Absenteeism, Accidents, and Attrition: Part-Time Versus Full-Time Bus Drivers

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ABSTRACT

When the use of part-time drivers was first proposed, there was some question as to whether they would be as reliable and committed as were full-time drivers. This paper provides comparative data to answer that question. ABSENTEEISM: the data indicate that part-time work has inherently lower absenteeism; holding sick-pay and probation effects constant, part-time drivers have less absenteeism than full-time drivers. This result becomes apparent when following an identical cohort over time as it moves between full-time and part-time work, and also in cross-section data across groups. The data also indicate that increases in the number of sick days allowed cause an increase in absenteeism for both part-time and full-time drivers. ACCIDENTS: holding constant hours of driving exposure, years of experience, and the daily time pattern of accidents, part-time drivers have lower accident rates. However, only one transit agency had sufficient data to permit this standardization. There is also an important daily pattern to accident rates: they do not increase and decrease as a function of the daily traffic cycle, but rather as a function of the daily human cycle--increasing in mid-afternoon to reach approximately the same rate on both weekdays and weekends. ATTRITION: there is a tendency for transit agencies to hire the wrong people for part-time work; 75 to 85 percent of those hired actually wanted full-time work, which leads to greater turnover and increased training costs. The quit rates of part-time drivers vary strongly with external economic conditions, moving inversely with the local unemployment rate.

When the use of part-time (PT) vehicle operators was first proposed, one of the principal concerns was whether part-time operators (PTOs) would be as committed and reliable as were full-time operators (FTOs). A number of these concerns are examined and it is concluded that, in general, PTOs are dedicated, competent employees whose performance is usually as good as, or better than, that of FTOs.

These conclusions are based on detailed case studies at five transit agencies. The agencies are a diverse group having a wide variety of experience with PT labor. They range in size from 60 to 1,100 buses, in peak/base ratio from 1.2 to 3.5, and in operating environment from new western suburb to long-established northeastern city. Interviews were conducted from 1982 to 1984, and each agency was visited at least twice. Detailed data were collected on scheduling and operator performance, and interviews were held with operations managers, department heads, union leaders, and vehicle operators. (Detailed descriptions of the agencies and methodology are contained in Chomitz and Lave (2) and Chomitz, Giuliano, and Lave (3).

COMPARATIVE ABSENTEEISM: PTOs VERSUS FTOs

The analysis concentrates on absenteeism resulting from sickness, although there are some data on injuries as well.

Table 1 presents comparative sick rates, PTO versus FTO, for all five of the case study agencies. The rates are computed as percentage of work days per year when an operator calls in sick. The FTO sick rate exceeds the PTO rate at every agency and, on average, it is 2.3 times higher.

TABLE 1 Comparative Sick Rates: PTOs Versus FTOs (%)

	Seattle Metro	OCTD[b]	SEMTA[c]	Tri-Met[d]	CCCTA[e]
FTO sick rate[a]	3.75	3.52	2.31	4.29	4.02
PTO sick rate	1.41	1.71	1.02	1.59	1.60

Note: Yearly cross-section data, with nothing held constant, that is, varying amounts of fringe benefits and sick pay.

[a]Proportion of yearly work days an operator will call in sick.
[b]OCTD = Orange County Transit District.
[c]SEMTA = Southeastern Michigan Transportation Authority. SEMTA is an unreliably small sample.
[d]Tri-Met = Tri-County Metropolitan District of Oregon.
[e]CCCTA = Central Contra Costa Transit Authority.

The five agencies represent a considerable range of sick leave policies: the number of paid sick days per year varies from 0 to 12; the degree of enforcement on required doctor's certificates varies considerably; one agency begins paying sick pay on the first day of illness, other agencies do not begin payments until the third day; and policies on accrual of unused sick leave vary considerably as well. These interagency variations can be used to explore the reasons why PTOs have lower sick rates.

Differences in Sick Pay as an Explanatory Factor

The customary explanation for the lower sick rate of PTOs is that PTOs do not receive sick pay, therefore, they cannot afford to be sick. Two of the agencies, Orange County Transit District (OCTD) and Central

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Costa County Transit Authority (CCCTA), provide examples in which PTOs and FTOs receive identical sick benefits. If the customary explanation is correct, and sick pay differences are the important causal factor, then it would be expected that PTO and FTO sick rates would be nearly identical.

At CCCTA, FTOs receive no paid sick leave during their first year, and PTOS never receive sick pay. These groups allow a natural comparison because both are relatively new to the job, and both should have similar concerns about acquiring good work records. (The PTOs are on informal probation because most of them want to be chosen for full-time work eventually. The FTOs are in their first year of work and hence are on formal probation for almost all of the period covered by these data.)

Table 2 gives comparative sick and injury rates for FTOs and PTOs. The rates are expressed as percentage of work days when the operators call in sick. Four different rates are reported. Rate SI is based on total sick and injured days; rate S is based on sick days only. In small samples like this, the presence of a few random instances of major illness can substantially bias the apparent rate. Thus, rate S40 excludes any operator who was sick more than 40 days (8 weeks); and rate S30 excludes any operator who was sick for more than 6 weeks. (Neither S40 nor S30 screening ever excludes more than 10 percent of the sample.) Proof that the S40 and S30 rates do standardize against random events can be observed by comparing the SI rates for PTOs against the S40 rates: the SI rates vary by almost two to one, whereas the S40 rates are close to each other.

TABLE 2 Comparison of FTOs with no Sick Pay and PTOs with no Sick Pay

	SI (%)	S (%)	S40 (%)	S30 (%)	No. of Operators
FTOs with no sick pay					
Hired in 1982 (1983 data)	5.87	3.92	3.56	3.03	18
Hired in 1983 (1984 data)	5.61	3.27	3.27	2.39	18
PTOs with no sick pay					
Hired in 1982 (1983 data)	1.67	1.67	1.67	1.67	18
Hired in 1983 (1983 data)	2.93	2.93	1.64	1.64	41
Hired in 1983 (1984 data)	2.36	2.36	1.52	1.52	23
Hired in 1984 (1984 data)	2.93	2.93	1.58	1.58	33

Note: SI = total number of sick and injured days. S = sick days only. S40 excludes operators who were sick more than 40 days. S30 excludes operators who were sick for more than 30 days. Data in these four columns are proportions of yearly work days.

Regardless of which definition is used, the CCCTA data indicate that PTO sick rates and injury rates are lower than FTO rates, even when both groups of operators have identical sick pay benefits. Something other than sick pay is making an important difference between PTO and FTO sick rates.

OCTD provides another instance in which PTOs and FTOs have identical sick benefits. It has a class of PTOs who receive 12 days per year of allowable sick pay, which is identical to the sick benefits of their FTOs. Comparative sick rates (using the S30 rate definition discussed) are FTOs = 3.25 percent and PTOs = 2.44 percent. Again, despite the existence of identical sick benefits, the PTO absenteeism rate is lower.

Table 2 and the percentages given in the preceding paragraph both involve cross-section data: two samples of operators are examined at a single point in time under the implicit assumption that the only difference between the two samples is their PT versus FT status. Obviously, such an assumption may not be correct in general, but OCTD provides a chance to validate it. OCTD allows one particular group of operators to switch back and forth between FT and PT status, while maintaining full sick leave benefits. (Some FTOs choose to switch to PT status during the summer, or to have a period of lighter duties, etc.) By examining the absentee records of these operators, both sick benefits and any possible variation in personal characteristics--for example, age and motivation--that might be related to absenteeism are held constant. The results show that there is a decline in absenteeism for FTOs when they move from FT runs to PT runs: the reported sick rates (excluding operators who were sick longer than 40 days) were FT runs = 4.50 percent and PT runs = 2.44 percent. Again, it can be observed that a lower sick rate is associated with PT work than with FT work. This does not mean that absenteeism is independent of sick pay (in the section Increases in Sick Pay Cause Increases in Absenteeism, it is demonstrated that there is a strong effect). Rather, the effects of sick pay are not sufficient to explain the difference in absenteeism between PTOs and FTOs.

Effect of Probation on Sick Rate

Probation is another factor that has often been cited as an explanation for the low PTO sick rate. Probation tends to keep operators on their best behavior, and PTOs spend a much higher proportion of their career with that status. The PTO probation period is often the same number of hours as the FTO probation period, but given their lower number of hours per day, PTOs spend more calendar days on probation, for example, for a typical 1,040-hr probation period, an FTO would be off probation in 6 months, but a PTO averaging 4 hours per day would be on probation for an entire year.

To measure the effects of probation, cohorts of PTOs and FTOs who had both begun work about the same time (roughly 1980) were identified, and their absentee records for a period about 3 years later were examined. The PTOs would be long past the probation period at this point, and both cohorts would have similar clock time on the job. Each cohort contained approximately 300 operators.

For each cohort, absentee records from June 1982 to June 1983 were examined. In each case, days sick plus days on workmen's compensation were added together. The absence rate for the PTOs was 0.067, and the rate for FTOs was 0.160; thus the FTOs were absent about 2.4 times more often than the PTOs. That is, for matched groups of operators, all well past their probation periods, the FTOs were absent more than twice as often as the PTOs.

Also compared were the absenteeism of this PTO cohort and the absenteeism of the total PTO population, most of whom have been hired more recently and hence are still on probation. The absentee rate for the total PTO group was 0.043, compared with the 0.067 rate for the older PTO cohort. That is, the older cohort is about 50 percent more likely to be absent. Thus it is concluded that probationary status does reduce absenteeism, but it is nowhere near a large enough factor to explain the general difference in absentee rates between PTOs and FTOs.

Regularity of PTO Baseline Sick Rate

One interesting sidelight on the PTO sick rates is their apparent consistency among transit agencies. There are data on absenteeism from four agencies (the sample from SEMTA is only 20 observations, which is too small to use for comparative purposes), and all have PTO sick rates of about 4 days per year.

Observed number of days sick per year for PTOs (yearly cross-section data from agencies with large samples) is as follows: Seattle METRO, 3.6 days; OCTD, 4.4 days; Tri-Met, 4.1 days; and CCCTA, 4.1 days. At CCCTA, this rate holds up for 2 separate years of data; the data for Metro, OCTD, and Tri-Met are for a single year's sample. The four agencies have in common their lack of paid sick leave for PTOs, but they differ on everything else--degree of supervision, attention placed on absenteeism, and so on. Pending additional work, it is probably best to regard the commonly observed 4-day sick rate as an interesting coincidence.

Some Speculative Guidance for Future Research

It has been observed that there is something inherent in PT work assignments that produces lower sick rates. Why might this be true? Three possible explanations are offered as a possible starting point for future research.

- Hypothesis 1: PTOs cannot afford to be absent. PT assignments produce barely enough money to live on, hence PTOs have a high incentive to show up for work. (Even in those agencies in which PTOs do get sick pay, they do not receive it on the first day of absence.) If this hypothesis were true, one would expect to find two effects: (a) that the difference in sick rates between PTOs and FTOs will disappear at agencies where PTOs get sick pay on the first day; and (b) that the difference in sick rates will be larger at agencies with no sick pay.
- Hypothesis 2: It is easier to work a short assignment than a long one if you are feeling sick. Hence, for any given degree of illness, an operator is more likely to report for work if he is facing an easy assignment. If this hypothesis were true, one might expect to find that the PTO sick rate moves closer to the FTO rate at transit agencies where PTOs work two shifts a day.
- Hypothesis 3: PTO status is similar to being on probation all the time; PTOs try particularly hard to acquire good work records because most PTOs want to be promoted to FT work. Although this appears to be a reasonable idea, the evidence at OCTD does not support it: regular operators may switch back and forth between FTO and PTO status, and hence are under no probation pressure, but they have lower absenteeism when they work part time.

PTOs VERSUS FTOs: OTHER ISSUES

Missout Rates

Although illness and injury are the major categories of absenteeism, there are other components as well. Missouts refer to situations in which an operator misses a run because of showing up late, oversleeping, and so forth. Because the definition of missouts appears to vary among agencies, it is not valid to compare rates across agencies. However, PTO versus FTO comparisons within a single agency should be valid. Table 3 gives a summary of the data across the five case study agencies. The results are decidedly mixed: PTO missout rates are lower than FTO rates at OCTD and Tri-Met (for three of the four categories), but they are higher at the three other agencies. In any event, the differences are small compared with the difference in sick rates between PTOs and FTOs. Thus, overall, if a reliability index, were to be formed by combining the sick rate and the missout rate, it is still apparent that the PTOs are more reliable than the FTOs.

TABLE 3 Comparative Missout Rates: PTO Versus FTO (%)

	Seattle Metro	OCTD	SEMTA	Tri-Met	CCCTA
PTOs	0.55	1.0	1.20	0.66	0.67
FTOs	0.35	1.5	0.60	0.44	0.38
FT extra board	–	–	–	0.86	–
FT regular relief	–	–	–	0.81	–
FT vacation relief	–	–	–	1.07	–

Note: Transit agencies are defined in Table 1. All figures are expressed as percentages of days per year. For Seattle Metro, data on late and unexcused absences were combined. The sample at SEMTA is too small—only 20 operators.

Allowing Operators To Switch from FTO to PTO Status

OCTD has initiated a unique innovation in the use of PT labor that increases the work options available to FT operators. Their FTOs bargained for the right to bid PT work runs during a given sign-up period. Those FTOs who go part-time retain their seniority and their full benefits: sick pay, holidays, vacations, leave and so forth. (Operators retain full health insurance, but pay for the other benefits is proportional to hours worked; for example, a regular operator on temporary PTO status, with a 3-hr run, would receive 3 hr of sick pay if he became sick.) However, for the duration of that sign-up period, they work fewer hours and receive less total salary. At the end of the sign-up period, they can return to FT status or remain on PTO status for another sign-up period. The FTOs wanted this as an option for situations such as a female FTO who wanted to spend more time with her children during the summer, an FTO suffering from burnout who wanted a period of reduced stress, and a chronically ill operator who needed a period of reduced work to regain his health.

Thus, the agency now has three classes of operators: FTOs; type A PTOs, who receive full fringe benefits; and type B PTOs, who receive no sick benefits. FTOs may switch into and out of the type A PTO status. During the first year, 16 regular FTOs decided to try a stint as PTOs. Subsequently 10 returned to FT status, and 6 elected to remain on PT status. Because they served in both PT and FT status during the year. Table 4 gives their records separately for the two types of work. The first two rows include all 16 operators, but 5 had unusually high sick or injury records (more than 40 days per year); the next two rows give the absentee records of the 11 operators with more typical sick rates. In the other agencies, the proportion of drivers exceeding the 40-day criterion is usually less than 10 percent. Why should there be 5 out of 16 here? These 5 operators all had unusually high sick or injured rates before bidding for PTO status. It is not known whether they chose PTO status to ease their work burden, or whether they were informally pressured into it by management, although the fact that 2 of the 5 have returned to FT status suggests that the decision was their own choice.

TABLE 4 Record of Type A PTOs (%)

	Sickness	Missout	Injury
All data included			
While serving as FTO	8.90	1.85	4.58
While serving as PTO	9.92	1.76	0.64
Without high sick or injury records			
While serving as FTO	4.50	1.69	0.00
While serving as PTO	2.44	2.07	0.98

Given the small size of the sample, and hence the way in which a single random instance of major illness or injury can affect the group average, it is probably best to concentrate on the last two rows, the rates that screen out the unusual incidents. The decrease in sick rate from 4.50 to 2.44 percent following a move to PT status is interesting. Sick benefits are identical in the two statuses, so there is no economic reason that might explain the change. [Perhaps after the typical 8-hr (or more) day of the FTO, the 3 (or more) hr of a typical PT shift appears to be so easy that a marginally sick operator will report for work anyway.] Missout rates do not change much, and they are similar to the FTO rates at this transit agency. There is an insignificant increase in the injury rate when operators move from FT to PT status.

It is also interesting to compare the records of those operators who chose to bid for PT status with those who did not. Table 5 gives a summary of the relevant data, and it is clear that the drivers who decided to try PT status had previously had higher sick and injury rates than did their colleagues. This is true whether comparing the total data in Rows 1 and 2, or the screened data in Row 3. After the move to PT status, their absenteeism decreased by almost one-half, from 4.50 percent (Row 3) to 2.44 percent (Row 4). That is, looking at the decision to bid PT status, the group that decided to move to PT status had previously been characterized by above-average absentee rates, but following the move to PT status their rates improved to become better than the average.

TABLE 5 Operators Who Bid PT Versus Those Who Did Not (%)

	Operators Who Bid for PT Work	Operators Who Did Not
All data included		
Sick rate on FT status	8.90	6.09
Injury rate on FT status	4.58	3.58
Without high sick or injury records		
Sick rate on FT status	4.50	3.52
Sick rate on PT status	2.44	NA

This agency provides an example of implementing PT labor to benefit the operators. There are no direct cost savings for the transit agency; it may even be slightly more expensive. (The agency agreed to the new policy as a bargaining concession to labor, in return for the agency winning the right to create an unusually inexpensive class of PTOs--one with lower wages and few fringe benefits.) From the viewpoint of the existing FTOs, the new policy is a major benefit that provides them with significantly more choices in their work lives.

The Effect of Irregular Work on Absenteeism

Tri-Met had enough detailed data to allow calculation of absenteeism broken down by the type of work assignment: part-time, regular full-time run, and extra board. The data in Table 6 indicate the effect of work type on absenteeism. There is some tendency for absenteeism to increase on irregular work assignments--those where an operator is not experienced on the particular route. The extra-board operators have more absenteeism in most of the categories. It appears likely that this results from their irregular work shifts--the degree to which the operators have

TABLE 6 Effect of Work Type on Absenteeism (days/yr)

Absentee Category	Extra Board	Regular Run	PT Run
Absent			
Excused	2.25	1.26	1.51
Unexcused	0.61	0.17	0.07
Sickness	9.10	11.15	4.13
Workmen's compensation	8.88	6.32	6.10
Sick persons performing light-duty work	0.19	0.21	0.00
Persons on workmen's compensation performing light-duty work	3.43	1.98	1.15
Oversleep	2.15	1.10	1.77
No. of driver-weeks of data	9,244	30,958	5,554

to deal with continually differing routes and times. (When the accident data are analyzed a similar relationship subsequently is found between work irregularity and accident rate. It is possible that the increase in the number of accidents with work irregularity occurs because the operator is unfamiliar with the route and is not able to devote full attention to basic driving. It is also possible that the increase in absenteeism with work irregularity occurs because of the higher stress of the unfamiliar runs.)

INCREASES IN SICK PAY CAUSE INCREASES IN ABSENTEEISM

In the section on Comparative Absenteeism, it was found that differences in sick benefits by themselves were not sufficient to explain the differences in absenteeism between PTOs and FTOs. That does not mean that the sick benefit differences are unimportant. In this section, an attempt is made to measure the effects of paid sick leave on the observed sick rate.

At CCCTA, operators have no paid sick leave their first year, and receive higher amounts of paid leave as their careers advance. This makes it possible to examine the experience of a fixed cohort of operators as they acquire progressively higher benefit levels, that is, the operators remain the same while the sick benefits vary. In Table 7 the sick rate behavior of two separate groups of operators is followed over time. Cohort No. 1 is a group in which drivers begin with no paid sick leave their first year, and move to 3 days of paid sick leave their second year; the result is an increase in the observed sick rate.

TABLE 7 Sick Rate Behavior of Two Groups of Operators Over Time

	1983 Sick Rate	1984 Sick Rate
Cohort No. 1		
Observed no. of sick days	8.5	9.1
Allowable no. of paid sick days (days/yr)	0	3.0
Cohort No. 2		
Observed no. of sick days	10.5	13.5
Allowable no. of paid sick days (days/yr)	5.2	12.0

Cohort No. 2 is a more experienced group of drivers, hired under an earlier, more generous contract. In 1983 they were entitled to an average of 5.2 paid days of sick leave each, and in 1984 they were entitled to 12 paid days per year; the result was an increase in the observed sick rate. As driver cohorts obtain more allowable paid sick leave, their observed sick rate increases.

OCTD data offer cross-section evidence on the relation between absenteeism and sick pay. It has one class of PTOs who receive no sick pay and another class of PTOs who receive 12 days of allowable sick pay per year. The following table gives a comparison of observed sick rates for the two groups of PTOs.

	PTOs with 12 Days of Paid Sick Leave (%)	PTOs with 0 Days of Paid Sick Leave (%)
Major sick rate: total sick and comp incidents	9.92	4.26
Baseline sick rate: (excluding employees with >40 sick days)	2.44	1.48

It can be observed that the group with more sick benefits has a much higher sick rate; that is, PTOs who receive paid sick leave have higher rates of absenteeism than do PTOs who do not receive sick pay. This result is true whether the comparison is made using the A rate (all sickness and injury), or the C rate (only sickness; excluding drivers with random, major episodes of sickness).

Cross-section data at CCCTA allow a somewhat more precise measurement of the effect of increasing sick benefits. CCCTA began with a provision for 12 paid sick days per year, but several years later began hiring new operators under a provision that gave them only 3 paid days per year, which increases to 6 paid days as they acquire more seniority. Sick pay is earned the first calendar year of service, on a pro rata basis, and is then available for use during the second calendar year. Thus, because the existing operators were hired under two different sets of benefit rules, and because operators earn differing amounts of sick benefits for use during their second calendar year of service, this agency provides observations for FTOs with four different levels of paid sick leave: 0, 3, 5.2, and 12 days.

The data in the first row of Table 8 indicate the amount of paid sick leave allowed and the data in the second row indicate the observed sick rates, measured as the ratio of sick days to total work days (using the average of the C and D rates). The data in the third row express the sick rate in terms of days per year. It can be observed that increases in the observed sick rate go along with increases in allowable paid sick days.

The data in the fifth row indicate the difference in observed sick rates between adjacent columns. For example, when FTOs move from 5.2 allowable paid sick days per year to 12 allowable paid days per year, their observed sick rate increases by 3.2 days. The difference in allowable sick pay was 6.8 days (12 minus 5.2). Taking the ratio of observed increase to allowable increase, it can be observed that the sick rate increased by about one-half of the increase in sick benefits. This same rate of increase is observed between the other columns as well. Looking at it in overall terms, when operators receive no sick pay, they are sick 7.77 days per year; if they are allowed 12 paid days per year, the 12-day increase in benefits brings about a 5.93 day increase in sick days. That is, the observed sick rate of FTOs increases about one-half as fast as the increase in sick benefits.

MEASUREMENT AND CONTROL OF ABSENTEEISM

Measurement Patterns of Absenteeism

At Metro, detailed breakdowns of absenteeism data on a garage-by-garage (division) basis were available, which afforded the opportunity to search for patterns among garages. Usually, they would be expected to be alike over the course of the year because (a) all the garages are exposed to the same physical hazards (e.g., diseases and bad weather), and (b) all were exposed to the same temptations (e.g., holidays and hunting season); thus the change in the daily absentee rate should be more or less synchronized across the garages.

Figure 1 shows the sick rate at each garage over the course of the year. The vertical axis is percentage times 1,000, that is, 30 means 3 percent

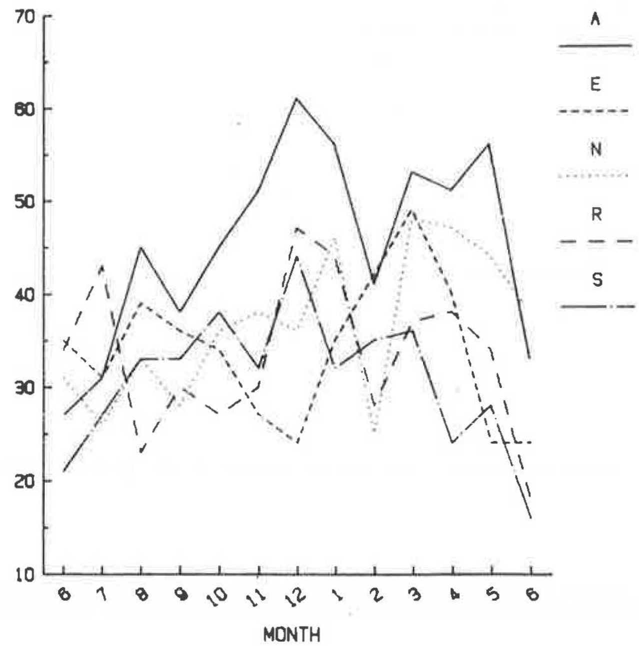

FIGURE 1 Sick rate at five garages over the course of a year.

TABLE 8 Amount of Allowable Sick Leave Compared with Amount of Absenteeism

	No. of Paid Sick Days Allowed			
	12	5.2	3	0
Observed sick rate (yearly percentage)	5.27	4.05	3.50	2.99
Observed sick rate (days/yr)	13.7	10.5	9.10	7.77
Observed effect of paid sick leave: difference between adjacent columns (no. of days)	3.2		1.4	1.3
Possible effect of paid sick leave (no. of days)	6.8		2.2	3.0
Observed difference divided by possible difference (%)	47		63	43

daily sick rate. The five trend lines are vaguely similar, although not as close as was expected. Is the lack of similarity caused by differences in supervisory practices among the garages?

In Figure 2, the sick rate and the excused absence rate are added together, and the total over time is plotted. It is easy to observe that the five trend lines now look more similar. It appears that the actual pattern of absentee behavior is the same at the five garages, but the manner in which the dispatchers record the absences is different. At some garages, when a driver calls in, the dispatcher will be more likely to record it as an excused absence; at other garages the dispatcher is more likely to record it as a sick absence. Drivers are similar, but there is considerable variation in the permissiveness of supervisory personnel.

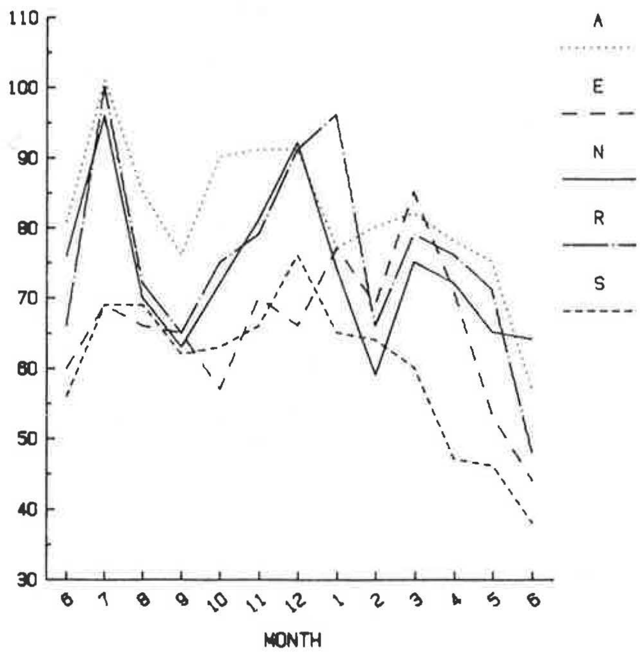

FIGURE 2 Total of sick rate plus excused absence rate plotted over time.

It is possible to use correlation coefficients to quantify these graphical patterns in a more formal way. If the drivers at the different garages did have similar absentee patterns, then the correlation coefficient between any two garages would be relatively high. Table 9 gives the correlations between the monthly pattern of sick rates at each pair of garages. The presence of all the coefficients in the .0-to-.2 range indicates that the similarity is not high.

Table 10 gives the correlations for the new variable, the sum of the daily sick rate and the daily excused absence rate. In Column 1, the intercorrelations between garages are given for this new variable, and in Column 2 the intercorrelations for the sick rate alone are given. The correlations in the left column are much larger than those in the right column. That is, the daily pattern of sick plus excused absence rates is more similar across garages than is the pattern of sick absence rates alone.

These results demonstrate why the analysis has been restricted to within-agency comparisons. That is, FTO versus PTO comparisons are made for each agency, rather than comparing the FTOs at one agency with the PTOs at another. If such large differences are observed between garages in a single agency, there is obviously significant measurement error in the sick rate data.

TABLE 9 Correlation of Sick Rates Across Garages

	Garage A	Garage E	Garage N	Garage R	Garage S
Garage A	1.00				
Garage E	-.04	1.00			
Garage N	.67	.06	1.00		
Garage R	.43	.00	.26	1.00	
Garage S	.59	.17	-.04	.33	1.00

TABLE 10 Correlation of Sick Plus Excused Absence Rates Across Garages

	Sick Plus Excused	Sick Rate
Garage A with Garage E	.44	-.04
Garage A with Garage N	.74	.67
Garage A with Garage R	.74	.43
Garage A with Garage S	.79	.59
Garage E with Garage N	.31	.06
Garage E with Garage R	.61	.00
Garage E with Garage S	.53	.17
Garage N with Garage R	.78	.26
Garage N with Garage S	.55	-.04
Garage R with Garage S	.66	.33

Effect of No-Fault Absentee Policy at OCTD

Figures 1 and 2 also show a long-term decline in sick rates, resulting from changes in absentee policy as management became concerned about the financial effects of the high sick rate. High absentee rates have become a growing concern at most transit agencies. The response at two of the case study agencies involved the formulation of a new philosophy concerning absenteeism, as follows:

> All absences are the same because they are all equally costly to the agency. We are not concerned with issues of fault, or with the fact that a particular absence had a "good" cause. What matters is the end result, and operators who are unable to fulfill their duties consistently should find work in industries where reliability is not so critical.

The traditional discussion of absenteeism concentrated on why it happened and whether the operator was to blame. The new philosophy ignores such moral wrangling and concentrates on the occurrence itself. Thus, this approach has been called the no-fault philosophy: if an operator is injury prone or chronically sick, or has habitual problems with conflicting obligations, then that operator is not capable of meeting the reliability needs of the transit industry.

Three years ago, OCTD implemented a new absenteeism policy based on this philosophy:

> 14 Counted Absences per year are grounds for immediate dismissal. A Counted Absence is any kind of absence except for bereavement, jury duty, military duty or pre-approved leaves for personal business or union business. On long periods of illness, only the first two days are Counted Absences.
>
> If an operator has no miss-outs for 90 days, then all the old miss-outs are cleared

from the record; there is no limit to the number of times an operator may do such record-clearing. If an operator has no Counted Absences for 120 days, then all the old Counted Absences are cleared from the record, but this may only be done once each year.

Did the new policy reduce absenteeism? A number of detailed comparisons were made. First, examining the two months before the new policy and the two months after the new policy took effect, it was observed that absenteeism decreased from 11.9 to 10.1 percent, a 1.8 percent decrease. (Absenteeism is the sum of sickness, injury, personal holidays, and leave.) To be certain that this decrease was not only the effect of seasonal variation, an additional measure was computed. By using seasonally identical 25-week periods before and after the new policy (August 17 to February 7 for both years), an absenteeism rate of 11.2 percent was calculated for the period before the new policy and a 9.4 percent rate was calculated for the period afterwards, a 1.7 percentage point decrease. For these same two periods the numbers of leaves and missouts were also calculated and it was discovered that these were essentially unchanged; that is, the improvement in absenteeism was not offset by a corresponding increase in other categories.

Overall, the new policy is clearly a success and appears to have reduced absenteeism by 1.7 to 1.8 percentage points. To put this figure into perspective, it is noted that it is probably responsible for a larger cost saving than that resulting from the use of PT labor at this agency (1.2 to 1.6 percent).

COMPARISON OF ACCIDENT RATES BETWEEN PTOs AND FTOs

Table 11 gives the comparative accident rates at CCCTA. PTO accident rates appear to be lower than those of FTOs on a per-year basis, although the data are not standardized for differences in driving exposure. The table also breaks down the accidents into chargeable and nonchargeable, where chargeable accidents are those that the operator could have prevented.

TABLE 11 FTO Accident Rates Versus PTO Accident Rates

	FTO	FTO	FTO	FTO	PTO	PTO
Years of experience	3.70	2.60	2.30	1.30	1.30	0.60
Total accident rate	1.33	1.50	1.17	1.59	1.17	0.95
Chargeable accident rate	0.49	0.27	0.34	0.59	0.58	0.38
Nonchargeable accident rate	0.84	1.23	0.83	1.00	0.59	0.57
Sample size	9	28	18	18	23	33

Note: Data are from CCCTA and are expressed in totals of all vehicle and passenger incidents.

Comparative accident rates at Tri-Met with data structured by the type of work assignment are as follows: extraboard, 2.20; regular run, 0.68; and PT run, 1.39. (Data are on a per-year basis, and driving exposure is not standardized.) The PTO accident rate is higher than that of FTOs who do regular runs, but lower or equal to that of regular drivers who do relief runs or extra-board work.

Accidents can also be broken down according to whether they are preventable or nonpreventable. The percentages of total accidents judged preventable are as follows: extra board, 45; regular drivers, 51; and PTOs, 60 (Tri-Met data). Thus, the PTOs are judged to have a higher proportion of preventable accidents. This might be an indication that PTOs are worse drivers, or it might be the result of misclassification: given the union opposition to PTOs, it is possible that the drivers who do the evaluation have some degree of bias against them.

The data in Table 11 and in the preceding two paragraphs give reports on accidents per year. However, this is not an entirely adequate statistic for judging the quality of the two driver groups. First, FTOs drive more and hence would be expected to have more accidents. Second, PTOs drive more during the congested hours of the day, which might increase their accident rates. Third, FTOs have much more experience, which ought to lower their accident rates. Fourth, there may be substantial differences in the driveability of the vehicles used by the two groups--size, age, and so forth. Ideally, the accident rates should be standardized for all of these different exposure factors. Attanucci, Wilson, and Vozzolo were able to standardize for exposure at the Massachusetts Bay Transportation Authority in Boston and found that PTOs had higher accident rates (1). However, the implementation of PT labor at MBTA was unusually difficult, probably a worst-case example in many respects, and even their accident situation has improved markedly since the initial period. Thus it is not clear that the Boston findings generalize to other transit agencies.

The data required to produce completely standardized accidents are extensive. For each accident one must have the following: (a) time of day, weekday versus weekend, PTO versus FTO; (b) driving experience of the operator; (c) daily platform time of that run; and (d) data on all the operators with the same experience and status who did not have accidents. The data on (a), (b), and (c) are stored in different files, maintained by different departments (Traffic Safety, Personnel, and Scheduling, respectively), and are often on different computers as well. Thus it was only possible to assemble a complete set of data files for Seattle Metro, and only for a 10-month period, January to October. The remainder of the section is based on these data.

The gross, unstandardized accident rates at Metro are PTOs, 0.529 accidents per operator; and FTOs, 0.930 accidents per operator. However, these data need to be adjusted for all the different exposure factors, beginning by looking at the effect of time-of-day on the accident rate. Table 12 gives numbers of accidents per bus hour of service, as a function of time. The table is in three main parts: accidents on weekdays, Saturdays, and Sundays. For each of the three parts the number of accidents, the number of buses in service at that hour, and accidents per bus hour are given. (The number of weekday buses is multiplied by 5 before dividing; accident rates are for the whole 5-day week, so number of buses needs to be expanded to match it. The final rates are multiplied by 100 for ease of presentation.)

A number of things should be noted in Table 12. Looking at Column 3, the PTO accidents occur during the daily peak hours because that is the period during which these operators are utilized. Note that accidents per bus hour vary considerably by time of day, ranging from a low of 0.38 accidents per bus at 5 a.m. to a high of 4.52 accidents per bus at 4 p.m.

Finally, and surprisingly, the weekend rates are not very different from the weekday rates, despite the substantially lower level of weekend traffic. Not only are the accident levels similar between weekday and weekend, but even the hourly patterns appear to be similar. One possible explanation of these data is that accidents vary as a function of the daily human cycle, not the daily traffic cycle.

TABLE 12 Daily Pattern of Accidents

	Weekdays					Saturday			Sunday		
Hour	No. of FTO Accidents	No. of PTO Accidents	Total No. of Accidents	No. of Buses	No. of Accidents/ Bus	No. of FTO Accidents	No. of Buses	No. of Accidents/ Bus	No. of FTO Accidents	No. of Buses	No. of Accidents/ Bus
4 a.m.	0	2	2	70	0.57	0	10	0.00	0	9	0.00
5 a.m.	3	4	7	373	0.38	2	84	2.38	0	54	0.00
6 a.m.	14	23	37	818	0.90	0	173	0.00	2	119	1.68
7 a.m.	51	61	112	846	2.65	2	202	0.99	0	137	0.00
8 a.m.	62	67	129	769	3.36	4	218	1.83	0	149	0.00
9 a.m.	45	9	54	460	2.35	7	227	3.08	3	159	1.89
10 a.m.	49	0	49	300	3.27	3	231	1.30	2	167	1.20
11 a.m.	46	0	46	303	3.04	10	232	4.31	3	175	1.71
noon	67	0	67	306	4.38	8	233	3.43	3	183	1.64
1 p.m.	72	0	72	383	3.76	11	236	4.66	5	180	2.78
2 p.m.	87	15	102	452	4.51	6	234	2.56	7	175	4.00
3 p.m.	87	71	158	702	4.50	11	233	4.72	4	176	2.27
4 p.m.	92	98	190	841	4.52	15	233	6.44	10	177	5.65
5 p.m.	73	99	172	845	4.07	7	240	2.92	3	179	1.68
6 p.m.	39	40	79	684	2.31	3	234	1.28	3	180	1.67
7 p.m.	27	6	33	328	2.01	4	200	2.00	4	158	2.53
8 p.m.	24	0	24	173	2.77	3	155	1.94	2	142	1.41
9 p.m.	19	1	20	162	2.47	3	147	2.04	5	140	3.57
10 p.m.	12	0	12	154	1.56	3	136	2.21	4	132	3.03
11 p.m.	4	0	4	130	0.62	1	125	0.80	1	124	0.81
Midnight	4	0	4	112	0.71	1	107	0.93	0	108	0.00
1 a.m.	5	0	5	85	1.18	2	82	2.44	3	108	2.78
2 a.m.	2	0	2	42	0.95	0	44	0.00	0	82	0.00
3 a.m.	1	0	1	7	2.86	0	7	0.00	0	43	0.00

Note: No. of Accidents/Bus = accidents per bus in service (x 100). For weekday runs, number of buses is multiplied by 5 before computing No. of Accidents/Bus. Data are from Seattle Metro.

Obviously, more work is needed before such a generalization can be made with confidence, but it is a fascinating notion. In any event, whether the daily pattern of accidents is due to congestion patterns or to some inherent human cycle, the important consideration for the analysis is that PTOs drive during those periods when accident rates are at their highest.

The greater exposure of PTOs to high-accident driving times must be standardized first. The great share of PTOs drive during two time periods, 6 to 8 a.m. and 3 to 6 p.m. During these periods there are 877 total accidents, and there are 5,505 buses in daily operation. The accidents occur over the entire 5-day week, so buses are multipled by 5 and the following is computed: accidents peak bus hour = 3.19 (multiplying the ratio by 100 for ease of presentation). There are 504 accidents during the nonpeak weekday hours, and there are 3,840 buses in service, thus 504/(5 x 3,840) is computed; for Saturday there are 106 accidents and 4,023 bus hours of service; and for Sunday there are 64 accidents and 3,047 bus hours of service. Thus the average accident rate for the nonpeak hours is 2.57 accidents per bus hour of service. Only FTOs drive during these low-danger, nonpeak hours; the PTOs all drive during the high danger peak hours.

Taking the ratio of these two figures, it would be expected that, other things being equal, the more dangerous driving hours of the PTOs would lead to a 24 percent higher accident rate. Next, the effects of driving experience and hours of exposure are analyzed.

The number of accidents per operator (over the 10-month period) is computed separately for the different experience cohorts of PTOs and FTOs and the results are given in Table 13. Looking at the top of the table, notice that as experience increases, the accident rate of FT operators declines, from 1.52 accidents per operator for the operators with 1 year of experience down to 0.92 accidents per operator for those with 5 years of operating experience. However, the same trend is not apparent for the PTOs; their accident rate appears to be remarkably stable

TABLE 13 Effect of Experience on Accident Rate

	FTOs		PTOs	
Years of Experience	No. of Accidents[a]	No. of Accidents/ Driver	No. of Accidents[a]	No. of Accidents/ Driver
1	114	1.52	77	0.46
2	49	1.02	91	0.42
3	12	2.40	95	0.45
4	58	0.84	101	0.51
5	197	0.92	51	0.77
Weighted avg[b]		1.05		0.48

Note: Data are for a 10-month period at Seattle Metro.

[a]Number of accidents used in computing the rate.
[b]Data are weighted by number of drivers in each category.

and independent of driving experience. However, this apparent stability is only an artifact of the differences in driving exposure.

For the FTOs, the work week tends to be relatively independent of years of experience: for their first 5 years at Seattle Metro, all FTOs work approximately a 40-hr week (as they acquire considerably more seniority, they can bid for runs with more overtime or more guarantee pay). However, the situation for the PTOs is different. PTO runs range from 2.5 hr to almost 6 hr in length, and there is considerable competition to receive the long runs because these offer the highest pay. Data on the average driving time for each experience cohort of PTOs are not available, but there are data on the number and length of PTO runs. Because PTOs bid for runs at this agency, and because the operator interviews revealed that the longest trippers were the most desirable, a simple bidding simulation was performed: the longest runs were assigned to the PTOs with highest seniority and any leftover long runs were assigned to the next highest seniority group of PTOs; then the next longest group of runs was assigned to the remaining PTOs with highest seniority, and so on.

Table 14 gives the results of the run assignment

TABLE 14 Adjustment for Differential Exposure by Part-Time Seniority

Years of Experience	Avg PTO Runs (min)	No. of Accidents/ PTO
1	140	1.34
2	157	1.10
3	204	0.90
4	240	0.87
5	330	0.96
Avg		1.03

Note: Data are for a 10-month period at transit Seattle Metro.

process. Column 2 gives the average PTO run varying between 140 and 330 min, depending on the amount of PTO seniority. To compute the final column: (a) first compute the ratio (FTO platform time divided by average PTO run time) for each PTO experience cohort, and (b) divide the raw PTO accident rates, from the top of the table, by the time ratio computed in (a). Note that the PTO accident rate now varies with driving experience, as expected. Also note that the PTO accident rates tend to be lower than, or about the same as, the FTO rates at each level of experience.

Overall, holding constant amount of driving experience and hours of exposure, the average FTO accident rate is 1.05 and the PTO rate is 1.03 (computed by using driver-weighted averages). These results do not standardize for differences in exposure to dangerous driving times, and that 24 percent adjustment would make the comparative PTO rate even lower. Thus, for Seattle Metro--after standardizing for hours of driving, exposure to dangerous driving, and years of driving experience--PTOs have lower accident rates than do FTOs. However, the relationship between accident rates and experience suggests that management should be concerned about the adverse consequences of operator turnover.

ATTRITION RATES AND THE EFFECT OF HIRING THE WRONG PEOPLE

Attrition is of interest because it increases training costs and accident rates (high attrition rates mean that a higher proportion of operators are still on the high-accident portion of the experience curve). It had always been expected that PTOs would have higher attrition rates than FTOs--it was less likely that people would regard PT work as a permanent career. However, it is possible that the attrition rate is even higher than it needs to be because management may be recruiting the wrong people.

By wrong people, it is meant that most of the current PTOs had actually wanted FT work not PT work. Surveys were not conducted among the PTOs to calculate the proportion who actually wanted FT work, but both the unions and the managers were asked to make a subjective estimate of this proportion. There was universal agreement on an estimate that 70 to 85 percent of the PTOs wanted FT work. Such PTOs leave as soon as suitable FT work becomes available. If they could transfer to FT positions at the transit agency, there would be no loss of training and experience; however in an era of constant--or even declining--transit service, it is unlikely that many PTOs will be able to transfer.

The Operations staff at these agencies was well aware of the problem of hiring the wrong operators. However, in four of the five cases study agencies, no evidence was found that the Personnel Office had made any serious, determined effort to screen out those PTOs who were only taking PT work as a temporary expedient. At one of the four it appeared as if the Personnel Office had deliberately structured the hiring process toward people who would want FT work. The hiring office was located in the midst of a high-unemployment area (the type of place where true PT candidates--for example, housewives and students--were unlikely to go); it was only open for a few hours per week, and only at a time when employed candidates would be at work; it refused to accept job applications at its suburban divisions.

An indirect estimate of PTO attitudes toward FT work can be constructed by looking at the relation between PTO quit rates and the general economic conditions in the area. If PTOs really want FT work, then quit rates will be low during periods of high unemployment in the local area, and when the local job market becomes tighter PTO quit rates would be expected to increase significantly. However, the calculation cannot be done in a simple manner because the effects of operator longevity must also be standardized. Quit rates vary as a function of experience, and are likely to be highest in the early years when the driver is still trying to figure out if this is actually the type of job he wants. Thus it was necessary to compute the expected quit rate for PTOs--expected, as a function of experience--to use as a baseline when comparing PTO quit rates to economic conditions.

In Table 15, five PTO cohorts are followed through their careers at Seattle Metro, and the relationship between PTO quit rates and the general economic condition in Seattle, as measured by its unemployment rate, is demonstrated. Each row is the time path of one cohort. The numbers in the row are Actual Quit Rate - Expected Quit Rate, where expected quit rate was computed from the average career path of all the PTOs at this agency, and the quit rate is expressed as a function of experience. A minus sign in the table means that the driver cohort has had less attrition than might be expected on the basis of experience alone; a plus sign means that the cohort has had greater attrition than would be expected, given their level of experience. The results in Table 15 provide evidence that many PTOs are only marking time until FT work becomes available somewhere. It indicates that PTO quit rates increase during boom times (when, presumably, it is easier to find FT work somewhere outside the transit agency); and that PTO quit rates decrease during recessions, when outside opportunities are reduced. Clearly, quit rates are inversely related to economic conditions,

TABLE 15 Analysis of How PTO Quit Rates Are Affected by Economic Conditions

	Year Hired					
	1979[b]	1980	1981	1982	1983	1984
Unemployment condition[a]	Steady	Steady	Rising	Rising	Falling	Falling
	Hired	+2.0'	+1.1'	-0.4*		
		Hired	-2.0*	-4.2*	-0.9'	
			Hired	-7.6*	0.0	+1.2*
				Hired	+0.7*	+3.1*
					Hired	+7.2*

Note: * = supports hypothesis, and ' = contradicts hypothesis. Sum of confirming deviations = 26.4. Sum of contradictory deviations = 4.0.

[a] Data in the first row indicate unemployment conditions during that year, for example, "Rising" means that the unemployment rate increased during that year.

[b] For each cohort of PTOs, the column gives year hired, and the subsequent quit rate compared with the experience-standardized rate.

and many of the drivers actually wanted some other type of work.

SUMMARY OF RESULTS AND SUPPORTING EVIDENCE

Five conclusions are presented. The first two are strongly supported by the data. The last three conclusions are supported by more limited data, typically involving only one or two agencies.

PT Work Has Inherently Lower Absenteeism

PTOs have lower sick rates than do FTOs; this result was found across a wide variety of situations. Furthermore, the conclusion held even when PTOs and FTOs received identical sick pay benefits, whether the benefits were identically high or identically low: (a) when both PTOs and FTOs receive paid sick leave, the FTOs have higher absenteeism; and (b) when neither PTOs nor FTOs receive paid sick leave, the FTOs have higher absenteeism. The same conclusion was reached by tracing an identical cohort of drivers who moved from FT to PT status. The same conclusion was also reached when the effects of probation on the behavior of PTOs were factored out.

Increases in Sick Pay Benefits Cause an Increase in Absenteeism

Even though the differences in sick pay between PTOs and FTOs are not sufficient to explain the difference in absenteeism, it was found that sick pay does matter. Specifically it was found that increases in the amount of paid sick leave available to an operator cause an increase in observed absenteeism. This result was found for FTOs when comparing those with sick pay to those without. This result was also found for PTOs when comparing those with sick pay to those without. Finally, this same result was found when the sick rates of FTOs were tracked over time as they moved into jobs with higher amounts of paid sick leave. In quantitative terms, it was found that successive increases in sick pay--from 0 days, to 3 days, to 5.2 days, to 12 days per year--were associated with successive increases in the observed rate of sickness.

PTO Accident Rates Are Approximately Similar to FTO Rates

This is confirmed in the rough, unstandardized data at all the agencies. Only one agency provided sufficient data to fully standardize for differences in driving exposure between PTOs and FTOs. At that agency, holding constant hours of driving, years of experience, and the daily time pattern of accident hazards, it was found that PTOs had lower accident rates than did FTOs.

Irregular Work Causes Increases in Absenteeism and Accidents

This is supported by data from a single transit agency, but it is the theoretically expected relationship.

There Is a Tendency To Hire the Wrong People for PT Work

First, casual estimates from managers or unions at all five agencies indicate that 70 to 85 percent of the PTOs actually want FT work. Second, at one agency with detailed data available, PTO quit rates increase when more jobs are available outside the transit industry, and they decrease when area unemployment increases. The consequences of hiring the wrong PTOs are varied. Higher attrition produces higher training costs but lower average wages for PTOs; this is because new PTOs are constantly coming in at the beginning of the wage progression. Higher attrition also produces higher accident costs because a higher proportion of the PTOs will be on the low-experience portion of the accident curve. (This does not contradict the third conclusion; experienced PTOs will have even lower rates than the average PTO.)

ACKNOWLEDGMENTS

This research was supported under a grant from UMTA, U.S. Department of Transportation. The author wishes to acknowledge the help and cooperation of the five transit agencies, without which the study would have been impossible. K. Chomitz and G. Giuliano made useful suggestions for clarifying the analysis and presentation. My contract monitor, Joseph Goodman, was supportive, patient, and helpful throughout the long process involved in guiding the project to a conclusion.

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Publication of this paper sponsored by Committee on Transit Management and Performance.