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THE DOMESTIC TRANSPORTATION MARKET

IN 1963, UNITED STATES households and firms produced 257 million domestic trips. Two out of every three American adults participated in this production process, and the average number of travelers per trip was 1.9. One out of every five domestic trips was produced by firms for business purposes; the rest were produced by households for personal purposes.[1]

The demand for trips is directly related to income. Only one out of every ten adults with an income under $2,000 belongs to the class of frequent travelers (i.e., travelers who take five trips or more annually), while about half of the adults with an income over $15,000 belong to this class. Alternatively, over one-half of all adults with an income under $2,000 did not take any trip during 1962, while only one-sixth of the adults in the $15,000+ class were nontravelers.[2]

[1] These figures are based on two transportation surveys conducted in the late fifties and early sixties. The first survey, conducted by the Social Research Center, Ann Arbor, Michigan, is summarized in J. B. Lansing and D. M. Blood's *The Changing Travel Market,* Ann Arbor, Michigan, 1964. The second survey, conducted by the Bureau of the Census, is summed up in *Census of Transportation, 1963,* Vol. I, *Passenger Transportation Survey,* Washington, D.C., 1966. For our purposes we can ignore the slight differences in the populations covered by these two surveys: (a) the Michigan survey covers the adult population in 1962, while the Census survey covers the whole population in 1963; and (b) the Michigan survey defines a trip as any travel to a place at least 100 miles away by one or more members of the household, while the Census survey also includes trips of less than 100 miles if they involve staying out of town overnight or longer. Both surveys exclude commuters.

[2] Lansing and Blood, *op. cit.,* pp. 14–15, 217.

TABLE 1

Distribution of Total Trips and Total Travelers by Means of Transportation and Distance of Trip: 1963

Distance of Trip (miles)	All Transportation	Auto	Bus	Air Carrier	Railroad	Other
			TRIPS			
Distribution by Means of Transportation						
All trips	100	84	4	5	3	4
U.S. trips						
Under 50	100	90	6	—	1	3
50—99	100	92	3	—	3	2
100—199	100	90	4	2	2	2
200—499	100	72	5	13	4	6
500 or more	100	47	4	33	8	8
Outside U.S.[a]	100	59	4	21	1	15
Distribution by Distance of Trip						
All trips	100	100	100	100	100	100
U.S. trips						
Under 50	23	25	29	—	10	21
50—99	23	26	18	—	24	10
100—199	28	30	26	10	22	19
200—499	16	14	18	37	24	25
500 or more	8	4	7	45	19	17
Outside U.S.[a]	2	1	2	8	1	8
			TRAVELER			
Distribution by Means of Transportation						
All trips	100	89	3	4	2	2
U.S. trips						
Under 50	100	94	3	—	1	2
50—99	100	95	2	—	2	1
100—199	100	93	2	1	2	2
200—499	100	82	3	8	3	4
500 or more	100	61	3	23	7	6
Outside U.S.[a]	100	67	2	16	1	14
Distribution by Distance of Trip						
All trips	100	100	100	100	100	100
U.S. trips						
Under 50	21	22	27	1	8	19
50—99	25	26	19	—	21	9
100—199	29	30	26	9	23	18
200—499	16	15	18	35	25	25
500 or more	7	5	8	46	22	18
Outside U.S.[a]	2	2	2	9	1	11

SOURCE: *Census of Transportation, 1963*, Vol. I, *Passenger Transportation Survey*, p. 18.
[a]Includes destinations in Canada, Mexico, and U.S. outlying areas.

The number of trips is inversely related to distance. Almost one half of all trips are overnight trips to a distance of under 100 miles, but only 8 per cent of the trips range beyond 500 miles (see Table 1). This relationship can be interpreted as a negative price effect, provided there is not a negative correlation between the attractiveness of the point of destination and the trip's distance.

The bulk of all trips was produced by private cars. Six out of every seven trips and nine out of every ten traveler-trips used this mode. Consequently, the share of public transportation and the share of the individual common carriers in the transportation market were quite small. The air carriers, the most popular among the common carriers, did not account for more than 5 per cent of the trips and 4 per cent of the traveler-trips. The respective shares of the bus and the railroads were 4 and 3 per cent of the trips, and 3 and 2 per cent of the traveler-trips. Only one out of every nine adults traveled by air, about one out of every twelve traveled by bus, and one out of every fourteen traveled by train.

What are the factors determining the modal split? The passenger's choice of mode depends on his price of time, and the time and money outlays involved in traveling by the various modes. There is no information on the passenger's price of time, and the data on the time and money inputs suffer from gross inaccuracies. The elapsed time of a trip depends not only on the mode used, but also on the distance to and from the terminals (i.e., airports, railroad stations, and bus terminals), the specific schedule, the number and length of stops en route, weather conditions, road congestion, etc. Similarly, the money outlays depend on a multiplicity of factors: class of service (e.g., first class vs. coach), additional en route expenditures (e.g., food, lodging), etc. In the absence of detailed data, one can use some rough approximations—the elapsed time of the fastest scheduled trip and the money outlays on coach service.[3] These data, though crude, provide sufficient

[3] The data relating to air trips are based on *The Quick Reference Official Airline Guide*, 1963. The rail and bus data were extracted from *The Official Guide of the Railways*, 1963, and from *Russel's Official National Motorcoach Guide*, 1963, respectively. Data on rail and bus fares were obtained directly from the New York Central and the Pennsylvania Railroad companies and from the Greyhound and Trailways bus companies. Auto traveling data are based on American Automobile Association estimates. Both rail and bus data do not include the time and money inputs involved in reaching and leaving the terminals.

information for the interpretation of the more obvious patterns of the modal split.

As indicated in the last chapter, both time and money outlays are linear functions of the distance traveled. Relating the data for these outlays for 38 routes originating in New York to their corresponding distances we found

$$
\begin{aligned}
T_A &= \underset{(0.08)}{2.56} + \underset{(.00008)}{.00210}\, M + U \qquad & r^2 = .95 \\
T_R &= \underset{(0.54)}{-0.59} + \underset{(.00050)}{.02542}\, M + U \qquad & r^2 = .99 \\
T_B &= \underset{(0.58)}{-0.32} + \underset{(.00054)}{.02841}\, M + U \qquad & r^2 = .99 \\
T_C &= 0.89 + \underset{(.00041)}{.02817}\, M + U \qquad & r^2 = .99 \\
P_A &= \underset{(.75)}{7.04} + \underset{(.0007)}{.06006}\, M + U \qquad & r^2 = .99 \\
P_R &= \underset{(1.52)}{5.59} + \underset{(.0014)}{.04265}\, M + U \qquad & r^2 = .96 \\
P_B &= \underset{(.51)}{3.56} + \underset{(.0005)}{.03264}\, M + U \qquad & r^2 = .99 \\
P_C &= .072\ M,
\end{aligned}
\tag{4.1}
$$

where A, R, B, and C denote air, rail, bus, and private car, respectively, P_i is the fare (in dollars), T_i is the elapsed time (in hours), and M is the shortest air distance (in miles). Air transportation is by far the fastest of all modes. The plane's effective speed of 480 miles per hour is more than ten times as fast as any ground transportation, the train's effective speed being 40 mph and the motor vehicle's effective speed being 35 mph.[4] A thousand mile trip that lasts less than 5 hours by

[4] The effective speed is not merely a function of cruising speed, but also of the number and length of stops, and the degree of circuity.

plane lasts close to 25 hours by rail and over 28 hours by the automotive modes.

The opposite hierarchy is observed when we consider public transportation's pecuniary costs. The plane, the fastest among the modes, is the most expensive, while the bus, the slowest, is the cheapest. However, the differences between the pecuniary costs of the public modes of transportation are much smaller than the differences in elapsed time. A one thousand mile trip costs $36 by bus, $48 by train, and no more than $67 by plane.

TABLE 2

Distribution of Total Trips and Total Travelers by Means of Transportation and by Family Income: 1963

(per cent)

Annual Family Income (dollars)	All Transportation	Auto	Bus	Air Carrier	Railroad	Other
			TRIPS			
Distribution by Means of Transportation						
All income	100	84	4	5	3	4
Under 1,000	100	83	8	1	2	6
1,000—1,999	100	81	7	2	3	7
2,000—2,999	100	83	9	2	3	3
3,000—3,999	100	85	6	2	4	3
4,000—4,999	100	86	5	3	3	3
5,000—5,999	100	90	3	3	2	2
6,000—7,499	100	87	3	3	4	3
7,500—9,999	100	88	2	4	2	4
10,000—14,999	100	78	2	13	3	4
15,000 and over	100	74	2	17	2	5
Income not reported	100	79	6	8	5	2
Distribution by Family Income						
All income	100	100	100	100	100	100
Under 1,000	6	6	12	1	4	9
1,000—1,999	5	5	9	2	5	10
2,000—2,999	5	5	12	1	6	4
3,000—3,999	7	6	10	2	9	6
4,000—4,999	10	10	12	5	11	7
5,000—5,999	10	11	6	5	8	7
6,000—7,499	14	14	11	7	19	11
7,500—9,999	16	17	8	12	10	15
10,000—14,999	12	12	7	30	10	15
15,000 and over	8	7	3	24	6	11
Income not reported	7	7	10	11	12	5

(*continued*)

TABLE 2 (Cont.)

Annual Family Income (dollars)	All Transportation	Auto	Bus	Air Carrier	Railroad	Other
			TRAVELER			
Distribution by Means of Transportation						
All income	100	89	3	4	2	2
Under 1,000	100	85	8	1	1	5
1,000—1,999	100	85	6	2	2	5
2,000—2,999	100	89	6	1	2	2
3,000—3,999	100	91	4	1	2	2
4,000—4,999	100	91	4	2	2	1
5,000—5,999	100	93	2	2	2	1
6,000—7,499	100	92	2	2	2	2
7,500—9,999	100	93	1	3	1	2
10,000—14,999	100	85	2	8	2	3
15,000 and over	100	80	1	13	2	4
Income not reported	100	86	3	5	4	2
Distribution by Family Income						
All income	100	100	100	100	100	100
Under 1,000	4	3	11	1	3	8
1,000—1,999	4	4	9	2	5	8
2,000—2,999	5	5	11	1	5	5
3,000—3,999	7	7	10	3	8	5
4,000—4,999	10	10	13	5	11	6
5,000—5,999	11	12	7	5	10	7
6,000—7,499	15	16	11	8	18	11
7,500—9,999	17	18	8	12	10	16
10,000—14,999	13	12	8	28	11	17
15,000 and over	7	6	3	25	7	12
Income not reported	7	7	9	10	12	5

SOURCE: The advance report of the *1963 Census of Transportation, Passenger Transportation Survey—National Travel, 1963 Summary.*

This reverse order of ranking for the three common carriers when ranked by time and by money outlays rules out the possibility of a uniform choice for all travelers. For most of the trips ranging beyond 135 miles there is a trade-off between time and money. The crucial factor determining the passenger's choice is his price of time, which is a monotonically increasing function of income. The passenger's tendency to use the fastest mode, the plane, is expected to increase with his income. Thus, while travelers with an income under $4,000 use this mode for less than one-fiftieth of their trips, a traveler with an income of $15,000 or more is likely to use it in more than one-sixth of all cases (see Table 2). Conversely, while over 7 per cent of the trips of the low income group were conducted by bus, this mode was used for only 2 per cent of the trips by the high income group.

A similar pattern is observed when we examine the effect of the purpose of the trip on the modal split. Traveling time can be more easily transformed into work when the trip is for business purposes than when it is for personal purposes. The foregone earning and the opportunity cost of time may, therefore, be higher in the first instance, and so may be the passenger's inclination to use the faster mode. These expectations are borne out by Table 3. Air transportation is used on no more than 3 per cent of all personal trips, as compared with 17 per cent of the business trips. On the other hand, only 2 per cent of business trips are conducted by bus, as compared with 5 per cent of the personal trips.[5]

The unique hierarchy of time and pecuniary costs is blurred, somewhat, if private modes of transportation are included in the analysis. The tacit assumption that the production function of trips is linear homogeneous in the time and money inputs serves as a close approximation in the case of public modes of transportation. In this case, the marginal costs of a trip are constant, and do not vary with the number of travelers participating in the trip. The assumption of constant returns to scale is not satisfied when a private mode of transportation is used in the production process. The pecuniary costs of a private mode are insensitive to the size of the party participating in the trip, as long as the party size does not exceed the capacity of the vehicle used (say, $n \leq 5$ in the case of a private car). The average cost per passenger is a decreasing function of the party size. A group of n passengers, who assign a high value to traveling en bloc, prefers a public mode of transportation (say, air transportation) to traveling by car only if the costs of the trip by car, for the group as a whole, exceed the trip's cost by air,

$$\sum_{i=1}^{n} \Pi_{iA} < \sum_{i=1}^{n} \Pi_{iC} \Leftrightarrow \bar{K} > \frac{P_A - (P_c/n)}{T_C - T_A}, \tag{4.2}$$

where $\bar{K} = \sum_{i=1}^{n} K_i/n$ is the group's average price of time. Given the average

[5] The interpretation of Tables 2 and 3 is somewhat oversimplified since it tends to overlook existing spurious correlations. Passenger's income and the trip's purpose and distance do not act independently. The two-way classification of the Bureau of the Census' published data does not allow the separation of the effects of these three variables.

price of time of the group, the tendency to travel by a public mode decreases with party size. Thus, as Table 4 indicates, over one half of the auto trips involved at least a party of two, while only one out of every six trips by public transportation involved a party of a similar size. Put differ-

TABLE 3

Distribution of Total Trips and Total Travelers by Means of Transportation and by Purpose of Trip: 1963

Purpose of Trip	All Transportation	Auto	Bus	Air Carrier	Railroad	Other
			TRIPS			
Distribution by Means of Transportation						
All purposes	100	84	4	5	3	4
Business	100	74	2	17	2	5
Visits to friends and relatives	100	86	5	2	4	3
Other pleasure	100	90	3	3	1	3
Personal or family affairs	100	83	6	3	3	5
Distribution by Purpose						
All purposes	100	100	100	100	100	100
Business	21	19	9	64	18	30
Visits to friends and relatives	40	41	50	16	50	31
Other pleasure	21	23	16	11	11	17
Personal or family affairs	18	17	25	9	21	22
			TRAVELER			
Distribution by Means of Transportation						
All purposes	100	89	3	4	2	2
Business	100	77	1	15	2	5
Visits to friends and relatives	100	91	3	2	2	2
Other pleasure	100	93	2	2	1	2
Personal or family affairs	100	88	4	2	3	3
Distribution by Purpose						
All purposes	100	100	100	100	100	100
Business	14	12	8	56	15	26
Visits to friends and relatives	45	46	50	19	51	32
Other pleasure	25	26	18	15	12	21
Personal or family affairs	16	16	24	10	22	21

SOURCE: *Passenger Transportation Survey*, p. 16.

TABLE 4

Distribution of Total Trips and Total Travelers by Means of Transportation and by Size of Party: 1963

(per cent)

Size of Party	All Trans-portation	Auto	Bus	Air Carrier	Rail-road	Other
			TRIPS			
Distribution by Means of Transportation						
All parties	100	84	4	5	3	4
Parties of						
1 person	100	75	7	9	4	5
2 persons	100	91	2	3	2	2
3 or 4 persons	100	96	1	1	1	1
5 or more persons	100	98	—	1	—	1
Distribution by Size of Party						
All parties	100	100	100	100	100	100
Parties of						
1 person	55	49	86	85	77	81
2 persons	23	25	10	11	15	13
3 or 4 persons	16	19	4	3	7	5
5 or more persons	6	7	—	1	1	1
			TRAVELER			
Distribution by Means of Transportation						
All parties	100	89	3	4	2	2
Parties of						
1 person	100	75	7	9	4	5
2 persons	100	91	2	3	2	2
3 or 4 persons	100	96	1	1	1	1
5 or more persons	100	98	—	1	—	1
Distribution by Size of Party						
All parties	100	100	100	100	100	100
Parties of						
1 person	29	24	72	70	58	62
2 persons	24	25	16	18	22	21
3 or 4 persons	30	32	10	8	17	13
5 or more persons	17	19	2	4	3	4

SOURCE: *Passenger Transportation Survey*, p. 24.

ently, while less than one-quarter of all car travelers traveled without accompaniment, over two-thirds of the travelers by public transportation went singly. Given the party size (n), the time and money outlays (P_A, P_C, T_A, and T_C), the tendency to travel by car is inversely related to the average price of time. In particular, when the group consists of m adults whose price of time is K, and $(n - m)$ children whose price of time is zero, then $\bar{K} = \frac{m}{n} K$, and the travelers' inclination to use a car is directly related to the percentage of children in the group.[6]

An additional factor enhancing the comparative advantage of the car is its effect on other inputs used in the production of the visit. The private car satisfies the traveler's need for mobility at the point of destination. A traveler by public modes of transportation may obtain the same mobility but only at additional costs (e.g., the costs of intracity public transportation, taxi, or rented car). Let R denote these additional costs, then the public mode is used only if

$$\bar{K} > \frac{P_A - (P_C - R)/n}{T_C - T_A}. \qquad (4.3)$$

The comparative advantage of the car is directly related to R. Direct evidence of this relationship is provided by the Michigan survey and by other surveys.[7] Some indirect evidence is contained in Table 3. The need for an auxiliary means of transportation varies with the purpose of the trip, being of special importance in the case of pleasure trips (e.g., sight-seeing and other forms of outdoor recreation). We would expect, therefore, as Table 3 duly testifies, that the percentage of auto trips for pleasure purposes (recorded in the table as "other pleasure") exceeds the share of auto trips for any other purpose of trip. Ninety per cent of all pleasure trips were conducted by car compared with 82 per cent for all other purposes of trip.[8]

[6] These conclusions are supported by the Michigan survey findings, Lansing and Blood, *op. cit.*, pp. 44, 70, 71.

[7] *Ibid.*, p. 44, and Opinion Research Corporation, *The Domestic Travel Market*, Vol. I, Princeton, N.J., 1962.

[8] A further factor affecting the choice of car is the accounting method used by the driver. According to the American Automobile Association's "Your Driving Costs," the marginal pecuniary costs in 1963 (gas and oil, tires and maintenance) were 3.7¢ per mile. The average costs for a car that covers 10,000 miles annually were 11.6¢ per mile. We used an estimate of 7.2¢ per mile, which was according

The time and money differential varies with the distance of the trip and so does the comparative advantage of the various modes. A passenger who travels in a group of size n (m of whom are adults whose price of time is K) prefers air transportation to traveling by car if his price of time

$$K > \frac{n}{m} \frac{7.04 + [.06006 - (.072/n)]M}{-1.68 + .02606M} = K^*_{A-C}, \tag{4.4}$$

where K and K^* are expressed in terms of dollars per hour, and R is assumed to equal zero. He prefers air to rail if

$$K > \frac{1.45 + .01741M}{-3.15 + .02331M} = K^*_{A-R}, \tag{4.5}$$

and he prefers air to bus if

$$K > \frac{3.48 + .02742M}{-2.88 + .02631M} = K^*_{A-B}. \tag{4.6}$$

An increase in distance increases the time differential more than the money differential, resulting in a decline of K^*.[9] The passenger's tendency to use the faster mode increases with distance. Put differently, the switching distance from ground to air transportation (M^*) is inversely related to the passenger's price of time.

The three equations describing the relationship between K^* and M are plotted in Charts 1, 2, and 3. Chart 1 traces the factors affecting the choice between air transportation and private car [equation (4.4), given different values of n and m]. The marginal pecuniary costs of a passenger who travels by car without accompaniment ($n = 1$) exceed those of an air traveler. An increase in distance increases the time differential and cuts the money differential between air and car, resulting in an accelerated dissipation of the car's comparative advantage. For any distance beyond

to the Opinion Research survey, *op. cit.*, the average cost the drivers thought they were paying. This estimate is very close to the average compensation paid by firms (8¢ per mile).

[9] Let $T_i = \alpha_{0i} + \alpha_{1i}M,$
$P_i = \beta_{0i} + \beta_{1i}M,$

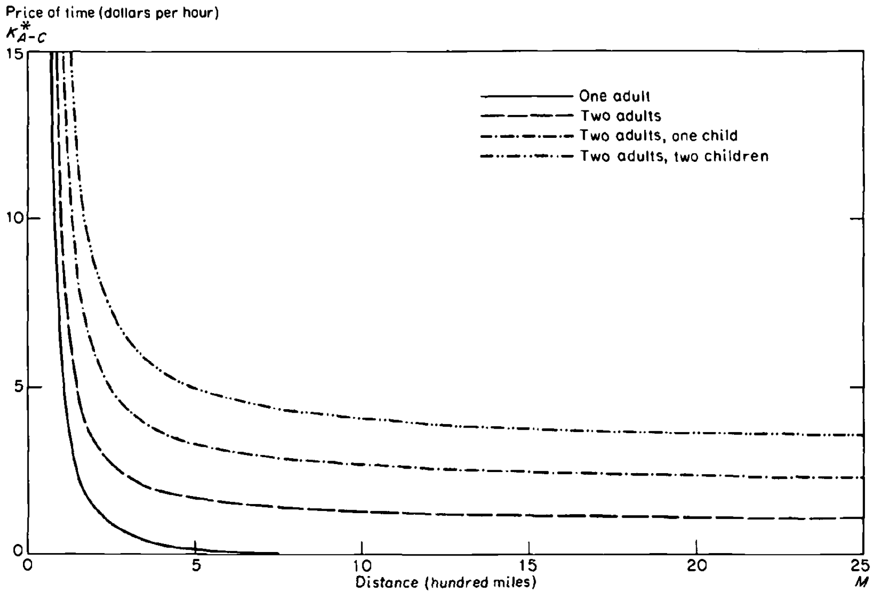
then

$$\frac{\partial K^*_{i-j}}{\partial M} < 0 \Leftrightarrow (\alpha_{0j} - \alpha_{0i})(\beta_{1i} - \beta_{1j}) < (\alpha_{1j} - \alpha_{1i})(\beta_{0i} - \beta_{0j}).$$

This condition is satisfied in all three cases (4.4), (4.5), and (4.6).

CHART 1

Factors Affecting the Choice Between Air and Private Car Transportation

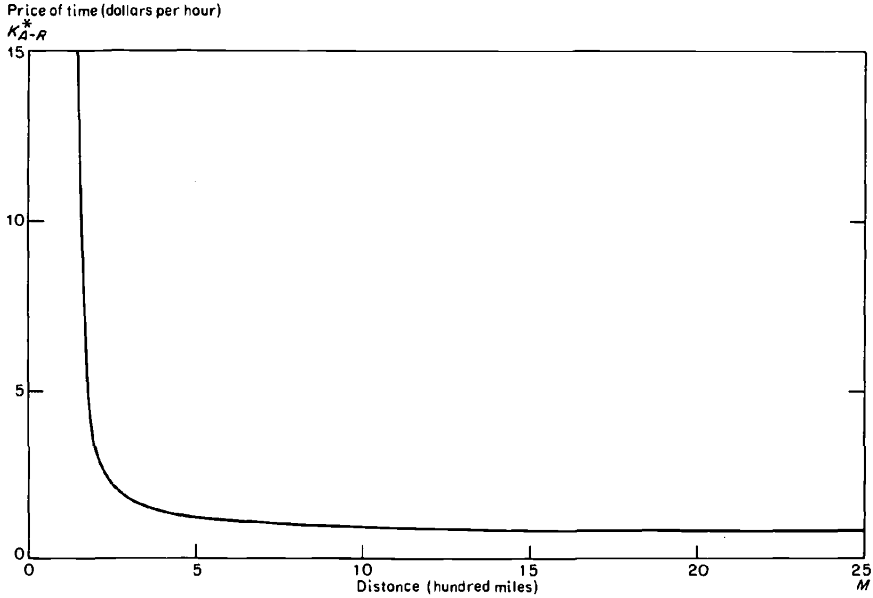


590 miles the pecuniary costs to a single traveler by car exceed those by plane, and air transportation becomes both faster and cheaper. When the party size exceeds one, the money differential between air and car increases with distance, though at a slower rate than the increase in the time differential. K^* drops very sharply in the interval $0 < M < 200$, the decline becomes more gradual for the range of 200 to 600 miles, and K^* becomes almost insensitive to changes of distance beyond 600 miles. A similar pattern is observed in Charts 2 and 3, which describe the factors influencing the choice between air and rail and between air and bus, respectively. Thus, relatively small increases in income and in the price of time are sufficient to secure the long range travel market for the airlines, but relatively large increases are required to loosen the ground transportation's hold on the short range market.

Table 1 describes the effect of distance on the modal split. Private cars are used on nine out of ten trips to a distance less than 200 miles, but on less than one half of the trips beyond 500 miles. Air trips, on the other hand, constitute less than one out of every one hundred short

CHART 2

Factors Affecting the Choice Between Air and Rail Transportation



range trips, as compared with one-third of the long range trips. The Michigan survey provides a more detailed breakdown of the trips according to distance and party size. These data show that nonbusiness travelers prefer auto to air in more than seven out of ten trips when the distance exceeds 500 miles. Auto is preferred to air in nine out of ten trips when the party consists of two or more travelers, but it is chosen in only three out of ten cases when the traveler has to go alone.[10]

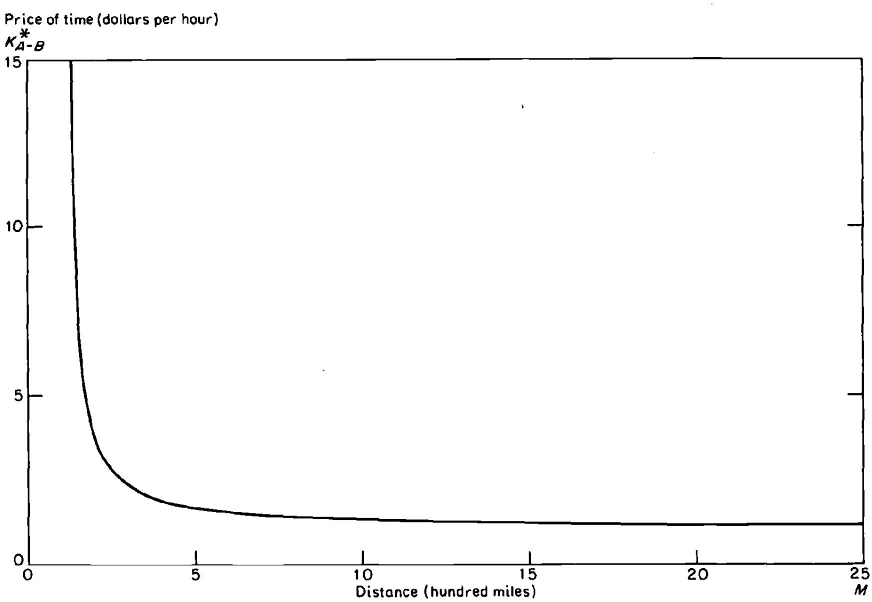
The switching distance (M^*) decreases with the price of time, resulting in an observed inverse relationship between the passenger's income and the range of his air trip.[11] Only 21 per cent of the air travelers going less than 250 miles have an income of less than $10,000. This income group comprises 31 per cent of the air travelers when the

[10] Lansing and Blood, *op. cit.*, p. 55 and Table 43, p. 248.

[11] The Port of New York Authority, *New York's Domestic Air Passenger Market, April 1963 through March 1964,* New York, May 1965, p. 15.

CHART 3

Factors Affecting the Choice Between Air and Bus Transportation



distance exceeds 800 miles. Business travelers assign a higher value to their time than personal travelers with the same income, and tend, therefore, to enter the air travel market sooner. The incidence of personal travelers increases with the length of the haul. The share of non-business air travelers is less than one half of the share of business air travelers when the distance is less than 800 miles, but the two shares are equal beyond that distance.[12]

A passenger prefers rail to bus if

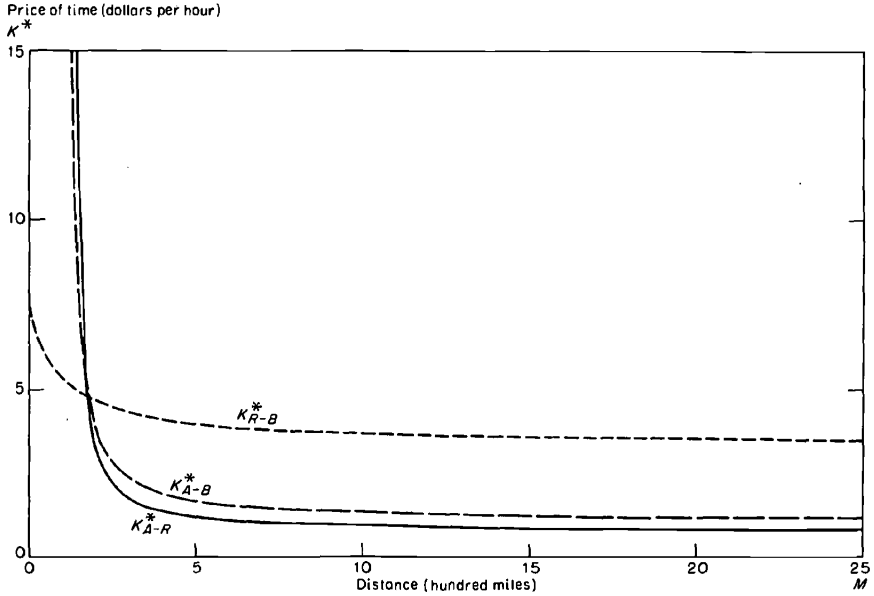
$$K > \frac{2.03 + .01001M}{.27 + .00300M} = K^*_{R-B}. \tag{4.7}$$

Combining equations (4.5), (4.6), and (4.7), we obtain a further insight into the factors affecting the choice of public mode of transportation. Chart 4 shows the effect of distance and the price of time on

[12] *Ibid.*

CHART 4

Factors Affecting the Choice Between Air, Rail, and Bus Transportation



the three-way choice of air, rail, or bus. For example, a passenger prefers to use air rather than rail transportation for a trip of 150 miles only if his price of time exceeds \$11.80 per hour, he prefers air to bus if his price of time exceeds \$7.10 per hour, and he prefers rail to bus if his price of time exceeds \$5.30 per hour. Bus transportation is, therefore, used for 150 mile trips only by individuals whose price of time is less than \$5.30 per hour, rail transportation by individuals whose price of time is between \$5.30 and \$11.80 per hour, and air transportation by individuals whose price of time exceeds \$11.80 per hour. Air transportation does not offer any time saving relative to rail as long as the distance of the trip is less than 135 miles. The public transportation travel market for a trip of less than 135 miles is, therefore, divided between the bus, which serves the low income passengers, and the railroad, which serves the high income passengers. Air carriers become an effective competitor only for a trip beyond 135 miles, cutting sharply into the railroad's share of the market. The railroad is squeezed out of the market when the distance of the trip exceeds 176 miles. When the distance is 176 miles a passenger prefers rail over the bus only if his price of time exceeds $4.70 per hour. However, if his price of time exceeds $4.70 per hour he prefers air to rail, resulting in the elimination of rail from the competition. The travel market for a distance beyond 176 miles is divided between the bus and the airline industry. Only a passenger whose price of time is less than $1.00 per hour will always use bus. The recent decision by some railroad companies to stop all passenger services for a distance beyond 200 miles,[13] as well as the great secular decline of the railroads' share in the passenger transportation market, is consistent with the prediction of this simple model.

Finally, Tables 1 and 2 and Charts 1 and 3 provide a crude measure of the relationship between the price of time and hourly earnings. Table 1 indicates that about 70 per cent of all common-carrier travelers to a distance exceeding 500 miles use air transportation. Given the income distribution of these travelers (Table 5), and assuming that the choice of mode is made solely on the basis of income, the minimum family income of air travelers is $4,700. The corresponding hourly earnings are $2.20 per hour. The income figures are based on the interpolation of data presented in Table 5.[14] Figure 7 suggests that the minimum price of time of air travelers going more than 500 miles is between $1.10 and $1.70 per hour. Assuming an average value of $K^* = \$1.40$ per hour, the price of time is found to be about 60 per cent of the traveler's hourly earnings.

A similar relationship is observed if one examines the modal split between auto and air travelers for the distance between 200 and 500 miles. The private car dominates this range, constituting 91 per cent of the combined traveler-trips of auto and air. Following our previous assumption, the minimum income of air travelers for this distance is $14,400 and their minimum hourly earnings are $3.90. Assuming that the average party size of auto travelers equals two (two being the average party size of auto travelers for all distances), the minimum price of time of air travelers is about $2.30 per hour, i.e., about 60 per cent of their hourly earnings.

[13] *New York Times,* July 27, 1966.

[14] The relationship between family income and hourly earnings is described in the next chapter.

TABLE 5

Distribution of Total Travelers by Means of Transportation and by Family Income: 1963

(per cent)

Annual Family Income (dollars)	Common Carrier Travelers		Auto and Air Travelers	
	Percentage	Cumulative Percentage	Percentage	Cumulative Percentage
All Income	100.0		100.0	
Under 1,000	5.3	5.3	3.1	3.1
1,000—1,999	5.6	10.9	4.2	7.3
2,000—2,999	5.8	16.7	5.2	12.5
3,000—3,999	7.2	23.9	7.4	19.9
4,000—4,999	10.0	33.9	10.5	30.4
5,000—5,999	7.5	41.4	12.6	43.0
6,000—7,499	12.5	53.9	16.9	59.9
7,500—9,999	11.4	65.3	19.1	79.0
10,000—14,999	19.5	84.8	13.7	92.7
15,000 and over	15.2	100.0	7.3	100.0

SOURCE: Table 2.

A somewhat higher estimate of the ratio of the price of time to hourly earnings is reached when one analyzes the auto-air split of travelers going more than 500 miles. At this range the share of auto travelers falls to 73 per cent, implying that the air traveler's minimum income and minimum hourly earnings are $9,200 and $3.00 per hour, respectively. According to the Michigan survey, the average number of auto travelers in a party for this range is three. Assuming that this party consists of two adults and a child, the minimum price of time of air travelers is, according to Chart 1, about $2.70 per hour, i.e., about 90 per cent of their hourly earnings.[15]

[15] The computation of the average party size is based on Lansing and Blood, *op. cit.*, Table 43, p. 248. Had we assumed the same party size for auto trips of 200 to 500 miles, the estimate of the minimum price of time of air travelers and the ratio of this price to hourly earnings would have to be raised to $4.40 and $1.10 per hour, respectively.

The last estimate agrees very well with an estimate based on the distribution of travelers using public modes of transportation for a distance of between 200 and 500 miles. Air carriers capture 57 per cent of this market, suggesting that the minimum income of air travelers is $6,200 and minimum hourly earnings are $2.60. The minimum price of time of these travelers is about $2.40 per hour (see Chart 3), i.e., about 90 per cent of their hourly earnings.