sold, distributed, and promoted by employers to their employees. Three affected groups were examined—employers, employees, and the transit operator. Enrolling 30 firms to participate in the sale of transit passes was accomplished very successfully and efficiently by having staff members with first-hand knowledge of the local business community schedule a personal meeting with the chief executive officer at each firm. However, the monthly transit pass, which was initially priced at little or no discount compared with cash fares, was not purchased by many employees who use the bus mainly for commuting purposes. However, by instituting a modest $2.00 discount in the pass price and encouraging employers to provide additional subsidies, the number of passes sold increased from an average of 120 to more than 1000 per month at the end of the first year. By the eighteenth month of the program, one-third of the employers were selling the pass at a discount to their employees. While the employer-promoted pass program resulted in some new transit riders (about 20 percent of the purchasers had previously used other modes), more than 60 percent of the pass purchasers were already regular bus commuters. Revenues lost because of the program were small (about 0.3 percent of regular monthly revenue) since 75 percent of the employees use the transit pass only for commuting.

The concept of selling and distributing transit passes through employers is the logical outgrowth of two trends that have emerged over the past decade. The first is the rapid growth (or renewed growth) in transit operators' use of transit fare prepayment (TFP) instruments, such as transit passes that are valid for trips taken over a specific period such as a calendar month. In early 1970, relatively few transit agencies in the United States offered regular transit riders the use of monthly transit passes. However, a recent fare survey completed by the American Public Transit Association (APTA) revealed that currently about two-thirds of the transit systems surveyed sell some type of pass. The monthly pass is the most popular, currently being offered for sale by 51.9 percent of the surveyed systems (1,2).

Paralleling this growth in new transit pass programs has been the advancement of the concept that places of employment have particular advantages in terms of establishing and coordinating programs to achieve ridesharing and other broad transportation goals. For example, beginning with the 1973 oil embargo, many major cities and employers began carpool-matching programs and later employer-sponsored vanpool programs. Interest in improving air quality led to proposals that employee-provided parking be curtailed or reduced, especially by large firms located in major urban areas. With this trend toward relying more heavily on employers to assume additional responsibility in the commuting patterns of their employees came the notion that employers should participate in the sale, distribution, and promotion of the ever-more-popular monthly transit pass. In addition, to the extent that employers could be encouraged to subsidize the price of the pass to their employees, additional revenues could be generated by the transit operator, especially at a time when new revenue sources are much needed.

In order to advance the concept of selling passes through employers as well as to monitor and evaluate the resultant impacts on transit operators, employees, and employers, the Urban Mass Transportation Administration (UMTA) provided Service and Methods Demonstration (SMD) grants to Jacksonville, Florida, and Sacramento, California, to implement similar employer-promoted monthly transit pass programs. Except for the employer-based pass program in Boston (3), there existed little documentation when these demonstrations began in 1977 that transit agencies could use to gauge, a priori, the demand and the economic and institutional reactions of adopting this type of program.

DEMONSTRATION OBJECTIVES AND ISSUES

The principal objective of the Jacksonville demonstration was to evaluate the impact on sales of monthly transit passes that are marketed and sold through employers. The intent of the program was to place as few demands as possible on the employers enrolled in the program while increasing the convenience to employees of purchasing a pass and using the transit system. Employers were encouraged to institute a payroll deduction plan as a pass payment option to further increase the convenience of purchasing a pass. Many of the employers eventually began subsidizing part of the pass price (either as a new employee fringe benefit or in lieu of providing or expanding employee parking) as a further incentive for their employees to buy a pass. These actions added further useful insights into the responses of employees to this type of pass program.

Research issues important to the evaluation can be associated with one of the following three groups involved in this type of pass program:

1. The employer who must sell and distribute the monthly transit pass as well as perform the administrative tasks of collecting, recording, and remitting revenues obtained;
2. The employee who decides whether to purchase a pass at his or her place of work, which in turn may influence his or her use of the transit system; and
3. The transit operator who makes available the monthly transit passes and operates the transit system.

In many instances, there is a direct interdependency between issues and impacts to be evaluated within each group (e.g., transit trip frequency of pass purchasers) and between groups (e.g., effect of employer subsidy on employee pass purchase decision). The identification of these behavioral linkages can provide a useful framework both for structuring the evaluation issues and for presenting the findings of the demonstration.

IMPLEMENTATION OF JAXPASS PROGRAM

The Jacksonville TFP demonstration, like its companion demonstration in Sacramento, instituted a program by which monthly transit passes could be purchased by employees at their place of employment with a minimum of personal inconvenience (4). In Jacksonville, the monthly transit pass, called JaxPASS, was introduced and made available only

Although trips by the nonminority group for both low- and high-income groups do occur that are longer than the longest observed trip for the low-income minority group (20 miles or less), only 3 and 5 percent of the trips made by the two nonminority groups are longer. Obviously, a generalization that low-income and minority riders make shorter trips than high-income and nonminority riders do is misleading.

SUMMARY AND CONCLUSIONS

There may be many valid reasons to prefer a graduated or distance-based fare system for transit over a flat-fare system. Some of these reasons may be based on equity considerations. However, a generalization that equity requires distance-based fares because low-income and minority riders always make shorter trips than high-income and nonminority riders do is not proper. In the Atlanta area, based on the analysis here, it appears that there are no significant differences in the distribution of trip lengths by race and income group. In fact, distance-based fares would, in general, discriminate for high-income minority riders against low-income riders of both minority and nonminority classifications. Therefore, although there may be equity and other considerations that make distance-based fares more appropriate than flat fares, on the basis of current information such may not be maintained solely on the generalization that low-income riders travel shorter distances than high-income riders do.

FOLLOW-UP ANALYSIS

Review of the previous discussion identified one critical shortcoming: The sample size for the analysis is very small. The fact that two independent small samples that are mutually consistent yield the same result mitigates this somewhat, but the criticism is certainly valid. Follow-up analysis of transit trips for the Atlanta area, however, tends to verify the original conclusion.

In the follow-up analysis a larger sample (1045) of weekday transit trips (from the same 1980 survey) was stratified into three income and five distance categories. Percentages for all trips are shown in each of the resulting 15 cells in Table 4. The distribution is shown graphically in Figure 1. Review of these data is not "confused" by broad dispersions of trip lengths and misinformation that might result from simple considerations of average trip lengths. The sample is also sufficiently large to overcome the criticism of the earlier study.

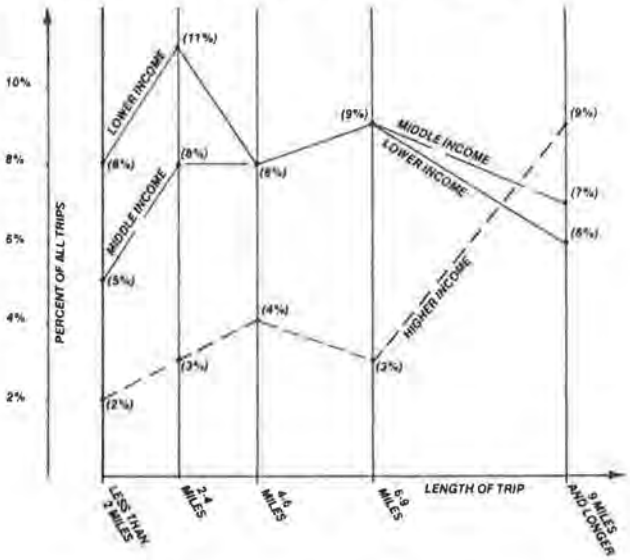
Consideration of the information in Table 4 and Figure 1 leads to the following conclusions:

1. The reason that average trip lengths for high-income riders may be longer is not simply that they are indeed longer but rather that there are very few short trips made by these riders.
2. The actual numbers of trips in the longest-trip-length category are similar for all three income groups; that is, trips by low- and middle-income riders tend to be just as long as those for high-income riders. A distance-based fare structure would charge higher fares to about as many, or possibly more, trips made by low- and middle-income riders as it would to high-income riders.

Table 4. Distribution of trips by length and income categories (N = 1045).

Trip Length (miles)	Trips by Income Group (%)			
	Low (<$10 000)	Middle ($10 000 to <$25 000)	High ($25 000+)	Total
<2	8	5	2	15
2 to <4	11	8	3	22
4 to <6	8	8	4	20
6 to <9	9	9	3	21
9+	6	7	9	22
Total	42	37	21	100

Figure 1. Distribution of trips by length and income categories.



The conclusion drawn from the initial analysis and previously stated is therefore confirmed by this follow-up analysis. That is, distance-based fare structures cannot be supported solely on the generalization that flat fares discriminate against low-income riders because these persons make short trips whereas high-income riders paying the same fare make long trips. Such might indeed be the case in specific areas, and there may be other warrants for distance-based fares. There is at least one case, however, in which it has been shown that the generalization does not hold.

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through a panel of employers enrolled in the demonstration. However, the Sacramento monthly transit pass, labeled PASSpoRT, was already being sold to the general public prior to the beginning of the employer-sponsored demonstration. It continued to be sold at regular sales outlets during the course of the demonstration (5).

During January and February 1979, various employers in the Jacksonville central business district were contacted and asked to participate in the TFP program. Orders for the monthly JaxPASS began in late February 1979 for passes valid for March 1979. Passes were initially priced at $14.00, reflecting a breakeven use rate of 40 one-way transit trips per month at the regular bus fare of $0.35. [The monthly JaxPASS was valid only on weekdays on regular bus routes in the inbound direction between 6 a.m. and 9 a.m. and outbound between 3 p.m. and 6 p.m. It was valid for unlimited travel at all other times on regular bus routes and at all times on the downtown shuttle. These restrictions were established so that the monthly pass would not compete with the higher-priced $7.00 unlimited-use weekly pass, which is designed exclusively for individuals who must make a full-fare transfer when commuting since Jacksonville Transportation Authority (JTA) does not have free or reduced-fare transfer privileges.] The JaxPASS was also usable on higher-fare routes by showing the pass to the driver and paying the difference in fare over the base fare.

After a disappointingly low level of pass sales during the first three months, the price of the pass was reduced by $2.00 to $12.00 starting in July 1979. This represents a breakeven use rate of 34.3 one-way trips per month. The pass price remained at that level throughout the remainder of the evaluation. (The JaxPASS price increased to $20.00 on September 29, 1980, at the same time base transit fares were increased to $0.50, but it continued to be sold to participating employees at a $2.00 discount. More importantly, when the demonstration grant ended, JTA continued to sell the pass at $18.00, leaving intact the $2.00 discount that previously had been funded through the demonstration grant.)

The following three sections describe the demonstration findings as they relate to employers, employees, and the transit operator.

EMPLOYER-RELATED ISSUES

Recruiting Employers

The enrollment of an initial panel of 30 employers to participate in the sale and distribution of monthly transit passes was accomplished very successfully; in fact, it was necessary to contact only 34 establishments. This very favorable response rate can be attributed to several key factors. First, a personal visit was scheduled with each potential seller. Second, the person contacted at each firm was a high official (usually the chief executive officer), who typically had the authority to make a direct decision to either participate or not participate in the program. Third, the representatives of JTA involved in signing up employers were very familiar with corporate concerns in general and with the Jacksonville business community in particular. Also, staff personnel were personally acquainted with some of the individual employers being contacted. Although a large percentage of employers may still have participated if other procedures were followed, these factors, either alone or in combination, certainly aided in the success and timely completion of this phase of the pass program.

An overwhelming majority of the employers who were contacted and who agreed to participate in the TFP program were in the single, standard industry classification--"finance-insurance-real estate." Of firms that participated throughout the first year of the program, 65 percent were in this industry classification. Within this group, 53 percent were insurance companies. It may be hypothesized that firms such as insurance companies take a strong interest in community affairs and employee welfare and thus are more likely to participate in a program of this nature. (Indeed, many insurance companies were also early participants of the very successful Massachusetts Bay Transportation Authority employer pass program that started in October 1974.)

JaxPASS Distribution Procedures

Employers, after having received the transit passes, were responsible for distribution and employee payment. Exactly 75 percent of the firms reported using some form of over-the-counter distribution procedure by which employees report to a designated place to pick up their pass. One medical facility distributes and sells passes through its gift shop because of its convenience and cash-handling capabilities. The remaining 25 percent of the firms hand deliver the passes to each employee. None of the firms reported distributing passes through their interdepartmental mail system, which is typically perceived to be a more theft-prone approach.

Initially it was hoped that many firms would institute a payroll deduction plan in order to maximize the perceived convenience of acquiring the pass each month and possibly as a way of minimizing the perceived cost of the pass. However, only 4 of the 23 firms (17 percent) that were participating at that time implemented payroll deduction as a means of collecting the pass price from their employees.

Employer Subsidization of JaxPASS

During the first nine months of the demonstration, very few employers were willing to subsidize the price of the pass to their employees (only one firm subsidized the pass by $4.00). However, as a few other firms gradually started to provide subsidies, a cascading effect seemed to occur so that by the eighteenth month of the program one-third of the employers were providing subsidies that ranged from a low of $4.00 (33 percent discount) to a high of $12.00 (100 percent discount).

It was initially hypothesized that firms would subsidize the pass if they lacked adequate employee parking. The information obtained from employer interviews indicates that this was true, but only to a limited extent because few employers appeared to have severe parking problems or would have saved money by reducing parking demand. The basic concept, however, is still a valid one, especially in areas that may have different parking supply characteristics.

Employer Administrative Costs and Benefits

The amount of time employers reported spending to set up and organize the JaxPASS program initially and then to maintain it on a monthly basis appears to have been quite modest. During the first pass-sale month, an average of about 4 person-h were necessary to accomplish the initial administrative activities. In the following months, the amount of administrative time required was reduced by more than 50 percent to an average of 1.6 person-h/month. The actual amount of time is dependent, of course, on the number of passes that are sold. Firms

Figure 1. Monthly JaxPASS sales: total and by subsidizing firms.

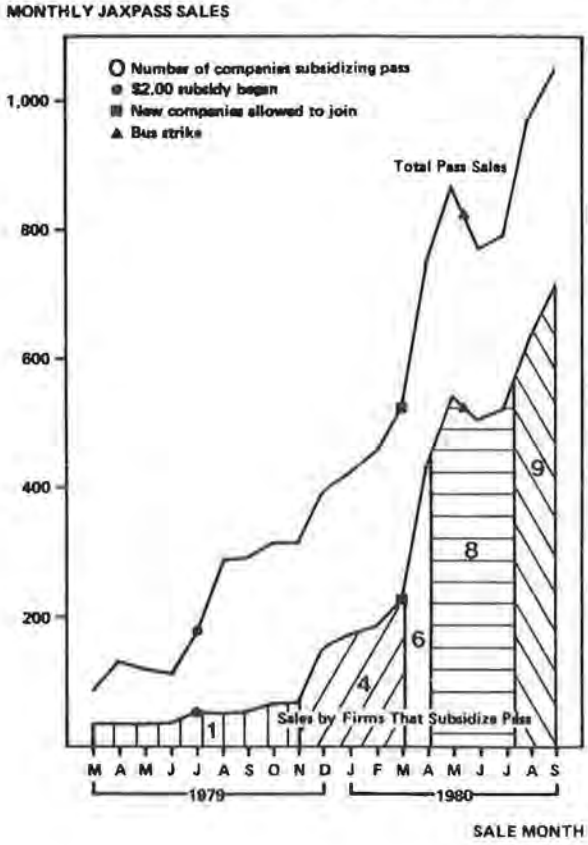
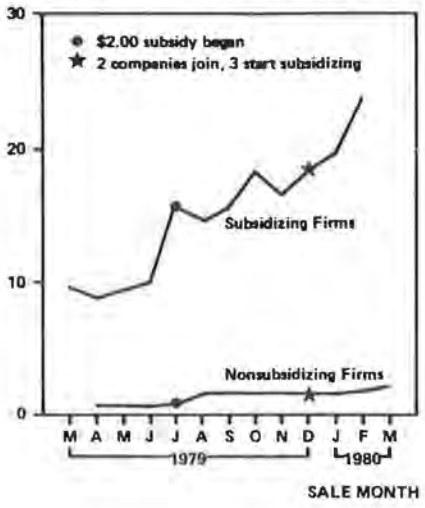


Figure 2. Percentage of eligible employees purchasing JaxPASS by subsidizing and nonsubsidizing firms.



selling more than 30 passes per month generally reported spending between 3 and 4 person-h/month, whereas firms selling less than 20 passes per month expended between 0.5 and 1 person-h/month. Because of the range of data, no information is available on the resources that would be required by employers selling 100 or more passes per month.

In general, administrative cost concerns were not a high-priority item among firms selling transit passes. In fact, none of the firms that sold passes at any time during the course of the demonstration dropped out of the program because of the administrative requirements. Firms that dropped out of the program did so because of very low or no pass sales.

Of the employers that were surveyed, 87 percent believed that they obtained a net positive benefit by participating in the JaxPASS program. The majority of these firms stated that their involvement provided their employees a convenient way of purchasing passes at work. Thus, the companies felt that if their employees were benefiting from the program, then they were also. In terms of more tangible or direct benefits, about one-third of the employers felt that the demand on company-provided parking spaces was lessened.

EMPLOYEE-RELATED ISSUES

JaxPASS Sales

After an inauspicious first-month sale of 89 passes in March 1979 (priced at $14.00 on the breakeven basis of 40 trips per month), sales rose by almost 50 percent during the second month, to 131. However, this turned out to be a short-lived gain and in fact represented a peak, as pass sales declined in the following two months, first to 120 and then to 113. Because it was recognized that sales were unlikely to grow at any appreciable rate in the near term, it was decided that the funds allocated in the demonstration grant for a one- or two-month, deep-discount subsidy experiment be used instead to reduce the pass price by $2.00 from $14.00 to $12.00.

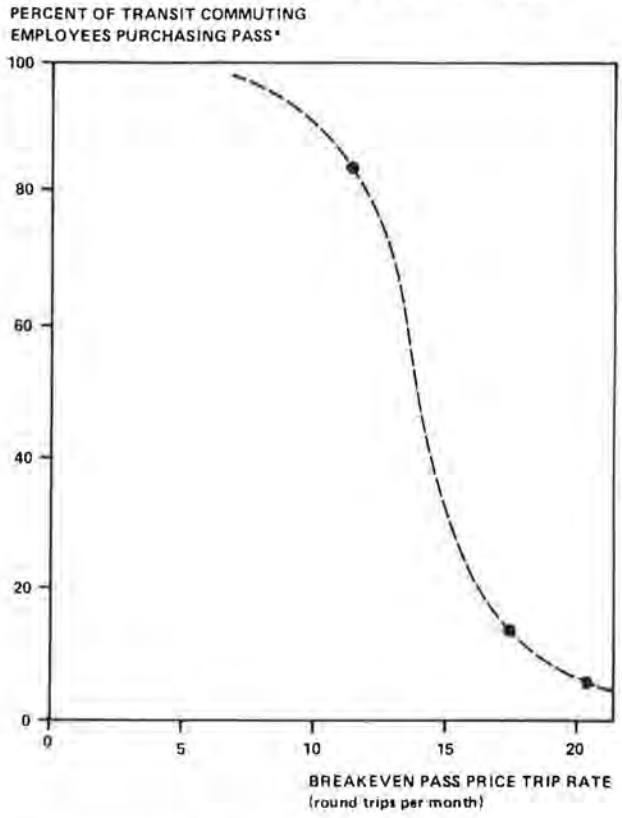
Figure 1 depicts the monthly variation in total pass sales from the start of the program in March 1979 until September 1980. Also shown are monthly pass sales for firms subsidizing the price of the pass (which amounted to $4.00 per pass for nearly all firms that subsidize) and the number of firms subsidizing the pass in any given month.

Figure 2 normalizes monthly pass sales by plotting the percentage of employees at participating firms who purchased a JaxPASS for both subsidizing and nonsubsidizing firms. This clearly shows the following:

1. Pass sales per employee are significantly higher for firms subsidizing the pass price compared with firms not subsidizing. In particular, over the first 12 months of the demonstration, JaxPASS penetration rates were 10 times higher for subsidizing firms than for nonsubsidizing firms. (Alternatively, JaxPASS sales per firm were 3 to 5 times higher for companies that subsidize compared with nonsubsidizing companies.)
2. Pass sales after the introduction of the general across-the-board $2.00 price discount increased more rapidly for nonsubsidizing rather than for subsidizing firms. For the firm already subsidizing the pass, average penetration rates (defined as percentage of employees buying a pass) increased 62 percent (from a three-month average of 9.4 percent to 15.2 percent) after the introduction of the $2.00 discount. However, the increase in pass penetration rates for nonsubsidizing firms was about twice as large, or 122 percent (i.e., from 0.6 to 1.33 percent).
3. Little or no secular growth in pass sales occurred over time for either subsidizing or nonsubsidizing firms. Given no outside changes (such as the introduction of a subsidy), the number of passes sold by a firm quickly reached a level of stability. The inference is that within one or two months all employees who are likely to buy a pass will do so, all else being equal.

Among three firms that began subsidizing passes

Figure 3. Sensitivity of pass penetration rate to breakeven pass level.



* Employees commuting by transit 3 or more days per week.

by $4.00 midway in the demonstration, average monthly pass sales (for a three-month period before and after the introduction of the subsidy) increased by a factor of 5 for two of the companies and by a factor of 7 for the third. These large changes suggest that pass sales are highly sensitive to a change in the inherent breakeven price of a pass. [Similar findings were also noted in an evaluation of TFP discounts in Austin and Phoenix (6)]. As an illustration of this point, Figure 3 depicts the percentage of transit users who purchased a JaxPASS versus the breakeven transit trip rate. (For the first four months of the demonstration the pass was priced at 40 one-way trips. When the $2.00 discount was instituted, it dropped to 34.3 trips. For firms providing an additional $4.00 subsidy, the effective breakeven rate was 22.8 one-way transit trips.) Figure 3 clearly shows that a relatively large change in pass penetration rates occurred when the breakeven level of the pass changed. Between 27 and 40 one-way transit trips per month, arc elasticities were computed and are fairly constant in the -5 to -6 range (i.e., a 1 percent decrease in the breakeven pass rate will result in a 5-6 percent relative increase in the percentage of transit users who purchase a pass). In the range of 20 to 25 trips, arc elasticities decrease to between -1.0 and -4.0, since at these lower breakeven rates most of the employees who could buy a pass would have already done so. Consequently, the percentage change in penetration rates, and thus elasticities, becomes smaller.

A two-week bus strike during the month of May 1980 resulted in a drop in pass sales in the month following the strike. The decline in passes sold per firm was twice as large among nonsubsidizing firms than among subsidizing firms (-13.6 percent versus -6.2 percent). Four months after the strike ended pass sales had not returned to their prestrike level. However, the difference was still twice as large for nonsubsidizing firms compared with firms that subsidize the pass (i.e., -7.6 percent versus -3.0 percent).

Socioeconomic Characteristics of JaxPASS Purchasers

Data from employee surveys conducted at the participating firms reveal that JaxPASS purchasers have socioeconomic characteristics that are very similar to those of employees who regularly commute to work by transit but continue to pay with cash fares. Characteristics were about the same for sex, age, number of licensed drivers in the household, and whether or not the individual holds a valid driver's license. The most significant difference between the two groups of bus commuters was the much lower household incomes of employees purchasing a JaxPASS compared with employees who use the bus but do not buy a JaxPASS ($13 080 versus $17 078). JaxPASS purchasers also tended to own fewer automobiles.

The group of employees who did not buy a JaxPASS and who did not use the bus regularly to commute to work contained proportionately more men, had much higher average household incomes ($21 231), owned more automobiles, were more likely to have a driver's license, and thus more household drivers, and worked overtime more often than both groups of bus commuters (i.e., JaxPASS and cash-paying users). Age was the only characteristic that was not significantly different among the three groups of employees.

Employee Changes in Travel Behavior

With respect to transit travel behavior, JaxPASS purchasers are distinguished particularly by the regularity with which the bus is used to commute to work; in particular, 92 percent indicated that they commute to work by bus five or more days per week. The transit use characteristics of these employees prior to buying a JaxPASS can be disaggregated into three groups. First, about 60 percent of the pass purchasers were already regular bus commuters and thus reported making no change in mode or transit trip frequency. The second group, representing about 20 percent of the purchasers, can be considered to have made a complete switch in modes and are therefore new transit users. The remaining 20 percent of the purchasers that make up the third group increased their use of transit by a more limited degree (e.g., by one or two days per week) since they previously used the bus three or four days per week to commute to work.

Assuming that commuting to work by bus is equivalent to taking two one-way commuter bus trips per day, JaxPASS purchasers made an average of 9.7 one-way commuter trips per week compared with an average of 8.0 for other bus commuters. Although these two means were statistically dissimilar ($t = 11.2$), as shown in Table 1, there was not a significant difference between the mean number of noncommuter one-way bus trips made on weekdays by JaxPASS (mean of 2.2) and non-JaxPASS commuters (mean of 1.9). Similarly, the means for the number of one-way bus trips made on weekends between the two groups (0.6 versus 0.4) is also not significantly different ($t = 0.9$). Thus, in terms of transit trip frequency, the major characteristic that distinguishes bus commuters who purchase a JaxPASS from those who do not is the degree to which transit is used to commute to work. The data indicate that JaxPASS purchasers are no more likely than other employed transit commuters to use the bus system at other times during the work week or on weekends.

Table 1. Comparison of means: employee travel behavior characteristics.

Characteristic	Pass Purchaser (A)		Nonpass Bus Commuter (B)		Nonbus Commuter (C)		t-Statistic[a]	
	Mean	SD	Mean	SD	Mean	SD	A-B	B-C
One-way bus trips per week								
Commuter (N=86, 243)	9.67	0.992	7.95	1.73	NA	NA	11.2	–
Noncommuter (N=71, 215, 547)	2.21	4.296	1.87	3.319	0.19	0.891	0.6	–
Weekend (N= 85, 249, 574)	0.65	2.24	0.41	1.28	0.01	0.138	0.9	–
Total (N=67, 183, 513)	12.12	5.17	10.23	4.98	0.25	1.39	2.6	–
Walk time to bus stop (min) (N=78, 224, 434)	7.06	7.05	7.25	8.67	9.71	12.08	0.2	3.0
Automobile commute time (min) (N=66, 203, 844)	21.88	9.28	19.21	8.37	21.98	11.01	2.1	4.0
Bus commute time (min) (N=85, 246, 304)	33.94	12.20	31.15	13.25	37.89	15.32	1.8	5.5

Notes: Data from employee survey, December 1979 to February 1980.
Sample sizes are given in parentheses for each of the three groups studied.

[a]Between groups.

The mean total number of one-way bus trips normally made per week by employees who purchased a JaxPASS was 12.1 (compared with 10.2 for other bus commuters). Assuming that an employee works between 46 and 47 weeks of the year, JaxPASS users take an average of about 47 trips per month. This represents about seven more one-way trips compared with the breakeven level of 40 based on the normal $14.00 fare credited to JTA or about 12.7 additional trips compared with the breakeven level of 34.3 after taking into consideration the $2.00 subsidy that was in effect at the time the employee survey was administered.

Turnover Among Pass Purchasers

Although aggregate JaxPASS sales at most firms held steady or increased very slightly over time (assuming no change in pass price or level of employer subsidy), there was a fairly large amount of turnover in the particular individuals buying passes. Among three employers who had the highest pass sales during the start of the program, between 40 and 58 percent of the employees who had purchased a pass during the first sale month were not buying the pass one year later. Because aggregate sales did not decline, however, these employees were replaced by other employees. Based on responses obtained from employees who discontinued buying a pass, it appears that the decision was a reflection of normal changes in transit travel behavior and work-related factors. However, almost 10 percent of those who stopped buying the pass did so because of a reported dissatisfaction with the time and directional restrictions on the pass.

TRANSIT-OPERATOR-RELATED ISSUES

JaxPASS Program Expenses and Activities

The administrative costs required by JTA to maintain the monthly JaxPASS program (as distinct from start-up costs) appear very modest. During the course of the demonstration, a relatively fixed panel of 25 to 30 employers participated. Because recruiting of new firms was held to a minimum, only 2 to 3 person-days/month were expended by staff at the Jacksonville Coach Company Lines (a firm that manages the daily operation of the transit system under contract to the JTA), whereas between 1 to 2 person-days/month were expended by personnel at JTA. After data-collection tasks associated with the demonstration evaluation had been completed, the monthly pass program functions were able to be handled by existing staff personnel. Clearly, however, larger pass programs would require additional and possibly full-time staff members.

Ridership Impacts

Partly because of the constrained size of the pass program, relatively few new riders began using the system strictly because of the availability of an essentially undiscounted transit pass. Factors such as the $2 pass price discount, employer subsidies (typically $4.00 per pass), and the increasing cost of gasoline had a much more significant impact on an individual's decision to purchase a JaxPASS and use the bus mode for commuting.

Revenue Impacts

Revenue impacts (positive or negative) of selling JaxPASS through employers were also small. If the $2.00 pass discount that was being provided from demonstration grant funds is considered as revenue to JTA, then JTA experienced a net revenue gain of about $500/month. However, excluding this amount as revenue to JTA, the pass program resulted in a net revenue decrease of about $1500/month. This amount represents only 0.3 percent of the monthly farebox revenue collected by JTA. To the extent that more employers can be encouraged to subsidize the price of the pass as a fringe benefit to their employees, thereby inducing some of the marginal transit users to buy a pass, the potential revenue loss to the transit operator can be reduced. Positive revenue gains are in theory also possible from this new revenue source.

Although it is difficult to determine precisely, all available evidence indicates that very little revenue was lost because passholders lent their pass to others for use on weekends or during off-peak hours. This type of abuse was minimized in Jacksonville by having a color-coded pass for men and for women. Also, only individuals old enough to be working (e.g., 18 years of age or older) were eligible to buy a pass. Bus drivers could therefore screen the use of the pass by children or young teenagers.

Unauthorized use of the pass was further reduced by the time and directional restriction of the pass since once an individual arrives at work, the pass is not valid again (except on the downtown shuttle) until the morning peak ends.

Last, no cash-flow advantages of the JaxPASS were realized because of the relatively small amount of revenue obtained from JaxPASS sales versus the farebox and because some employers submitted pass-sale receipts toward the end of the month, which tended

to offset the cash flow gains by employers who submitted receipts early in the month.

CONCLUSIONS

The Jacksonville TFP demonstration has provided a very useful data set for quantifying the impacts that result from implementing an employer-based monthly transit pass program. The main conclusions of the demonstration are highlighted below.

Although the pure convenience aspect of being able to purchase a pass at one's place of employment resulted in few individuals switching from other modes to transit, convenience did play a major part in a transit user's decision to buy a pass at work. This was revealed when 58 percent of the pass buyers stated that they would discontinue buying a pass if it was sold only through JTA's regular pass outlets.

In contrast to passes available to the general public, and thus to the entire transit-dependent community, passes sold through employers were typically thought of and used as commuter passes. Few new transit trips were taken by pass purchasers during off-peak hours or on weekends. Consequently, pricing the pass to provide little or no discounts over cash fares, with employees bearing all the up-front risks (e.g., unexpected sick days), resulted in a low level of pass sales. However, providing modest pass discounts and encouraging employers to subsidize the pass as an employee fringe benefit, or in lieu of an employer-provided parking space, resulted in substantial increases in pass sales.

Soliciting employers to participate in the program was successfully accomplished by relying on a personal meeting with a high executive officer at each potential firm. Most of the employers recognized the benefits to their employees by participating in the JaxPASS program. In fact, by the eighteenth month, one-third of the employers (9 out of 28) were providing partial (usually $4.00) or full subsidies to their employees who bought a pass. Administrative costs borne by the employer were small, ranging from 0.5 to 4 h/month. No firms discontinued their involvement in the program because of the administrative requirements associated with selling and distributing passes to their employees.

Administrative resources expended by the transit operator consisted of 3 to 4 person-days/month. These activities were handled by existing staff members. Of course, much larger TFP programs would require full-time staff.

The JaxPASS program resulted in some new transit users and the new revenue from these individuals helped to offset the revenues lost to the more frequent transit users who also bought passes. On balance, the introduction of the program resulted in slight negative revenue loss (about 0.3 percent of total monthly revenues). However, as additional employers join in subsidizing the pass price, thereby encouraging more marginal transit users to buy a pass, revenue losses because of the pass should decrease further.

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The opinions and conclusions expressed in the paper are mine and do not necessarily reflect the views or policy of TSC, UMTA, or JTA.

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Abridgment

Graphical Person-Machine Interactive Approach for Bus Scheduling

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A highly informative graphical technique for the problem of finding the least number of buses required to service a given schedule of trips is described. The purpose is to develop the methodology for variable bus scheduling in which trip departure times can vary within acceptable tolerances. This is a continuation of a research project concerned with the problem of fixed scheduling where the timetable of trips and length of trip times are fixed. The motivation for this study comes from the Israel National Bus Carrier, Egged, which is responsible for scheduling an average of 54 400 daily trips by about 5200 buses. Consequently, the research takes on a practical nature. The approach used is based on the deficit-function theory where the deficit function at time t defines the total number of trips that have departed from a given terminal k less the number of trips that have arrived at k up to and including time t. The method developed is capable of aiding the scheduler to perform his or her tasks through a person-machine conversational mode. It allows