ECONOMIES OF SCALE IN THE TAXICAB INDUSTRY

Some Empirical Evidence from the United States

By Anthony M. Pagano* and Claire E. McKnight†

Economies of scale in transport have been studied by numerous authors. There have been many, sometimes conflicting, studies in railroad and truck transport, such as Koenker (1977), Flott (1965), Koshal (1972), Miller (1973), Borts (1960) and the classic study by Meyer et al. (1959). Economies of scale in public transport have also been empirically tested in a number of studies, including Anderson (1974), Koshal (1970) and Lee and Steedman (1970).

In contrast to this rich empirical base, economies of scale and costs in the taxicab industry have received little attention. Only two studies seem noteworthy. One is by Brown (1973), who found that average costs are U-shaped; but he used secondary data developed for regulatory purposes, and this probably contributed to the lack of statistical significance in the estimated average cost functions. Thus the results of his study cannot be viewed as conclusive. The other is Beesley's (1979) examination of costs and supply of the taxi industry in London. That study contributed to the understanding of taxi-related costs, input prices, and the determinants of the supply of cabs, but it did not cover the presence or absence of economies of scale.

Even though economies of scale in taxicabs have not been as thoroughly examined as in other modes, the presence of economies or diseconomies of scale can have significant implications for public policy.

Especially in the United States, taxicabs are subject to economic regulation at the local level, either by the states or by individual municipalities. If economies of scale are present, regulation should encourage the granting of licences in more than one municipality in order to obtain efficient size. By contrast, in many areas, the current regulatory scheme discourages a firm from serving more than one municipality, since the firm would be subject to different sets of sometimes conflicting regulations.

If substantial diseconomies are present, then regulations which limit the number of firms in a given area may help to perpetuate inefficient operations. If, on the other hand, economies of scale are present and the taxicab industry is deregulated in smaller areas, the question arises whether monopoly providers will result, or whether several small firms can coexist in one area. If it creates monopoly, deregulation of the taxi

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industry may not be a viable public policy option, at least in smaller cities.

Several researchers (e.g., Hollinder and Blair, 1978; Rosenbloom and Altschuler, 1977) have suggested that transport for the elderly and handicapped may be provided more cost-efficiently by subsidising existing private taxicabs rather than by establishing publicly run dial-a-ride service. Not only are relative costs of the two modes and service quality important, but also knowledge of the taxicab cost function will indicate the effect of increased ridership on costs of operation. This information will be useful in designing a subsidy scheme that will encourage the creation of firms of the most efficient size to provide such services.

DESCRIPTION OF THIS STUDY

Data on taxi companies were gathered by personal interviews done jointly with the Chicago Area Transportation Study (CATS) for its regional Coordinated Taxi Study and as a part of a study of economies of scale in paratransit (Robins, Pagano and McKnight, 1981). The taxi sample was drawn from a list of 38 taxi companies in the six-county Chicago metropolitan area compiled by the Taxi Advisory Board, a group of taxicab company owners and regulators which advises the Chicago Area Transportation Study. Twenty-eight of the taxi companies agreed to personal interviews. These personal interviews, lasting between three and seven hours per company, were conducted in 1980 and in some cases were supplemented by cost information from annual financial reports. Three companies refused to disclose cost information, and one was actually a livery service; this brought the usable taxi sample to twenty-four companies. One company had a ridership (500,000 trips per year) which was twice the size of the next largest (250,000). This firm was subsequently dropped from the analysis, leaving a total of 23 firms in the sample.

The interviews covered organisational arrangements; trip characteristics; applicable regulations; size; cost and revenue (including total annual costs and revenue); fare structure; revenue per trip; and factor costs for dispatching, administration, maintenance, insurance, fuel, and vehicles.

The reason for using the personal interview approach was that taxicab companies have an incentive to overstate costs and understate revenues when dealing with regulatory agencies. Instead of relying on possibly erroneous data, we collected detailed information on factor inputs, prices, and costs. The information was then pieced together to form cost estimates which we felt were accurate. In no case did we rely solely on cost information provided by the firms for regulatory purposes. Thus the quality of the cost data used in this study should be well above that of public filed financial data.

SAMPLE CHARACTERISTICS

All the taxi companies in the sample operate in the six counties surrounding the city of Chicago. Much of the area is suburban, but it also includes several medium-sized older cities. None of the companies operates in the city itself. They are all regulated by the local municipalities; regulations govern the fare structures and safety and meter...
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requirements, and determine where and in what circumstances passengers can be picked up. Frequently, a taxi company that operates in two or more municipalities will have to operate under two or more different fare structures and sets of regulations. A taxicab is generally not allowed to pick up passengers in an area in which it is not licensed unless previously called by the passenger. However, it is permitted to take passengers to destinations outside its service area. All but one of the companies in the sample share their service areas with competing firms.

Eleven of the 23 companies pay drivers a commission or a percentage of the fare revenue, ranging from 35 to 50%. Six companies lease vehicles to drivers for either a flat rate per shift (12 or 24 hours), a fixed rate per mile, or a percentage of the fare revenue. Under the lease arrangement the driver is considered self-employed, and the company has no responsibility for providing employee benefits or withholding income and social security taxes. Two companies both lease cabs and hire drivers on commission. The remaining four companies are dispatch associations; that is, these companies own no cabs but provide dispatching and, in some cases, licensing and insurance to independent owner-operators for an affiliation fee.

Some characteristics of the sample are presented in Table 1. On average, 71% of the taxi companies' business is typical passenger business. The other 29% consists primarily of package delivery, but also includes some contrast business. Of the passenger business, 95% is dispatched. Thus, the cost models developed in this paper are relevant to firms whose business is primarily dispatched, as opposed to cruising central city trade.

DEVELOPMENT OF THE COST MODEL

The first step in the development of the cost model was to specify the output unit. However, in the taxicab industry, as in all transport, the unit of output is not easily specified. Vehicle miles are frequently used, since these are readily measured and less dependent on demand than ridership. But the final product is the transport of people. Passenger trips and passenger miles are two measures of output which attempt to measure this final product. In this study, separate cost models were developed for each output measure. The dependent variables are average total costs per passenger trip, average total costs per passenger mile, and average total costs per vehicle mile.

Taxicab operations can differ in size because of differences in the size of the service area or because of differences in ridership within similar sized areas served. The effects on average cost may be quite different. Thus, ridership density, measured by ridership per square mile of service area, was included in the analysis as a dependent variable.

In addition to size of output, qualitative differences in output may affect costs. These include average trip distance, average waiting time for a dispatched vehicle to arrive, ride quality, etc. Only average trip distance was included in this study. This may result in a larger unexplained variation in cost than if these other qualitative variables were included. However, the primarily suburban nature of the sample probably results in a fairly homogeneous group of firms with respect to quality variations in output, other than trip distance.

Input prices may also be important in explaining cost differences among taxicab
Table 1
Service Characteristics of Taxi Sample
(Sample size = 23)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years in operation</td>
<td>29.0</td>
<td>4—54</td>
</tr>
<tr>
<td>No. of vehicles</td>
<td>18.6</td>
<td>1—65</td>
</tr>
<tr>
<td>Service area (square miles)</td>
<td>26.8</td>
<td>5.5—63.0</td>
</tr>
<tr>
<td>Population density of service area (people/square mile)</td>
<td>4,570</td>
<td>1,643—11,163</td>
</tr>
<tr>
<td>Percent of business represented by traditional passenger business</td>
<td>71.0</td>
<td>25.0—100.0</td>
</tr>
<tr>
<td>Cost per passenger trip:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commission/lease</td>
<td>$2.32</td>
<td>$1.28—$5.60</td>
</tr>
<tr>
<td>Dispatch associations</td>
<td>$0.48</td>
<td>$0.32—$0.63</td>
</tr>
<tr>
<td>Cost per passenger mile:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commission/lease</td>
<td>$0.73</td>
<td>$0.37—$1.37</td>
</tr>
<tr>
<td>Dispatch associations</td>
<td>$0.15</td>
<td>$0.10—$0.18</td>
</tr>
<tr>
<td>Cost per vehicle mile:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commission/lease</td>
<td>$0.31</td>
<td>$0.14—$0.63</td>
</tr>
<tr>
<td>Dispatch associations</td>
<td>$0.05</td>
<td>$0.03—$0.08</td>
</tr>
<tr>
<td>Annual ridership (one-way trip)</td>
<td>110,100</td>
<td>4,500—250,000</td>
</tr>
<tr>
<td>Ridership density (one-way trips per square mile)</td>
<td>7,050</td>
<td>220—32,000</td>
</tr>
<tr>
<td>Annual passenger miles (000 trip miles)</td>
<td>406</td>
<td>21—823</td>
</tr>
<tr>
<td>Total vehicle miles (000 miles)</td>
<td>852</td>
<td>40—3,000</td>
</tr>
<tr>
<td>Annual miles/vehicle (000 miles)</td>
<td>52</td>
<td>30—75</td>
</tr>
<tr>
<td>Average trip distance (miles)</td>
<td>3.4</td>
<td>1.0—6.0</td>
</tr>
<tr>
<td>Per capita income of service area (000)</td>
<td>6.0</td>
<td>3.4—9.4</td>
</tr>
<tr>
<td>Distance from the centre of Chicago (miles)</td>
<td>26.0</td>
<td>8.0—47.0</td>
</tr>
</tbody>
</table>

Firms. However, since all observations in the sample are drawn from the same metropolitan area, variations in prices across taxi firms should be minimal, except for building rent. The distance from the CBD was included in the analysis to reflect any differences in rent.

The manner in which taxicab operations are organised can affect reported costs. Dispatch associations only have expenses associated with administration and dispatching, while commission and lease companies have vehicle expenses as well. So we also included variables reflecting the type of organisation.
Finally, environmental variables were considered. The environmental variables of primary importance in determining costs in taxicab transport are those that describe the operating environment, particularly congestion, average speed, the closeness of origins and destinations, and whether there are a few strong trip attractions or many dispersed ones. These are all difficult to measure, but they are usually related to passenger trips per square mile of service area and distance from the CBD.

REFINEMENT OF DATA

Each company had its own estimate of capital depreciation, but we computed a different value in order to better reflect the economic cost of capital equipment. For annualised vehicle cost, the purchase price minus a resale or salvage value was divided by the years of operating life. Other equipment with a short life was treated in the same way as vehicles. Most of the companies rent office and garage space: annualised capital cost for buildings and radio towers owned by the companies was computed at 10% of their current value.

This approach to calculating annualised capital costs may be considered unsatisfactory, since borrowing costs for vehicles have not been explicitly considered. However, we have found that vehicle depreciation constitutes only 7% of annual costs of the typical company in the sample. Thus the omission of borrowing costs for these short-life assets should not significantly affect the results of this analysis, especially in light of the uncertainties associated with estimating salvage values and years of operating life.

Frequently, smaller taxicab companies use the services of unsalaried administrators and dispatchers. The costs of these unsalaried personnel were imputed by assuming that they were the same as those of salaried administrators and dispatchers. As administrative cost was frequently given as a total factor cost rather than broken down by salaries and other costs, we imputed the cost of one person to be $10,300 by regression analysis. However, several of the taxi firms operate from an office in the home. While the dispatcher, who is frequently a family member, is available full time, he or she may not be working full time. Thus the imputed cost for the very small operations may be overstated.

In addition to these two categories of cost, many taxicab firms, particularly the dispatch associations and lease companies, have no accurate figures for driver cost. This is because driver earnings for these types of firms are collected from fares by the driver and do not go through the company’s hands.

Initially, it was thought that separate models could be developed for driver hours per passenger trip and per passenger mile. Driver cost could then be obtained through various assumptions concerning driver earnings per hour. A total cost model could then have been developed by combining these estimates of driver expense with estimates of costs excluding driver expense from a separate cost model.

\[^1\] Administration cost = \(-16,800 + 2,100 \) Ridership + \(10,300\) Administrators.
\[
\begin{align*}
(1.17) & \quad (1.65) \\
(7.39) & \quad (7.39)
\end{align*}
\]

\( R^2 = 0.96 \quad F = 147 \quad \text{Parentheses indicate student t value.} \)

All 24 firms, including the largest, were used to develop this estimating equation.
### Table 2

**Estimated Cost Models**

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Cost/Passenger trip</th>
<th>Cost/Passenger mile</th>
<th>Cost/Vehicle mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>+0.8790</td>
<td>+0.1186</td>
<td>+0.5507</td>
</tr>
<tr>
<td></td>
<td>(2.11)</td>
<td>(1.08)</td>
<td>(4.84)</td>
</tr>
<tr>
<td><strong>Measures of Output</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ridership</td>
<td>+0.0660</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.27)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/Ridership</td>
<td>+1.6872</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7.50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ridership density</td>
<td>−0.2793</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger miles</td>
<td></td>
<td>+0.0050</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.29)</td>
<td></td>
</tr>
<tr>
<td>1/Passenger miles</td>
<td></td>
<td>+1.6116</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.12)</td>
<td></td>
</tr>
<tr>
<td>1/Total vehicle miles</td>
<td></td>
<td>−0.0101</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.23)</td>
<td></td>
</tr>
<tr>
<td>Annual miles per vehicle</td>
<td></td>
<td>−0.0029</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.23)</td>
<td></td>
</tr>
<tr>
<td><strong>Quality of output</strong></td>
<td>+0.2684</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average trip distance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/Average trip distance</td>
<td></td>
<td>+0.9410</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.76)</td>
<td></td>
</tr>
<tr>
<td><strong>Organisational factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispatch association</td>
<td>−1.9557</td>
<td>−0.6067</td>
<td>−0.2223</td>
</tr>
<tr>
<td>(1 if dispatch, 0 otherwise)</td>
<td></td>
<td>(7.15)</td>
<td>(6.44)</td>
</tr>
<tr>
<td><strong>Environmental factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per capita income</td>
<td>−0.0217</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.95)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from CBD</td>
<td>−0.0175</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.92</td>
<td>0.88</td>
<td>0.82</td>
</tr>
<tr>
<td>$F$-value</td>
<td>31.77</td>
<td>33.91</td>
<td>20.85</td>
</tr>
</tbody>
</table>

**Notes on Table 2**

Costs exclude driver expense.

The number in parentheses under the coefficient is the two-tailed t-value; unless otherwise indicated the t-value is significant at the 5% level.

* indicates the t-value is significant at the 10% level.

Ridership density is measured as the number of one-way passenger trips per year per square mile of service area.

Ridership is measured in 10,000 one-way passenger trips per year.

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However, both management and drivers decide the number of vehicles that should operate at any given time; driver hours supplied are the result of that decision. The decision is based on the profitability of operating, which, in turn, is based on overall demand for taxi service and total competition. Thus, driver hours per passenger trip or per passenger mile reflect an equilibrium between supply and demand. This was borne out by the low coefficients of variation for driver hours per passenger hour and per passenger mile (about 30) relative to those for the other average costs (about 45). To model driver hours adequately would require us to estimate a set of simultaneous equations requiring data (total demand and competition in the service area) that we did not have. The cost models were therefore developed without driver expense as a cost element.

The upper range of ridership in the sample is 250,000 trips per year. Of the firms surveyed by Control Data Corporation (1977), the median size was 212,000 trips per year. Thus the cost models developed in this study are valid for the lower half of the range of sizes of taxicab firms in the United States.

RESULTS

Multiple regression analysis\(^2\) was used to estimate the relationship between taxicab company costs and size. Separate cost models were estimated for average cost per passenger trip, per passenger mile and per vehicle mile. Costs were regressed against variables reflecting quality of output and organisational and environmental factors, as well as measures of the amount of output produced. The results are shown in Table 2. The cost per passenger trip model explains 92% of the variation of the data; it has an F-value of 31.77, which is significant at the 1% level. The cost per passenger mile model has an \(R^2\) of 0.88 and an F-value of 33.91, also significant at the 1% level. The cost per vehicle mile model has an \(R^2\) of 0.82 and an F-value of 20.85, significant at the 1% level.

In the cost per passenger trip model, the output measures are ridership, ridership inverted and ridership density. All three variables are significant at the 5% level, according to two-tailed t tests. The presence or absence of economies of scale involves

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Notes on Table 2 (continued)

Passenger miles are measured in 10,000 trip miles. The variable was calculated as ridership multiplied by average trip distance/10,000.

Total vehicle miles are measured in 1,000 vehicle miles. The variable was calculated as number of vehicles multiplied by miles per vehicle/1,000.

Annual miles per vehicle are measured in 1,000 miles.

Average trip distance is the distance of one-way passenger trip, and is measured in miles.

Per capita income is the 1976 per capita income of the service area measured in $1,000.

Distance from CBD is the linear distance in miles from the centre of Chicago to the dispatch office of the taxicab company. In all cases, the office is within the company’s service area.

Total sample size for each equation was 23.

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\(^2\) The SAS general linear model package was used for the analysis (SAS Institute, 1979).

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a complex interaction among these variables, and will be discussed in the following section.

For the model of cost per passenger mile, the appropriate measure of output is passenger miles. Passenger miles and passenger miles inverted are both significant at the 5% level. Their signs follow the same pattern as the coefficients of ridership and ridership inverted in the cost per passenger trip model.

In the cost per vehicle mile model, total vehicle miles is the output measure. Total vehicle miles inverted and annual miles per vehicle are both significant at the 5% level, and the coefficients of both indicate that there are decreasing costs as vehicle miles increase.

The only quality of output measure included in this analysis is average trip distance. It is significant at the 5% level in the cost per passenger trip model. The coefficient of average trip distance indicates that a firm whose average trip distance is one mile higher than another will have average costs per passenger trip of $0.27 greater. The coefficient of average trip distance inverted indicates that the cost per passenger mile initially drops off rapidly as average trip distance increases, and continues to decrease gradually for still longer average trips. However, trip distance also affects passenger miles. Its full effect is discussed and graphed in the next section.

The main organisational difference between taxi companies is whether or not they are dispatch associations. The coefficient of the dummy variable for dispatch associations is highly significant in all three models, and indicates that the costs for the dispatch association are $1.96 per passenger trip, $0.61 per passenger mile, and $0.22 per vehicle mile less than the costs of commission/lease companies. These differences can be explained by the fact that dispatch associations incur costs only for dispatching, administration and office overhead; vehicle-related expenses are incurred by the drivers and are not part of the association costs. The difference in costs between commission and lease companies was not significant in any of the models.

For cost per passenger trip, the distance from the Chicago CBD was significant (t-value = 2.15), and indicated that cost per passenger trip drops about two cents for each mile that the service area is distant from the CBD.

For the cost per vehicle mile, per capita income proved to be significant at the 10% level. Its coefficient indicates that cost per vehicle mile decreases two cents for each $1,000 increase in the per capita income of the service area. This may reflect increased efficiencies induced by increased competition from automobiles in those areas. It may also reflect the more efficient operation achieved for long airport trips, which are more prevalent in higher income areas.

IMPLICATIONS FOR THE ECONOMIES OF SCALE HYPOTHESIS

In order to understand the implications of the models presented in Table 2 for the hypothesis of economies of scale, the effects of the output variables are graphically displayed in this section. The approach taken is to simplify each cost equation, assuming all other variables except those being examined to be constant. The relevant output variables are then allowed to vary, within the range of the data in the sample; this results in a simplified relationship between cost and size. When the effects of the variations in the output variables are graphed, the values of other variables are
assumed to be the median for the sample. The median was used so as not to bias the graphs with extreme points. Variables that are the product or ratio of other variables, e.g., passenger miles and ridership density, were constrained to be within the range of the sample. The value of the dispatch association dummy variable is assumed to be zero. Thus the graphical results display cost estimates for commission/lease companies, excluding driver cost.

Ridership can increase either by an increase in service area or by an increasing ridership within the same service area. Since service area is only significant in the cost per passenger trip model, this is the only model in which the effect of this variable can be examined. The effect is shown in Figure 1. In this graph both service area and ridership have been increased so as to maintain the same ridership density along each curve. It can be seen that cost per trip drops off rapidly as ridership increases to about 50,000 trips per year, and then begins to increase again. Apparently the very small operator cannot use fixed overhead efficiently; but with riderships over 50,000 the operator needs more dispatchers and/or administrators and encounters mounting
coordinated costs. The effect of increasing ridership by increasing ridership density within the same service area is shown in Figure 2. Again a U-shaped cost curve is evident.

The cost per passenger mile model is portrayed graphically for varying riderships and trip distances in Figure 3. Again, within the range of the data in this sample, a U-shaped cost curve is evident. Costs decline rapidly as output is increased at very low levels of passenger miles. Unit costs increase much more gradually above the optimum levels of output.

For the cost per vehicle mile model, the only output variables are total vehicle miles and annual miles per vehicle. This is graphed for changes in vehicles and in miles per vehicle in Figures 4 and 5. It should be noted that the number of vehicles has very little effect on cost per vehicle mile, the difference between one vehicle and five (or 100) being about $0.0002. However, there are strong, virtually linear, economies with increasing annual mileage. This would appear to mean that very small operations are not efficient because vehicles are not used as intensively as in larger operations.
CONCLUSIONS

The results of both the cost per passenger trip and cost per passenger mile models imply a U-shaped average cost curve for small to medium-sized taxicab firms which primarily serve dispatched business. Up to 50–60,000 trips per year, average costs fall. From 75,000 to 250,000 trips per year, average costs increase. The cost per vehicle mile model implies that one reason for decreasing average costs of very small operators is that vehicles are not used as intensively as in larger operations. As the number of vehicles increases, however, further reductions in costs per vehicle mile are relatively small.

Given the uncertainties attached to the coefficient estimates, several implications for public policy result from this analysis. One is that the granting of licences on a municipality basis, which constrains the size of the firms, may not lead to service being provided by a firm of the most efficient size. A licensing scheme involving several municipalities could result in more cost-efficient taxicab service.

Secondly, in areas where the number of trips exceeds 100,000 per year, more than

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3 A model including the 24th and largest firm (ridership of 500,000 trips per year) indicates that average costs for very large firms may be lower. This implication is based on only one observation in this data set, but a study by the Chicago Area Transportation Study (1980) has indicated that two other very large firms located in the city of Chicago may also have significantly lower average costs.
For formulae see Appendix.

**FIGURE 4**

*Taxicab Cost per Vehicle Mile Model: Effect of Number of Vehicles*

one firm can provide service efficiently. Thus, deregulation of larger markets probably would not result in monopoly providers.

Finally, if public policy is oriented toward relying on small taxi firms to provide the elderly and handicapped with special transport services, more efficient operations will result if the resultant increased ridership causes smaller firms to become closer to optimum size.

**APPENDIX**

The figures in the text were generated from the following formulae:

*Figure 1*

Line 1: \[ CPT = 1.32088 + 0.0066R + \frac{16.872}{R} \]

Line 2: \[ CPT = 1.23709 + 0.0066R + \frac{16.872}{R} \]
For formulae see Appendix.

**Figure 5**

*Taxicab Cost per Vehicle Mile Model: Effect of Annual Mileage per Vehicle*

Line 3: \( CPT = 1.06951 + 0.0066R + \frac{16.872}{R} \)

*Figure 2*

Line 1: \( CPT = 1.34881 + 0.0061345R + \frac{16.872}{R} \)

Line 2: \( CPT = 1.34881 + 0.0054828R + \frac{16.872}{R} \)

Line 3: \( CPT = 1.34881 + 0.003807R + \frac{16.872}{R} \)
Figure 3

Line 1: \[ CPM = 0.7459 + 0.0005\ PM + \frac{16.116}{PM} \]

Line 2: \[ CPM = 0.495 + 0.0005\ PM + \frac{16.116}{PM} \]

Line 3: \[ CPM = 0.275 + 0.0005\ PM + \frac{16.116}{PM} \]

Figure 4

\[ CVM = 0.2755 + \frac{0.0101}{VM} \]

Figure 5

\[ CVM = 0.4205 + \frac{0.005}{M} - 0.0029M \]

where:

- \( CPT \) = Cost per passenger trip
- \( R \) = Annual ridership (thousands)
- \( CPM \) = Cost per passenger mile
- \( PM \) = Passenger miles (thousands)
- \( CVM \) = Cost per vehicle mile
- \( VM \) = Total vehicle miles (thousands)
- \( M \) = Annual miles per vehicle (thousands)

REFERENCES


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