

they could be some 25 to 30 percent below equivalent 1981 CAB mail rates), the U.S. Postal Service could justify airlifting certain categories of surface-rated mails. This could mean more domestic mail being transported by air, but less being transported in scheduled service belly compartments. Once again, this could mean a further erosion of combination aircraft yields. The major carriers will undoubtedly bid for U.S. Postal Service contracts, which probably total more than \$400 million annually, but not all carriers will necessarily get them, whereas all carriers will face continued and increased pressure on the profitability of their passenger operations.

If these challenges are real, the larger airlines will react in a number of ways to counter low-fare, short-haul specialists, medium long-haul low-cost specialists, express-package specialists, forwarder-cargo airline specialists, and other new-entrant carrier specialists. It could take a decade to wage a counter-strategy, and during those years the larger airlines could experience large and continued losses. (This conflict might well be similar to the decades-long battle of the large international scheduled airlines versus the charter carriers on the North Atlantic, where everyone lost.)

Domestically, some of the stronger major airlines, such as United, American, Delta, and Northwest, could eventually win this conflict and force a number of new entrants out of business. To do so, however, will require a sustained erosion of their potential profit base. Furthermore, some of the weaker major airlines will be caught in the middle and may not survive.

As part of the counter-strategy, some of the larger carriers will probably get far larger. They may effect further mergers, integrate with freight

and other specialist concerns, possibly create specialist carriers of their own, and become giants if they can.

The so-called nationals, in order to be viable in the longer term, may also have to form liaisons, mergers, or acquisitions and formulate a difficult strategy of rapid growth without incurring large losses. Long-haul national carriers could merge with medium- and short-haul feeder carriers, for example, or vice versa, and become effective full-service airlines (e.g., Transamerica with Republic, World with Frontier). They also may have to integrate with freight specialists, if possible. There will be a number of failures, and these will not all be new entrants or smaller airlines.

The danger of deregulation in the long term is that it may produce, in the United States, the opposite of what was intended--for example, less competition, half a dozen mammoth air transportation companies, and very few small- or medium-sized carriers (above the regional category).

In the interim, the economic outlook for the larger established airlines during this decade is generally bleak except for a year or two of fair profits--but certainly nowhere near the sustained 15 percent return on investment the industry needs to reequip periodically and to provide effective growth and service. For some carriers the challenge to remain viable will be difficult. Long-range strategic planning and development of innovative concepts have never been more important.

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Discount Fare Market Research, 1981-1983

DONALD J. BENNETT

ABSTRACT

In 1981 and again in 1982-1983 Boeing sponsored surveys of passengers flying on U.S. and Canadian airlines to determine their responses to various proposed discount fare plans. From analysis of these surveys, it is apparent that (a) passengers will use reduced fares, even for small savings, whenever it is convenient for them to do so; (b) passengers who did not use a discount fare listed fare restrictions more often than any other reason; and (c) the ability of passengers to meet restrictions varies greatly depending on the characteristics of the market being considered. Incorporation of these findings into the design of discount fare plans is critical for an airline with an objective of maintaining or increasing

profit levels. Proposed discount fare plans must be carefully evaluated. Market research is necessary to determine discount levels that will stimulate additional travel without undermining profitability. Characteristics of travel in the targeted markets must be determined in order to design restrictions that effectively control the tendency of potential full-fare passengers to divert to discount fares.

Discount fares can have a significant effect on the profitability of an airline. To understand this effect, it is necessary to evaluate the response of the marketplace to a proposed fare--from the point of view of both the traveling public and an airline's competitors. Boeing continues to sponsor

research that attempts to characterize these responses and their effects on airline profits.

Although most publicity about deep discount pricing and fare wars has occurred since the Deregulation Act of 1978, the first Boeing studies began in the low traffic growth years of the early 1970s. With the cooperation of 18 airlines Boeing has surveyed more than 63,000 airline passengers since 1972 to gauge their response to different discount fares (Figure 1). In actual airline planning environments, many times that number of surveys may be needed annually; however, for the purposes of investigative research, all that is required is sufficient detail to ensure that results are statistically significant. Summaries of previous Boeing discount fare management research are available (1-4).

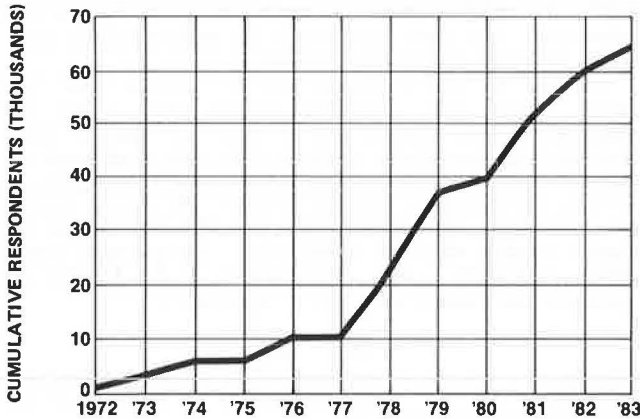


FIGURE 1 Boeing involvement in promotional fare surveys.

Boeing has recently analyzed two sets of passenger surveys of discount fares. The first surveys were conducted from August to November 1981; the second from September 1982 to March 1983. The two sets involved a total of 10 U.S. and Canadian airlines and 25,000 passenger responses (Figure 2).

The primary questions addressed by the 1981 and 1982-1983 survey were

1. How are passengers responding to the discount fare environment?
2. Will passengers accept degradation in quality of service in exchange for fare reductions?
3. What types of restrictions are effective in preventing the use of discount fares by travelers who would otherwise fly at full fare?

For proprietary reasons the survey results presented are composites of the individual airline and

1981	1982/83
<ul style="list-style-type: none"> • AIR CAL • AMERICAN • CONTINENTAL • FRONTIER • USAIR • WESTERN 	<ul style="list-style-type: none"> • AIR CAL • AIR CANADA • CONTINENTAL • CP AIR • PIEDMONT • REPUBLIC • WESTERN
13,000 PASSENGER RESPONSES	12,000 PASSENGER RESPONSES

FIGURE 2 Airline participants in surveys.

market results obtained; therefore, they may not apply to specific market situations. They are intended to be compared with proprietary individual market data and to indicate trends.

RESTRICTIONS ARE IMPORTANT ELEMENTS OF DISCOUNT FARE PLANS

One objective of the 1981 and 1982-1983 surveys was to evaluate consumer perception of airline pricing. Passengers were asked a series of fare-related questions designed to identify the type of fare they thought they were using for their current trip. The results reflect the types of fare plans available at the time the surveys were conducted (Figure 3).

In 1981 discounts in the U.S. approached 45 percent of the published full coach fares. Restrictions varied from none to a requirement for 2 weeks advanced booking combined with a Saturday night stay. During this period U.S. travelers were about evenly divided between those who thought they were paying full fare and those who thought they were paying less. Fifty-one percent of the U.S. respondents thought they were using a discount fare.

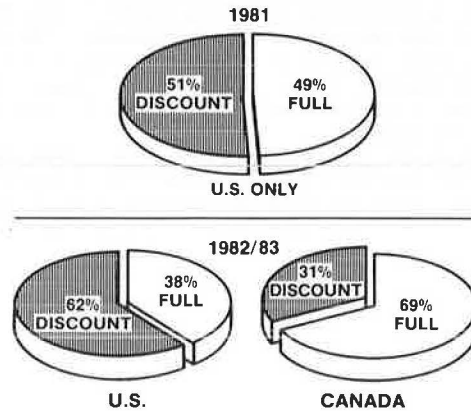


FIGURE 3 Passengers' perceived fare.

During the 1982-1983 surveys U.S. discounts approached 50 percent of published full coach fares and many markets had no restrictions on the lowest available fares. Accordingly the number of U.S. passengers who thought they were paying less than full fare increased from 51 percent in 1981 to 62 percent in 1982-1983. However, only 31 percent of the Canadian respondents thought they had obtained a discount in this same 1982-1983 time period. This difference in the number of perceived discount fare users is probably attributable to restrictions incorporated into the Canadian discount fare plans. In Canada typical fare restrictions required 2 weeks advanced booking combined with a "first Sunday" earliest return to qualify for discounts of approximately 45 percent.

Further evidence of the effectiveness of restrictions in limiting the use of discount fares was obtained when respondents were asked why they had not used a discount fare. Restrictions were the most frequently given reason why full-fare passengers did not use a reduced fare (Figure 4).

PASSENGERS ACCEPT TRAVEL INCONVENIENCES FOR SMALL SAVINGS

A second objective of the surveys was to gain some insight on how fares affect passenger behavior in

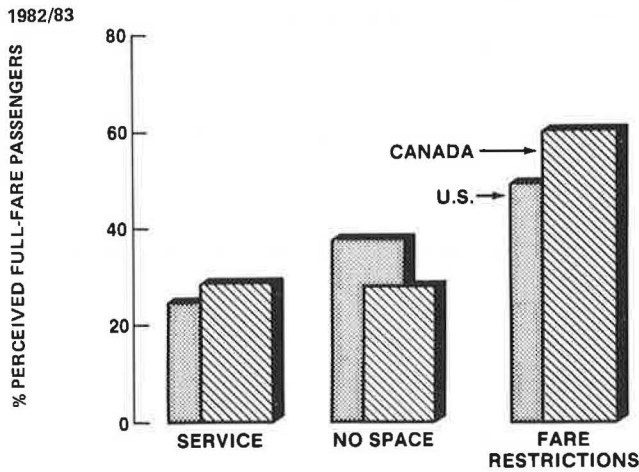


FIGURE 4 Why passengers did not use a discount fare.

the flight selection process. The issue addressed was the trade-off between level of discount and quality of service. Specifically, will passengers accept degradation in quality of service to obtain a fare reduction?

In both the 1981 and 1982-1983 surveys, 20 service quality versus discount fare scenarios were tested. Each respondent evaluated only one scenario (Figure 5). In 1981 the discount levels tested were 10, 20, 30, 40, or 50 percent lower than the current fare. In 1982-1983 the discounts were 5, 10, 30, 50, or 60 percent lower than the current fare. To obtain the discount, quality of service would be reduced by the addition of one or two stops. In some scenarios one of the stops required an airplane change (connect). Respondents were advised that each additional stop, whether through plane or connect, would increase their travel time by 1 hour. The airline and airplane type would remain the same.

Results obtained from the surveys are expressed as diversion rates (Figure 6). This diversion rate for a given scenario is the fraction of passengers surveyed who said they would accept the proposed reduction in quality of service to obtain the discount fare. The top of each shaded band in Figure 6 represents the diversion rates associated with the scenarios that require one additional stop. The bottom of each band represents scenarios that require one through-plane stop and one connect (i.e., two stops). Diversion rates for the one-stop/one-connect and through-plane two stop scenarios are bounded by these limits.

In 1981 more than half the passengers surveyed said they would accept the reduced service and use the discount fare. A large proportion of the respondents indicated they would use the fare even at

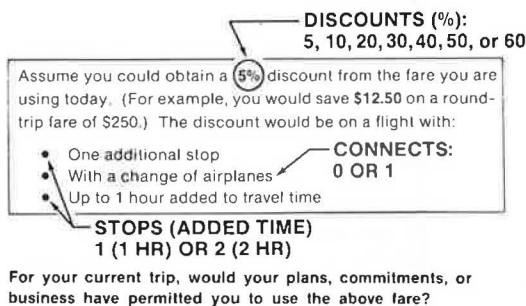


FIGURE 5 Service quality versus discount fare scenarios.

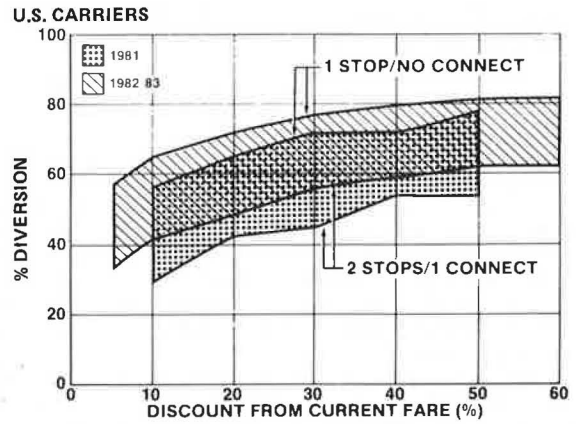


FIGURE 6 Diversion by percent discount.

small reductions. As the discount increases, the increase in diversion rate is disproportionately small. Comparisons of 1981 with 1982-1983 measured diversion rates show that the 1982-1983 respondents were even more willing to divert.

The 1982-1983 survey was expanded to examine diversion rates as a function of dollar savings, in addition to a percent reduction from the current fare. The results provide an even stronger indication of passenger willingness to sacrifice quality of service for small reductions in fare (Figure 7).

About 60 percent of all passengers said they would divert to a flight requiring an extra stop for savings of only \$25 or less. For any amount greater than \$25, the responses indicate more than 80 percent would be willing to divert. Even with the inconvenience of two extra stops, one of which entails an airplane change, and the addition of 2 extra hours of travel time, approximately 70 percent of the respondents said they would divert if the savings were more than \$50. Further study is recommended to confirm these results because few data are available for some specific savings intervals. Similar data from Canadian carriers were not extensive enough to be statistically significant.

The implication of these results for the airline industry seems clear. Diversion is not so much a function of discount as it is of convenience. Passengers will divert, even for small savings, whenever it is convenient for them to do so. To minimize the diversion of passengers who would otherwise pay full fare, restrictions are necessary.

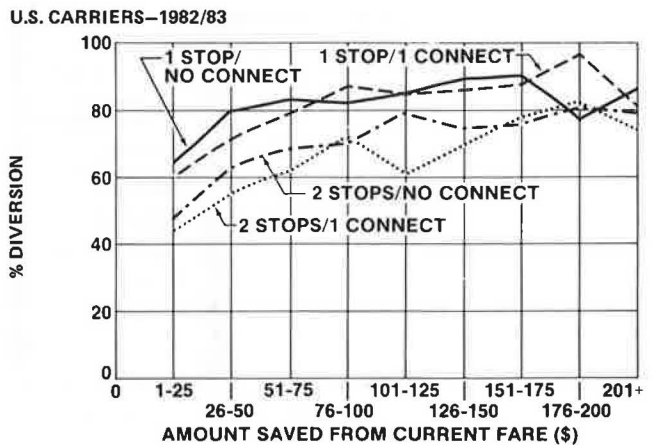


FIGURE 7 Diversion by amount saved.

BUSINESS VERSUS PLEASURE CLASSIFICATION IS A INSUFFICIENT RESTRICTION

A third objective of the survey was to evaluate the extent to which restrictions reduce the diversion of full-fare passengers to a discount fare. The evaluation of a passenger's ability to meet restrictions was based on the characteristics of the trip being taken when the survey was conducted. Passengers were questioned about the advance planning and duration of their current trip as well as whether they would be away over a weekend (Figure 8). Passengers were also asked the primary reason for the trip (Figure 9), their perceived fare type, and who paid for their ticket.

Analysis of the survey results revealed widely varying ability to meet restrictions. To obtain more meaningful results, it was necessary to group the respondents into homogeneous groups instead of attempting to evaluate all of the responses together. To group the respondents, analysis of variance was performed on the advance trip planning, advance reservations, and trip duration responses. Validation of these classifications was based on responses detailing perceived fare type, who paid for the ticket, and primary trip purpose.

Results indicate that the traveling public can be more accurately grouped into four categories (i.e., discretionary business, discretionary personnel, nondiscretionary business, and nondiscretionary personal travelers) than into the often used business versus pleasure definitions (Figure 10). Roughly one-third of the responses fell in each of the nondiscretionary business, discretionary business, and discretionary personal categories. The names are somewhat arbitrary labels for groups of passengers who exhibit similar trip characteristics. Although not necessarily indicative for all travelers within each category, the names generally reflect the predominant trip purpose.

The ability to meet restrictions easily varied greatly among categories (Figures 11-14). Nondiscretionary personal travelers were the least able to meet advanced booking restrictions. Little attempt was made to analyze results from this category because it involved such a small proportion (about 4 percent) of the responses. Nondiscretionary business travelers were also frequently unable to meet potential fare restrictions. At the other end of the

How long before your departure from home did you decide to make this trip?

days

How long will you have been away by the time you return home?

days

Between the time you left home and your return will you have been:

Away over a Friday night?
 Yes No

Away over a Saturday night?
 Yes No

FIGURE 8 Trip planning questions.

Why are you taking this trip? (Please check all items that apply.)

- Business appointment
- Business conference/convention/meeting
- Government/military
- Accompanying family member
- Vacation/sightseeing
- Visiting friends/relatives
- Personal emergency
- Moving/attending school/research
- Other

FIGURE 9 Reasons for travel.

spectrum, the discretionary personal travelers were best able to qualify for discounts; and discretionary business travelers fell between the other two major categories.

The percentage of passengers who satisfy any particular combination of conditions is probably a minimum that could divert if really given a chance to pay a lower fare. The data reflect only what passengers actually did with regard to trip planning and duration for their current trip. No comparable data were collected to determine passenger willingness to compromise travel plans to obtain fare reductions.

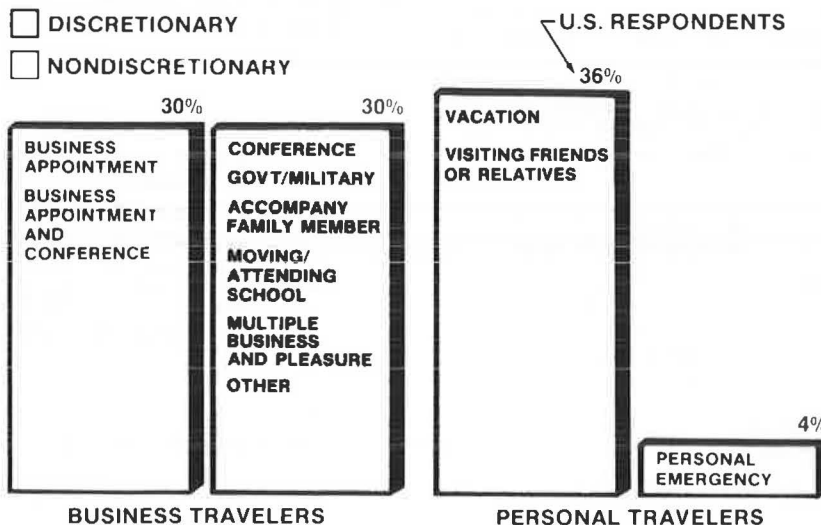


FIGURE 10 Reason for travel grouped by similar characteristics.

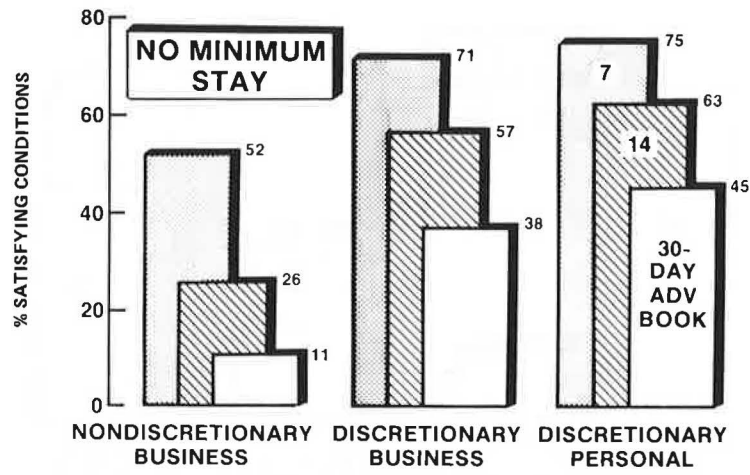


FIGURE 11 Ability to meet fare restrictions—U.S. carriers 1981, no minimum stay.

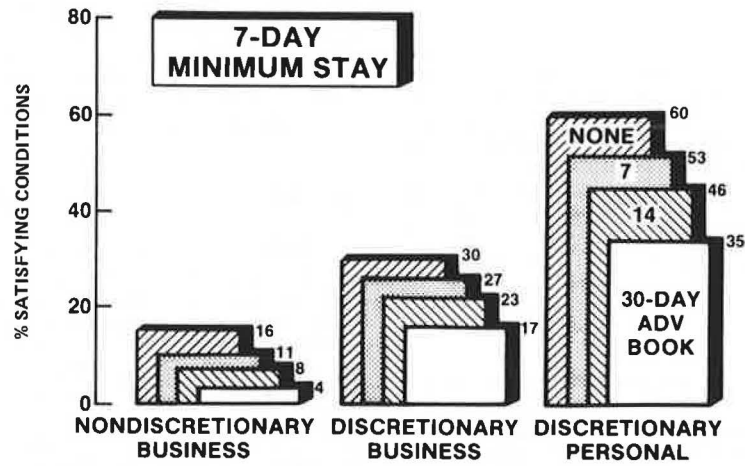


FIGURE 12 Ability to meet fare restrictions—U.S. carriers 1981, 7-day minimum stay.

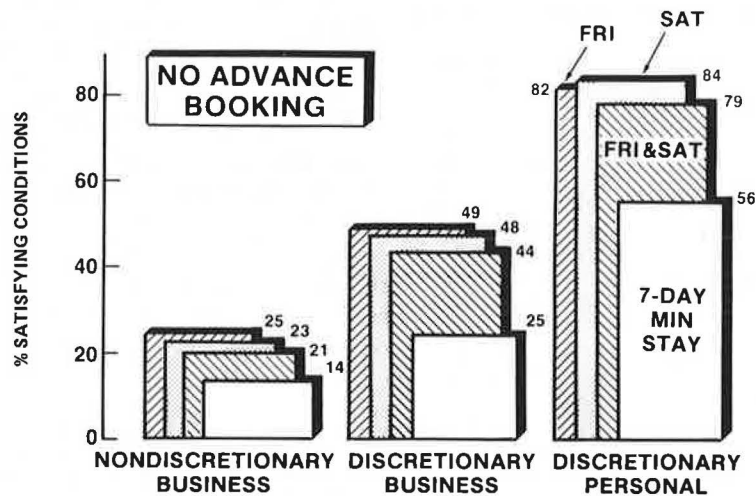


FIGURE 13 Ability to meet fare restrictions—U.S. and Canada 1982-1983, no advance booking.

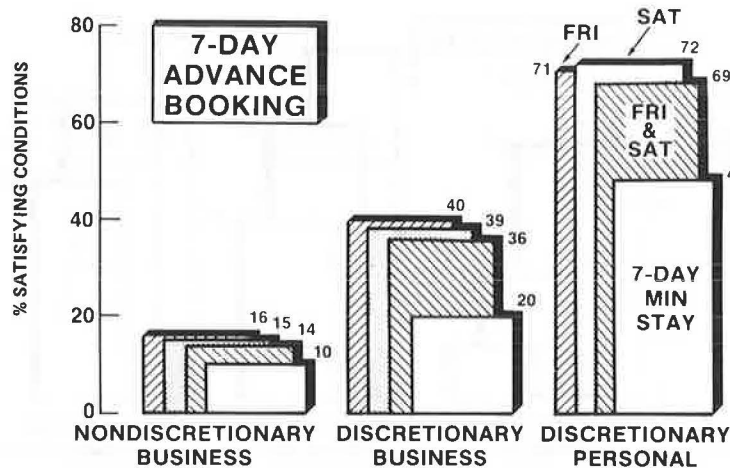


FIGURE 14 Ability to meet fare restrictions—U.S. and Canada 1982-1983, 7-day advance booking.

HALF OF ALL BUSINESS TRAVELERS MAY REACT LIKE VACATIONERS

The characteristics of discretionary business travelers may be more like those of discretionary personal (pleasure) travelers than nondiscretionary business passengers (Figure 11). Therefore, advance booking restrictions alone are likely to be effective for only the nondiscretionary business third of U.S. passengers. Even for that group, more than 50 percent made reservations at least 7 days in advance of their flight. This suggests that if prebooking is the only restriction, it probably needs to be significantly longer than 1 week to be effective in controlling diversion from higher fares.

COMBINATIONS OF RESTRICTIONS FURTHER REDUCE DIVERSION

Adding a 1-week minimum stay condition to an advance booking requirement significantly reduces the number of passengers who can easily comply (Figure 12). This is especially true for the business traveler. When a 1-week stay is required, discretionary business passengers show characteristics closer to nondiscretionary ones than they did without that condition. If only one type of restriction is to be used, a 1-week minimum stay is probably a more effective diversion control than a 1-week prebooking requirement.

Questions about weekend overnights were included in the 1982-1983 series of surveys. For nondiscretionary business travelers, a weekend-stay requirement is almost as restrictive as a full-week stay requirement (Figure 13). The other two major categories of passengers are more likely to be able to comply with a weekend stay than a full-week requirement. The passenger's ability to satisfy restrictive conditions is further reduced if a 1-week advance booking is added to weekend overnights (Figure 14).

These results emphasize that an airline should evaluate a targeted discount market carefully before implementing a proposed fare plan. Because different segments of the traveling public exhibit a wide variety of travel characteristics, market composition must be determined to develop an effective set of restrictions. Based on the aggregated data, a 7-day minimum stay requirement was an effective restriction; however, it could be prohibitive or useless in individual markets. For example, in the Los Angeles-Las Vegas market, a 7-day minimum stay

would probably eliminate almost all travelers. At the other extreme, a long-range vacation market such as Chicago-Honolulu might be largely unaffected by a week's minimum stay requirement. To prevent diversion effectively and still encourage additional air travel, discount fare restrictions must be developed and applied on an individual market basis.

DISCOUNT FARES MAY RESULT IN LOSS OF PROFIT

An airline must strengthen its traffic base before introducing discount fares to improve profitability, because a reduction in yield (revenue per passenger-mile) unavoidably accompanies discounts. Ideally the desired increase in traffic will result from new passengers. That is, people who would not have traveled at all, or would have used some alternate mode of transportation, will be induced to fly by attractive discount fares. From an airline's perspective, this is highly desirable. The marginal cost of carrying an additional passenger is low. Even though the discount fare is less than the published full fare, the potential for increased profit exists.

As demonstrated by the results of the 1981 and 1982-1983 surveys, passengers who otherwise would have flown at full fare will also attempt to use the reduced fare. From these passengers, the airline receives less revenue than they would have without offering the discount—with a negligible corresponding reduction in costs. Because of the high likelihood that competitors will match the lowest fares, an airline cannot depend on enticing passengers from competitors. Therefore the question becomes, Will profit increases resulting from carrying new traffic be sufficient to offset profit losses that result from full-fare passengers who switch to the reduced fare?

At a minimum, an analysis of stimulation and diversion rates is required. The stimulation rate is the number of passengers who will fly only with a discount (expressed as a percentage of potential full-fare passengers). The diversion rate is the percent of potential full-fare passengers who will try to use a reduced fare. These concepts are significantly different from the generation and dilution rates used some times. Generation is the percent of on-board passengers flying at reduced fare and dilution is the percent reduction in average yield after introducing the discount fare.

In its simplest form, the percent net revenue change that results from the introduction of a discount fare plan is

$$\begin{aligned}
 [\% \text{ net revenue change}] &= [\% \text{ revenue increase due to stimulation}] \\
 &\quad \text{less } [\% \text{ revenue decrease due to diversion}] \\
 &= [\text{stimulation rate} \times (1 - \% \text{ discount})] \\
 &\quad \text{less } [\text{diversion rate} \times \% \text{ discount}]
 \end{aligned}$$

U.S. AND CANADIAN DISCOUNT FARES IN 1982-1983 WERE UNPROFITABLE

Using the results from the 1982-1983 surveys, it is possible to quantify this simplified model of the effect of discount fare plans on net revenue. Some assumptions are used that limit the validity of the model.

- Stimulation and diversion rates for both the United States and Canada are from the 1982-1983 survey estimates. These results are composites resulting from the various discount levels available during the survey.

	U.S.	Canada
Stimulation (%)	25	15
Diversion (%)	67	34

- Sufficient capacity is available to accommodate all full-fare and discount passengers.

The first assumption, relying on composite data, implies that stimulation and diversion rates are independent of discount level. Although probably realistic for diversion, this assumption is reasonable for stimulation only at moderate levels of discount, say 20 to 40 percent (2,3). It is also assumed that respondents were representative of their nation as a whole. The second assumption implies that there is no rejected demand on the flights under consideration. This is generally not true. Variability of demand, alone, results in the requirement to turn away passengers occasionally. This phenomenon may be exacerbated by the implementation of poorly designed discount fare plans. Often prebooking restrictions are a condition for obtaining reduced fares. If capacity management techniques are not used, the early booking characteristics of discount-fare travelers may result in the displacement of potential full-fare travelers.

It is likely that these simplifying assumptions are technically invalid for many actual markets. Nevertheless, this simplified example clearly depicts the danger of poorly designed discount fare plans. The United States exhibited both higher stimulation and diversion rates than Canada, resulting in greater revenue increases due to stimulation, but also greater losses due to diversion (Figure 15). At discount levels in excess of 25 percent, the estimate of U.S. net revenue change is less than that for Canada (Figure 16). Estimated net revenue change is negative for both countries if the average discount exceeded 30 percent.

These results become more bleak when associated profit levels are considered. In actual operation, there are added costs associated with each new passenger, such as fuel, food, and advertising. There is also the probability that some full-fare demand will be turned away, reducing profit levels even further.

DETAILED ANALYSIS IS REQUIRED BEFORE IMPLEMENTATION

To maintain or increase profitability, proposed

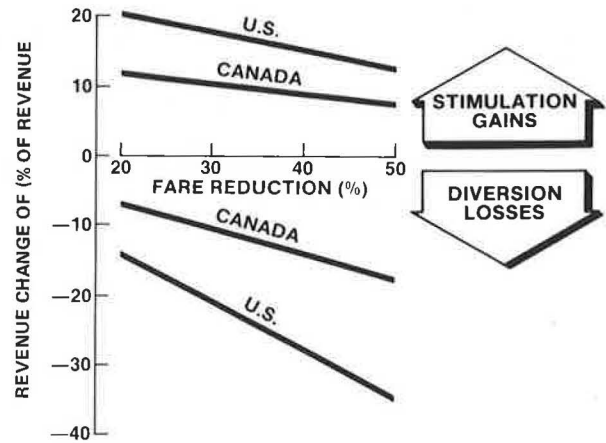


FIGURE 15 Stimulation and diversion impact, 1982-1983.

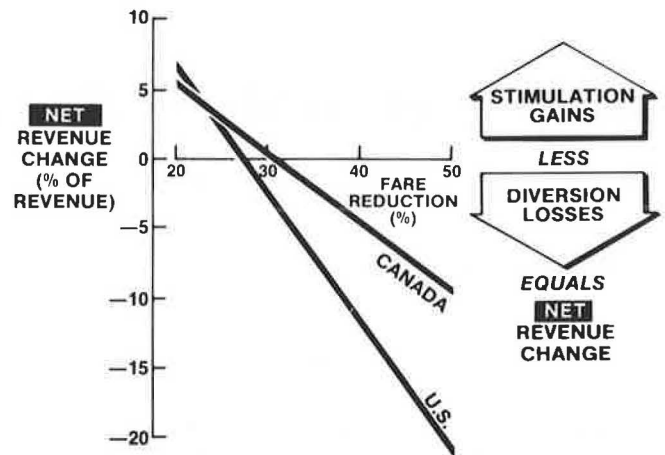


FIGURE 16 Net revenue impact, 1982-1983.

discount-fare plans must be carefully evaluated. Most successful discount-fare plans will exhibit stimulation rates that are somewhat lower than the associated diversion rates. However, care must be taken to foster stimulation while controlling diversion and protecting full-fare demand from displacement. Market research is necessary to determine discount levels that will stimulate additional travel without reducing profits. Characteristics of the targeted markets must be determined before restrictions can be designed to effectively control diversion. Also, capacity management is required to determine appropriate discount capacity to protect full-fare demand.

SUMMARY

1. Fare is a major variable in the flight selection process of an airline passenger.
2. Passengers will divert to flights that require longer transit times for a small saving.
3. Restrictions help minimize diversions. The effectiveness of a restriction is dependent on the characteristics of the passengers in each market.
4. It is highly probable that the discounts offered in the United States and Canada in 1982-1983 reduced profits.

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Airline Cost Trends as Viewed by an Airframe Manufacturer

G. RUSSELL MORRISSEY

ABSTRACT

Aircraft price trends and aircraft operational costs are presented. It is shown that compared with other airline costs, the investment cost per seat for commercial transports has been a bargain. Operational costs per seat mile declined by 75 percent between 1936 and 1971. Trends in investment cost per seat are analyzed, beginning with the introduction of turbine-powered transports. The cost impact of applying advanced technology to commercial transport airframes is also reviewed. The average annual rate of technology improvement is estimated at 2.5 percent. It is shown that the technological sophistication of commercial transport aircraft has more than doubled in one generation. But because of a decline in cost weight per seat in successive models of families of aircraft, constant dollar investment cost per seat for turbine-powered transports has risen only modestly. Airline labor costs for profitable carriers will increase at or above increases in the consumer price index, whereas labor settlements less than this index may be the pattern for unprofitable carriers. Aircraft productivity, measured by annual seat miles per aircraft, increased at an average annual rate of almost 8.5 percent between 1957 and 1979. Future increases in productivity are most likely to occur by increasing aircraft utilization. Design-to-cost procedures and computer-assisted design and manufacturing techniques will minimize the cost of future commercial transport aircraft, and future jet aircraft will continue to be a bargain.

Aircraft price trends are reviewed in this paper. Constant-dollar investment cost per seat of turbine-powered transports rose at a modest average annual rate of 0.5 percent in the 1960s and 1970s. These prices do not reflect the advanced technology that has been incorporated into them. The approach used to measure improvements in technology was to compute the rate of change in constant dollars per pounds of aircraft cost weight. This rate far exceeded the increase in investment cost per aircraft seat. This investment in technology brought about a significant decline in direct operating costs between 1947 and 1971. More recently labor and fuel have caused an increase in direct operating costs. Current wage settlements are about 9 to 10 percent and it is not clear at this time whether organized labor will adapt its goals to the new deregulated environment. Jet fuel prices in 1982 dollars are not currently forecasted to surpass 1981 levels until the late 1980s.

Potential increases in aircraft fleet fuel efficiency, attributable to improvements in airframes and engines, are expected to average 2.7 percent between 1981 and 1992. When U.S. domestic trunk operational costs from 1967 to 1980 are unitized on a cost per flight hour basis, it is evident that maintenance costs have not risen in proportion to the increases in airframe size, technological complexity, and Federal Aviation Administration requirements.

Although there have been only modest increases in investment cost per seat, annual seat miles per aircraft increased at an average annual rate of almost 8.5 percent between 1957 and 1979. System-related airline costs remain high, and automation of the air traffic control system to reduce flight delays is the probable solution. There will be continued efforts on the part of the commercial