Effects of Disseminating Service Information and Free Ride Coupons on Bus Ridership

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Although several studies of system-wide, free-fare experiments have suggested that such programs do not stimulate sustained ridership gains and actually result in revenue losses, the possibility remains that targeted, route-specific free-fare programs could stimulate ridership without significant disruption on individual routes. Studies of service information dissemination also suggest that this may be an effective means of stimulating ridership and revenues. In this paper, the effects on ridership of distributing (a) route-specific service information only and (b) information with free-ride coupons to residential areas bordering three high-ridership urban bus routes are described. In addition to one premeasure and two postmeasures of ridership on the routes, surveys of riders on the routes and of all coupon users were undertaken. The experimental design controlled externalities affecting ridership. Neither the information alone nor the coupons caused significant ridership gains. Most coupon users were existing high-frequency, transit-dependent riders. Few new riders were gained, and existing riders did not significantly increase their frequency of bus use. Survey findings also suggest that with direct-mail promotions, it is not sufficient to target areas bordering bus routes, as many current and potential riders may not live in these adjacent areas.

As local public transit agencies attempt to increase ridership and revenues, one question that arises is the extent to which simply informing people about services will stimulate ridership. Marketing efforts emphasizing information dissemination are based on the recognition that among the many determinants of mode choice are awareness and knowledge of transit services. Further questions that arise are whether incentives in the form of free rides are effective in inducing trial by new riders and whether any immediate effects are sustained in the form of longer-term gains in ridership and revenues.

These questions are significant to transit agencies as they devise and implement marketing strategies. If it is true that dissemination of information does yield ridership gains, it is appropriate to allocate marketing resources to programs that inform the public of transit services and their features. It is important, of course, to target groups with a potential for becoming riders, as it is not efficient to undertake programs that spend a large share of marketing funds reaching staunch nonriders unlikely to use transit services. With free-fare promotions, it is not effective to primarily reach existing riders who merely use free-fare coupons as substitutes for cash fares they otherwise would pay.

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RELATED STUDIES

Some evidence exists to suggest that information dissemination and free ride programs may be effective. Ellson and Tebb *(1)* studied a network of eight rural bus services in South and West Yorkshire, England. About 12,000 leaflets containing schedules and route information were distributed on buses, at fixed distribution points, and from model libraries. Ridership on the services increased 13 percent 4 weeks after distribution and was still more than the predistribution level 17 weeks after distribution. The extra revenues directly attributed to the information dissemination were about four times the cost of producing and distributing the leaflet. These results later were substantiated in a study by the Transport and Road Research Laboratory (TRRL) in the city of Bingley, West Yorkshire *(2)*.

Several cities have experimented with elimination of offpeak transit fares to stimulate ridership. In the fall of 1979, the Utah Transit Authority charged no offpeak fares for 1 month *(3)*. The free fares were billed as an introductory offer, and publicity was given to the program to try to stimulate people who did not regularly ride the bus to try it and continue riding. Ridership data and the results of an on-board survey were analyzed. Weekday ridership increased between 4 and 12 percent as a result of the free fares. Most of the extra bus trips during the month of promotion would otherwise have been taken by car, and between 17 and 50 percent were taken by people who had not previously used the system. While a long-term increase of 8 percent on weekday ridership was observed, the hypothesis that no long-term effect occurred could not be rejected.

UMTA has sponsored studies of the effect of system-wide, offpeak free fares in Denver, Colorado *(4)*, and Trenton, New Jersey *(5)*. During the free-fare periods, offpeak ridership increased by about 50 percent. Relatively little of the increase was sustained when fares were reinstated, however. Revenue losses of approximately 40 percent were experienced in Denver. The demand for offpeak service created problems for schedule adherence, capacity, and perceived security.

In a study by the Southern California Rapid Transit District (SCRTD), the effect of alternative means of distributing line-specific free-ride coupons for underutilized lines was examined *(6)*. Three distribution methods (newspaper inserts, direct mail, and door hangers) were tried, each on one line; a fourth route served as a control. A before-measure ridership count was taken within 6 months of the project, and the after-measure count was taken 3 months after coupon distribution. Surveys of coupon recipients and coupon users were undertaken. The

coupons were found to increase ridership 18 to 22 percent, depending on method. About three-quarters of the coupons were redeemed by existing users; SCRTD concluded that the trips taken by coupon users were in addition to their regular trips.

RESEARCH OBJECTIVES

The purpose of the research project was to explore the effect on ridership on selected bus routes of an urban transit system of dissemination of information about those routes and of coupons for free rides. The primary question posed was "Does dissemination of information and free-ride coupons stimulate trial by new riders or increased use by current riders, and is any immediate effect sustained over time?"

Specific research objectives included the following:

1. To examine the effects on ridership of the dissemination of information about services.
2. To determine the groups among which information dissemination is most likely to stimulate ridership.
3. To identify the effects on ridership of the dissemination of coupons for free rides, including examination of the time of day of use and the extent to which any increases represent net new ridership as opposed to use of coupons to replace fares that otherwise would be paid.
4. To explore the extent to which dissemination of coupons is effective with different types of recipients (new versus previous riders and frequent versus infrequent riders).

RESEARCH METHODOLOGY

The research reported here was conducted in 1986 in Norfolk, Virginia, a city with a large downtown business district and several large military installations. Two different types of experimental stimuli were applied: (a) information about bus service on a specific route, and (b) information accompanied by a coupon for a free ride on a specific route. Two bus routes were designated as experimental routes, with coupons distributed along part of each route and information only along another part of each route. On a third route, information only was disseminated along part of the route, while another segment served as a control. The bus routes were selected after detailed analysis of all the routes in the system (including their ridership, operating characteristics, and demographics of service areas). The objective was to select three routes that were similar in frequency and hours of service, ridership levels, and characteristics of riders. Routes 1 and 2 were experimental routes. Route 1 ran from the Norfolk CBD along a major street, skirting the huge Naval base and continuing to its terminus at the Naval amphibious base. With a 14-min headway and 89 hr of service per day, this route served approximately 3,200 riders on weekdays. Route 2 ran from downtown Norfolk past a medical center and a university to the Naval base. Serving approximately 2,700 riders on weekdays, this route provided 70 hr of service per day with 15-min headway. Route 3 included experimental and control sections. It, too, originated in downtown Norfolk and ran along a major street to the Naval base. It operated 90 hr per day with a 15-min headway and averaged weekday ridership of 3,300 riders. The experimental design is presented in Table 1.

Four major types of pre- and postmeasures were obtained during the project, as follows:

1. Measures of ridership,
2. Measures of coupon redemption,
3. Measures of coupon users' characteristics, and
4. Measures of riders' characteristics.

TABLE 1 EXPERIMENTAL DESIGN

Route Segment	Route Number	Description	Treatment Condition: Information Only	Information and Coupon	Control
1	1	Northern		X	
2	1	Southern	X		
3	2	Northern	X		
4	2	Southern		X	
5	3	Central	X		
6	3	Balance			X

For each route included, postal carrier routes bordering the route or within four blocks of the route were identified. Carrier routes that also were close to other bus routes were excluded. Because most routes originated in the downtown area, the area immediately surrounding the CBD was excluded. To avoid possible spillover effects, buffer zones in which information and coupon distribution were withheld were established between route segments.

Two types of material were distributed to experimental route segments. The information-only material consisted of a two-color brochure (a single sheet of paper folded into several panels). Separate brochures were developed for each route. The cover featured a photograph of a bus being boarded and identified the route name and number and major destinations served. Inside the brochure were a complete route schedule, route map, fare and service information, and instructions for using the bus. The material distributed on coupon segments differed only in that a banner across the front of the brochure read, "Free Rider Coupon Inside, See Details." On these brochures, the last panel was a coupon good for a free ride on all zones on that route, valid until a date approximately 5½ weeks from the date they were mailed. A short questionnaire on the back of the coupon sought information on riding habits and personal characteristics, and the front bore the notation that the coupon could be used only if the questionnaire were completed.

The materials were mailed to every residential postal address in the carrier routes included in the experimental route segments. Table 2 presents the number of packets distributed in each route segment.

A total of 29,155 brochures were mailed, including 13,025 with coupons and 16,130 with information only.

Measures of Ridership

An important measurement was obtained by counting riders boarding at each stop along each of the routes. These measurements were obtained during three periods: (a) a premeasure

TABLE 2 NUMBER OF HOUSEHOLDS PER PROJECT ROUTE SEGMENT

Route Segment	Route Number	Description	Treatment Condition: Information Only	Treatment Condition: Information and Coupon	Treatment Condition: Control
1	1	Northern	–	7,958	–
2	1	Southern	5,052	–	–
3	2	Northern	4,407	–	–
4	2	Southern	–	5,067	–
5	3	Central	6,671	–	–
6	3	Balance	–	–	9,750
		Total	16,130	13,025	9,750

period in mid-February 1986, (b) a postmeasure period in mid-March 1986, after information was mailed on March 7, 1986, to gauge short-term effects, and (c) a second postmeasure period in mid-April 1986, to gauge longer-term effects. Because ridership varied by day and by block, observations were made on the same three blocks on each of the same 3 days for each route during each measurement period. For example, if the 6:15 a.m. run on Route 1 was observed on the Monday and Thursday of the third week in February, measurements were obtained on the same run and the same days in March and April. In all, about 15 runs were observed on each route on each of 3 days in each of three periods.

Measurements were made during the morning peak and midday offpeak periods; it was not necessary to measure the afternoon peak period, as it was not expected to differ significantly from the morning peak period. Evening and weekend offpeak periods were not measured because they were not as critical to system revenues and ridership. The second and third weeks of the month were chosen because they were least likely to be affected by unusual peaks in ridership.

Measures of Coupon Redemption

The number of coupons redeemed was determined by counting the number deposited in fare boxes each day.

Characteristics of Coupon Users

The questionnaires on the back of coupons yielded the following information: use of the bus system before use of the coupon, frequency of previous use, time of day of coupon use, household size, access to motor vehicle, zip code of residence, age, and annual household income.

Characteristics of Riders

A survey of on-board riders on the project routes was conducted to gather information about rider characteristics and awareness of and response to information dissemination. The self-administered questionnaires were printed on cards, distributed on board to riders and collected before they left the bus. The questionnaire addressed the following areas: use of the bus service before the date of information dissemination, frequency of previous use, household size, access to motor vehicles, zip code of residence, age, and income. In addition, riders were asked whether they recently received information in the mail from Tidewater Regional Transit (TRT). In order to identify coupon users without publicizing the dissemination of coupons to those did not receive them, the questionnaire asked if the information received included a questionnaire and whether the respondent completed that questionnaire. In addition, the interviewers recorded the route segment (information only, coupon, or control) in which the rider boarded and the time of boarding.

The on-board survey was conducted during the second 2 weeks in March, at the same time as the on-board count of ridership and immediately after the information and coupons were mailed. Like the on-board survey, they were concentrated in the morning peak and midday offpeak periods. Approximately 400 questionnaires were completed per route.

FINDINGS

The findings are reported for each of the major data collection methods.

On-Board Survey of Riders

A total of 1,252 riders were surveyed on the three experimental routes. Most riders were high-frequency regular riders who were transit-dependent young adults. Most riders used the system before information and coupons were distributed, and only 9.6 percent were new riders. The majority (61.4 percent) of the previous riders rode the bus 5 days or more per week. Nearly half (44.9 percent) of the riders began their trips between 6 and 9 a.m., although another 46.7 percent began their trips in the midday offpeak period between 9 a.m. and 4 p.m. Only about 37.0 percent of riders usually had access to an automobile. Most (62.6 percent) of the riders lived in households with combined annual income under $15,000, and 39.4 percent reported incomes under $10,000. Over half (55.1 percent) of the riders were 19 to 34 years old. Only about 10 percent of the riders were elderly. About half (48.2 percent) of the riders lived in households with three to five members.

Riders on the three routes did not differ significantly with respect to annual household income, awareness of receiving information, previous use of the bus system, or the frequency of previous users. Not surprisingly, the route serving the university had more riders aged 19 to 24 years.

Only 24.4 percent of those boarding in information-only segments were aware of receiving information, and 21.7 percent of those boarding in coupon segments reported receiving information by mail. Interestingly, 15.4 percent of those boarding in areas to which no information was distributed reported receiving information. There are two possible explanations for this anomaly. The first explanation is that the areas in which riders board are not necessarily near their homes, so a treatment applied in one section of a bus system can have effects in other areas. The second explanation is that there is some amount of error in respondents' reported awareness of promotional activities.

One reason for the relatively low level of awareness is the fact that many riders do not live in areas immediately adjacent

to the routes. Areas of residence were assessed by asking respondents for their home zip codes. Many riders did not live in the areas defined at the onset of the project as bordering the routes (17.3 percent on Route 1, 62.4 percent on Route 2, and 17.5 percent on Route 3). Many of these appeared to be riders who transferred from connecting routes.

When new riders were compared to previous riders, no clear differences emerged, and results were not consistent across routes. On two routes, new users were more likely than previous users to have access to motor vehicles. On one route new riders tended to be younger and have lower incomes than previous riders; on another, new riders were more likely to use the bus during peak times.

On all routes, those riding 5 days or more per week were least likely to have access to motor vehicles. High-frequency riders were more likely to board during morning peak hours, as expected, because they tended to be commuters. On one route, very infrequent riders (those riding less often than once per week) were younger.

Examination of the differences between those who reported receiving information and those who did not failed to yield any indication of distinctive characteristics of riders who attend to transit information. Those who reported receiving information and those who did not were essentially similar with respect to previous use of the bus, frequency of previous use, time of boarding, age, income, household size, and access to motor vehicles.

As noted, approximately 9.6 percent of riders were new riders (a finding that suggests that there is a relatively high level of turnover among riders). Of these, 15.9 percent (1.5 percent of all riders) were defined as net new riders gained by information dissemination, a category applied to all new riders who reported receiving information. Thus most of those who were aware of receiving information were already riders, and most were high-frequency riders. Relatively few new riders were gained by the dissemination of information.

Survey of Coupon Users

A total of 909 coupons, or 7.0 percent of the 13,025 mailed, were redeemed. On Route 1, 623 coupons, or 7.8 percent of those distributed, were redeemed; whereas on Route 2 the 286 coupons used represented 5.6 percent of those mailed. About 22.3 percent of the coupons were redeemed during the first week after they were mailed, and 38.9 percent were redeemed during the second week. In the last half of the 5½-week period during which they were valid, only 23.3 percent of the coupons were redeemed. Those using their coupons early in the project were more likely to be high-frequency riders, whereas late users were more likely to be elderly. More than half the coupons were used for offpeak trips. Of those used during peak periods, most were used during the morning peak period, whereas those redeemed during offpeak periods most often were used during the midday periods on weekdays. Peak-period users were more frequent bus users than those who redeemed their coupons during offpeak periods. Peak- and offpeak-period users did not differ significantly with respect to age, income, household size, or vehicle access.

Most coupon users (93.8 percent) were previous riders who used the bus often, although not as frequently as all riders. About 42.9 percent of those who previously used the bus reported that they rode 5 days or more per week, compared to 61.4 percent of all riders surveyed during the on-board survey. Most coupon users were transit-dependent—only 30.4 percent usually had access to cars.

Coupons seemed to appeal largely to low-income persons. Some 51.6 percent of the users reported annual household incomes under $10,000, and 29.1 percent reported incomes of less than $7,000. By comparison, of the riders responding to the on-board survey, 39.4 percent reported incomes under $10,000, and 22.6 percent reported incomes under $7,000. The age distribution of coupon users was similar to that for all riders: 23.6 percent were 19 to 24 years old, and 33.7 percent were 25 to 34 years old; only about 1 in 10 was 60 years old or older.

When coupon users who previously rode the bus were compared to new riders, few differences were apparent. Among the previous riders who used coupons, the relationship between frequency of use and rider characteristics is what would be expected. The ages of high-frequency riders (those who use the bus 5 days or more per week) were more likely to be in the typical working range of 19 to 59 years old. These riders were also more likely to have used their coupons during the peak periods associated with commuters.

The coupon users on the two routes were compared. Those redeeming coupons on Route 2, which had the lower rate of coupon redemption, tended to have higher incomes, to be slightly older, and to live in larger households. The two routes did not differ with respect to previous use of the bus system, frequency of previous use, or access to motor vehicles.

Analysis of Boarding Count Data

Boarding count data were obtained by recording the number of riders boarding at each stop on each run observed on each of 3 days during each of three measurement periods. The number of stops ranged from 161 on Route 2 to 240 on Route 3. As a first step, stops were grouped into the carrier routes in which they are located. When the street along which a bus ran served as a dividing point between two carrier routes, those carrier routes were treated as a group. Had they not been grouped, all riders boarding on outbound runs would have been coded in one carrier route and those boarding on inbound runs in another carrier route, regardless of where they lived. The information entered into the database was the number of boarding riders in a given carrier route cluster on a given run on a given day for a given period.

Transformation of the data was required. The results gained by simply looking at the absolute magnitude of changes between periods would have been distorted by the scale effects of differences in the routes and the sizes of carrier route clusters and by possible externalities. It was not possible to calculate meaningful percent changes because of the problems inherent in determining the percent change implied by a drop from 3 or 4 riders to none. To counteract these problems, boarding counts were standardized to deviations from average boardings. Analysis of variance was then done on the differences in z scores between the premeasure and first postmeasure counts, between the premeasure and second postmeasure counts, and between the first and second postmeasure counts.

The total number of boardings by period are presented in Table 3. Overall, ridership on the three routes rose 9.6 percent from February to March and then declined 4.8 percent between March and April. Peak ridership rose 2.0 percent from February to March and 4.5 percent between March and April. Even greater initial gains were seen in offpeak ridership, which rose approximately 13.0 percent between February and March but declined 8.5 percent in April.

Ridership on the route segments on which information only was distributed rose 4.8 percent between the premeasure and the March measure, taken shortly after the information was distributed. However, it declined about 6.5 percent between the March and April observations. Results on the segments that received coupons for free rides showed stronger gains—a rise of 9.7 percent in total boardings between February and March and a decline of only 0.4 percent between March and April. Interestingly, however, the control segment showed the sharpest ridership increases, with a 22.7 percent gain from February to March and a decline of 8.5 percent in April.

Analysis of variance was used to determine if differences between boardings from period to period were statistically significant. Separate analyses were done for changes between the premeasure and the first postmeasure, the premeasure and the second postmeasure, and the first and second postmeasures. The dependent variable in each was the change in the standardized boarding counts between the two periods under consideration. The treatment condition (information only, information with coupon, and control) and time period (peak or offpeak) were introduced as factors. Table 4 shows the results for the test for short-term and longer-term effects. Despite observed gains in ridership, differences among the three treatments and between peak and offpeak periods were not statistically significant.

The obvious conclusion is that dissemination of information or of free-ride coupons did not have a significant effect on ridership on the routes studied. Neither the treatment nor the time of boarding explained variations in ridership, and there was no significant interaction between treatment and time. Further, the pattern of no significant difference held true when treatment and time were considered individually as factors and when route was introduced, either alone or in conjunction with either time or treatment, or both.

To determine whether the characteristics of adjoining neighborhoods were associated with the boarding levels in neighborhoods, a number of demographic and economic characteristics of carrier routes were introduced as covariates. The following demographic characteristics were considered:

- Median household income,

TABLE 3 TOTAL BOARDING COUNTS AND PERCENT CHANGE

	Total Boardings			Percent Changes		
	Periods 1	Periods 2	Periods 3	Periods 1-2	Periods 1-3	Periods 2-3
Total	2629	2882	2743	9.6%	4.3%	(4.8)
Peak	800	816	853	2.0	6.6	4.5
Off-Peak	1829	2066	1890	13.0	3.3	(8.5)
Coupon	890	976	972	9.7	9.2	(0.4)
Peak	270	258	306	(4.4)	13.3	18.6
Off-Peak	620	718	666	15.8	7.4	(7.2)
Information Only	1276	1338	1251	4.8	(2.0)	(6.5)
Peak	382	400	391	4.7	2.4	(2.3)
Off-Peak	894	938	860	4.9	(3.8)	(8.3)
Control	463	568	520	22.7	12.3	(8.5)
Peak	148	158	156	6.8	5.4	(1.3)
Off-Peak	315	410	364	30.2	15.6	(11.2)

NOTE: Totals are across all observed routes, runs, days, and carrier routes for a given boarding period.

TABLE 4 ANALYSIS OF VARIANCE OF CHANGE IN BOARDINGS

Source of Variation	Sum Of Squares	DF	Mean Square	F	Significance of F
Pre-Measure to Fist Post-Measure					
Main Effects	4.869	3	1.623	1.149	.328
Treatment	1.120	2	.560	.396	.673
Time	3.571	1	3.571	2.528	.112
2-Way Interaction	1.515	2	.758	.536	.585
Pre-Measure to Second Post-Measure					
Main Effects	3.005	3	1.002	.666	.573
Treatment	2.914	2	1.457	.968	.380
Time	.089	1	.089	.059	.807
2-Way Interactions	.790	2	.395	.263	.769
First Post-Measure to Second Post-Measure					
Main Effects	6.337	3	2.112	1.472	.220
Treatment	1.330	2	.665	.463	.629
Time	4.791	1	4.791	3.338	.068
2-Way Interactions	.778	2	.389	.271	.763

- Percent of households owning motor vehicles,
- Percent of households owning more than one motor vehicle,
- Percent of households in single-family dwellings,
- Percent of households in owner-occupied dwellings,
- Percent of households residing at the current address for 2 years or less,
- Percent of households that are black,
- Percent of households with children,
- Percent of households with only an adult female and no adult male present, and
- Median age of adults aged 18 and over.

For carrier route groups, weighted averages of characteristics for the group as a whole were obtained. Analysis of variance using these characteristics as covariates failed to reveal any pattern of relationship between neighborhood characteristics and changes in boarding levels.

CONCLUSIONS

Dissemination of route-specific service information in a form resembling bus schedules and of single free-ride coupons to residents in areas bordering bus routes was not effective in significantly increasing ridership on those routes. Relatively few new riders were induced to use bus service by the receipt of coupons or information, and existing riders did not significantly increase their frequency of usage. In short, information and coupons stimulated little ridership that could have been expected to result in sustained gains in ridership and revenue.

Most of the riders who were aware of receiving information and most of those who redeemed coupons were existing, high-frequency riders, whose low incomes and lack of access to motor vehicles suggested they were transit-dependent.

At least half of the free-ride coupons redeemed were used for offpeak trips, usually during the weekday offpeak period. This statistic suggests that though free-ride coupons apparently did not attract a large number of new riders, they also did not result in the worst-case outcome of being used primarily by high-frequency riders during peak periods.

The mass distribution of information to residential areas bordering bus routes must be undertaken with caution. Mailing solely to adjoining neighborhoods does not reach riders who transfer from other areas and risks wasting a large number of the promotional materials on staunch nonriders unlikely to be induced to use transit services. To target informational programs for existing services, it may be wise to begin by conducting relatively inexpensive on-board surveys of existing riders to identify both the specific geographic areas in which they live and their characteristics. Direct-mail methods will then allow the transit marketer to target specific areas feeding these

services that appear to have high probabilities of containing residents who resemble existing riders and may be induced to use bus service or, if they are already riders, to take additional trips by bus.

Finally, it may be necessary to develop informational materials that do not resemble traditional transit schedules. Disseminating coupons for more than one ride or awarding coupons to those who actually ride may yield different results.

These results are not consistent with those of other experimental projects; however, it is difficult to compare findings because of significant differences in research designs and analysis techniques. Although information dissemination was found to be effective in two English studies, the projects are not comparable with the research described here because the latter was conducted in an urban area, and information was mailed to all nearby residents rather than being made available on buses and at distribution points.

Comparison of this project with free-fare studies in Salt Lake City, Denver, and Trenton also is difficult. First, all these projects involved elimination of offpeak fares system-wide, whereas this project offered single-use route-specific free rides good at any time of day. Denver and Trenton were year-long projects, whereas the coupons distributed in Norfolk were good for 1 month. Further, it is difficult to compare statistical analyses. In Denver, for example, the issue of ridership change was complicated by external influences (introduction of a new fare structure 1 month before project initiation, substantial service increases, and some route restructuring). The measurements of ridership in Denver had to be based on estimated ridership without the free-fare project, with data adjusted for externalities. In the project reported here, ridership measures were based on actual counts, with the days and runs observed carefully matched across observation periods. Although ridership gains were observed, they did not prove to be statistically significant.

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