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TIME-SAVED AS A DISCRETIONARY MANAGEMENT TOOL FOR THE AIRLINES

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PRIOR to air jet-powered equipment a non-stop flight from New York to Los Angeles aboard a conventional DC-7 aircraft required approximately eight hours and forty-five minutes. An eastbound flight with the assistance of more favorable winds made the excursion in about seven hours and fifteen minutes. With jet equipment the elapsed flying time between these cities was cut by about thirty-eight per cent in both directions. The westbound flight consumed about five hours and twenty-five minutes; eastbound, four hours and thirty minutes. The transcontinental traveler had saved three hours and twenty minutes on his westbound journey and two hours and forty-five minutes on the eastbound trip.

A two-stop flight in a DC-7 aircraft between New York and Los Angeles would have required an additional two hours and forty minutes. Under these circumstances, non-stop jet equipment would have saved six hours westbound and five hours and twenty-five minutes eastbound, or about forty-three and forty-seven per cent, respectively.[1]

Non-stop or reduced-stop scheduling and faster aircraft have been employed since 1938 to improve airline service as technology, regulatory approval, and financing became available. These means of reducing the time factor were eagerly sought and largely achieved following World War II. Since that time the Civil Aeronautics Board has been occasionally criticized for having granted some of these non-stop awards. The apparent effect had been to superimpose a new route network upon that previously authorized. Supposed generating capabilities of faster air service influenced these decisions.

A second wave of equipment obsolescence hit the industry a little over a decade later, beginning about 1958. It was thought that faster equipment, among other things, would contribute to air traffic growth. The common denominator in these decisions, whether made by CAB or airline management, was the time factor and its impact on air traffic growth. Non-stop awards, on the one hand, could result in reduced flying time by avoiding intermediate stops and terminal time delays. Such authorization could in some instances overcome route circuity. Faster equipment, on the other hand, could affect actual in-flight time from take-off to landing. The implicit assumption was that if travelers could somehow save time, they would increasingly tend to utilize air service.

The value of time to the traveler is shrouded by individualistic differences and varying circumstances of business and personal travel. In order to gain some insight into the efficacy of time-saved, the Phoenix air market was investigated over a decade of air travel into and out of this large air travel market. The objective was to determine to what extent time-saved

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[1] Official Airline Guide, March, 1958, and March, 1961.

over competing modes of travel was a contributing factor to air traffic growth.[2]

The Phoenix metropolitan area appeared to be an ideal hub area for this type of study. It had grown over the decade at an average rate of about eight per cent. Being among the fastest growth areas in the country, significant changes in air service were also characteristic of this period.

I. Methods and Data Used

Time-saved was defined in terms of the fastest airline schedule between two points as opposed to the fastest time of a competing mode irrespective of the class of service this may have represented. The competitive features of private automobile travel were computed on the basis of a forty-mile-per-hour speed up to a maximum of twenty hours of driving time. About ten per cent of the city-pairs selected were affected in this way. Airport-to-airport time was adjusted by estimated travel time from airport to city center.

Additional factors were hypothesized as determinants of air traffic in order to measure the *relative* importance of the time-saved factor.[3] Population, income per capita, and income distribution of the metropolitan areas were all considered as possible factors influencing the size of air traffic among city-pairs. These had population at their common factor. Extremely high intercorrelations of from 0.97 to 0.99 were found among these measures. This suggested that income distribution and per capita income were fairly proportionate to population variations. The income distribution factor as measured by the number of households earning over 7,000 dollars per year of disposable personal income, however, showed the highest level of reliability. The standard error of its regression coefficient as a per cent of the value of the coefficient was less than one per cent. It was, therefore, chosen to represent the population and ability-to-pay dimensions of city-metropolitan areas.

The variations in distance separating metropolitan areas were considered in a distance factor computed on the basis of air miles, airport to airport.[4]

Differences in first-class air fares among city-pairs were also analyzed. High intercorrelations of air fares and distances of from 0.96 to 0.97 were found. This suggested that the distance factor could accurately represent differences in cost. The high intercorrelations also suggested that the increase in air fare, as distance increased, was fairly proportionate to such increases in distance.

Regression and correlation analyses were made with data in logarithmetic form in order to consider percentage differences rather than absolute differences in values of variables.

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[2] A. W. Schoennauer, *An Analysis into the Time-Saved Factor as a Generator of Air Passenger Traffic,* doctoral dissertation, U.C.L.A., 1962. Additional research beyond the dissertation was made possible by a grant of funds by Arizona State University. This article presents a composite of these findings.

[3] Numerical quantities for these measures were secured directly or computed from data provided in Sales Management, May 10, 1952, and subsequent May 10th issues through 1961. Sales Management estimates of population and income for metropolitan areas have proved to be highly reliable. For a descriptive discussion of their methods and tests of accuracy see any May 10th issue of this publication.

[4] CAB, Origination-Destination Airline Revenue Passenger Survey, Vol. 3, March, 1952 (Washington: Air Transport Association of America, 1952), pp. 470-475, and subsequent editions through 1961.

The Phoenix segment of the total air market for the years 1952, 1955, 1958, and 1961, was selected for analysis. The first three periods were characterized by a relative high stability in fare levels as well as in type of aircraft flown. The period, 1961, represented a sharp contrast in both fare level and aircraft utilized. Both higher fares and faster equipment characterized that period. One hundred and thirty-six city-pairs met the criteria of representing metropolitan areas, being serviced by railways, and having experienced six or more one-way air trips during the twenty-eight-day time span of the CAB surveys.

Air traffic flow between city-pairs was quantified on the basis of the number of one-way trips to and from the base city.[5] A round trip was considered as two one-way trips. Traffic figures were converted to yearly data by an appropriate constant dependent upon the time span covered by the sample surveys. The statistical computations were performed by computers at the Western Data Processing Center, University of California, Los Angeles.

II. Statistical Results of the Analysis

A high degree of relationship between air traffic and the three independent variables was found for the four time periods. The multiple correlation coefficients ranged from 0.87 to 0.89. This meant that about seventy-six to eighty per cent of the variation in air traffic was explained by distance, income distribution, and time-saved differences.

Distance accounted for an average of seventeen per cent of the variation over the four time periods. When the income distribution factor was entered into the calculations, it accounted for an additional sixty per cent of total variation. When the time-saved factor was considered, it accounted for an average of only slightly over one per cent of the total variation.

These results are particularly significant when viewed over time. Table I shows the lessening importance of the distance factor, the growing importance of income distribution, and some improvement during 1958 and 1961 in the time-saved factor. The distance factor dropped consistently from twenty-one to twelve per cent; income distribution rose consistently from fifty-five to sixty-six per cent; and time-saved showed only a high of 1.9 per cent in 1952, dropped to .3 per cent, and rose successively thereafter to 1.5 per cent.

The relative importance of each of the three variables was also illustrated by the use of the partial correlation coefficient when squared, which showed that part of the variation not explained by other independent variables but accounted for by the new factor when it is considered. The relative position during each year is critical here as well as a comparison of position over time. Income distribution proved to be the outstanding variable, distance followed, and time-saved trailed again. Table II presents this data.[6]

III. Managerial Aspects of the Time-Saved Factor

A significant aspect of the statistical analysis was concerned with the reduction of the time-saved variable into its component parts. Time-saved

[5] *Ibid.*

[6] A complete reference of statistical data and findings, including regression equations, are on file with The American Documentation Institute Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington 25, D.C.

TABLE I.

PROPORTIONAL VARIATION EXPLAINED BY DISTANCE, INCOME DISTRIBUTION, AND TIME-SAVED FACTORS IN ACCOUNTING FOR VARIATIONS IN AIR TRAFFIC VOLUME OVER FOUR TIME PERIODS

FACTOR	TIME PERIOD			
	1952	1955	1958	1961
Distance	21%	20%	15%	12%
Income Distribution	55%	59%	60%	66%
Time-Saved	1.9%	.3%	.6%	1.5%

TABLE II.

UNEXPLAINED VARIATION IN AIR TRAFFIC ACCOUNTED FOR BY DISTANCE, INCOME DISTRIBUTION, OR TIME-SAVED WHEN ALL VARIABLES BUT THE ONE UNDER CONSIDERATION HAVE BEEN TAKEN INTO ACCOUNT

FACTOR	TIME PERIOD			
	1952	1955	1958	1961
Income Distribution	72%	74%	71%	76%
Distance	37%	38%	25%	28%
Time-Saved	8%	2%	2%	7%

contained both discretionary and non-controllable elements insofar as management would be concerned. The time-saved factor was a composite of a distance dimension, an airline equipment dimension, number of stops enroute, terminal time, as well as policy decisions affecting in transit time of competing modes.

In order to isolate the discretionary from non-discretionary elements, the distance dimension was considered in a separate distance factor. In this way when time-saved was introduced into the analysis, after the distance factor had been considered, the additional variation explained by time-saved would not embrace the distance dimension.

Airline equipment remained largely fixed during each time period, and throughout the 1952-1958 time span. The variations in aircraft air-flight speed servicing the 136 city-pairs during any given year did not appear to have been of significant proportions.

Under these analytic adjustments and the circumstances of equipment, the time-saved factor represented only the discretionary elements of the number of stops and terminal time, and the one non-controllable element of competitive mode policy time adjustments.

In order to demonstrate this process, correlation and regression analyses were made on two bases: (1) with only income distribution and time-saved as independent variables and (2) with distance, income distribution, and time-saved as variables. In the two-variable approach, time-saved accounted for an average of twenty per cent of the variation in air traffic. Here time-saved embraced the distance dimension. In the second approach the distance factor accounted for an average of seventeen per cent of the variation and time-saved accounted for an average of one per cent of the variation in air traffic volume. Time-saved was now in its more meaningful dimension, embracing those elements over which management had control. The distance dimension had been separately accounted for. The other element, competitive mode policy decisions affecting intransit time, could be indirectly offset or in some instances used to the advantage of the airline carriers when the effect was to render other mode time in a less favorable position.

IV. An Interpretation of Statistical Results

The significance of these results must be interpreted in view of the conditions and policies existing in the passenger transportation industry at the time. The fare level for the airline industry remained relatively constant with the exception of part of 1958 and thereafter. The average yield for first class passengers per revenue-passenger-mile for all domestic certificated carriers ranged from 5.87 cents in 1952 to 5.19 cents in 1957. The range for coach was 4.17 cents to 4.25 cents.[7] A number of upward adjustments have been made since then.

Air equipment remained relatively fixed from 1952 to the beginning of jet conversion sometime in 1958. Air schedule adjustments were most pronounced with this conversion. Rail schedules, however, showed some deterioration in service after 1954. Abandonments of some trackage, less service, together with poor connecting schedules affected many of the city-pairs analyzed. The statistical results of this study infer that rail service

[7] CAB, Forecast of Airline Passenger Traffic in the United States: 1959-1965. (Washington: CAB, 1959).

deterioration or airline and CAB stop or terminal time adjustments had little effect upon airline traffic growth. Although the time-saved factor's relative importance rose both in 1958 and 1961, its overall position remained unchanged. The slight rise in its 1961 position obviously reflected the equipment change. This slight upward trend remained disappointing, however, when viewed against the reduction in flying time of some thirty-eight per cent by jets as against conventional aircraft. Time-saved, as defined, therefore, appeared to have been incontrovertibly relegated to a minor position of importance at least insofar as this market was concerned.

The extreme importance of the ability to pay factor (income-distribution variable measured by the number of households of a metropolitan area earning over 7,000 dollars per year in disposable personal income) had grown consistently over the four time periods. During 1961, sixty-six per cent of the variation in air traffic was accounted for by this variable, an increase of six per centage points from 1958. This factor consistently ranked first in importance but had never achieved quite the eminence it did during 1961. Its importance consistently increased over the four time periods, despite the fact that average airline fares, deflated, dropped slightly each year from 1952 to, but not including, 1958.[8] This apparent dichotomy may be explained by the tendency of some consumers to regard a price increase in dollar terms rather than real terms. The pre-eminence of this factor seemed to confirm that ability-to-pay best explained the level of air traffic volume between any given city-pair.

The diminishing importance of distance, which accounted for only twelve per cent of the variation in air traffic for 1961, down from twenty-one per cent in 1952, followed logically from the geographical shrinkage accomplished over the past decade by higher air speeds and more modern highways. This suggested that, for example, jet air trips of 500 miles requiring approximately one hour and an air trip of 1500 miles requiring around three hours, may be viewed by many consumers with almost complete impartiality, other things being equal. While an additional 1000 miles could have been considered quite a disadvantage a number of years ago, it could now be viewed in a perspective of only two hours additional ride. With increased flight speeds, distance separating city-pairs is exerting less and less influence in accounting for differences in air traffic among city-pairs.

V. Summary

This analysis has shown that the Phoenix air market, generally, had gained little in traffic growth through discretionary adjustments in stops and terminal time, which were superimposed over an existing reasonable scheduling structure. The important condition to this conclusion is that a reasonable route pattern had existed. Undue circuity, excessive stops, or unduly slow aircraft do not meet the condition set forth. Unilateral changes could benefit an airline through transfer of travelers already a part of the given market. Such adjustments when met by competing airlines would be, however, largely lost. In the long run, only the consumer would have gained by such action.

Equipment conversion appeared also to have contributed little to traffic growth. The purpose of this conversion can be largely explained in terms

[8] *Ibid.*

of competitive necessity. The consumer again had gained, efficiency was forced: the way of private enterprise.

Distance separating city-pairs has exerted a lessening influence over the years. This has suggested that perhaps distance would be more meaningful when measured in terms of air time rather than air miles.

Real traffic growth appeared to be largely a matter of ability-to-pay. Although fare reductions result in an increase in this ability-to-pay, it cannot be deduced *from this study* that fare reductions would automatically lead to any real increase in air traffic. Air fare reductions perhaps could enable a new market to reach the airlines if other deterrants beyond the scope of this study were measured and overcome.

It should be noted that statistical inferences beyond the market analyzed are obviously risky unless market characteristics are quite similar. The market analyzed was largely characterized as a long-haul market and to some extent air traffic was aided by the winter tourist attraction of the region. The average air trip was around 1400 miles as compared with a national average in the five hundred mile-range. Additional statistical studies of major hub market areas could establish a pattern from which action suggestions could be made with greater reliability. If in fact further research verified the findings of this study, then decisions altering time in transit should be based upon considerations other than the supposed traffic generating capabilities of time-saved.