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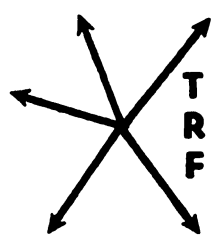

TRANSPORTATION RESEARCH FORUM

The Costs of Providing Paratransit Services

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INTRODUCTION

DURING THE DECADE of the 1970's paratransit came of age. Dial-a-Rides, minibusses, and "maxi-taxi's" (many funded by UMTA sections 5 and 6 funds) became accepted parts of an "integrated" public transportation system. Senior citizens programs (16(b) funds), specialized services for handicapped individuals (504 mandate), and social services such as meals on wheels (H.E.W. funding) appeared. Private, public, profit oriented, and not for profit groups became para-transit providers.

Most of these providers have several things in common. They are typically publicly funded, serve targeted populations with generally low income and emphasize transportation needs for social service delivery. However, these programs began to proliferate and as various agencies started competing for scarce public resources to provide essentially the same service, regional transportation inventories began revealing literally several hundred geographically overlapping mini transportation systems. Several authors (Hills and Mundy, 1978; Hood et al, 1978; Cutler, 1979; and others) began calling for more efficient use of existing fleets and of the transportation dollar.

The purpose of this paper is to examine some of the policy issues involved in the debate over paratransit services. This paper will also present new preliminary empirical information on these issues through the use of data collected from a sample of paratransit providers in the Chicago metropolitan area.

POLICY ISSUES

There are many policy issues regarding paratransit that need to be studied. These include questions of equity, resource allocation, and the form of subsidy to be used. In this paper, however, we will concentrate on efficiency of delivery: how best to organize the production of paratransit services. The emphasis is not how much paratransit is desirable, but rather, how best to produce paratransit services. This set of issues concern managerial of X-efficiency in Leibenstein's (1966) terminology.

Issues concerning how best to arrange the production of paratransit services are best addressed by examining the range of public policy options possible. At a minimum, the following alternatives are available:

1. **Do nothing.** Currently there are many organizations providing some form of special transportation to different clientele groups. These include: social services agencies, churches, nonprofit groups, neighborhood clubs, ambulance services, taxi, and delivery services. One option is to do nothing except perhaps to fill in the gaps for some segments of the population which still lack adequate transportation in certain areas.
2. **Coordination of existing services.** This option would continue the use of the existing structures to provide services. Public policy would create incentives for these agencies to share equipment and facilities and to pick up each other's clients.
3. **Displacement or consolidation existing services.** This option would encourage the creation of a separate service. Existing providers could contract with this organization for services, or services could be arranged independently of these agencies. Some agencies would probably still provide parallel service.

Many variations of this last option are possible. These include:

- Public ownership and operation of a special transportation agency.
- Existing fixed route transit systems would provide paratransit services.
- Placing greater reliance on private firms such as taxi and ambulance services.

In choosing between the various possible combinations, many different questions have to be considered. One question involves what is "politically" acceptable to the clients, providers, and the public? Another involves the nature of restrictions on the use of subsidizing funds and the willingness of the private sector to participate. A primary consideration is the cost of each of these delivery modes for providing equivalent services.

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There are many different topics concerning the delivery of paratransit service that need further study before the costs of any of these service combinations can be predicted. Of those, we are specifically addressing the following:

1. **Economies of scale.** Are there economies of scale that might compensate for the loss of specialized transportation services aimed at specific groups? There are several reasons to believe that there would be economies of scale. For one, a large clientele means that trip origins and destinations should be more dense, thereby creating the possibility for higher vehicle productivities. Similarly, some programs have peaks in travel demand (e.g., meals on wheels programs, where the clients all need to travel near the noon hour); if program demands are meshed, vehicles can be utilized more evenly through the day. Another area is in dispatching. Since one dispatcher can handle up to 60–90 vehicles, small programs may be using dispatch time inefficiently.

2. **Quality of service provided.** Even if economies of scale are not present, it is possible that a higher quality service might result from larger organizations providing the service. For example, the use of more specialized equipment for the handicapped might be justified if a wider market is served. On the other hand, if paratransit services are provided by large organizations, service quality may actually fall since the personal touch that many small volunteer organizations can provide would be lacking.

3. **Labor and unions.** Different transportation providers pay vastly different wages. Taxi driver wages are frequently very low (Sen **et.al**, 1978). Many charitable groups use volunteer labor. By way of contrast, publicly owned bus companies have shown a strong tendency to unionization. Unionization has raised costs by increasing wages and by imposing restrictive work rules. Rules that prohibit part time labor can be very expensive if there is peaking in demand. To what extent would public ownership and operation of paratransit affect labor costs and unionization? Would the subsidization of privately run services also affect labor costs?

4. **Private/Public supply.** Many would argue that the profit motive holds costs down. Studies indicate that the average taxi cost per vehicle hour is considerably cheaper than the average cost for publicly run dial-a-rides where the services provided are similar (Sen, **et al.**, 1978; Altschuler, 1979). It is not clear to what extent meeting the needs of special clients (e.g., the wheel chair bound) contributes to higher cost. Comparing administration costs between the two sectors might shed light on whether publicly run paratransit services tend to become "topheavy."

5. **Elderly and handicapped.** How viable an option is paratransit as a means to fulfill section 504 requirements of the Rehabilitation Act of 1973 concerning the elderly and handicapped? Would the costs of providing such alternative services be less than the costs of making existing transit systems accessible to these groups?

STUDY DESCRIPTION

In order to examine questions of cost and supply in paratransit delivery, a mail survey was conducted of paratransit services in the northeastern Illinois and southeastern Wisconsin region. The questions covered: type of organization (profit, nonprofit), revenue sources, type of service offered, characteristics of clients, number and types of vehicles, ridership, trip characteristics, and cost information. The cost information included: total annual cost, cost per mile and per passenger trip, cost breakdown in percentage (driver, administration, rent, maintenance, insurance, fuel, depreciation, and other), driver wages, and number of employees by type and whether they were paid or volunteer.

A total of 429 questionnaires were sent to prospective paratransit providers in the Chicago metropolitan area in early 1980. One hundred twenty three responses were received including 68 from agencies not providing these services. Fifty five usable responses were received from agencies providing some form of special transportation services. Taxi cabs were not included in this phase of the study, but will be included later in the research. The research also excluded car pools, van pools and other private arrangements among groups of individuals. In addition, ambulance services and transportation privately provided for residents of institutions or homes (such as homes for the mentally retarded) were excluded from consideration. The sample thus consists of non-taxi agencies providing specialized transportation services to the public.

RESULTS AND ANALYSIS

Of the total of 55 usable responses received, 30 responses had reported cost information. While the sample size is not overly large, it is adequate for making inferences regarding cost differentials among services with different characteristics. However, as can be seen from Table 1, when the total sample is distributed among several groups, the number of observations in some categories is quite small. Thus, care must be taken so as not to interpret the results as exact estimates of paratransit costs.

TABLE 1

COST FACTORS AND PARATRANSIT COSTS

Cost Factor	N	COST PASS TRIP $	COST VEH. MI. $	COST/ PASS MI. $	OCCUPANCY RATE
Overall	30	4.65	.93	1.08	.86
Service Type					
DIAL A RIDE	*21	4.81	.80	1.21	.66
OTHER SPECIAL TRANS.	10	4.06	1.06	.72	1.47
Special Groups					
WHEELCHAIR BOUND	5	9.65	.92	1.38	.66
OTHER HANDICAPPED AND ELDERLY	20	2.99	.89	1.10	.81
NONE	5	6.27	1.06	.71	1.50
AVERAGE TRIP DISTANCE					
0-5 Mi.	20	2.83	.93	1.17	.79
6-10 Mi.	5	7.66	1.04	1.02	1.02
Over 10 Mi.	5	9.28	.92	.74	1.24
GOVERNMENT ASSISTANCE PROVIDED					
Yes	** 25	3.77	.82	1.07	.77
No	4	11.12	1.48	1.35	1.10
PART OF A LARGER ORGANIZATION					
Yes	26	4.34	.86	1.11	.77
No	4	6.69	1.31	.82	1.60
FOR PROFIT ENTERPRISE					
Yes	** 5	12.48	1.49	1.21	1.23
No	24	3.12	.86	1.06	.81
RADIO DISPATCH					
Yes	**16	5.55	.98	1.08	.91
No	13	3.66	.86	1.06	.81

* Sample size exceeds 30 since one organization provides both type of service.

** One provider did not respond.

Rather, the results should be viewed as providing "ballpark" estimates of the cost relationships.

The results of the analysis of the costs are shown in Table 1. The average total cost per passenger trip for the entire sample is $4.65. Average total costs per vehicle mile were reported as $.93, while the total cost per passenger mile is $1.08. The average trip length is 5 miles. Average driver wages is $5.06. The ratio of the last two columns in the table gives the occupancy rate in passenger miles per vehicle mile travelled. Overall, the average occupancy rate for the entire sample is less than one, which indicates that there is some room for improving the overall efficiency of operations.

The type of service provided was divided up into dial-a-ride and other special transportation services. This latter group includes fixed route, subscription, and charter services. As can be seen from the table, dial-a-ride costs are

more expensive on a passenger trip and passenger mile basis. The reverse is true, however, for vehicle mile costs. This probably reflects the use of larger vehicles for fixed route, subscription, and charter services. The occupancy rate is over twice the rate for dial-a-ride, reflecting the ability to better plan trips.

Average costs were calculated for organizations aiming their services specifically at either wheelchair bound or other handicapped and elderly individuals. A third grouping contains those services not specifically aimed at either group. As can be seen, the occupancy rate is lowest and costs on both a passenger trip and passenger mile basis are highest for providers carrying the wheelchair bound than the other two categories.

Although the cost per passenger trip for those organizations carrying the wheelchair bound are more than three times as large as those serving other handicapped and elderly, the differences in costs per passenger mile are not nearly as large. The reason for this is that average trip lengths for services aimed at the wheelchair bound are much longer (8.75 miles) than the average for all organizations providing paratransit services in the sample. Thus, the differential in cost per passenger trip cannot be explained solely on the basis of additional costs entailed in providing services to the wheelchair bound.

The table does provide some indication of how costs are affected if services are aimed at the wheelchair bound. The costs per passenger trip and mile for organizations in the sample which had an average trip distance between 6–10 miles are $7.66 and $1.02 respectively. The costs of $9.65 and $1.38 for organizations catering to the wheelchair bound are between 30 to 35 percent greater than these costs.

With regard to average trip distance, costs per passenger mile diminish with distance and the occupancy rate increases the longer the average trip. These results imply better utilization of vehicles with longer trip distances.

Although the number of organizations not receiving some form of government assistance is quite small, the magnitudes involved clearly suggest that the costs of those organizations receiving government assistance are less than those not receiving assistance. This is true for all three categories of costs. However, the occupancy rate for those services receiving aid is considerably less than those not receiving assistance. One possible implication is that while governmental assistance has resulted in lower costs, it may have also reduced incentives to increase the efficiency of operations.

Average costs were calculated for providers who were part of a larger organization and those who were not. The concept tested was that, if part of a larger organization, paratransit costs would be lower due to shared overhead and administrative expenses. The results were inconclusive, for while costs per passenger trip and vehicle mile are less for those services provided as part of a larger organization, costs per passenger mile are greater.

One additional piece of information is an estimate of the percent of total expenses attributable to administration. Of the 55 usable questionnaire responses, 26 provided an estimate of this percentage. Sixteen of the respondents were part of a larger organization and estimated on the average that administrative expenses comprise 13.7 percent of total costs. Nine services were provided by independent organizations and the average percent of total costs attributed to administration was 15.7. Thus, it seems that sharing of expenses may contribute to lower costs of providing paratransit services.

All three cost categories show that for profit enterprises have higher average costs than not for profit services. A partial explanation could be that not for profit services are more likely to receive volunteer drivers and to make use of volunteer vehicles. For profit enterprises may be more efficient as indicated by the occupancy rate.

The final cost factor examined is whether radio dispatching is used. The table shows that costs are slightly higher for services which utilize radio dispatching. However, occupancy rates also improve probably due to reductions in dead heading time.

An important question in the policy debate concerning paratransit is whether economies of scale exist in the provision of these services. There are two ways this could occur. The first is by average costs falling as the total size of the operation increases. If this were the case, economies could be achieved by expanding service areas with each provider specializing in a particular client group.

Second, economies of scale could occur with increased ridership density. If this were the case, within a given service area, individual agencies should be encouraged to consolidate.

The data from the sample of paratransit agencies was used to examine these two questions. The results are shown in Figures 1 and 2. In Figure 1, costs per passenger mile are plotted against annual ridership. Two key findings emerge. First, costs per passenger mile are quite small for the two agencies with annual ridership over 200,000. These two systems are primarily fixed route services.

Secondly, there seems to be some heteroskdasticity in the data, since there is a much larger variation in costs for lower annual ridership agencies. A possible explanation is that those agencies with low ridership and low costs tend to be those that rely on volunteer

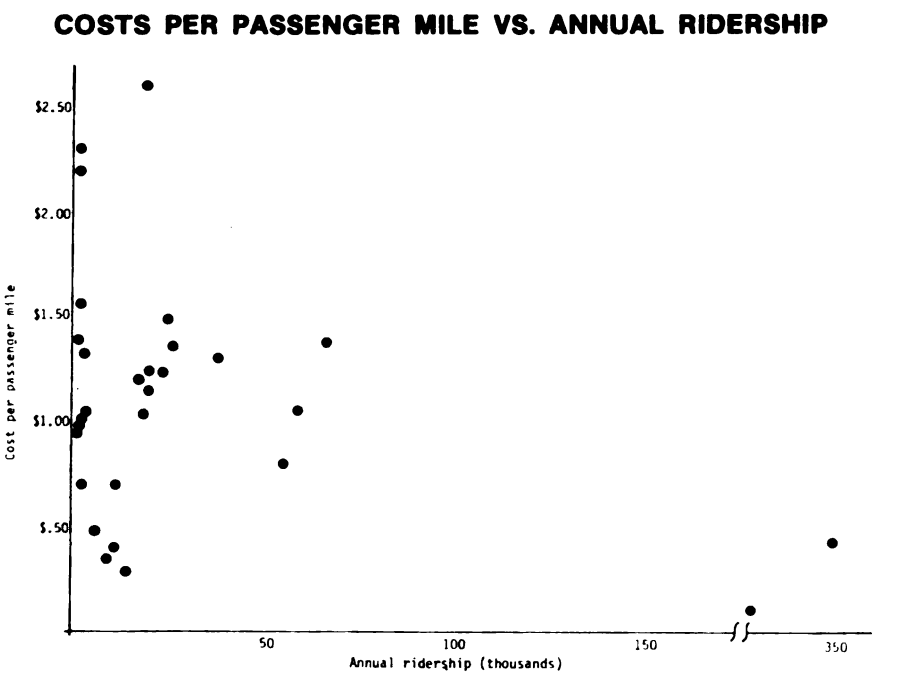

FIGURE 1

drivers and vehicles and share administration and other overhead expenses. Thus, costs per passenger mile may appear low. Of the two agencies with large costs, on the other hand, one is very similar to an ambulance providing service for the wheelchair bound.

Thus, if the fixed route systems are ignored and the systems with low ridership and low costs are excluded, it seems that costs per passenger mile are fairly constant as ridership increases. This suggests constant returns over a wide range of ridership. Lower costs do not appear until ridership increases to such an extent that a different type of service is feasible.

These data thus suggest that economies of scale will probably not be obtained by expanding the service areas of agencies to increase ridership, unless ridership increases to such an extent that fixed route systems are feasible. In addition, if consolidation occurs, it might well be that those very small agencies receiving volunteer help and shared administration expenses will be absorbed into a larger entity required to pay full administration expenses without volunteer services.

In Figure 2, costs per passenger mile are plotted against ridership density as measured by riders per square mile of service area. As can be seen, the same general patterns of Figure 1 show up here as well. Costs do not decrease until the very large ridership associated with fixed route systems appear. The same heteroskdastic pattern also exists. Generally, the results seem to imply constant returns with respect to ridership density. This would mean that no cost savings would result from consolidating services within the same service area so as to increase ridership density. The only exception would be if consolidation would result in a fixed route system becoming viable.

Finally, information from the questionnaires was used to calculate a crude quality of service index. If the service offered dial-a-ride without reservation, a two was recorded. Dial-a-ride with reservation was given a value of one. If the agency aimed its service at the wheelchair bound or handicapped and elderly, a value of one was assigned. A one was assigned to services providing radio dispatch. These numbers were then added for each of the organizations in the sample, yielding an index of service. The index could theoretically vary from zero to four, with a higher value of the index implying a higher quality of service. The results are shown below:

COST PER PASSENGER MILE VS. RIDERSHIP DENSITY

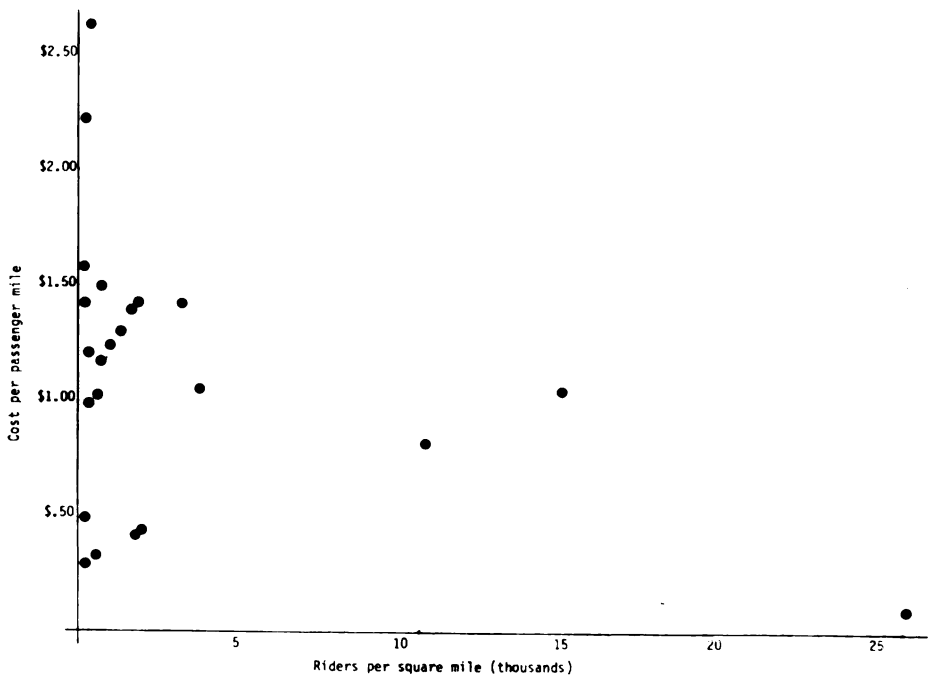

FIGURE 2

Quality of Service Index	Sample Size	Annual Average Ridership
1	15	55,500
2	10	42,700
3 or 4	13	18,000

The index shows that higher quality service (as measured by the index) is associated with smaller operations. The results do not support the contention that service quality improves with larger size operations. Consolidation of agencies providing paratransit services may not result in increases in service quality and indeed may result in lower quality service.

CONCLUSIONS AND FUTURE RESEARCH

The preliminary research reported in this paper leads to several conclusions. The results with respect to economies of scale seem to imply constant returns. Economies associated with large size do not occur unless ridership increases to such an extent that some sort of fixed route service is feasible. At very low ridership levels, paratransit providers may be able to utilize volunteer labor and vehicles and to share administrative and overhead expenses with a larger organization. Such savings would be lost if agencies consolidate.

The findings seem to indicate that public policy should not be directed toward consolidation of existing services. Government policy may perhaps best be directed towards correcting any gaps in service and dealing with special problems such as the wheelchair bound. A continuation of the subsidy program through section 16(b)(2), which provides assistance for private, non-profit groups serving the elderly and handicapped, may be preferable to efforts to consolidated or coordinate services.

The average cost per passenger mile for the dial-a-ride providers in the sample is $1.21. The average fare per mile for a five mile taxi ride in the Chicago metropolitan area is $1.02 (based on a sample of 20 area firms). Not only is this less than the overall average for dial-a-ride providers in this sample, but is considerably less than the average for agencies for which government assistance is not provided. It is also less than the $1.21 average cost per passenger mile of the profit making enterprises included in the sample. The implications are that either taxi is more efficient or that taxi

costs are lower because a different type and quality of service is being offered. These implications will be studied further in the remaining phases of this research.

If taxi is more efficient, then quite possibly taxi could be used to provide service to the wheelchair bound. This study indicates that paratransit costs increase by approximately 30-35 percent when service is aimed at this group. If these results are applicable to taxi costs, then it would be expected that taxi could provide this service for an additional charge of 30 to 35 percent.

Our study also found that average driver wages in the sample is $5.06. This compares with wages of between $8 to $11 per hour for Chicago metropolitan area fixed route transit systems. The implication is that if paratransit were provided by conventional fixed route transit systems, total labor costs would increase significantly.

The results of this study are based on averages taken from a sample of paratransit firms in the Chicago metropolitan area. Clearly, it would be desirable not only to estimate cost relationships but also to have measures of the precision of these estimates. In addition, simple averages do not indicate the effect of changing one cost factor, while holding all others constant. Such analysis requires multiple regression and correlation procedures. The next phase of this research will be directed toward such quantitative analysis of paratransit costs. The research reported in this paper hopefully has provided some insights into paratransit cost relationships.

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