APPLICATIONS OF ECONOMIC THEORY IN DECISION-MAKING IN THE AIRLINE INDUSTRY

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APPLICATIONS OF ECONOMIC THEORY

IN DECISION-MAKING IN THE

AIRLINE INDUSTRY

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PREFACE

The idea for this study arose from a course I teach in Managerial Economics at Colorado State University. The general skepticism of students with respect to the relevance of economic theory to actual management problems and the lack of available illustrations of theory in action made it apparent that a need exists for more studies to be made into the operations of a single industry and firm. Thus, this dissertation was undertaken in an effort to identify and document actual managerial decisions made on the basis of theoretical economic concepts, methods of analysis by which these concepts have been made operational, and environmental conditions encompassing decision-making. The accessibility of Frontier Airlines and willingness of company officials to provide data prompted the selection of this particular firm and the airline industry as objects of study with which to attack elements of these general problems.

Like so many who have gone before, but undoubtedly more so than they, I am deeply indebted to Professor Wilson J. Bentley. Without his concern, patience, and encouragement, I could not have finished the degree. And I am especially grateful for the privilege of having been able to spend time in personal discussions and in observation of his "approach".

To the other members of my graduate committee - Professors S. K. Adams, E. J. Ferguson, and R. L. Sandmeyer - I express a sincere thanks

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The final typing was done by Miss Velda Davis; for this and numerous other tasks which she so graciously performed, I am most appreciative.

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CHAPTER I

INTRODUCTION AND PURPOSE

Introduction

Experience, both as a student and as an instructor, has persuaded the author that most management students are not convinced of the practical relevance of the traditional economic theory of the firm to management decision-making. More presentation of theory frequently supplemented with hypothetical examples selected primarily to illustrate concepts rather than reflect reality, has not served well in making disciples. Expositions of the analytical tools accepted by theorists as requisite to enlightened decision-making are abundant. There is, however, a dirth of studies and illustrations of actual managerial applications. Although the stated function of texts in managerial economics is to narrow the void between theory and practice, much of the literature is theoretical and admonitory rather than descriptive. There is usually a serious failure to establish a sense of the complex, dynamic context in which such decisions are made and an even greater failure to specify by real example or description just <u>how</u> firms go about making the necessary analysis.

All sources examined to date, omitting texts in operations research, which purport to establish the efficacy of economic theory in decision-making, generally follow one of four patterns:

1. Highly mathematical, theoretical models dealing with

marginal cost functions of public utility-type firms.

2. Questionnaire surveys of selected private firms to ascertain if those firms do in general use certain economic concepts in decision-making.

3. Occasional citations by authors of "examples" drawn from studies of various industries to illustrate a particular concept. For example, "proof" of the relevance of price elasticity of demand analysis invariably consists of studies made for various products in agriculture or perhaps steel; the industry or firm cited, however, changes when another principle is introduced and the "proof" of application, if any is given, comes from another industry better suited to illustrate the concept.

4. Extremely simple, fabricated illustrations devised in an attempt to put "meat-on-the-bones" of pure theory.

It must be stated that although the above contributions are valuable to both students and instructors, they are incomplete and often inconvincing. More detailed study needs to be made into the operations of a single industry and firm to identify and document decisions actually made on the basis of theoretical economic concepts, methods of analysis by which these concepts have been made operational, and environmental conditions encompassing decision-making. In short, there is a need for investigation into genuine, practical applications of theory as well as for contributions to theory itself.

As objects of study with which to attack elements of these general problems, the airline industry was chosen for analysis, with specific attention given to a single firm in the industry, Frontier Airlines.

Objectives of the Study

The major thesis of this study may be stated in a threefold proposition; namely,

1. That economic theory <u>is</u> applied in managerial practice in the airline industry.
2. That even in the face of insurmountable obstacles to quantify all or any salient variables, theoretical concepts nevertheless form highly useful frameworks within which decisions are formulated and precipitated.
3. That in less hostile environs, reasonable quantitative approximations to theoretical functions are in fact calculated and used with confidence in decision-making.

In the process of validating the thesis, the study will narrow the void between theory and practice by presenting a more realistic picture of economic theory in action. More specifically, it will

1. Establish a more authentic sense of the nature of the political, social, and economic environment in which decisions are made.
2. Identify in detail actual procedures used to make the economic analyses pertinent to decisions.
3. Note modifications in economic theory necessary to render concepts operational in dynamic business situations. Limitations and complexities of exact application of theory will be indicated.
4. Identify and discuss sources of economic data and

assumptions underlying their use.

5. Ascertain, where possible, actual results of decisions.

This study does not attempt to cover all aspects of either management or economics, but deals with fundamental theoretical economic concepts traditionally cited in managerial economics texts. A summary of these basic principles, adapted largely from Leftwich (1), is presented in Appendix A.

Overview of the Study

If the logic of fundamental concepts comprising the traditional economic theory of the firm is practically applied by management in decision-making, then analysis of economic decisions should yield incisive evidence and information. Therefore, in order to accomplish the objectives of the study, a two-phase analysis of airline management decisions is made.

First, a search of recent literature is conducted in order to

1. Develop a portrait depicting important aspects of the political, economic, and social environment of the domestic air transportation industry and of Frontier Airlines as it functions generally in that industry.
2. Discover evidence of the prevalence of managerial application of theory, both subjectively and quantitatively, in decision-making throughout the industry. This initial phase is subsequently pursued in Chapters II and III.

Chapter II discusses industry environmental characteristics such as economic aspects of governmental regulations which circumscribe the areas for corporate economic actions, important distinctions between classes of commerical air carriers which have significant bearings on competitive conditions and, thus, greatly influence the economic decisions of individual firms, and product, marketing and operating cost characteristics which further identify major constraints within which individual firms must operate.

Chapter III delves into economic facts of demand analysis in air transportation, and the kind and amount of attention given by the industry to determinants of demand, price elasticity of demand, and pricing strategies; in addition, it sets the stage for a subsequent analysis of Frontier Airlines' revolutionary 50 per cent standby fare decision.

The second phase of the study, contained in Chapter IV, consists of detailed case analyses of selected economic decisions made by Frontier Airlines in 1966. Information and data were obtained from company documents and interviews with persons having partial responsibility for the decisions and related economic evaluations.

The basic objective of case analysis is to determine how the logic of economic theory is made applicable in practice, both when reasonable quantitative approximations of theoretical functions can be calculated and when they cannot. This objective is accomplished by demonstrating the mechanics of analytical procedures used by Frontier, identifying sources of input data, specifying underlying assumptions, and noting environmental conditions. Theoretical economic concepts providing the rational foundations for the decisions include price elasticity of demand, cross elasticity of demand, price discrimination, marginal (incremental) cost, and marginal (incremental) revenue. The four decisions analyzed are a major pricing decision, two new route application decisions, and a flight scheduling decision.

CHAPTER II

ASPECTS OF THE GENERAL ENVIRONMENT OF THE DOMESTIC AIR TRANSPORTATION INDUSTRY

Introduction

Barnard (2) has demonstrated that it is possible to generalize extensively from experience in the management of every sort of business and to form some notions that apply to a variety of industries. The same is true of the applicability of certain economic concepts in decision-making. But, by confining a study of applied economic concepts to a single industry and a single company, one can generalize to a greater extent. One should find more in common and fewer differences in principle and practice from one firm to another, and an investigation of the relevance of certain economic concepts in a single firm should provide reliable insight into the operations of others similarly situated. But however much there is in common from one airline to another, there are still important differences. All airlines are not brought into being under similar circumstances, nor do the different geographical, economic, social, and political environments in which they continue provide them with equal profit opportunities.

Since the end of World War II, the airline industry has emerged as one of the nation's major industries. Increased speed of air travel, improved comfort, convenience and service, lower fares and a shift in the nation's travel habits have all contributed to the spectacular growth rate of airline passenger traffic, which in the last three years has averaged over 16 per cent annually.

In order to further build the framework for the study, it is desirable to establish some of the relevant facts concerning the general environment of the domestic air transportation industry and of Frontier Airlines as it functions in that industry.

Economic Aspects of Federal Government Regulation

The present system of federal economic regulation of civil air transportation in the United States was established in the Civil Aeronautics Act of 1938. Since 1940, economic regulation of the domestic airlines has rested in the hands of a five-man Civil Aeronautics Board (CAB). Airlines management prerogatives and competitive practices are circumscribed by the Board's edicts.

Some of the more important economic regulations pertinent to this study are summarized below (3). The analysis and discussion in future chapters will reflect their influence on management thinking and practices.

1. Certificates of public convenience and necessity are required of air carriers to operate in interstate commerce. The certificates are to cover particular routes and may be restricted as the Board sees fit. For instance, the Board can require a carrier to make certain intermediate stops between two points. But the Board cannot restrict the right of a carrier to add or otherwise change schedules.

2. A carrier cannot transfer or abandon a certificate without the Board's approval, and once certified, is under obligation to furnish reasonable service with safe and adequate equipment and facilities.

3. Applications for certificates are to be granted if the Board finds

> ..... that the applicant is fit, willing and able to perform such transportation properly and to conform to the provisions of this Act and the rules, regulations and requirements of the Board hereunder, and such transportation is required by the public convenience and necessity (4).

4. The Board may require operating reports from air carriers and may prescribe the system of accounts.

5. The Board may investigate alleged unfair or deceptive practices or unfair methods of competition in air transportation, and may order the carriers to cease and desist from any such practices.

6. Rates and fares are to be published and strictly adhered to. Charges must be open to public inspection and filed with the CAB.

7. The Board must have 30 days notice of changes in rates and fares and has the power to suspend proposed changes for 180 days.

8. Carriers are to charge just, reasonable, and non-discriminatory fares.

9. The Board has authority to reject, modify or revise any tariff. It can set exact domestic fares, minimum or maximum limits, or both. Either upon complaint or upon its own initiative, the Board may conduct a

hearing to decide whether a particular domestic rate, classification, or practice is unjust or unduly preferential. It may suspend any proposed tariff change to determine its "lawfulness".

10. The Civil Aeronautics Act contains a "rule of rate-making" which reads as follows (3):

> In exercising and performing its powers and duties with respect to the determination of rates for the carriage of persons or property, the Board shall take into consideration, among other factors:
>
> 1. The effect of such rates upon the movement of traffic.
>
> 2. The need in the public interest of adequate and efficient transportation of persons and property by air carriers at the lowest cost consistent with the furnishing of such service.
>
> 3. Such standards respecting the character and quality of service to be rendered by air carriers as may be prescribed by or pursuant to law.
>
> 4. The inherent advantages of transportation by aircraft.
>
> 5. The need of each air carrier for revenue sufficient to enable such air carrier, under honest, economicl and efficient management, to provide adequate and efficient air carrier service.

Classes of United States Commercial Air Carriers

There are nine generally recognized classes of operators in the air transport industry of the United States. These classifications are used by the Civil Aeronautics Board in connection with the economic regulation of the industry and, under the Federal Aviation Act, are based largely on the scope of operations authorized or allowed by that

Act. Seven classes of carriers have certificates of convenience and necessity authorizing them to conduct regularly scheduled services (5). The two most important and widely known classes and the ones germane to this study are:

1. The Domestic Trunk Carriers. There are currently eleven trunk lines, most of which operate long-haul, high-density traffic routes between the principal traffic centers of the United States. The airlines included are

American	Delta	Northeast	United
Braniff	Eastern	Northwest	Western
Continental	National	Trans World	

2. The Domestic Local Service Carriers. These carriers operate relatively short-haul routes of lesser traffic density between the smaller traffic centers and between these centers and principal centers. The thirteen airlines comprising this class are

Allegheny	Lake Central	Ozark	Southern
Bonanza	Mohawk	Pacific	Trans-Texas
Central	North Central	Piedmont	West Coast
Frontier			

Local Service Carriers

In 1945, a separate class of domestic airlines, known as local service carriers, was established to serve the passenger markets of smaller cities. Originally, twenty-three carriers were established but due to abandonments and merges, only thirteen are presently operating.

From their beginnings, local service carriers have operated at a disadvantage with respect to the trunk carriers.

1. Traffic potential has been limited due to

   a. competition from well established forms of surface transportation, especially the automobile.

   b. Relatively short length of hops. This greatly reduces the inherent advantages of air transportation over surface transportation, namely, speed and frequency of scheduled service.

2. The relatively short length of hops and small amount of traffic make the type of plane adapted to trunk operations not as well suited for local service. Yet on many routes, trunk and local service carriers compete for the available traffic.

3. Air transportation fares are at a comparatively high level with respect to surface transportation and this, coupled with lower traffic potential, has thrown a substantial burden on the government in the form of airmail subsidy payments.

Trunkline carriers' primary interest has been and is in the long-haul traffic. With this in mind, the Board established local-service carriers for the specific purpose of developing the short-haul, local markets. To prevent local-service carriers are competing with trunks and to insure adequate service at the smaller communities, the Board has frequently required local-service carriers to serve all points on their routes on all flights. Restrictions of this sort are being liberalized, especially in Board attempts to reduce the subsidy requirements of local-service carriers. For example, where new routes are authorized, the Board permits "skip-stop" service between terminals after each intermediate point has received two daily round trips, with the exception that where a trunk carrier provides service between the terminals, the local-service carrier is normally required to make at least one intermediate stop.

Although local-service carriers now have permanent certificates, the Board has the power to enforce a policy which requires intermediate points named in a carrier's certificate to show an average of at least five enplaned passengers per day over a test period to warrant authorization for permanent service. Under this so-called "use-it-or-lose-it" policy, service to such points will be withdrawn if this condition is not met.

Local-service carriers are heavily subsidized by means of air-mail payments in excess of the "service rate". The "service rate" is considered the "cost" of transporting air mail and consists of two parts:

1. A uniform ton-mile rate of 30.17 cents per ton-mile.
2. A terminal charge per pound of mail enplaned which varies by class of airport from 3.32 cents per pound at the largest airports to 33.21 cents at the smallest airports.

All airlines are paid the same "service rate" for transporting mail, but the local service carriers receive additional mail pay based on their "need". The "need" subsidy makes up the difference between the carrier's costs incurred by "honest, economical and efficient management", and its revenues received from "just and reasonable rates".

Local service carriers are currently paid a subsidy rate per seat-mile flown per month which varies inversely with traffic density as measured by the average number of aircraft departures per station/per day. To prevent carriers from receiving more subsidy than needed, another formula-system is used to recoup earnings in excess of a prescribed rate of return on investment. A standard rate of return is computed for each airline and is a weighted average of a return of 5.5 per cent on debt capital, 7.5 per cent on preferred stock, and 21.35 per cent on common stock equity, subject to a maximum over-all return of 12.75 per cent and a minimum of 9 per cent. Fifty per cent of any profits above the standard rate of return, but not exceeding 15 per cent of the standard, must be refunded, and 75 per cent of any additional profits must likewise be refunded. The Board does not permit subsidy to be paid for flights performed on routes which the Board designates as non-subsidy or subsidy-reduction routes (3).

Today, no trunk carrier except Eastern receives a "need" subsidy and the Board is attempting through a variety of means to gradually reduce and eliminate the $65 million annual subsidy now paid to the local service carriers as well. Local service carriers, particularly Frontier Airlines, insist that the best way to reduce subsidy is through route strengthening.

Product, Marketing, and Operating Cost Characteristics

The Product

Air carriers in essence offer one commodity -- arrivals. But for purposes of analysis and decision-making, it is necessary to think in terms of "the product".

The "product" of air carriers is the sum of the equipment, services and schedules which they provide for the traveling public. The various elements of the product include:

1. Equipment. Modern equipment is a potent competitive weapon, and equipment parity is virtually essential to the maintenance of a competitive position. The customer appeal of new equipment is due in part to its increased speed, greater comfort, and improved schedules. The sheer psychological attraction of the "latest innovation" is also a major factor.

2. Scheduling. Schedule frequency is an important competitive consideration. The carrier with infrequent service or with less frequent service than its competitor is at a disadvantage because it does not offer the "full-line" available on its competitor.

   Times of arrival and departure at major traffic points likewise play a crucial competitive role, as does quality of schedules. In the latter, the number of intermediate stops, the type of equipment used, and the configuration basically determine relative "quality".

   Optimum scheduling involves a comprise between equipment availability and utilization on the one hand, and the most attractive schedule pattern for each route point served on the other.

3. In-flight service. Meals, drinks, movies, music, attractive stewardesses and other "frills" provided to keep the passengers comfortable and happy are relatively low-cost and are used competitively in an attempt to

differentiate the product. They are a basic part of the "product" offered by each carrier.

4. Ground services. Airlines also try to offer services which will keep the passenger happy on the ground as well as in the air. Whether in such areas as reservations, ticketing procedures, or baggage handling, there is considerable rivalry to be at least as good as the competition and preferably better.

Customers

In the airline industry, as in others, "the customer matters most". Every manager must continually ask himself how his plans will affect the carrier's customers. Questions of pricing, scheduling, or advertising may require detailed projections and calculations, but the point of reference from which to consider most if not all policy decisions is that of customer reaction. This requires a consideration of the people the carrier desires to serve.

There are a number of ways of classifying passengers. Among these commonly regarded as useful are (6):

1. Frequency of travel.

   a. Regulars are people who always fly by the particular airline, and are valuable to any airline since over a few years they may each spend hundreds of dollars. They deserve that little extra attention usually paid to the "good" customer who sustains the fortunes of the airline.

   b. Occasionals are people who sometimes fly by the particular airline. They characteristically choose a carrier because of its special features or because its schedules permit achieving desired arrival times.

c. First timers:

(1) By the particular airline. They may never fly again by the particular airline, become occasionals, or become regulars.

(2) By any airline. They may never fly again by any airline, or by the particular airline, or they may become occasionals or regulars. First-timers represent a challenge because they are uncommitted; they are the people who cause any airline to grow.

2. Income. Airlines must take account of the different spending powers of their passengers. The element of product that is usually referred to as "services extra-to-carriage" is, within the limits of CAB regulations, characterized by the ability of people to pay more than just the bare minimum to travel by air from one place to another. Knowledge of the distribution of their passengers' income-ranges enables airlines to direct their marketing with greater precision. The importance of personal incomes if, of course, less in expense-account travel. There, it is necessary to assess the prosperity of firms rather than individuals.

3. Occupation. Knowledge of the occupations of its

passengers provides airlines with a means of identifying them in the population at large. This is particularly useful in considering ways of attracting businessmen to air travel, but its usefulness is not confined to business traffic. It may be helpful to know, for example, that a sizeable proportion of holiday traffic is composed of schoolteachers or professional men; then sales promotion efforts can be aimed directly at these people.

Airlines usually consider business travelers and pleasure travelers to be significantly different sorts of traffic. Characteristically, the former contains more regulars, and the latter more first-timers. Businessmen are usually more concerned with frequency of service, regularity and punctuality than are pleasure travelers. Travelers on business have been the largest source of demand for first-class seats, but recent significant changes in the travel habits of businessmen have caused carriers to make substantial alterations in seating configurations.

Useful designations for airline traffic are summarized in Table I (6). At present, passengers form by far the large proportion of airline customers. Passengers are the "raw materials" of an airline organization, and as such they are mixed up in the process of production.

TABLE I

CLASSIFICATION OF AIRLINE TRAFFIC

Airline Customers	Traffic Customers Generate
Passengers	1. Passengers 2. Free Allowance Baggage 3. Excess Baggage 4. Hand Baggage
Shippers	1. Mail 2. Ordinary Freight 3. Express Freight
Charterers	1. Bare Hull Charters 2. Aircraft and Crew Charters

Selling the Product

Using various fare plans, airlines have differentiated conditions of passenger carriage to develop separate markets. Examples of these markets are given in Table II. Airlines must carefully assess the value of these divisions of the passenger market. If they do not represent abiding features of demand, but rather artificially stimulated and temporary phenomena, then they may be more nuisance than they are worth. Airlines are justified economically in differentiating markets if:

1. Some passengers are persuaded to leave a less profitable and enter a more profitable market, and/or
2. Some people are persuaded to fly who would not otherwise have flown, and
3. The increased net profit resulting from increased

traffic due to promotional fares exceeds the decreased net profit resulting from transfer customers.

TABLE II

MARKETS OF PASSENGER CARRIAGE

Fare Plan	Markets of Passenger Carriage
Regular Fares	1. First Class 2. Coach 3. Economy
Promotional Fares	1. Excursions 2. Family 3. Youth 4. Military Standby 5. Regular Standby

With respect to regular fare service, some of the "extras-to-carriage" that are used to distinguish the various classes of passenger transport are:

1. Separate compartments.
2. More leg-room and elbow-room.
3. Better food and free drinks.
4. A higher proportion of cabin attendants to each passenger.

However good the product, it still must be sold. Aside from promotional fare schemes, airline sales programs typically include advertising and promotion as the most important elements. The objectives of these efforts include:

1. Establishing a unique and favorable corporate identity.
2. Identifying the carrier with a particular region, route, or destination.
3. Convincing customers of the superior product of the carrier.
4. Persuading people to travel by air.

Operating Costs

In the air transportation industry, "output" is measured in a number of ways, depending on the use of the data. Revenue passenger miles and revenue ton miles are frequently used, both being measures of distance, which is what the user of air service pays for.

For eleven trunklines the average unit line-haul operating cost, in cents per revenue ton mile (RTM), is approximately $0.52, while the average for thirteen local service carriers is approximately $1.00 per RTM (7). The vast differential in expense level between the trunklines and the local service carriers is generally agreed to be due to basic differences in carrier route structures and the characteristics of service and traffic generation which are inherently determined thereby.

For example, the average trunkline flys about twice as many route miles (approximately 6,000) as the average local service line (approximately 2,900). The average distance between stations served by the relatively short-haul local carriers (68 miles) is approximately one-half that of the relatively long-haul trunkline carriers (122 miles), but the average total number of stations operated is approximately the same (43 to 46 stations). Thus, local carriers service and staff more stations per route mile, putting them at an automatic cost disadvantage. This basic cost handicap is further compounded by certificate provisions limiting the local's ability to operate nonstop services justified by traffic demands and this further increases the differential between the average aircraft stage distance of the average trunkline (approximately 375 miles) as compared to that of the average local carrier (approximately 100 miles). Also, since the average local carrier generates its traffic from smaller cities as compared with the average trunkline, the local carrier achieves less than 10 per cent of the daily traffic generation per route mile achieved by the average trunkline (approximately 17 daily RTM per route mile versus 197).

These operating characteristics are representative of the kinds of differences in route characteristics between locals and trunklines and, thus, serve as a basis for identifying the differences in unit line-haul expenses (7). In general terms, then, unit line-haul operating costs (in cents per RTM) vary inversely with distance of aircraft flight and traffic haul. There is less general agreement on the relative degree to which other cost-causative factors influence unit cost levels. These include:

1. Skill of management.
2. Difference of basic wage and price levels between carriers.
3. Scale or "size" of operations.
4. Volume of traffic serviced.
5. Per cent of capacity utilized (load factor).

These and other cost-causative factors all have their individual and cumulative influence on line-haul unit operating costs.

Airline costs are officially divided into two major categories, direct costs and indirect costs.

<u>Direct costs</u> generally refer to the costs of the actual transportation the user buys on the aircraft operating costs. Aircraft operating costs, typically composing 50 per cent of total operating costs, consist of the expenses of:

1. Flying Operations.
2. Direct Aircraft Maintenance.
3. Aircraft Depreciation.
4. Applied Aircraft Maintenance Burden.

These costs are basically incurred on a time basis, although there are areas for debate such as Maintenance Burden. Flying Operations and Direct Maintenance are closely related to hours of flight, and Depreciation, although an annual charge, reduces to an hourly one depending upon the annual rate of aircraft utilization.

If the cost of operation for a specific aircraft is reasonably constant per hour, it follows that any measure of its line-haul costs (for instance cents per available ton mile) will vary directly with the number of miles it can fly in an hour -- that is, realized speed. Industry operating statistics show that as speed increases with increasing stage distance, the line-haul direct cost per mile correspondingly decreases (7). Since it is less costly to fly the airplane for each mile as the distance between stops increases, it follows that the direct cost for each seat or available ton of capacity provided also becomes less costly on a mileage basis as stage distance increases. Thus, the direct unit cost of capacity utilized, measured in revenue ton miles, will likewise decrease.

A similar result obtains when direct unit costs are compared as between two types of aircraft, say a large jet as used by trunklines versus the smaller twin engine piston aircraft widely used by local carriers. The large-capacity, high speed jet, used on route structures having long average stage distances and which generate sufficient traffic to reasonably use the great capacity available, shows a significantly lower unit cost in cents per RTM than the smaller-capacity, slower piston aircraft used to service shorter average stage distances and carry smaller average revenue loads.

Indirect costs generally refer to the costs of selling and servicing the traffic carried plus general ground support and general supervision of the enterprise as a whole. Basic categories of expense accounts included are:

1. Direct Ground Equipment Maintenance.
2. Applied Ground Equipment Maintenance Burden.
3. Ground Equipment Depreciation.
4. General Services and Administration.
   - A. Passenger Service.
   - B. Aircraft and Traffic Servicing.
   - C. Promotion and Sales.
   - D. General and Administrative.

In addition to costs of plant and station facilities, these categories include such specific costs as promotion, sales, reservations, ticketing, loading and unloading traffic, accounting functions and related supervisory personnel. The basic expense categories are roughly proportional to the number of traffic units serviced, primarily passengers, and are not, in contrast to direct costs, closely related to the hours of flight. Even those ground expenses required solely to service aircraft at stations are related, at least indirectly, to the volume of traffic since aircraft movements are basically tailored to traffic demand.

Once all the ground functions have been performed to promote, sell, reserve space, ticket, and load a passenger on the aircraft, the bulk of these servicing costs have been incurred. In terms of per passenger expense, it then makes little difference the number of miles he moves in the aircraft; but it does mean that the passenger moved over a long distance will produce a lower line-haul unit cost (cents per RTM) than one moved over a short distance.

Carrier operating costs in cents per RTM arising from the several variable and interrelated factors of route structure, service characteristics and traffic are a function of revenue ton miles per departure, the so-called Service and Traffic Index (STI) (7). This relatively simple index, shown in Figure 1, is widely considered to be accurately responsive to changes in any of the basic service or traffic characteristics of an airline operation, singly or in combination. The STI-Unit Expenses trend line is intended to show just that: the trend of unit cost in relation to STI Value, rather than the precise cost level which should prevail for a given STI for all carriers. While the STI does not account for the impact of all cost-causative factors, it does respond to service and traffic characteristics which exert primary influence on costs. The STI-Unit Expense trend line does indicate the degree of cost change which is expected to occur if a carrier's STI is advanced by improvement in the aforementioned characteristics.

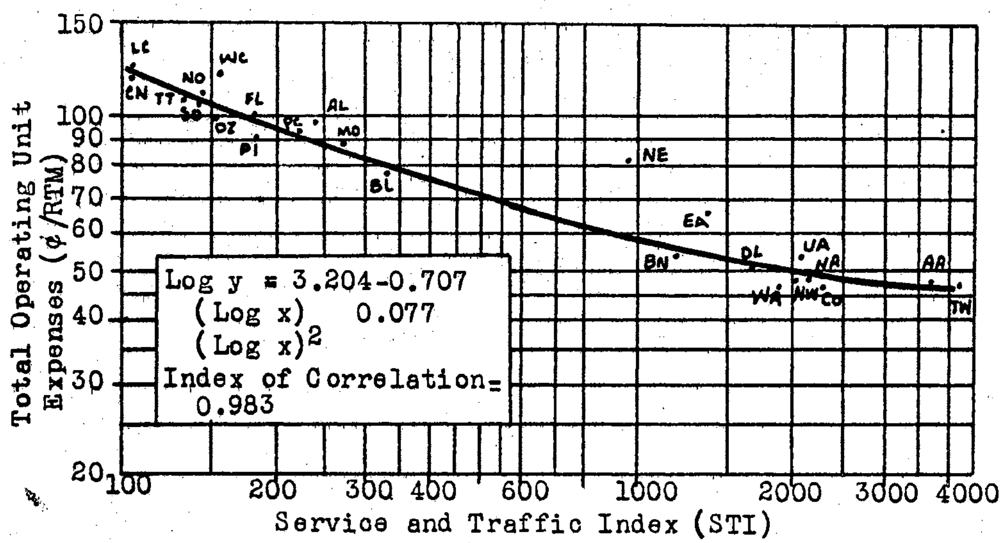


Figure 1. Total Operating Unit Expenses and the Service and Traffic Index

Efficiency of effort may be expressed by costs per ton and seat-mile flown and sold. But in the airline industry this ratio is largely determined by factors other than the quality of management. Because every journey, irrespective of its length, gives rise to broadly similar efforts in selling, ticketing, reservation, maintenance, embarkation, and disembarkation, costs per mile tend to vary inversely with the length of journey. The shorter the journey the higher the cost per mile flown because the fixed costs of efforts in marketing and production are spread over fewer miles. Therefore, an airline with relatively short average journey lengths must face higher costs per mile flown, all other things being equal, than an airline with relatively long average journeys.

For decision-making, it is usually difficult to establish the cost of a single route. Nevertheless, an estimate must often be made and the following general cost classifications are useful in making the analysis:

1. Variable costs. Costs incurred solely for a route, and that increase directly with the amount the route is used. For example, an increase in flying hours on a route would increase such costs as maintenance, fuel, oil, and landing fees, all directly attributable to the route.
2. Fixed costs. Costs that do not vary with output in the short run and that can be attributed entirely to a route. For example, if an aircraft and crew were used exclusively on a route, the total depreciation and crewing costs would be allocated to the route.
3. Apportioned costs. Unavoidable costs that are a portion of total costs relevant to more than one regional route and which are reasonably attributable to each. For example, portions of the total cost of a station may be attributed to a number of routes using some "reasonable" basis.
4. Overhead cost. Unavoidable costs that do not directly pertain to routes but which must be "shared" arbitrarily. For example, legal and administrative costs are real expenses that must be covered; but, if a route or group of routes ceased to be operated, it is not likely that these costs would be reduced by an amount equal to the proportion charged.

Areas Requiring Economic Decisions

The Civil Aeronautics Act sets forth a general declaration of policy designed to guide the Board in all determinations of public convenience and necessity. In that policy statement, one finds that the Board is to pursue the activities of both promoting and regulating air transportation. Promotion and regulation in turn are to be carried out in pursuit of multiple objectives: highest degree of safety, sound economic conditions, proper adaptation to the needs of domestic commerce, the Postal Service, and the national defense. Competition is to be employed as a means "to the extent necessary".

Malcolm A. MacIntyre, former president of Eastern Air Lines, Inc., set forth in a recent address the general competitive economic problem-areas facing managerial initiative under governmental control (8). The areas he identified will serve as additional general framework within which the relevance of certain fundamental economic concepts of the theory of the firm to managerial decision-making will be analyzed. They include:

1. Price setting.
2. New route applications.
3. Product development promotion and differentiation.
4. Cost estimating and control.
5. Equipment selection.
6. Flight scheduling.

CHAPTER III

DEMAND ANALYSIS IN AIR TRANSPORTATION

Introduction

The theory of demand in all its ramifications constitutes a major portion of the traditional economic theory of the firm. And, on the application side, a progressive management must devote substantial amounts of resources to analysis of determinants of demand, changes in demand, elasticity of demand and pricing strategies since the economic facts of life definitive of these phenomena ultimately determine the firm's sales and revenues.

This chapter identifies and discusses economic facts peculiar to demand analysis in air transportation. It also demonstrates that firms in search of added profit formulate policies within the framework of economic theory and, thus, make theory practical and useful though lacking statistical measurements of important variables. The corporate actions reported with respect to product differentiation, advertising, and various pricing schemes demonstrate specific attempts by firms to implement economic theory in crucial decision areas. Finally, this section, by describing important environmental characteristics, lays additional groundwork for a subsequent case analysis of Frontier's 50 per cent standby fare decision.

Demand for Air Transportation

Demand for a product is defined as the various quantities of it which consumers are willing and able to take off the market at all possible alternative prices during a given time period, other things constant. Factors which have been shown to have a significant influence on demand for air transport between any two points include (6):

1. The population sizes of the two cities and the distance between them.
2. The natural obstacles to ground transport and their effect on the time-saving of air transport.
3. The occupation of the people who inhabit the area served.
4. The state of the over-all economy.
5. The various seasons of the year, days of the week, and the time of day. Traffic changes from winter to summer, from weekend to weekday, from day to night, and from certain hours of the day or night to others.
6. The number of stops. Generally, the less frequent the number of stops, the greater is demand.
7. The frequency of service. A widely accepted rule in the industry is that traffic tends to increase more than proportionally with increases in frequency of service.
8. The timings of services. As would be expected, certain timings, particularly arrival times, are more attractive to customers than are others.

In the air transport industry, quantity demanded seldom matches quantity supplied since usually either too little or, more likely, too much capacity is provided at any given price. Since airlines are unable to "produce" output in times of low demand for stock accumulation to be sold later at times of high demand, they tend to equip themselves to deal with peak demand to avoid losing any traffic. They then seek to utilize this idle capacity and reduce costs by schemes to generate more off-peak traffic.

Demand forecasting is very important in the air transportation industry. Airlines list the following factors as relevant in the preparation of a forecast (9):

1. Past company and industry growth.
2. General economic activity.
3. Type and capacity of aircraft and equipment available.
4. Action of competitors.
5. Seasonal variations.
6. Probable effects of CAB decisions upon existing competition.
7. Judgment of company executives.

The two leading forecasting methods are:

1. Trend and cycle analysis, using standard time series analysis on data provided by historic sales records. The objective is to discover long-run growth trends and cyclical and seasonal fluctuations.
2. Judgment of company executives, based on wide experience and a "feel" for the market.

All reports on the air transportation industry show phenomenal growth in industry demand with growth rates in the near future expected to be around 15-17 per cent annually. Historically, at least two-thirds of all domestic commercial flying is done by businessmen, and much of the increased demand over the past few years can be accounted for by more business flying. Much of the increased business travel is essential, having been created by the expanding operations of many companies which require repeated trips by company officials and professional employees (10). With no reduction in the national economic growth rate in sight, airlines can look forward to a continuing excellent base.

However, some business travel is not so essential. Firms with increasing earnings are sending more lower-echelon managers as delegates to conventions and conferences. Not only do such trips benefit the company but they also improve employee relations. With fast, medium-range jet service between more and more cities, "trouble-shooting" trips or customer relations trips can be made easily and quickly. Such flying impresses clients and seems to be gaining as a status symbol as well as a competitive necessity.

The most significant trend for airlines today, outside of increases in military-related travel, is the increase in pleasure travel. Due to the continuing prosperity of the economy, more discretionary income is going for travel, particularly air travel. According to Business Week (10),

> Flying is taken so much for granted, particularly by young people, that a whole new, and surprisingly large, market for airlines is emerging--what might be called adventure and impulse flying. As tenuous as this business sounds, many such travelers are likely to keep flying, for whatever reason, the rest of their lives.

Competition for passengers has been getting progressively more intense and airlines have eagerly sought to increase traffic by means other than price reductions. Among the recent attempts to shift the individual firm's demand curve to the right -- and, as most firms follow suit, the industry demand curve -- is the decision made by American Airlines in 1964 to retain the services of the big credit card company, American Express (11). Since then, other carriers have signed contracts with credit card companies. The objective is to get more pleasure travelers to fly by letting them, as credit card holders, pay for their tickets in installments. The reasoning is that for many travelers, a trip now with a year to pay is too enticing to pass up.

Thus, the firm and industry demand curves for air transportation are shifting to the right, due in part to some of the factors named above.

Changes in Demand for Air Transportation

A change in demand results when the conditions held constant in defining a given state of demand change. Thus, instead of a price decrease, a given firm may actively seek to increase the quantity it sells by influencing consumer preferences through product differentiation and product advertising.

Product Differentiation

Product differentiation is defined as the existence of a preference, real or fancied, in the mind of the buyer for the product of a given seller. The differentiability of an industry's product is a very important trait of market structure since it will likely influence the character of competition, particularly product competition. The objective of a firm in a given industry with respect to attempts to differentiate its product is to create a body of customers, present and prospective, who consider its "brand" somewhat superior to others. To do so, it must make consumers think that its brand has unique and superior characteristics. If it is successful, it will, among other things, cause an increase in demand for its product relative to that of competitors.

At first glance, air transportation does not appear to be a readily differentiable product because airlines:

1. Charge essentially the same fares.
2. Fly at the same speeds, thus making elapsed times between cities equal.
3. Use standardized aircraft.
4. Provide essentially the same in-flight comforts and amenities.
5. Provide comparable service in ground passenger handling facilities.
6. Have comparable safety records.

Thus, if two airlines serve the same city-pair with comparable quality service, it may seem that, aside from a price differential, one of them could do very little to cause a significant preference by consumers for its flight. And yet, competitive product improvements and other attempts at product differentiation are very important competitive practices on the part of airlines.

The three main kinds of product improvement which produce "successful" product differentiation are:

1. Reducing scheduled time of flights. The speed advantage of air travel over other means is one of the main

reasons for the continued growth of air traffic relative to, and at the expense of, other means of travel, particularly on long hauls. However, small changes or advantages in elapsed flight time would seemingly be unnoticed by passengers or would not be particularly important due to long ground travel times to and from airports.

2. Increasing the frequency of available flights. A widely accepted notion among airline managements is that air travelers are more apt to seek a reservation with a carrier which is known to offer frequent flights. In fact, if a carrier experiences a decrease in demand for its service between a city-pair and is seeking some way to minimize the effect of the resulting low-load factor on its over-all profits, it will usually not reduce the number of flights offered per day. To do so may further reduce its lead factor as regular and potential customers gravitate to the other airlines. Thus, in an attempt to lower costs by reducing the quantity of service offered, such a carrier would likely be faced with even greater decreases in revenue as traffic is lost not only from flights canceled but also from its remaining flights as well.

3. Employing faster, larger, and more comfortable aircraft. In markets where new aircraft have been introduced, the carriers making the innovations have consistently experienced significant increases in traffic among

> people who would not otherwise have flown, as well as transfer of traffic from competitors not equivalently equipped, even with higher prices.

With apparently increasing vigor and enthusiasm, airlines are seeking to tap the near unlimited potential market for air transportation. Competitive actions taken individually have the aim of shifting the demand curve to the right for the individual firm with respect to competition. At the same time, however, such aggressive competitive behavior serves to draw an ever increasing number of customers into the market, thereby increasing total market demand as well.

One costly aspect of this competition is the race to secure airline stewardesses (12).

> Millions of dollars are spent annually to find young ladies with the precise qualities that will insure their rapid departure from the company. The better the stewardess the girls will make, the better are their prospects for marriage .... Despite this apparent waste of money, the search for and training of these girls goes on at an ever costlier pace.

Each major airline maintains a lavish training school, and the investment in each girl by the time she graduates ranges from $1,000 to $3,000. Average length of employment is eighteen months. In fact, one trunkline, American Airlines, has recently been running a series of cartoon-ads in leading national publications depicting a regular customer who is surprised to find that his regular flight no longer has his favorite stewardess serving it. The captain explains that she has just married. The message the airline is promoting is, of course, that it offers stewardesses who are so charming and beautiful that it cannot keep them and that the customer will find his flight all the more enjoyable because of it.

Delta Airlines also is using ads showing photographs of one of its stewardesses as she performs her duties with wide smiles. The caption reads that the airline's aim and her job is a "happy ship", that Delta's friendly stewardesses have a special knack for helping passengers enjoy their travel, and that customers will thoroughly enjoy Delta's unique brand of personal service. The reason for these large competitive expenditures are obvious: to attempt to differentiate the product and to increase the individual firm's demand. A report in Business Week concludes (12):

> Why are airlines so willing to run what one vice-president calls "our school for brides"? They wouldn't have it any other way. With most planes practically identical, the fares the same, and the food similar, the only noticeable difference is the quality of cabin service. For many passengers the charm and attractiveness of the stewardess--or lack of it--personify the airline.

Perhaps the most striking example of attempted product differentiation is that of Braniff International. A new president took office in April, 1965, and in a reported interview said (13):

> On our present system, there's going to be an aggressive marketing program. Braniff is going to look different than it's ever looked before--airplanes, interiors, ticket offices, uniforms. It's going to be a new Braniff with a positive image and the customer is going to think of us as a warm company. We will innovate. We're going to pursue actively the traffic available to us and we're going to serve it well.

Later on in 1965, Braniff revealed its palns to gain more customers by such promotion. Among other things, Braniff

1. Painted the fuselages of all its jets in solid colors.
2. Fitted out its hostesses with a series of quick-change uniforms especially and uniquely designed by an Italian designer.
3. Banished plastic cups and dishes from the airplane and

began serving all meals on china and all drinks in glasses.

4. Issued permanent baggage checks to regular customers to speed up the check-in process and to build customer relations.

Business Week reported (14):

> All this--and more--is designed simply to attract attention to the airline, and the record shows that the application of such luxuriant icing to the basic means of air transportation can work wonders.

Product Advertising

The most effective means of increasing quantity sold of a product is usually a price decrease. But airlines generally are either denied or prefer to avoid the use of this competitive weapon and in large part resort to other means. The place and purpose of advertising in the over-all marketing policies of airlines is to attempt to build customer "brand" preferences. Since airlines are not able to display their product to potential new, first-time customers, they must attempt to create a preferential notion of the superiority of their product in the minds of the potential customer. Since the product offered is nothing more than "arrivals", most ads include destination and the points pertinent to destination such as speed of the aircraft, frequency between city-pairs, on-time performance, and special amenities offered by the particular airline. Much airline advertising has been and is directed to those already flying, for the prupose of diverting the existing market from one airline to another.

A major objective of advertising is to create a distinctive corporate image or identity in a basically indistinctive product market.

The prime current example is Braniff International's so-called innovations and subsequent advertising of those innovations. Braniff calls it "The End of the Plain Plane" and with color layouts of its new look, mentions the 17,543 changes have been initiated! Woven into these basic advertisements are facts concerning increased frequencies between major cities, stepped up on-time average, faster jets, streamlined ticketing, 6-minute baggage delivery, and new write-your-own-ticket service.

In 1961, Continental Airlines staged a big promotion by painting all its airplanes a brilliant gold, put its crews into gold uniforms, and its ground crews into gold overalls and astronaut helmets. According to Business Week (14), "That certainly attracted attention to Continental and in the long run it paid off, too." Currently, Continental is advertising itself as "The Proud Bird With the Golden Tail" and asks the question of ad viewers:

> How do you show something you can't see? How do you show the difference between Continental and the other major airlines? How do you show pride? That's the difference. You can't see it--you feel it!

These ads go on to talk about how Continental employees maintain their individuality, interests, and involvement in how their airline is run due to the fact that Continental, as a major airline, is not a big, impersonal one. Then the pitch is made: "Come travel with Continental Airlines and feel the difference pride makes."

United Airlines has been generally depicting situations with which individuals can identify. For example, United portrays a scene of a small girl taking her first flight with her father who is actually on a business trip and the fun both are having; another is that of a wife "tricking" her husband into taking her along on his weekend business trip and charging her fare by credit card. Then follows the identifying phrase, "Fly the Friendly Skies of United."

American Airlines' main image-objective is "American built an airline for professional travelers." The content of present ads generally start with some question such as, "If Gene Kelly doesn't wait in line, why should you?" The main message then describes the outstanding service offered by American, its superb cuisine and so forth, all originally provided to meet the exacting demands of corporation presidents, actors, and other professional travelers. The ads typically close with: "If you aren't a professional traveler yourself, we thought you'd at least like to know how to get the same service. Just take the same airline."

Local service airlines have not so far made the same attempts to identify themselves with catchy phrases but have instead seemingly concentrated on informing the public as to just where they do offer service and how good it is. One common ad is that showing the route map of the carrier with major cities served pointed out. Like trunklines, they are quick to advertise the purchase and installation on routes of any newer, faster aircraft, particularly jets.

Since air travel is not usually purchased frequently by those other than business travelers, building up loyalties to a particular airline is thought to be difficult. Nevertheless, large expenditures are made each year in an attempt to specifically do just that, as well as promote air travel in general and management must decide just how much to spend on advertising in the first plcace. There are no known formulas which measure the return on a given outlay nor is there a way to conclusively isolate the effect of advertising. Nevertheless, the decision must be made and evaluated.

Recently, Mohawk Airlines, a local service carrier which purchased nine BAC One-Eleven short-range jets, found itself in stiff jet service competition with American Airlines in the New York City-Syracuse market. Mohawk, the first local service carrier to acquire jets, put several into service during July, 1965, between this city-pair, offering six flights per day, with a one-way first-class fare of $17.90. American got into the market in March, 1966, with the same aircraft, offering eight flights daily at a one-way coach fare of $15.55. The market is already made up largely of commuting businessmen, though the introduction of jets is expected to further increase business-commuting.

Despite the new competition, Mohawk reported an 80 per cent increase in passenger travel the first two weeks of April, 1966 over April, 1965. According to Business Week (15), "Mohawk credits much of the increase to a recent heavy advertising campaign in the Syracuse newspapers." At the time of the report, American was countering with its own ad campaign.

The importance of advertising dollar-wise can be seen in industry statistics. In 1965, the average percentage of total revenue spent on advertising by the twelve trunklines was 2.7 per cent. The largest dollar amount was the approximately $20 million made by TWA. By comparison, Braniff spent $4.5 million, having doubled its expenditure over 1964, and Frontier spent $480,000. In 1966, Braniff alone spent $6.5 million on advertising and feels it received at least that much worth in free publicity (16).

Although business travelers constitute the foundation of the air transportation industry, the greatest potential for increased traffic lies in the yet untapped, tremendous-sized market of automobile travelers. This is particularly true for local service airlines. Surveys have shown that automobile travelers not only generally are unaware of the relative cost of air transportation versus automobile, but also have never really considered taking an airplane to a vacation spot for general pleasure or for visiting with family and friends on trips of around 500 miles or less. Hence, much current advertising is directed toward this major travel market, emphasizing the economy, safety, speed, and other advantages of air travel.

But every dollar spent on advertising will have to be taken from some alternative use. Therefore, management not only must decide how much to spend on advertising and its probable effect, but also where to do it, what media to use, and when.

Price Elasticity of Demand and Pricing Practices

Management may take one of two, or both, discretionary actions to influence the quantity sold of its product. It may attempt to increase the demand for its brand by various means of product differentiation and advertising, and/or it may reduce price in an attempt to increase quantity demanded. The extent to which the latter is successful in bringing about increased sales and revenue depends in large measure on the price elasticity of demand not only of the firm's particular brand, but also of the entire market since any individual competitive pricing action will almost certainly be followed in an industry like air transportation. Thus, one of the crucial questions facing any airlines contemplating a price change is how responsive will consumers be to the change; that is, by how much will quantity demanded change with a given price change, assuming all other determinants of quantity taken remain constant.

Measuring Price Elasticity of Demand for Air Transportation

Attempts to accurately calculate the price elasticity of demand for air transportation have, for the most part, proven fruitless. The results of two studies are cited by Caves (4), one having been made by American Airlines and submitted as evidence in the recent CAB General Passenger Fare Investigation proceedings and the other from the Civil Aeronautics Board's Office of Carrier Accounts and Statistics.

American Airlines acknowledged that its calculations "were of the roughest sort," but insisted that other plausible methods were just as rough and inconclusive. In the Board study, the statistical procedures were considered acceptable but the results unacceptable due to the high intercorrelation of the independent variables. The influence of both income growth and time could not be adequately held constant and so distorted the real effect of price changes on passenger-miles flown. Miller (9), in reviewing the same General Passenger Fare Investigation, cites part of the testimony of United Air Lines:

> The third matter for consideration is the effect of the increase in fares of 17 percent upon our market. There is no precise way of determining in advance what such an effect will be. Lacking any scientific approach to this question, it then becomes largely a matter of judgment. In our judgment, the increase in fares which we propose will have no appreciable effect upon our market.

American Airlines and the then Capital Airlines concurred with the statements of United, saying in fact that they believed, on an intuitive basis, the demand for air transportation to be inelastic.

Any attempt to measure price elasticity of demand for any product must contend with shifts in the demand curve caused by any number of non-price determinants of quantities demanded at particular prices. Furthermore, demand for air transportation is divisible into at least two major classes, personal (or pleasure) travel and business travel, both of which are further divisible into several sub-classes. Thus, the elasticity of demand for air transportation, so-called, is an aggregative and necessarily more imprecise concept.

The conclusion of two authorities in the field of air transportation summarize the present state of knowledge with respect to price elasticity of demand:

> Caves (4): There is, in short, no clear evidence about the aggregate demand elasticity for air transport at the present time.

> Barry (6): The fact is we know very little about the elasticity of demand for air transport. We have had too little experience to judge from, and research is made difficult by the continual changes in factors other than price. It is not easy to isolate the effect of price changes.

In the absence of exact data and precise knowledge, airline management must nevertheless make decisions with respect to pricing. Their proclivity, past and present, has been to act as if the demand for their product were inelastic, as evidenced by their continued advocacy of price increases. This is especially true of trunk carriers. Local service carriers are forced by the competition of automobile travel and other surface transportation to behave as if they, at least, face a more elastic demand and so usually lead what efforts there are in the industry for more competitive price decreases.

The CAB and Price Elasticity of Demand

In June, 1965 the Civil Aeronautics Board got a new chairman, Charles S. Murphy. In his first speech to airline managements, he dealt with the topic of price elasticity of demand for air transportation (17). In essence, he told the carriers that reductions in passenger fares and continued increases in carrier profits can take place concurrently. He pointed out that the record over the last two years showed:

1. A 10 per cent reduction in long-haul first-class fares
2. A 50 per cent cut in military furlough fares
3. A 33 per cent cut in family plan fares for a coach group of three
4. An 80 per cent cut in excess baggage charges

while net profits increased:

1. In 1964 by 180 per cent over 1963
2. In 1965 by 211 per cent over 1964.

Mr. Murphy (17) further stated:

> I will readily concede that these examples do not establish the proposition that any and all fare reductions result in increased profits. On the other hand, I think you must concede they do establish the proposition that the two things can exist simultaneously... For the present, I will leave this with a simple statement that, in my judgment, reductions in passenger fares are not necessarily synonymous with reduced profits.

Later in the same month of November, 1965, Mr. Murphy delivered his second speech to airline officials, again setting forth his economic philosophy (18). While expressing his pleasure at the excellent earnings of the industry, he nevertheless called their attention to the fact that about 45 per cent of the passenger seats offered by the industry move empty. He remarked:

> We are fortunate indeed that American technology has produced the amazingly efficient jet. Otherwise, we could well be in deep trouble at the moment. For I know of no

> other industry which could approach a profitable state operating at little more than half of its capacity. But even in your industry, it would be folly from the standpoint of your private interests, the national economy and the public welfare to accept such a waste of potential as just one more regrettable fact of life.

Mr. Murphy emphasized that even though air travel is indispensable to the time-poor businessman and that this market is highly dependable, the greatest potential market and one which must be reached is the money-poor domestic pleasure traveler. With respect to tourism by air, he said (18):

> The task of developing tourism will inevitably call for price reductions -- selective but substantial. For there is another very real difference between personal and business travel which is well to keep in mind -- the net cost of the seat to each... The businessman's transportation is paid for with pre-tax dollars, personal travel with after-tax dollars... It is small wonder that the pleasure traveler has his ear close to the ground when it comes to price.

Chairman Murphy also had some specific suggestions for the carriers in the way of special-fare programs, though maintaining that the airlines themselves are the best judges of what promotional fare approaches are required. Foreigners can travel anywhere in the United States at a flat charge on most local service carriers and several trunk lines, and Mr. Murphy suggested that such a program for United States citizens be considered, either on a space-available basis to protect regular fares or only on off-peak flights having very low passenger load factors. As an additional means of penetrating the pleasure travel market, he further proposed special excursion fares and all-expense tours.

After the two speechs by Mr. Murphy, various industry spokesmen registered their disagreements with Murphy's over-all pricing philosophy, especially with respect to excess capacity. They particularly feel it is an erroneous assumption that, because they fly so many empty seats, fares should be lowered. On the contrary, most air carriers generally believe that rapid and increasing capital expansion is needed to make traffic grow, not fare reductions. Most of them feel, "It is the convenience of air service, the assurance that seats both there and back are readily available and not the price that has caused and will continue to cause airline business to grow..." (19).

Going into 1966, the CAB refused to permit the airlines to collect an erstwhile traditional surcharge whenever a piston flight was replaced with a jet. The trunk airlines quickly told the CAB this action would cost them approximately $146 million in revenue per year. The carriers, fearful of a CAB imposed across-the-board fare reduction that they believe would reduce revenue per passenger without increasing passengers, have increased applications for special bargain fares for groups who normally do not fly.

Selected Airline Pricing Decisions

Mr. Murphy's suggestions to the industry, in particular the eleven trunklines, for fare plans to develop the pleasure-travel market are not exactly new; nor do all airlines take the viewpoint that fare reductions can only prove unprofitable for the industry. So-called "promotional fares" of one kind or another existed long before Mr. Murphy took office. For instance, the Executive Vice President for Bonanza Air Lines, a local service carrier, criticized the industry in 1962 for its failure to properly define the objectives of promotional fares, guide the development of the particular market sought, advertise the service and, in general, actively seek a wide public acceptance of the service. He pointed out then what all airlines know -- that the auto traveler is by far the largest untapped potential and that only a fractional penetration of this potential would be worth a fortune to the industry. In citing Bonanza's own promotional fare program initiated in April, 1961, he said (20):

> We are not shrinking from the prospect that use of the fares might reduce yield. We firmly believe -- and the facts fully sustain us in this -- that the additional traffic generated far more than offsets the reduction in fares and provides a very substantial gain in net revenue. Not only have we produced new excursion traffic but we have also produced a growth in full fare paying traffic in the excursion markets that is four times the rate of growth in the non-excursion markets.

In late 1961, Continental Airlines announced a "startling", revolutionary decision with respect to pricing and the elasticity of demand in the airline industry. Airlines have for several years offered two basic types of service, first-class and coach, but in November, 1961, at a time when industry losses approached $35 million, Continental proposed a third industry-wide, "no frills" jet economy class with fares 25 per cent below regular jet coach fares. This was a period of slow growth and jet over-capacity in the industry, and the CAB was faced with determining whether the lower fare would increase new traffic sufficiently to increase airline profits or whether it would result in even heavier losses for the industry.

The president of Continental maintained that the 16 to 35 per cent increase in fares since the mid-fifties had seriously damaged the industry and that a price decrease was necessary to restore traffic growth. Continental's position was stated to the Civil Aeronautic's Board as follows (21):

> At the present time, over 75 per cent of our jet revenue passenger miles are in Club Coach service. We know that a portion of this traffic is business traffic that has been diverted from First Class. We do not believe very

> much of this business traffic will be diverted to the new "economy service," since it will be "Spartan" in nature... In the Club Coach section of the aircraft, we will be providing 42 seats at a load factor of 50-55 per cent, or approximately 40 per cent of the traffic we are now carrying in this section with capacity reduced 50 per cent. In the economy section, we anticipate a load factor of 60 per cent, comprised of 25 to 30 passengers diverted from existing Club Coach service and 15 to 20 new passengers in the markets, attracted by new low fares. This new traffic will consist of the following:
>
> 1. Newly created traffic among the people now unwilling or unable to spend the time required to travel by surface means and unable to afford air travel at existing price levels.
>
> 2. More frequent travel among present air travelers due to reduced prices.
>
> 3. Travel diverted from surface transportation.
>
> These load factors would result in a requirement for Continental Airlines to develop approximately 550,000 additional revenue passenger miles per day. Even assuming that no new travel is created, this represents a diversion from existing surface travel of only 2.4 per cent of the 22.5 million daily estimated surface passenger miles in Continental's market area. There is no question but that this modest diversion from surface transportation media will be realized with the planned reduction of fares.

The industry's most vocal dissenter was United Airlines. United maintained that "... for longer-haul business travel, the distinguishing characteristics of air transportation such as speed and comfort provide a value so great, price is not, in United's opinion, a serious consideration" (21).

Both airline managements cited statistics, examples and other reasons to support their respective positions concerning the importance of price is stimulating air transportation. Finally, the CAB voted to suspend Continental's plan because, "... there is substantial question as to the economic validity of the proposed fares if applied to the industry as a whole" (21).

About a year later, in August, 1962, Continental submitted a revised proposal to the CAB which would establish "economy" fares in selected markets 20 per cent below conventional coach fares, instead of the originally proposed 25 per cent. In addition, the coach fares were to be raised 10 per cent, cutting what many felt to be an excessive spread between coach and first-class fares that had caused considerable transfer of traffic to the lower-cost class. The CAB approved the new plan on an experimental basis because it was "... uncertain what appeal the reduced fares would have to the public and we cannot, therefore, forecast accurately the impact of the proposal on the net revenue of the carriers" (21):

Although other airlines had in the past experimented with reduced fares in special travel markets (in particular, commuter type city-pairs), Continental's experiment was generally acknowledged to be the most important up to that time in attempting to increase the sales of air transportation by fare reductions. It is a prime example of a decision made on the basis of price elasticity of demand considerations, but where the exact or even nearly exact elasticity coefficient was not known and where "experts" argued from opposite positions.

During the same year that Continental proposed and subsequently installed its third-level economy fare, the Assistant General Manager of Irish International Airlines wrote an article commenting on the economic state of the industry and the causes of the airlines' depression (22). Research at his company shows that the public is mainly concerned with two factors, safety and price, and that speed, comfort, and scheduling reliability, though important, have less powerful an impact. Speed, he grants, has been the predominant advantage of the airplane as a mode of travel, but the industry has been and is obsessed with speed. Noting that the greatest amount of passenger travel involves segments shorter than 500 miles, he bemoans the fact that carriers rushed to buy long-haul expensive jets instead of demanding an economic short-haul aircraft. He remarked (22)

> If we had been less amenable to the blandishments of manufacturers and had given reduction of fares a higher priority than increased speed, would we not have served the public better and would we ourselves not be in a better financial position? ... It is time that the economic relationships such as cost/price and demand/supply took precedence over technological allure.

One of the most unique market "experiments" in air travel history is being conducted under strong competitive pressures in the Los Angeles-San Francisco market, currently the largest air market in the world between two cities. In the last three years since 1962-63, the compounded annual growth rate has been 25 per cent per year. A flight is 340 miles one way, and the current jet "commuter" fare of 3.97 cents per mile (a one-way tariff of $13.50 plus tax) is lower than any other air fare in the United States (23).

Three trunks (TWA, United, Western) and one intrastate carrier, Pacific Southwest Airlines (PSA), compete in this market, PSA having initially recognized and developed the potential. Approximately 16,000 round trip seats per day are flown by the four carriers, United carrying 37.8 per cent of the traffic; PSA, 32.8 per cent; Western, 18.9 per cent; and TWA, 10.5 per cent. Over its limited intrastate route in 1964, PSA had a pre-tax margin of profit of 27.9 per cent, a record for the industry. According to <u>American Aviation</u> (23), "It accomplished this by charging lower fares to build up higher traffic volumes. As on-time record of 94 per cent helped too."

Competition in this market has included equipment, scheduling frequencies, in-flight services, and the matching of fare cut with fare cut. The development of this low-fare, jet commuter service has caused the industry to reconsider the effects of lower fares on market sales, especially when accompanied by improved aircraft. One of the questions arising from this California experience is whether there will be similar high-capacity, one-class, low-fare commuter service between other high-traffic city-pairs.

New Industry Promotional Fare Plans

During 1965-66, air carriers received CAB approval to put into effect several additional promotional fare plans. This reflects the Board's policy of encouraging domestic air carriers to provide "low-fare, no-frill" service in markets where traffic demand is sufficient to support economical operations (24).

The use of third-level "economy" fares, along the lines originally proposed by Continental in 1962, which are set 15 to 20 per cent below coach fares, was expanded.

The Family Fare discount was liberalized by the trunkline carriers by extending the period of applicability to coach passengers and to additional days of the week. The fares are available to encourage heads of families to take their wives and families with them on out-of-town trips. The man-of-the-house pays full jet coach fare, but gets one-third off for his wife and two-thirds off for each child under 22 years of age. TWA, the originator of the plan, expects its family passenger miles to increase from 700 million a year to 1.3 billion, resulting in a $34 million increase in revenue (25).

Round-Trip Excursion fares are available involving a 25 per cent reduction from regular fares. They are designed primarily for those who do not or cannot use the family plan. The traveler cannot return in the same calendar week and must arrange his trip so that he does not travel on those hours of the week and days of the year when air traffic achieves abnormal peaks.

Youth Fare plans were introduced in January, 1966, originally by American Airlines and Allegheny Airlines. Such plans provide that anyone between the ages of 12 and 22 years can purchase an airline identification card entitling him to fly at one-half coach fare on a space-available, no reservation basis. Youth fare plans are in effect year around except for heavy traffic holiday periods.

A Board official recently described the youth fare proposals and a special standby fare proposal by Frontier Airlines as "unique ventures" in rate making (26). The objective of youth fare plans is to gain an increase in short-run revenues by filling otherwise idle seats and to enhance long-run profits by exposing a coming generation of adults to air travel. Although there have been problems for the airlines with the youth fare, Business Week reported (27): "There is no doubt that the youth fare has generated a substantial and desirable increase in business, up to 2½ per cent for some lines."

In general, the airlines are developing fare reductions aimed at stimulating domestic personal and vacation travel. Feeling that relatively few people desire other standard goods and services, they seek to take into account the different needs of customers and offer a range of products at varying prices to meet this diversity of needs. They are also recognizing the importance of price elasticity of demand in pricing decisions. For example, fares for the summer of 1965 for the New England area were varied in an attempt to maximize profit for the carriers by seeking to allocate available capacity in an optimum fashion. On peak travel days, normally Friday and Sunday, a premium of 10 per cent is charged above normal fares. Since the carriers are not able to accommodate all customers requesting service at normal rates, a premium is charged in an attempt to ration the facilities to those who are willing to pay for them. On days when demand is low and load-factors are down, usually Tuesday, Wednesday, and Saturday, a discount of 10 per cent is given to induce new customers to travel by air and regular customers to postpone otherwise peak-day travel plans. Normal fares apply on Monday and Thursday (24).

Price Discrimination

In the air transportation industry, a fare or price is the sum of money a customer pays for being transported from one point to another. Thus, what the customer pays for and what the carrier offers as a product is, in essence, an "arrival". But customers do not view night arrivals as equivalent to day arrivals or weekday arrivals the same as weekend arrivals, and so forth. So, by increasing the number of fares and conditions-of-carriage available to customers, an airline can increase the number of markets for its product and the amount of traffic carried. Not only will this increase the firm's revenue over that obtained from a single tariff, but it will also increase the use of equipment and will likely decrease unit costs.

Discriminating markets by prices is possible and profitable if the price elasticities of demand at each price level differ among the markets and the firm is able to keep the markets segmented. Price discrimination occurs whenever a firm charges different prices to different segments of the market for the same product, or charges prices that are not proportional to the marginal costs of slightly differentiated products.

The Clayton Antitrust Act of 1914 prohibits price discrimination between purchasers when such discrimination is not justified on the basis of cost differences and where the effect is likely to lessen competition. Regulatory agencies such as the CAB are charged with enforcing discrimination statutes contained in legislation pertaining particularly to the public utility type firms under their supervision. For example, the Civil Aeronautics Act requires that airlines maintain "just and reasonable" rates and that (4):

> No air carrier ... shall make, give or cause any undue or unreasonable preference or advantage to any particular person, port, locality, or description of traffic in air transportation in any respect whatsoever, or subject any particular person, port, locality, or description of traffic in air transportation to any unjust discrimination or any undue or unreasonable prejudice or disadvantage in any respect whatsoever.

In general, it is difficult, first of all, to determine if products are in fact different products or simply different versions of the same thing and secondly, what the true marginal costs are of producing each product. In particular the CAB must interpret what constitutes "unreasonable" and "unjust" price or other discrimination and what constitutes discrimination itself.

Without attempting to establish the historical findings of the Board with respect to price discrimination investigations, it can safely be said that the Board's record shows variable interpretations and only occasionally are they founded in price-marginal cost analysis.

At any rate, the Board has encouraged and permitted carriers to institute promotional fare plans of the variety previously described without finding them unreasonable, unduly preferential, or unjustly discriminatory. Whether or not the various product prices are in fact proportional to the marginal costs of production is yet to be determined; a priori one would suspect they are not. But, at any rate, the airlines have found that charging different prices to different segments of the air transportation market is a profitable policy.

CHAPTER IV

CASE ANALYSIS OF ECONOMIC DECISIONS OF FRONTIER AIRLINES

Introduction

Chapters II and III dealt with important facets of the economic, political, and social environment of the airline industry and with management thinking and practices that make basic theoretical economic concepts operational, especially in demand analysis. This chapter will more conclusively affirm, through case studies, the validity of the previously stated thesis and examine in detail the anatomy of economic decision-making.

The analyses which follow are of four decisions made by Frontier Airlines in 1966. In each case, theoretical economic principles furnish the general framework within which the decision was formulated. The basic objective of case analysis is to determine how the logic of theory is made applicable in practice, both when reasonable quantitative approximations to theoretical functions can be calculated and when they cannot. This will be accomplished by demonstrating the mechanics of analytical procedures used by Frontier, identifying sources of input data, specifying underlying assumptions and noting environmental conditions.

Decisions of Frontier selected for analysis include the following:

1. 50 Per Cent Standby Fare Decision. Though acclaimed a

"unique venture in rate making", this decision did not occur in a vacuum; ample precedent existed, as did CAB encouragement. In this major pricing decision, price and cross elasticity of demand considerations are paramount, yet quantification of relevant variables is not possible. The case analysis deals with the role of economic theory in inspiring the decision, environmental factors bearing on the decision, the content of the fare proposal, Frontier's reasoning in making the decision, and the revenue results of six months operation in markets where the fare is applicable.

2. Las Vegas Route Decision. It is one thing to assert that a decision is profitable if the resulting incremental revenue exceeds incremental cost, and another thing to make reliable estimates of either. The case analysis disects this major route application decision into its many component parts in order to ascertain just how Frontier makes such an evaluation. Particular attention is given to methods of cost and revenue analysis, data sources, and assumptions. Cost-output relationships are examined, and Frontier's use of marginal costing is noted and illustrated.

3. Douglas Route Decision. This new route application is considerably less important economically than the Las Vegas proposal, but basically the same revenue and cost estimating procedures are utilized. In this decision, Frontier explicitly uses an added cost approach

to route costing. That is, Frontier's route cost forecast, in keeping with economic theory, is based on the marginal cost of added service, rather than and in contrast to the average, fully allocated cost approach typically used by the CAB. On part of the new route, the 50 per cent standby fare will be made available. Thus, in its revenue forecasts, Frontier, while not computing price and cross elasticity of demand coefficients, does quantify the extent to which the price decrease stimulates additional sales (E_p), and the effect of the price decrease on quantity sold of other service offered (E_c). The case analysis examines and illustrates Frontier's reasoning underlying its incremental revenue and incremental cost estimating procedures.

4. The Service to Jackson Decision. The question here is whether a new flight between two existing Frontier stations, Casper and Jackson, is "paying its own way". Since no new stations or aircraft are required to provide the service, the problem is obviously one of comparing incremental revenue attributable to the added flight with incremental cost incurred. The case analysis examines Frontier's evaluation bases and methods.

Aspects of the General Economic Environment of Frontier

Organizational Structure

Data for the study were obtained from Frontier Airlines documents and personal interviews, primarily with the Director of Economic Planning. Figure 2 is an abbreviated organization chart and shows the position of Economic Planning in the corporate structure.

Route Characteristics

Frontier Airlines, owned by RKO-General and its parent, General Tire and Rubber Company, is a local service carrier based in Denver, Colorado. Frontier was formed in 1950 by merging three small feeder lines. Its present route system covers 30 per cent of the land area of the United States, an eleven state area which contains only 2 per cent of the nation's population. Normally, about one-half of Frontier's traffic consists of passengers connecting to and from trunklines. Figure 3 is a map of Frontier's present route authority.

Frontier serves 59 cities in the Rocky Mountain and High Plains regions, many of them quite small. Though these cities produce a relatively small volume of traffic, most of them have an extraordinary need for air service because of the rugged mountain terrain, long distances and severe winter weather which makes surface transportation difficult and slow. Frontier also provides service over many relatively short segments where there is a demonstrated need for air service. Due to these and other characteristics, a large amount of Frontier's operations cannot pay for themselves without substantial subsidy assistance. In fact, Frontier receives over $6 million annually in subsidy payments.

Like all local service carriers, Frontier competes with trunk carriers over parts of its system, while enjoying some "monopoly" power over other parts. About 5,000 of Frontier's 6,500 route miles are not served by another airline. Frontier's two main trunk competitors are

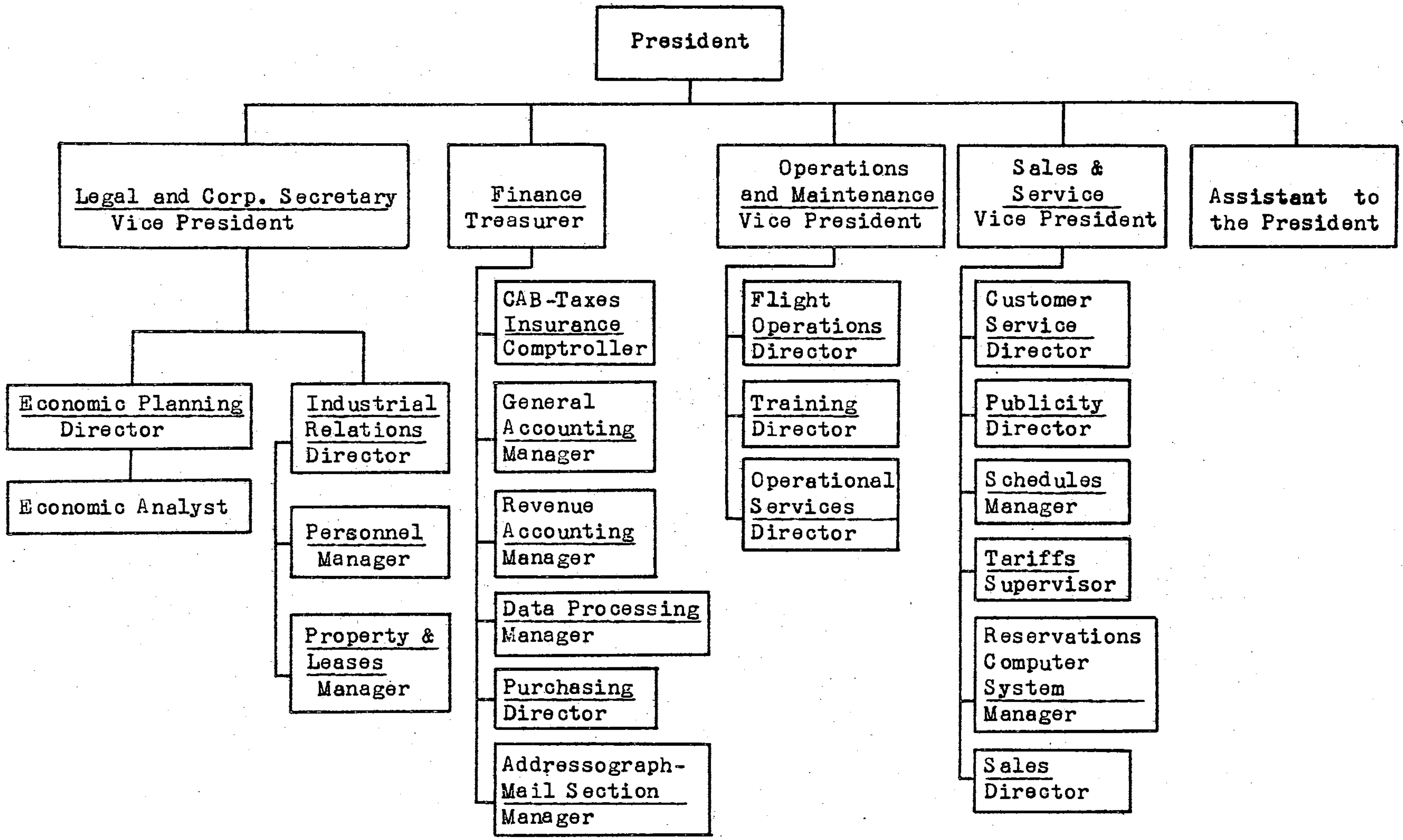


Figure 2. Frontier Airlines Organizational Chart

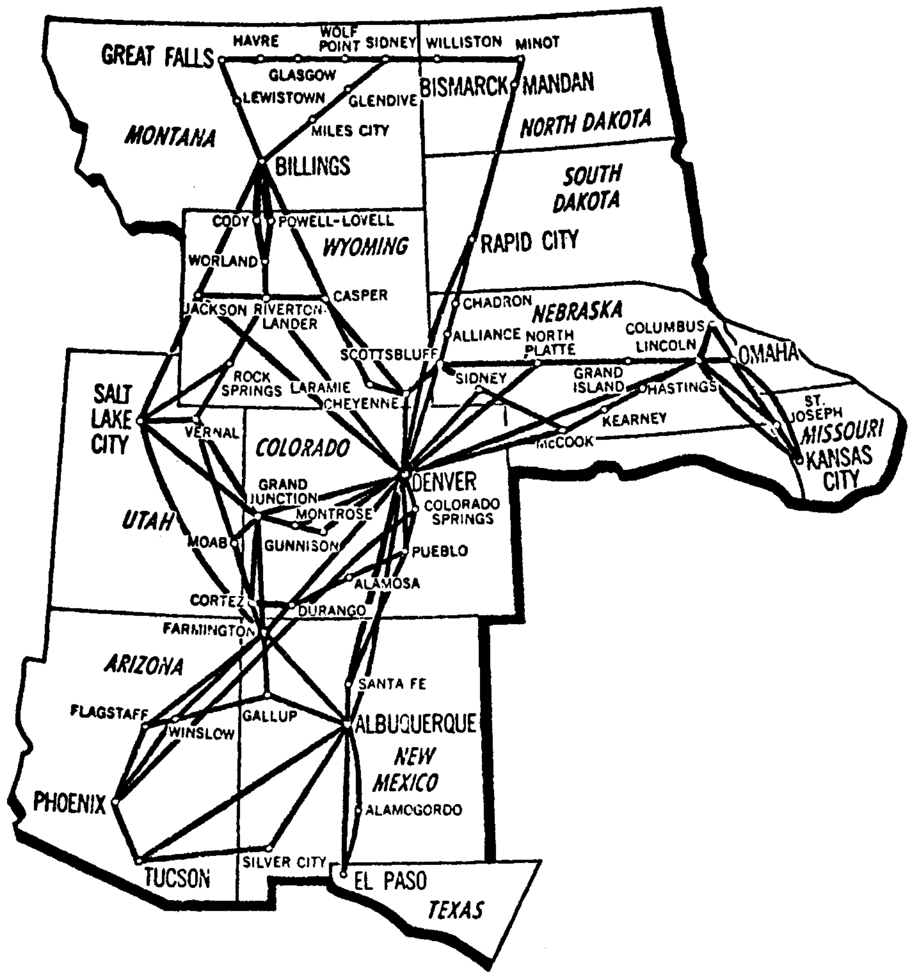


Figure 3. Frontier Airlines Present Route Authority

United Airlines and Western Airlines, particularly on east-west routes. Figure 4 shows Frontier's present system and the competition it faces from other carriers serving the same points.

System Operating Statistics

Since the current president of Frontier took over the position in early 1962, the firm has experienced rapid growth. In 1962, Frontier flew 91,597,000 revenue passenger miles; by contrast, in 1965, Frontier flew 218,139,000 revenue passenger miles, an increase in "output" of over 100 per cent in four years. Selected statistical data on Frontier's 1965 system operations are given in Tables XXIII and XXIV in Appendix B.

Traffic Promotion Plans

The outstanding growth of Frontier since 1962 is attributed to the dynamic leadership of its president and to the unprecedented growth in the entire air transportation industry. Considerable market stimulation is accounted for by recent promotional fare plans of Frontier which include the following:

1. Group Developer Plan. This is a group-travel plan whereby the organizer receives a free ticket for every seven paid tickets. Frontier encourages employees to sell this business by paying an incentive rate of 5 per cent on group sales.
2. Commuter-Car Package. On its heavy-volume Kansas City--Lincoln route, Frontier has put in a $25 commuter nonstop roundtrip fare with special car rental rates of $11 flat

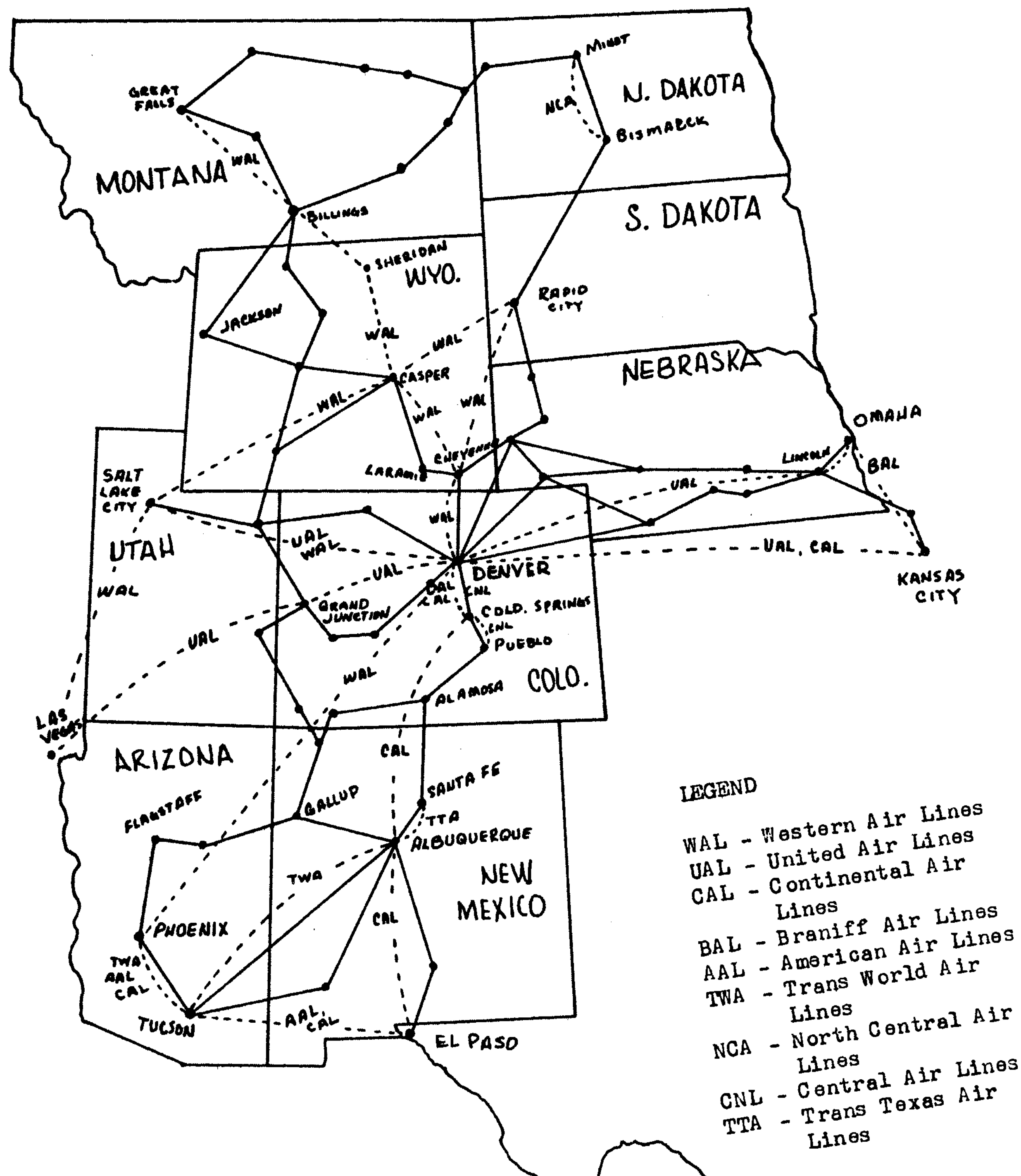


Figure 4. Frontier Airlines Competitive and Monopoly Routes

fee for 24 hours and 50 miles of driving. Car distance is 440 miles roundtrip and requires over four hours each way. Frontier is asking in its ads, "Can you drive your car 440 miles for $36?"

3. Family Plan. Under this plan, the most liberal in the industry, the first member of the family pays the full first-class fare, the second member pays one-half fare, and all other members up to age 22 pay only one-fourth fare. The plan permits travel on any day of the week and on separate flights (within 24 hours) if desired.
4. Military Standby Fare. Members of the Armed Forces, in uniform and on authorized leave, receive 50 per cent discounts. Once accommodated, they cannot be "bumped" at intermediate stops in favor of a reservation passenger.
5. Vacationland Area Fares. This plan offers unlimited travel with confirmed reservations for 30 days anywhere on Frontier's system for $100. The plan is available to all persons residing in states wholly east of the Mississippi River, plus the west coast states, Hawaii, and Alaska. Tickets must be obtained at a point served by Frontier within 15 days after arrival by common carrier. Private car arrivees are ineligible.
6. Discover America Plans. Frontier offers low cost, all expense package plans for travellers desiring to visit one or more of the nine national park areas served by Frontier.

7. "21" Fare. Travelers between the ages of 12 and 22 holding a Frontier "21" Fare Identification Card may travel on any flight, anywhere on Frontier's system with confirmed reservations at a 40 per cent discount. (Many carriers offer a 50 per cent "student" standby fare.)

Frontier believes that these and other promotional plans entice many people into flying who would otherwise travel by other means or not at all. An operating principle in the industry is that when people fly once, they come back.

Frontier's 50 Per Cent Standby Fare Decision

Introduction

> Anyone can learn a formula for the elasticity of demand. But the estimation of price elasticities in actual markets requires a variety of skills; and the application of the knowledge of such elasticities to decision-making problems is far from simple (28).

In economic theory, profit-maximizing pricing behavior by individual firms is set forth in abstract analytical form as illustrated in Appendix A. It is assumed that individual firms know the shapes of their cost and revenue curves and, thus, know the price elasticity of demand at every potential price-quantity combination making up the firm's individual demand curve. Given revenue and cost data, a firm, realizing various maximum quantities can be sold at various prices, will adjust its price and quantity offered until the marginal revenue from the last unit sold is just equal to the marginal cost of producing that unit. Hence, both cost of production and demand for the firm's product determine the price, and a firm will adjust its price and profit-maximizing level of output as demand and cost conditions change. In economic theory, the price-quantity decision made by the firm is one of maximizing short-run profits; no explicit attention is given to long-run repercussions of short-run actions.

It must be noted explicitly that in establishing the optimum price and quantity in the short-run, a firm will ignore fixed costs and base its decision on marginal costs. If the firm is considering a price decrease, it will evaluate the marginal cost of each additional unit sold against the marginal revenue received from its sale. If marginal revenue exceeds marginal cost, the pricing decision is "profitable" in the short-run even though price per unit may be less than average total cost. As long as price exceeds average variable cost, fixed costs are irrelevant and have nothing to do with pricing in the short-run.

Since many of the assumptions made in economic price theory are difficult to fulfill in actual business practice, pricing decisions can seldom be made with the certainties portrayed in theory. Instead, according to Joel Dean, author of the first leading textbook in Managerial Economics, the most pervasive pricing method used in actual business practice is that of cost-plus or full-cost pricing (29). Two of the chief reasons for using this method are:

1. It offers a relatively simple, mechanical, expedient method of setting price.
2. It provides a method for obtaining "adequate" profits where the exact shape of the demand curve is unknown or where firms eschew price experimentation.

In cost-plus pricing, firms generally take some measure of standard cost as their basic cost figure. This cost is determined by computing unit costs of labor and materials and by estimating unit overhead and selling and administrative costs for operations at some arbitrary percentage of capacity, or "standard" output, irrespective of the actual volume of operations. A "fair" profit percentage is then added to cost to arrive at the selling price. For example:

Direct Labor Expenses, plus

Direct Material Expense, plus

Allocated Overhead Expenses, plus

<u>Allocated Selling and Administrative Expenses, equals</u>

Fully Allocated Standard Cost of Product, plus

<u>A Percentage Markup on Full Cost, equals</u>

Product Selling Price.

By its very construction, a cost-plus approach eliminates demand conditions from having any significant influence on individual prices, and thereby fails to consider the possible effects of price changes on quantity sold. It mechanically bases individual prices on accounting costs which include arbitrarily allocated overhead, selling and administrative expenses, and gives no consideration to the explicit costs often most relevant to short-run decisions, namely marginal or incremental costs.

Basically, an air carrier's revenue potential on a given route is determined by the amount of traffic it can generate at the fare the traveling public is willing to pay. The two, of course, are interrelated. In practical terms, the user of air service is price motivated to use it or not by his subjective judgment on the value of air service relative to its cost, weighed against the value/cost relationships of available alternative modes of transportation. The point to be made is that the user of air service is buying transportation from one place to another like any other commodity on the basis of its value to him and without direct interest in the cost to the air carrier of providing the service. Any air carrier, then, should be demand oriented and price its product within a range which will attract sufficient traffic to justify its services. Firms which do give specific attention to price elasticity estimates, either quantitatively or judgmentally, may be considered firms which seek, at least to some degree, to follow the precepts of marginalism rather than rely exclusively on mechanical procedures such as cost-plus pricing.

The 50 Per Cent Standby Fare

In December, 1965, Frontier Airlines officially filed with the Civil Aeronautics Board a 50 per cent space-available tariff applicable between selected points on Frontier's system. The objectives of the experimental tariff, as stated by the Vice-President of Sales and Service, are:

1. To fill empty seats on less desirable flights.
2. To develop facts as to the stimulative effect of reduced fares in developing increased traffic.

Frontier originally requested that the tariff be approved on an experimental basis for an initial period of six months -- from January 24, 1966 to July 31, 1966 -- during which time careful records and statistics would be maintained for the consideration of the Board and Frontier's management in determining whether the fares should be continued. Frontier explicitly stated it had no intention of continuing the fares after July 31, 1966, unless the traffic and revenue results indicated that the fares were "economical".

Frontier considers that there is ample precedent for its standby fares. In 1961, the Board permitted the operation of comparable "no reservations fares" by Allegheny Airlines in the Pittsburgh-Philadelphia market. In the official investigation of that case, the Board permitted Allegheny to install no-reservation fares at a 42 per cent discount from regular first-class fares and subsequently authorized Allegheny to continue the service at a level 25 per cent below regular first-class fares after investigation.

Another supporting precedent is the Board's recent approval of half-fares for military standby passengers traveling on leave. These fares were approved by the Board on the basis that the standby traffic constitutes added passengers on services which would be operated in any event, and the reduced fares are thereby justified on an "added cost" basis.

In both of the foregoing situations, the fares apply on all services. In contrast, Frontier proposed that its fares would be applicable only on flights which are less desirable in terms of intermediate stops and elapsed time. For example, the standby fare between Rapid City, South Dakota and Denver, Colorado is applicable only on multi-stop flights operated with DC-3 equipment; in this same market, Frontier also operates two daily Convair 580 non-stop round trips and Western Airlines operates one DC-6B non-stop round trip. In the Salt Lake City-Denver market, Frontier's fare applies to service which must make a minimum of one stop, whereas United and Western operate ten daily non-stop round trip schedules, including eight with pure jet equipment.

One minor exception to the above includes two city-pairs where there is no superior service since Frontier is the only airline serving the cities. These are Chadron, Nebraska-Denver and Alliance, Nebraska-Denver. In these markets, the fares were proposed as a means of measuring the promotional effect of reduced standby fares in low-density markets. The existing revenues in these markets are so small that no serious adverse effect in the form of competitive impact and serious revenue dilution can be sustained under any circumstances. Load factors on the flights involved are very low and there is ample space for additional passengers.

Frontier based its economic justification for proposed standby fares on the same principle under which the Board has permitted carriers to offer reduced night coach and other off-peak fares. These fares are justified on the ground that the passenger will utilize space which will otherwise go unused and that the service can accordingly be treated on an added-cost basis. Frontier recognized the possibility that some of the passengers using the reduced fares would be passengers who would otherwise use Frontier's regular reservation services, but anticipated that such diversion would not be large because:

1. A very large part of Frontier's traffic in these markets consists of connecting passengers who would normally insist upon a reservation.
2. The services are sufficiently slower in terms of elapsed time as to preclude the use of such services by the typical passenger.

Instead, Frontier believes there is a substantial number of potential passengers not now using air transportation who would take advantage of such services at the lower rates. For instance, the service should be particularly attractive to persons traveling on personal business for whom the difference in fare is important and who are, thus, willing to accept the uncertainty of standby service and longer elapsed time.

Frontier maintains that standby passengers should be costed on an added-cost basis since they will not be carried unless there is space available on the aircraft after handling all regular-fare passengers.

Some of the specific rules and regulations pertaining to the one-way standby fares are that:

1. They apply for transportation in either direction on a standby basis on any flight, other than non-stop, operated by Frontier, between points named.
2. They may not be used in combination with any other tariff to construct through fares.
3. They are not applicable to or from intermediate points.
4. Standby passengers will be enplaned on a flight subject to availability of space at departure time and only after all passengers having reservations for the flight have been enplaned.
5. When a standby passenger has been accommodated on a flight, he will not be removed at an intermediate point to accommodate other revenue passengers.
6. Stopovers at intermediate points are not permitted on standby fare tickets.

Table XXV in Appendix C summarizes the twenty city-pairs and the proposed one-way standby fares included in Frontier's proposal. Column 1 indicates the cities between which the standby fares are applicable, Column 2 indicates the one-way standby fare, and Column 3 indicates the routing number.

Table XXVI in Appendix C explains and summarizes by routing numbers the routing of flights between the cities named and Table XXVII in Appendix C is an explanation of abbreviations used.

Frontier's fare proposal was immediately protested as "unlawful" by four competing airlines and the National Trailways Bus System (30). The protestants argues in general terms to the CAB that Frontier's proposal was discriminatory in that it would offer reduced fares for a service "like and contemporaneous" with full-fare service and that it was economically unsound. The latter argument contained the charge that Frontier's no-reservation restriction placed on the standby fare was meaningless because of Frontier's low load factor. The result would therefore be significant diversion of traffic on Frontier's own flights, making it necessary for Frontier to generate more than two new passengers for every standby passenger and significant diversion of traffic from other carriers to Frontier. Western Airlines specifically charged that the proposed standby fares would break Frontier's fare structure at intermediate points since a passenger could buy a standby fare between two points but get off at an intermediate point which was his real destination. For instance, a Frontier passenger could pay a $26 standby fare between Denver and Phoenix, but get off at Flagstaff, and save $21 from the regular $47 Denver-Flagstaff reservation fare. Frontier generally took the view that only data based upon actual experience could prove whose position was correct.

The CAB voted 3 to 2 to permit Frontier to install the standby fare proposal on an experimental basis. The Board said (31):

> While we will permit Frontier to pursue this experiment, we believe that the complaints have raised questions as to the

> lawfulness of the proposed fares which are substantial enough to make it appropriate for us to order an investigation. This will enable the Board to maintain a surveillance and to evaluate the results of this tariff on the basis of actual experience to determine whether it has the substantial beneficial effects to the traveling public and the carrier anticipated by Frontier or, on the other hand, has the untoward results feared by complainants. In our view this experiment must be strictly controlled and it should not be spread to any other markets of Frontier during the experimental period.

As previously mentioned, Frontier originally filed for the experimental standby fare to extend from January 24, 1966 to July 31, 1966, but in June, 1966 requested that the experiment be extended to January 24, 1967. In its tariff revision, Frontier amended the tariff to provide that a standby passenger who is not accommodated on a flight will be given a reservation on the next flight to the same destination if he desires such a reservation. This proposal brought new complaints from competing carriers, but the CAB dismissed them in favor of Frontier.

Results of the Decision

Frontier's experience with the standby fares during the period of their effectiveness has been most favorable. Table XXVIII in Appendix C is a summary of passengers and revenues in the standby fare markets for the six months period of February through June and September, 1966 compared with the same period in 1965. The months of July and August are omitted because the major trunkline strike during those months had a significant dampening effect upon the growth of standby traffic.

An analysis of Frontier's experience for the six months period shows that:

1. Passengers in the 20 standby fare markets increased

83 per cent compared with a 34 per cent increase in all other Frontier markets.

2. Revenues in the standby markets increased 70 per cent contrasted with a 29 per cent increase in all other markets.
3. The standby fare passengers totaled 32,201 and produced $576,525 in revenues.
4. The increase in passengers in the standby fare markets, excluding standby fare passengers, was 35 per cent, which compares favorably with the 34 per cent growth of traffic in all other markets during the same period.
5. The average fare under the standby plan was $17.90 per passenger, which is larger than the average local service carrier fare of $16.52 for the year 1965 and compares with Frontier's average of $22.15 per passenger for the year 1965.

During February and March, 1966, Frontier conducted a survey of its standby passengers and analysis of the questionnaires reveals the following facts:

1. 19 per cent of all standby passengers completed the questionnaire.
2. 56 per cent of the standby passengers were traveling on vacation or for personal reasons.
3. 9 per cent were making their first journey by air.
4. 15 per cent would not have made the trip but for the standby fare.

5. 43 per cent would have made the trip by surface transportation (25 per cent by automobile; 10 per cent by train; 8 per cent by bus).
6. 20 per cent would have used another airline.
7. 22 per cent would have traveled via Frontier.

Frontier has had no significant difficulties with respect to passenger handling, "no-shows", or other suggested problems raised in complaints against the standby tariff at the time of the original filing. As for the guaranteed reservation provision of the fare for standby passengers unable to board a flight, Frontier finds, as it expected, that this option has been used sparingly because only a small number of passengers are actually unable to board the flight of their choice. For example, during the months of September, October, and November, 236 standby passengers were "unabled" (1.67 per cent of 14,091 standby passengers). Of the 236 unabled passengers, 167 were confirmed on later flights (1.2 per cent of the standby passengers). This rule has provided a significant benefit for those few standby passengers who were unabled on the flight of their choice. It has had no adverse effect on Frontier's revenues and has made the standby fares more attractive.

Frontier believes that the standby fares have been an unqualified success in increasing traffic and revenues and in developing air transportation over Frontier's system. In December, 1966, Frontier requested that the CAB extend the expiration date of the standby fares from January 24, 1967 to June 30, 1967.

Analysis of the Basis for the Decision

Frontier's decision to provide standby service at a 50 per cent fare reduction is directly related to two fundamental economic concepts, price elasticity of demand, E_P, and cross elasticity of demand, E_C. These elasticity of demand concepts are employed below to organize relevant variables in the decision into a framework for analysis. A review of actual reasoning used by Frontier is then presented to contrast theory and practice.

Price elasticity of demand (E_P) measures the percentage change in quantity sold of a given product which results from a one per cent change in price. If demand is elastic, a price decrease results in an increase in total revenue. Cross elasticity of demand (E_C) measures the percentage change in quantity sold of a given product which results from a one per cent change in the price of a related product. If a decrease in the price of one product causes a decrease in demand for another product, the former is a substitute for the latter and the greater the numerical value of E_C, the greater is the degree of substitution.

For example, if product A is a normal good, a decrease in its price will increase quantity demanded per time period, and the more elastic the demand, the greater will be the increase in the firm's total revenue. The additional units of product A will be sold to three classes of customers:

1. Customers who are already buying product A from this firm but who increase their purchases as price decreases.
2. Customers who are not purchasing product A from this or any other firm but who enter the market as its price decreases sufficiently to attract them.
3. Customers who are purchasing a similar product B, either

from this or another firm, but who substitute the now relatively cheaper product A for product B.

In the latter instance, a decrease in the price of A results in a decrease in the demand for B; and quantity taken of product B decreases. Since the price of product B remains unchanged, there will be a decrease in the total revenue from the sale of product B, and the greater the degree of substitution, the greater is the decrease in total revenue.

If one firm is producing both A and B, the price decrease in product A will be profitable in the short-run, other things constant, only if the increase in total revenue from the additional units sold of product A exceeds the decrease in total revenue resulting from a decrease in demand for product B and the decrease in revenue on the original quantity of product A sold at its original price. Furthermore, the net increase in total revenue must exceed the difference between the increased cost of producing additional units of product A, minus the decreased cost of producing less units of product B. A firm making such a short-run pricing decision should ideally know the E_P for product A, the E_C with respect to product B (and, thus, the exact shapes and positions of the demand curves for its products), and the exact cost functions pertinent to both.

The preceding hypothetical pricing decision generally portrays Frontier's situation with respect to the standby fare. However, discussions with Frontier officials revealed that they know, quantitatively, none of the above information. In the first place, Frontier had no quantitative estimates of even expected consumer response to its price change. Yet, officials felt, subjectively, that the decision would be economically sound. They "expected" significant increases in standby traffic without serious dilutions from full-fare traffic, though some substitution was anticipated. One surprise, however, is the net complementary effect that standby fares apparently have on demand for full-fare reservation traffic. In fact, as stated earlier, the growth of reservation traffic in markets where the standby fare is applicable has kept par with, and even exceeded, that of other markets. This result was contrary to all expectations.

Though lacking quantitative measures, the president of Frontier nevertheless has a general pricing policy which is based on his subjective evaluation of price elasticity of demand for air transportation. All of Frontier's special fares, and especially the standby fare, are based on his philosophy which in general terms is as follows:

> There are two basic types of passengers, business, and personal, and there are many differences between them in terms of flying habits and desires. One of the major differences is actual cost or incidence of plane fares.
>
> Those who fly on business are spending pre-tax dollars, since the fares can be included as business costs. Thus, the government in a sense "pays" about one-half the cost of air travel. Those who fly for personal reasons are spending after-tax dollars and bear the full cost of plane fares. Since business travelers are already going for "half-fare" and have more compelling reasons to travel by air, any special fare-reduction programs would not stimulate significant additional passenger-miles and carriers would lose revenue.

To the personal traveler, price is of much greater importance. Substitute means of travel tend to attract him due to significant cost savings, so he must be enticed to travel by air by reducing as far as possible one of the biggest barriers -- high cost. Therefore, the carrier must make it attractive to personal travelers by offering cost savings similar to those actually experienced by business travelers. The personal traveler is sensitive to prices and will respond favorably to price decreases and other promotional fare plans.

In instituting a standby fare, the figure of 50 per cent-of-regular-fare was chosen by the president, based on his general pricing philosophy and judgment that a price cut must be dramatic to bring results. Specifications and restrictions of the fare were for the purposes of winning CAB acceptance and minimizing traffic transfers from Frontier's own regular-fare service. As for statistical estimates of relevant price elasticity and cross elasticity of demand coefficients, there were none. Frontier has found it impossible to determine reliable demand coefficients, either before a decision is made or after data are received on decisions which have been in effect.

Attempts to calculate a realistic value for price elasticity of demand on the basis of six months traffic and revenue data summarized in Table XXVIII in Appendix C proved fruitless. Several factors immediately confound any quantitative approach.

1. In many respects, the standby fare is a new product and not a price reduction on an existing one. Since the conditions of carriage are significantly changed and

regular reservation fares are still in force, it is questionable to even consider measuring percentage changes in price and quantity.

2. The increase in traffic in the standby fare markets is both a result of the fare decrease and normal growth over time. Thus, it is necessary to accurately determine what amount of the total increase in traffic over the previous year is due to an increase in quantity demanded in response to the price decrease and what amount is due to a change in demand in response to changes in income, population, travel habits, advertising, and so forth.
3. The total Frontier traffic carried at standby fares consists of customers who would not have flown at all except for the reduced fare, some who would have flown with Frontier anyway at a higher fare, and others who would have flown with competitive carriers. Any analysis of market price elasticity of demand must isolate the effect of price decreases on the former group, since the latter two groups planned to travel by air in any event. Even if such a difficult task could accurately be accomplished, the percentage change in quantity in response to the price decrease would be a questionable value since there actually is no meaningful original base from which to calculate the percentage change.

In the standby fare decision, Frontier gave only cursory thought to the possibility of retaliation of competitive trunk lines. A

Frontier official emphasized that the trunks have little "stomach" for this type of pricing philosophy--or so Frontier believes! When asked about Frontier's reaction to possible future retaliation by competitors, he replied that Frontier would "look again" at its policy if others should follow suit. He commented that "so far, so good," but did admit that should competition retaliate, Frontier might see the day when it wished it had never heard of standby fares! But, Frontier is not presently concerned about the possibility of such a development.

Conclusion

In summary, one can readily see that the existing promotional fare schemes of Frontier and other carriers plus the encouragement given by the CAB chairman to fill empty seats with new pleasure travelers by "selective but substantial" price reductions make Frontier's 50 per cent standby fare less than totally original; its main uniquenesses are the size of the cut and its application to any passenger willing to standby. The seed was planted by others long before Frontier stepped forward to reap the harvest.

By way of general environmental conditions, it is significant to note that Frontier's over-all load factor prior to the decision was low, indicating substantial amounts of idle capacity and fixed costs. Its relatively shorter hops and more frequent stops, constraints imposed by governmental regulations, place Frontier at a disadvantage with respect to its trunk line competition. Lacking equipment superiority or even parity, or any other competitive weapon to shift its demand curve, Frontier was actually faced with only one realistic alternative to increase sales: a price reduction. But knowing, or at least believing, the price-insensitivity of business travelers relative to pleasure travelers, Frontier was basically forced to seek to attract the latter without diluting its revenues from the former; in other words, discriminating between passengers by charging different prices for essentially the same service -- arrivals. Of course, significant differences exist between regular and standby passengers since one has a reservation, the other does not; once enplaned, however, there is no difference. Thus, the essential elements of the decision were more or less dictated by environmental conditions: within the confines of government regulations, find a way to sell more pleasure travel to fill empty seats on competitively less desirable flights without seriously diluting business travel and other existing revenues so as to be more competitive with short-haul ground transportation. Frontier's solution was market segmentation by price through the mechanism of the standby fare.

In this decision, Frontier definitely formulated its policy within the framework of theoretical economic concepts. Particularly germane to the decision were considerations of the amount of transfer passengers from its existing traffic (cross elasticity of demand), the degree of potential new customer response to the price decrease (price elasticity of demand), and the economics of price discrimination. But an exact, formal application of theory requires quantification of all relevant variables, implying perfect knowledge. Yet, as already indicated, Frontier had no such information. Officials, using subjective criteria, did not "expect" significant transfers of traffic from regular to standby fares, "believed" potential pleasure travelers are significantly motivated by price, and "felt" a price decrease must be dramatic to bring the kind of results desired. Nevertheless, theoretical principles were employed as tools of logic and reasoning with which to organize and qualitatively evaluate pertinent economic variables. Thus, theory was practically applied and the impossibility of deriving statistical revenue and cost functions did not negate its usefulness in formulating a major decision.

Frontier's Las Vegas Route Decision

Introduction

To provide deeper insight into the "anatomy" of economic decision-making, it appears desirable and necessary to break an important decision down into its component parts. Such a detailed analysis reflects the numerous considerations necessary to make reasonable quantitative approximations to theoretical functions as well as to establish a truer sense of the environmental conditions surrounding the decision.

The following detailed analysis of Frontier's Las Vegas route decision will reveal sources of input data, assumptions underlying their use, and analytical procedures employed by Frontier in answering the main question of whether or not the expected incremental revenue attributable to the service will exceed the expected incremental cost. Specifically included are traffic forecasts and resulting revenue estimates, aircraft operating statistics and resulting operating costs, and traffic servicing expenses. Initial paragraphs present aspects of the general environment by discussing Frontier arguments before the CAB to justify the proposed service; thus, governmental constraints on management actions are depicted.

As described in Appendix A, the traditional unit cost curves of economic theory, assuming a short-run production function of initially increasing and then decreasing returns to the variable resource, have the familiar U-shape. This means that as output of a single product per time period increases, total cost per unit initially decreases, reaches a minimum and then increases due to decreasing efficiency of the added units of variable input.

However, statistical cost studies in non-agriculture industries seemingly show average variable and marginal costs to be constant, resulting in L-shaped average total cost curves. This means that as output increases, the added cost per unit of added output is constant since added units of variable input have equal efficiency, but average total cost per unit continuously decreases slightly since the total fixed cost is spread over a larger number of units.

Controversy exists over the "true" shape of the short-run cost function, with both the traditional U-shaped and the L-shaped curves receiving support. As for the implications of this controversy with respect to management decision-making, Haynes (28) says:

> Perhaps the greatest benefit to management is to create an awareness that there are no firm generalizations about cost behavior and that each firm and each industry must measure and predict its own cost patterns. One reasonable way for a manager to go about estimating the impact of a decision on cost is to use his own judgment and experience in determining how the different categories of cost will react to the decision.

In analyzing this route decision of Frontier, the objectives specified earlier are amended to specifically include two objectives suggested by Haynes:

1. To determine as far as possible the shapes of relevant cost curves; that is, the way unit cost functions "behave" as output increases.
2. To specifically identify <u>how</u> Frontier "estimates the

impact of a decision on costs."

Summary of Las Vegas Route Proposal

In April, 1966, Frontier Airlines applied to the Civil Aeronautics Board for an amendment of its Certificate of Public Convenience and Necessity to allow Frontier to extend its service to Las Vegas, Nevada. Frontier currently serves Grand Junction, Colorado, and is specifically seeking an extension of that route to Las Vegas. To date, the CAB has not issued a ruling on Frontier's Proposal.

Figure 5 is a map of Frontier's present system and the proposed new route segment.

To obtain CAB approval, Frontier must convince the Board of the need for additional service to Las Vegas and of the ability of Frontier to provide it on an economic basis. In arguments before the CAB to establish need, Frontier deals with three main points.

First, Frontier charges that existing service between Las Vegas and Denver is seriously deficient, inconvenient and inadequate. Las Vegas is a natural and important vacation area for Denver and the large area beyond Denver served by Frontier, yet Denver has only one daily jet non-stop frequency to Las Vegas and only two total frequencies, including DC-6 propeller service via Grand Junction. The only carrier serving the Las Vegas market from Denver via Grand Junction is United Airlines, although Western Airlines serves the city via Salt Lake City, and United's jet service is extremely inconvenient since its departing flight leaves Denver at 10:20 P. M. and the return flight arrives in Denver from Las Vegas at 12:56 A. M.

The need for additional service between Las Vegas and Grand Junction

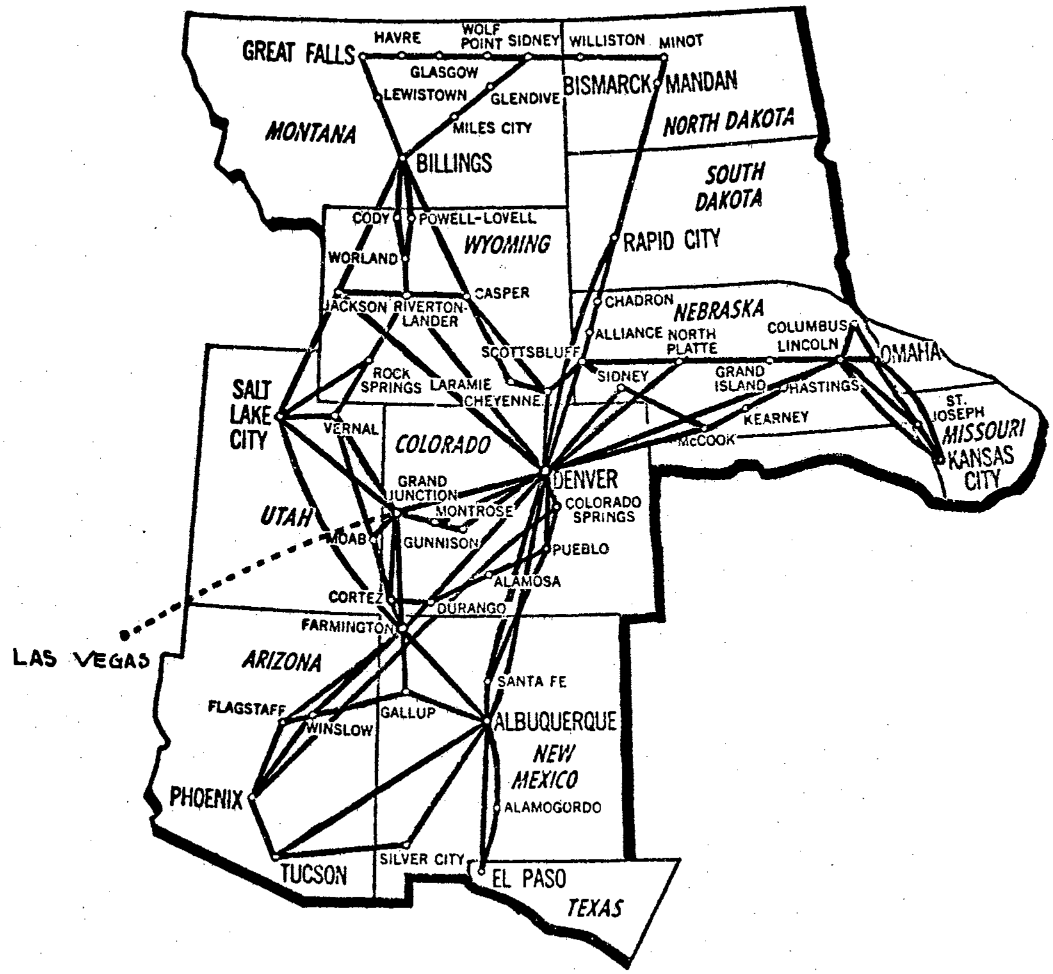


Figure 5. Frontier Airlines Present System and Proposed Route to Las Vegas

is further evident from the fact that United flies only one round trip daily with DC-6 equipment. By comparison, service from Grand Junction to other important regional cities such as Denver, Salt Lake City, and El Paso varies from three to five daily round trips.

Table III illustrates the inadequacy of service between Denver and Las Vegas by comparing the service from Denver and from Las Vegas to other nearby western cities.

Secondly, Frontier maintains that there has been a serious lack of traffic development in the Denver-Las Vegas market. Table IV illustrates this by comparing the traffic between Las Vegas and major metropolitan western cities with that between Phoenix and the same cities.

As shown in Table IV, the Las Vegas-Denver traffic is much lower in relation to Phoenix traffic than for any of the other cities. In Frontier's view, there is no apparent reason for this except for inadequate Las Vegas-Denver service.

Thirdly, Frontier contends that it will provide substantial service improvements for other points on its system, in addition to the benefits provided in the local Denver-Grand Junction-Las Vegas markets. Frontier's proposed service will open up a large area of 24 smaller cities north, east, and south of Denver for first one-carrier service to Las Vegas, with major reductions in travel times. In addition, important service improvements between Kansas City, Lincoln, Colorado Springs, and Las Vegas would include more desirable arrival times, reduced travel time, new one-carrier service, and new one-plane service.

At the time of the proposal, Frontier had already planned to install Boeing 727 jet service between Denver and Grand Junction in the

Fall of 1966 by replacing some existing Convair 580 flights with soon-to-be-delivered new jet equipment. Of Frontier's planned two round-trip schedules to Las Vegas, both using jet equipment, one will simply be an extension of existing schedules. For this schedule, the only added jet service as a result of the Las Vegas decision will be that from Grand Junction to Las Vegas.

TABLE III

COMPARISON OF SERVICE FROM DENVER AND FROM LAS VEGAS TO OTHER NEARBY WESTERN CITIES

	No. of Round Trip Flts.[a] (One-stop or less)			1964 Psgrs. Local and Conn.[b]
	Total	Jet	Prop.	
Denver-Las Vegas	2	1	1	36,910
Denver-Phoenix	5	2	3	63,260
Denver-Albuquerque	7		7	41,700
Las Vegas-Denver	2	1	1	36,910
Las Vegas-Salt Lake City	4	1	3	29,300
Las Vegas-Albuquerque	2	2		24,190
Las Vegas-San Francisco	8	8		121,490
Las Vegas-Los Angeles	27	19	8	565,310

[a] March, 1966.

[b] 1964 CAB Competition Study.

TABLE IV

TRAFFIC COMPARISON: LAS VEGAS-DENVER VS PHOENIX-DENVER

Base City	1964 Total Local and Connecting Passengers: Between Las Vegas And	Between Phoenix And	% Las Vegas of Phoenix Psgrs.	No. of Flts. Nonstop and 1-stop (9-64): LAS	PHX	Intercity Mileage: LAS	PHX
Los Angeles	565,310	268,720	210%	60	28	228	356
San Francisco	121,490	84,980	143	14	12	416	652
Albuquerque	24,190	26,300	92	4	4	482	329
Salt Lake City	29,300	38,860	75	8	4	362	504
Mean			130				
Denver	36,910	63,260	58	4	10	605	586

The other round trip will be a newly installed jet flight replacing a Convair 580 flight between Denver and Grand Junction, and extended from Grand Junction to Las Vegas. The entire schedule will represent added jet service attributable to Frontier's decision, since the Convair 580 flight between Denver and Grand Junction will not be replaced with jet equipment if Frontier does not receive Las Vegas certification. Also, if its proposal receives CAB approval, Frontier plans to put on an additional daily round trip Denver-Colorado Springs flight using Convair 580 equipment to provide direct on-line connection to Las Vegas. Frontier's proposed one-plane added service to Las Vegas is illustrated in Figure 6.

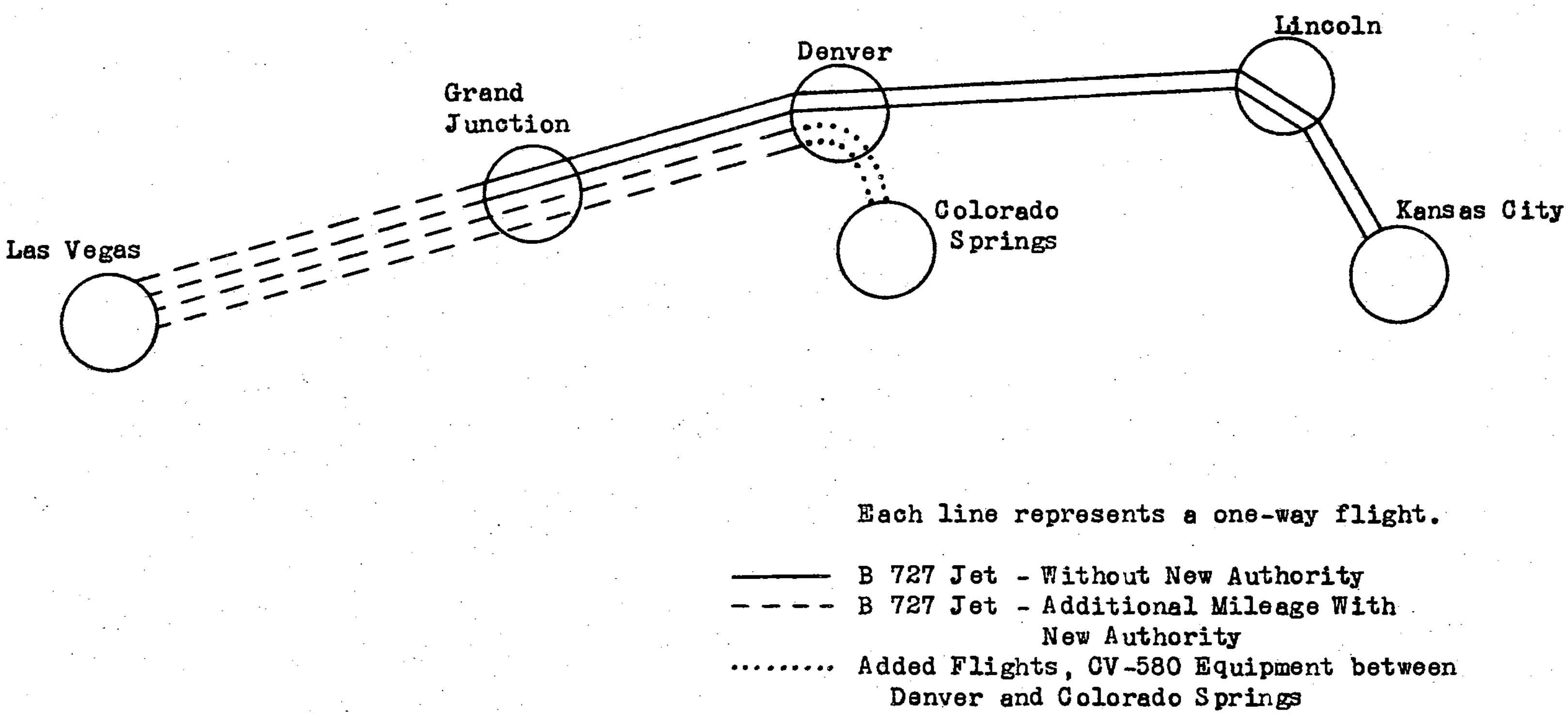


Figure 6. Frontier Airlines Proposed One-Plane Service to Las Vegas

In order to "prove" to itself and to the CAB that it can provide the needed service on an economic basis, Frontier was faced with the task of estimating the impact of the decision on total cost and total revenue. Frontier is specifically requesting that the route be awarded on a subsidy-ineligible basis, and estimates that the service, on a non-subsidy basis, will produce in the first year of operation a net operating profit of $624,800. As a further incentive to gain acceptance by the CAB, Frontier guarantees to apply this stated amount to a reduction in its annual subsidy requirement of $6.5 million.

Frontier's estimates of the change in total revenue (incremental revenue) and the change in total cost (incremental cost) are strictly short-run, applying only to the single year, 1967. Table V is a summary of estimated financial results attributable to the proposed service to Las Vegas. The discussion which follows is a detailed analysis of <u>how</u> Frontier made its economic evaluation.

TABLE V

SUMMARY OF FINANCIAL RESULTS ATTRIBUTABLE TO PROPOSED SERVICE TO LAS VEGAS, YEAR 1967

Commercial Revenues:	
Passenger	$ 2,706,992
Mail and Property	123,300
Total	$ 2,830,292
Operating Expenses:	
Aircraft Operating Expenses	$ 936,601
Servicing Expenses:	
Stewardess	54,891
Local Station	320,000
Regional and System	453,000
Total Operating Expenses	$ 1,764,492
Operating Profit	$ 1,065,800
Provision for Return on Investment and Taxes	441,000
Reduction in Present System Subsidy Need	$ 624,800

Traffic Forecast Before Frontier Service Improvement

Frontier estimates that its change in total revenue as a result of the decision to extend service to Las Vegas will be a total of $2,830,292 the first year, almost all of which will be in the form of passenger revenue. Frontier's first step in estimating incremental revenue was to estimate, by markets, the total number of local and connecting passengers expected to travel over its entire system to and from Las Vegas with other airlines and before Frontier service improvement.

Based on a CAB survey of passenger traffic in major markets for the years 1959 through 1965, Frontier made a forecast of the estimated 1967 passengers by major market. The CAB requires every carrier to report the origin and destination of every ticket sold whose number ends in zero. Since carriers must keep records of every ticket sold, it is a relatively simple matter for them to supply these data. The CAB then compiles passenger origin-destination statistics from this 10 per cent sample. Frontier simply took the CAB survey samples and expanded them by a factor of 10 to estimate the total passengers who traveled between Las Vegas and major cities in its system for the years 1959 through 1965. The 1967 estimate arrived at for each major market is average of constant rate and constant increment extrapolations of least squares lines on 1959-1965 data. Results are summarized in Table XXIX in Appendix D.

The estimated number of passengers in each market for 1967 is determined, as previously mentioned, by extrapolation of least squares lines. This assumes, of course, that the past is a reliable guide to the future. But the years 1959-1962 are generally considered slump years for air carriers, as compared to 1963-1965, when business was booming. Thus, an extrapolation of least squares lines to determine expected 1967 passenger traffic would tend to understate the real growth, assuming traffic continues to grow as it did in 1963-1965. Frontier agrees that this is undoubtedly true but that keeping 1959-1962 data in the projection desirably "tones down" the forecast. If only the 1963-1965 data were used, the forecast would show a bias of very high growth rate, which may well be over-optimistic, despite the fact that industry observers forecast continued prosperity. Of the two extremes, Frontier prefers the former since it is more cautious. Obviously, the accuracy of Frontier's revenue estimate is directly related to the accuracy of this and other passenger forecasts.

In addition to major markets, Frontier made estimates of 1967 local passenger traffic for two groups of smaller markets within its system. The results of the estimates are summarized in Table XXX in Appendix D.

In Group I city-pairs, which mainly included small cities north of Denver, CAB surveys of historic passenger traffic between Las Vegas and the cities named are used to calculate a three-year (1962-1965) average for each market. Then a three-year average of 2,370 passengers is calculated for all markets. The 1967 forecast for each market is determined by multiplying the three-year average by an expected growth factor of 58 per cent.

To arrive at the factor of 58 per cent, Frontier found the relationship between the three-year average of all markets in Group I (2,370 passengers) and the composite market forecast (3,740 passengers) made by extrapolation of least square lines for "Other Frontier Points Beyond Denver-Las Vegas" as shown in Table XXIX in Appendix D. Thus,

$$2{,}370\ (1.00 + X) = 3{,}740$$

$$X = \frac{3{,}740 - 2{,}370}{2{,}370} = .58$$

$$X = 58 \text{ per cent.}$$

Using 58 per cent as an expected growth factor, Frontier then estimates the expected passenger traffic in each city-pair listed in Group I.

For example, a three-year CAB survey of sample passengers in the Las Vegas-Casper market shows an average of 740 passengers per year. Frontier expects this market to grow, in 1967, to

$$740 \times 1.58 = 1{,}170 \text{ passengers.}$$

The Group II city-pairs consist primarily of towns in west and southwest Colorado near Grand Junction. Expected traffic between Las Vegas and these cities is quite small. Again employing the results of CAB surveys, Frontier calculates the average number of passengers per year traveling between a given city and Las Vegas for the years 1963-1965, then estimates a 50 per cent increase in traffic from these base figures for 1967. The 50 per cent expected growth factor was arrived at by scaling down from the growth factor estimated for the Grand Junction-Las Vegas market shown in Table XXIX in Appendix D. The growth expected in this market from 1964 (2,110 passengers) to 1967 (3,490 passengers) is 65 per cent. Frontier simply took a "reasonable guess" and figured the cities named in Group II would generate a 50 per cent increase in traffic if Grand Junction generated 65 per cent!

Connecting traffic is traffic which changes airlines during a trip. In Table XXIX in Appendix D, estimates are given for connecting traffic between points in California and two cities in Frontier's system, Grand Junction and Lincoln; Colorado Springs-Denver connecting traffic is also shown. Table XXXI in Appendix D summarizes historic and forecast connecting traffic for other major markets, adjusted to exclude connecting traffic in minor markets. Frontier uses as its measures of expected growth in the number of connecting passengers the same per cent factors used in the local traffic forecasts for the same city-pairs, as calculated in Table XXIX in Appendix D.

The local and connecting Las Vegas passenger traffic estimates for 1967 for every city in Frontier's system, derived as described above, are subsequently used in Table XXXI in Appendix D to forecast Frontier revenues attributable to the service. These traffic estimates are projections of historic traffic flows, assuming no change in quality or quantity of service offered; that is, the estimates do not include any estimates of the effect on total passenger traffic that introduction of new service by Frontier might have. But the new and improved service Frontier proposed certainly is expected to stimulate the passenger traffic flows that have been developed by historic services. The degree of stimulation in any specific market is determined by the type and degree of service improvement offered. Broadly speaking, the amount of stimulation expected due to improved service is based on judgment; but Frontier uses statistical studies of stimulation as guides in its traffic estimating procedures.

<u>Stimulation of Historic Traffic by Frontier Service Improvement</u>

Frontier's proposed new services offer several types of service improvement, depending on the specific market. In its estimating process, Frontier systematized its application of stimulation factors by coding types of improvement as follows:

Code	Type of Service Improvement
A.	First one-carrier one-plane service replacing two-carrier.
B.	First one-plane service replacing one-carrier direct on-line connecting service.
C.	First one-carrier direct on-line connecting service

Code	Type of Service Improvement
	replacing two-carrier.
D.	First one-carrier service replacing two-carrier.
E.	First competitive one-plane service.
F.	Additional service.

The stimulation factors used for codes A through D have been influenced by two independent statistical studies of the effect of replacing two-carrier service with single-carrier, single-plane service. Results of these studies are portrayed graphically in Figure 7.

The statistical relationship between the "Stimulation Factor" and the "Annual Local Passengers Before One Plane Service" shown in Figure 7 was jointly developed by Frontier and a management consulting firm. The "C E A Data" shown is the result obtained by the consulting firm in a similar analysis done for California Eastern Airline (CEA).

As Figure 7 and discussion pursuant to it point out, the stimulation factors shown are a statistical result of replacing two-carrier service with one-carrier one-plane service, the type of service improvement designated code A. Service improvement code C is considered to have a stimulation effect of 50 per cent of code A, and code D, 10 per cent of code A. It should be noted that the stimulation effects of codes C and D are purely judgemental, seasoned by experience. In fact, Figure 7 represents a best-decision-basis-available technique and is not purported to be inviolable. The use of this specific estimating device is unique to Frontier and its forecasts are seldom challenged on this particular basis. When challenged, however, Frontier has been able to present sufficient examples over its system to justify, in general limits, its use of this type of reasoning. Frontier readily

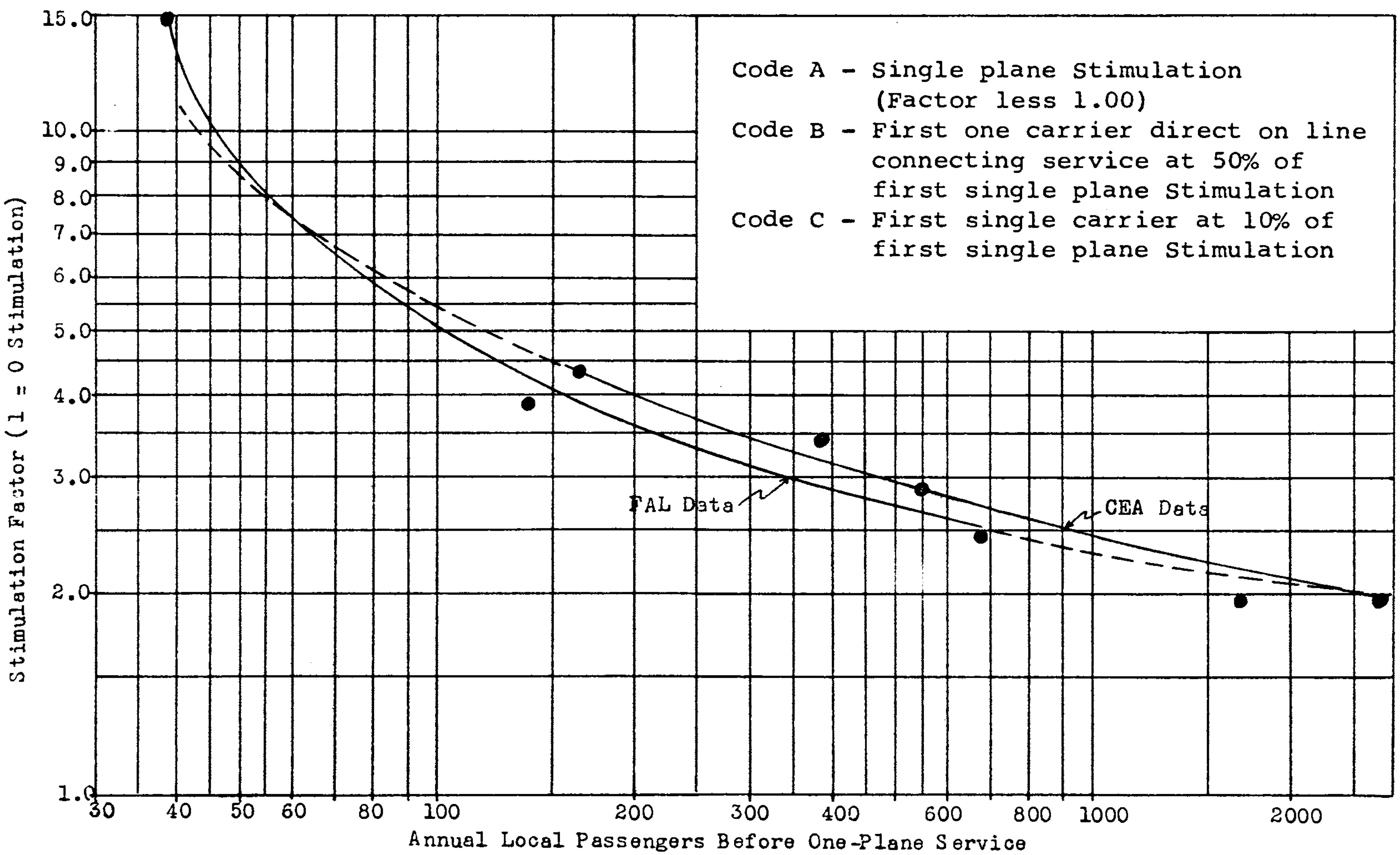


Figure 7. Single Plane Stimulation Factor Related to Size of Market

admits that this procedure is open to question, but does believe that "good" and "reasonably accurate" estimates can be made and the results used with confidence in decision making. "Better" results perhaps could be obtained with a more sophisticated technique, but the expected cost of developing such a technique, if, in fact, one exists, is thought to outweigh the gain.

The stimulation factors in markets where Frontier's service improvement results from new competition, code E, are basically derived from a systematized method of weighing service quality before and after the introduction of the new service. A Service Quality Index is constructed for the before and after periods based on assigned values per flight as follows:

<u>Equipment Values by Flight</u>

Jet	8
Electra	6
Viscount/Constellation/ DC-6/DC-7	5
CV-580	4
F-27/CV-340/440/M-404	3
CV-240/M-202	2
DC-3	1

<u>Stop Value by Flight</u>

Non-Stop	8
One-Stop	6
Two-Stop	4
Three-Stop	2
Four or More Stops	1

These values represent minor Frontier revisions of values developed by the CAB Bureau of Operating Rights from extensive statistical analyses of the effect of placing local service carriers in competition with trunklines. Although the Bureau's statistical analyses were done for the purpose stated, Frontier feels that the principles involved are basic for determining the impact of competitive service in any market. Primary determinants are service frequency, equipment quality and service quality measured inversely by intermediate stops. In brief, the so-called Service Quality Index resolves to nothing more than a systematic numeric method for evaluating these factors before and after introduction of competition. Figure 8 graphically portrays the relationship of competitive stimulation to improved service quality used as a guide by Frontier. For example, as assumed 100 per cent improvement in service quality should provide a stimulation approximating 60 per cent.

Frontier computes the Service Quality Index (SQI) as follows:

SQI = frequency of flights x stop value by flight
x equipment value by flight.

For example, if United offers four non-stop flights daily between Colorado Springs and Phoenix using jet equipment, and there is no other carrier serving this city-pair, United's Service Quality Index is

SQI (United) = 4(flights) x 8(stop value) x
8(equipment value) = 256.

Now assume Frontier enters this market and adds two one-stop flights daily using Convair 580 equipment. Frontier's addition to the SQI for this market would be

SQI(Frontier) = 2(flights) x 6(stop value) x
4(equipment value) = 48.

The resulting total market SQI is then

SQI(Total Market) = 256 + 48 = 304.

Frontier's service would result in a percentage increase in the Total Service Quality Index of

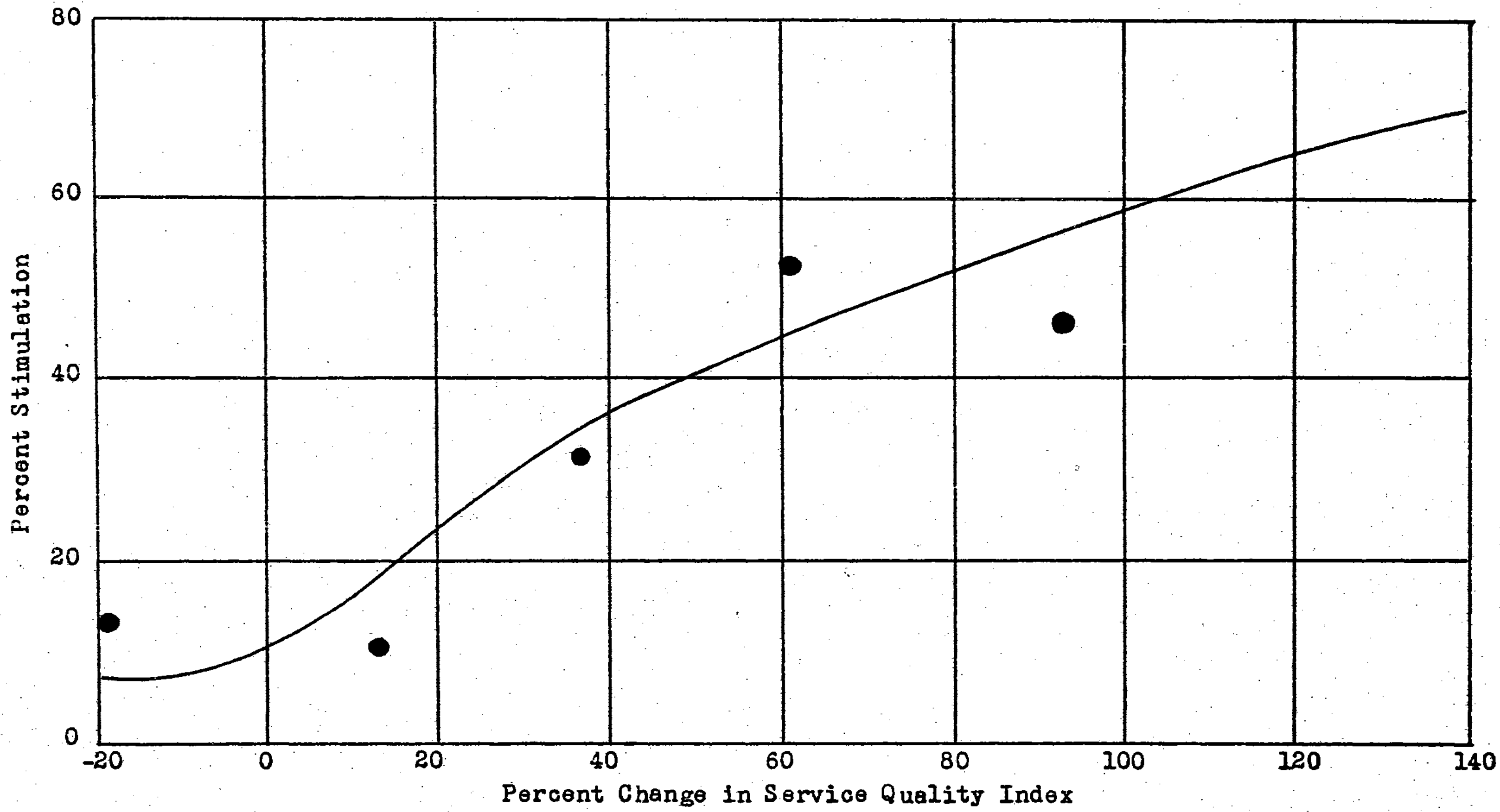


Figure 8. Per Cent Traffic Increase After Local Service Competition Related to Per Cent Increase in Total Market Service Quality Index

$$\frac{48}{256} = 18.8 \text{ per cent.}$$

In Figure 8, an 18.8 per cent increase in the Service Quality Index would result in approximately a 22 per cent stimulation of traffic in the total market, after introduction of Frontier's competitive service. Frontier would not necessarily carry all this newly created traffic, but would share in the total market with United on the basis of Frontier's Service Quality Index as a percentage of the total market Service Quality Index. That is,

$$\frac{\text{Frontier SQI}}{\text{Total Market SQI}} = \frac{48}{304} = 15.8 \text{ per cent, equals}$$

Frontier's participation in the total Colorado Springs-Phoenix market.

<u>Estimated Added Frontier Passenger Traffic After Service Improvement</u>

Table XXXII in Appendix D is a summary of Frontier's forecast of added passenger traffic and revenues attributable to the proposed service to Las Vegas. The estimated total passengers, local and connecting, shown for 1967 are taken from Tables XXIX, XXX, and XXXI in Appendix D.

In Table XXXII in Appendix D, each city in Frontier's system is coded according to the type of service improvement resulting from Frontier's entrance into the Las Vegas market, and the appropriate traffic stimulation factor is determined. The procedure for estimating the number of passengers Frontier expects to carry is explained below by examining different types of service improvement.

For example, in the Kansas City-Las Vegas market, the estimated total passengers for 1967, before Frontier service improvement, is

13,160. Frontier identifies the type of service improvement as code E, the introduction of the first competitive one-plane service. Using the Service Quality Index (SQI) procedure previously discussed, Frontier estimates a 20 per cent increase in total traffic in this market, after introduction of Frontier service improvement. Thus, the stimulation factor is 1.20, as shown. To find the estimated 1967 total market after Frontier service improvement, multiply the stimulation factor times the estimated 1967 passengers before Frontier service improvement. Thus,

$$13{,}160 \times 1.20 = 15{,}792 \text{ passengers.}$$

To determine the number of passengers Frontier expects to carry out of the total Kansas City-Las Vegas market, it is necessary to estimate Frontier's per cent participation. For this particular market, Frontier expects a participation of 20 per cent. For each market, this percentage is based on Frontier's "best judgment" -- nothing more. Thus, Frontier expects to carry 20 per cent of 15,792 forecast passengers, or 3,158 passengers.

The Omaha-Las Vegas market has a service improvement of code F, indicating "like additional" service. The traffic stimulation factor is 1.05, meaning Frontier expects to stimulate the total market by 5 per cent. The stimulation factor for this type of service improvement is also based on the Service Quality Index procedure, but is, according to Frontier, a "watered-down" version.

The Grand Island/Hastings/Kearney-Las Vegas market has a service improvement of code D, indicating the first one-carrier service replacing two-carrier. The traffic stimulation factor is estimated to be 1.30, and is determined by the use of Figure 7. The number of "annual local passengers before one plane service" is estimated at 460 total. Measuring along the horizontal axis of Figure 7 to 460 passengers, then up to curve, the stimulation factor of 2.9 can be read off the vertical axis. Thus, the code A stimulation factor so found is

2.9 - 1.0 (since 1 = 0 stimulation) = 1.9.

This means that <u>if</u> the service improvement in this market were code A, total traffic could be expected to increase by 190 per cent. But, since it is, instead, code D, a code D service improvement is estimated to be only 10 per cent as stimulative as code A. Therefore, the expected percentage increase in traffic in this market due to code D service improvement is

190 per cent x 10 per cent = 19 per cent

and the resulting traffic stimulation factor is 1.19, unadjusted. After making this initial calculation, Frontier frequently alters the factor to bring it closer into harmony with its own judgment as to the degree of "actual" stimulation expected from service improvement. Such is the case here. Although the calculated value of 19 per cent represents a starting point, Frontier feels that the actual stimulation of this market from service improvement would be greater, somewhat in the order of 30 per cent. Thus, the adjusted value of the traffic stimulation factor is 1.30.

The percentage participation that Frontier expects in the total Grand Island/Hastings/Kearney-Las Vegas market after Frontier service improvement is designated by "S". "S" means "by-the-amount-of-stimulation". For example, the total estimated passengers for 1967 before Frontier service improvement is 460. Frontier expects to stimulate the market by 30 per cent, resulting in a total market after Frontier service improvement of 598 passengers, a net change of 138 passengers. Thus, the meaning of "S" is that Frontier expects to carry 138 passengers, the amount of the stimulation, rather than some percentage of the total market, as is the case in other markets.

The procedure described above is used to estimate the number of passengers Frontier expects to carry between Las Vegas and each city on its system. By way of review, the process involves, for each market:

1. Forecasting the total 1967 Las Vegas passenger traffic, before Frontier service improvement.
2. Determining the estimated stimulation factor, and multiplying it times the traffic forecast to determine the 1967 passenger traffic expected, after Frontier service improvement.
3. Estimating Frontier's percentage participation and multiplying this percentage times the total passenger traffic, after Frontier service improvement, to determine the number of Las Vegas passengers Frontier expects to carry in 1967.

Incremental Revenue Attributable to Las Vegas Service

Total added passenger revenue expected to be generated by Frontier's Las Vegas service is found by multiplying the forecast number of Frontier passengers traveling between Las Vegas and the cities named, times the appropriate fares. The proposed fares are summarized in Table XXXIII in Appendix D.

In establishing regular fares in specific markets, Frontier's most important considerations are the quantity and quality of available substitute means of transportation. This involves primarily a consideration of competititve airline service and surface transportation (mainly automobile, and secondly, bus; rail is of limited importance). For Frontier's system, geographical characteristics make surface transportation generally inferior to air transportation. Furthermore, on many north-south routes, Frontier has little or no competition from other air carriers.

On these routes, Frontier charges fares, on a rate per mile basis, that are generally higher than those on more competitive routes. Frontier's stated objective is to maximize short-run total revenue by charging relatively higher fares where demand is more inelastic while still maintaining a long-run view of price effects on market growth. The "optimum" fare levels are based on judgment since no calculations are made to estimate price elasticity of demand in these markets. On east-west routes, Frontier faces stronger competition from other air carriers, and so charges fares that are competitive with, if not identical to, other airlines. In these markets, Frontier is generally a price-follower and not a price-leader.

In arriving at the proposed fares between Las Vegas and Denver, Frontier took into account several factors. Only United Airlines serves Las Vegas directly from Denver, via Grand Junction. United offers one daily non-stop round trip between Denver and Las Vegas using jet equipment and one daily round trip, with a stop at Grand Junction, using propeller equipment. The United non-stop jet service departs Denver at 10:20 P. M., MST, and arrives in Las Vegas at 10:50 P. M., PST, for an elapsed time of 1 hour, 30 minutes. The jet first class one-way fare is $53.45, and jet coach is $47.20. The propeller flight leaves Denver about 11 o'clock in the morning MST, makes a stop at Grand Junction, and arrives in Las Vegas about 1:20 in the afternoon, PST. The elapsed time is 3 hours, 20 minutes and the one-way fare is $39.65; all seats are coach. The only other existing Denver-Las Vegas service is that offered by Western Airlines via Salt Lake City. The Western flight leaves Denver at 12:10 P. M., MST, and arrives in Salt Lake City at 1:15 P. M., MST; after a change of planes, the flight then leaves Salt Lake City at 2:10 P. M., MST, and arrives in Las Vegas at 2:12 P. M., PST, for a total elapsed time of 3 hours for the Boeing 720 and DC-6 equipment used in the service. The first class one-way fare is $53.45, the same as that of United's non-stop flight.

One of Frontier's two proposed jet flights from Denver would leave at 8:40 A. M., MST, stop in Grand Junction for 10 minutes, then proceed to Las Vegas, arriving at 9:36 A. M., PST, for an elapsed time of 2 hours. The second flight would leave Denver at 3:00 P. M., MST, and, after stopping in Grand Junction for 10 minutes, arrive in Las Vegas at 3:56 P. M., PST, for an elapsed time also at 2 hours.

The reason to state these comparative departure and arrival times is to point out the comparative "quality" of Frontier's proposed service versus that of it competition, in terms of elapsed time of flight and time of day. Frontier plans to use Boeing 727 jets on both flights, making Frontier's equipment "quality" equal to United's relatively late night non-stop flight, and superior to United's noon propeller flight. However, on its jet flights between Denver and Las Vegas, Frontier does make one stop - Grand Junction. A flight with one-stop is generally considered inferior to a non-stop flight, other things equal. Frontier, however, after considering other things not equal, proposes to offer its one-stop jet service at fares equal to United's non-stop jet service - $53.45 first class and $42.70 coach. Frontier feels that its service is superior to United's and certainly to Western's, but reasons that establishing fares identical to theirs will in effect be a price decrease and, thus, serve to insure the economic soundness of the decision.

As shown in Table XXXIII in Appendix D, Frontier quotes two fares for jet flights, jet first class and jet coach. In order to estimate added total revenue from the proposed Las Vegas service, it is first necessary to estimate the total number of passengers Frontier expects to carry, and what percentages of the total would travel first class and coach. Making use of a 1964 CAB survey of traffic between Las Vegas and twenty-nine cities west of the Mississippi River, Frontier calculated the percentages traveling first class and coach, took the mean, and arrived at a passenger-mix expected of 20 per cent first class and 80 per cent coach. On the assumption that this 20/80 mix will likewise be its average experience, Frontier made appropriate calculations to determine total added revenue expected to be generated by each city on its system. For example, Frontier expects to carry 3,158 passengers between Kansas City and Las Vegas in 1967. If 20 per cent travel jet first class and 80 per cent jet coach, Frontier's expected added revenue in this market is

3,158 passengers	x 20% first class	x $93.50 =	$	59,055
3,158 passengers	x 80% coach	x $74.80 =		188,974
			$	248,029.

Table XXXII in Appendix D summarizes by cities the expected passenger traffic and passenger revenue attributable to Frontier's service to Las Vegas.

Although passenger revenue is by far the more important, added mail and property revenue is nevertheless significant, totaling $123,300. This value is determined by:

1. Multiplying the number of passengers times the distance in miles between each city and Las Vegas to find the number of total revenue passenger miles (RPM = 39,154,000).
2. Converting revenue passenger miles to revenue passenger ton miles on the basis that .095 revenue passenger ton miles is equal to 1.000 revenue passenger mile (i.e., approximately ten revenue passengers are equal to one revenue passenger ton). Thus, 39,154,000 RPM x .095 = 3,720,000 revenue passenger ton miles.
3. Converting revenue passenger ton miles to mail and property ton miles on the basis that the latter, based on Frontier's 1965 system experience, is 7.36 per cent of the former, after adjustment to account for the resort nature of the Las Vegas market. Thus, 3,720,000 revenue passenger ton miles x 7.36% = 274,000 added mail and property ton miles.
4. Calculating the resulting added revenue from mail and property, based on Frontier's 1965 system experience of an average of $.45 per mail and property ton mile. Thus, 274,000 mail and property ton miles x $.45 = $123,300 added revenue from additional mail and property traffic.

The forecast change in total revenue attributable to Frontier's decision to add the Grand Junction-Las Vegas route to its system is

Incremental Passenger Revenue	$ 2,706,992
Incremental Mail and Property Revenue	123,300
Total Incremental Revenue	$ 2,830,292.

Aircraft Operating Data

Frontier estimates that total incremental operating expenses for the Las Vegas service, made up of aircraft operating expenses plus servicing expenses, will amount to $1,764,492 in 1967. In order to estimate incremental cost, it is first necessary to estimate relevant aircraft operating data.

Frontier's proposal specifies that one Denver-Grand Junction schedule currently flown with CV-580 equipment will be replaced with B-727 jet equipment if Frontier receives certification, with the schedule extending to Las Vegas; the other schedule will simply be an extension to Las Vegas of an already planned jet schedule between Denver and Grand Junction. Also, an additional daily round-trip flight between Colorado Springs and Denver will be scheduled to provide direct on-line connection to Las Vegas. The added aircraft miles, hours, and departures attributable to the proposed service are calculated in Table XXXIV in Appendix D and summarized in Table VI, including relevant services and traffic data.

Direct Costs: Aircraft Operating Expenses

Frontier estimates the total net added aircraft operating expenses attributable to the proposed service to Las Vegas to be $936,601.

TABLE VI

SUMMARY OF AIRCRAFT OPERATING DATA AND SERVICE AND TRAFFIC DATA, LAS VEGAS SERVICE

	B-727	CV-580	Net Total
Aircraft Operating Data:			
Revenue Aircraft Miles Flown	744,016	(95,864)	648,152
Revenue Aircraft Departures Performed	2,146	-0-	2,146
Aircraft Stage Distance	347	-	347
Revenue Aircraft Block Hours Flown	2,045	(316)	1,729
Total Aircraft Block Hours	2,086	(322)	1,764
Service and Traffic Data:			
Revenue Passengers			71,216
Revenue Passenger Miles (000)			39,154
Available Seat Miles (000)			64,209
Average Passenger Load			60.4
Passenger Load Factor			61.0%

Aircraft operating expenses consist of four major cost categories which, along with estimated dollar amounts, are summarized in Table VII.

TABLE VII

AIRCRAFT OPERATING EXPENSES, LAS VEGAS SERVICE

Flying Operations:	B-727	CV-580	NET
Crew Costs	$180,105	$(17,262)	$162,843
Fuel, Oil, and Taxes	292,812	(12,880)	279,932
Insurance	50,419	(2,167)	48,252
Other Costs	2,232	(332)	1,900
Total Flying Operations	$525,568	$(32,641)	$492,927
Direct Maintenance-Flight Equipment	188,220	(19,774)	168,446
Applied Maintenance Burden-Flight Equipment	95,393	(6,897)	88,496
Depreciation-Flight Equipment	193,310	(6,578)	186,732
Total Aircraft Operating Expenses	$1,002,491	$(65,890)	$936,601

The analysis which follows delves in some detail into the mechanics of aircraft operating cost analysis by identifying specific expenses incurred, sources of cost data, assumptions, and procedures used by Frontier to estimate the added Boeing 727 expenses summarized in Table VII.

The decrease in Convair 580 aircraft operating expenses shown in Table VII are estimated by multiplying the appropriate unit cost, based on Frontier's 1965 system CV 580 cost experience (Appendix F), times the net decrease in total aircraft block hours flown resulting from the Las Vegas service. The elimination of one CV 580 schedule from Denver to Grand Junction, plus the addition of one from Colorado Springs to Denver results in a net decrease of 322 total aircraft block hours flown. Due to the mechanical nature of the calculations, no category-by-category estimate of CV 580 costs will be presented but they may readily be determined as indicated.

Flying Operations. This function includes expenses incurred directly in the in-flight operation of aircraft and expenses incurred in the holding of aircraft and aircraft operational personnel in readiness for assignment to an in-flight status. The four sub-categories are:

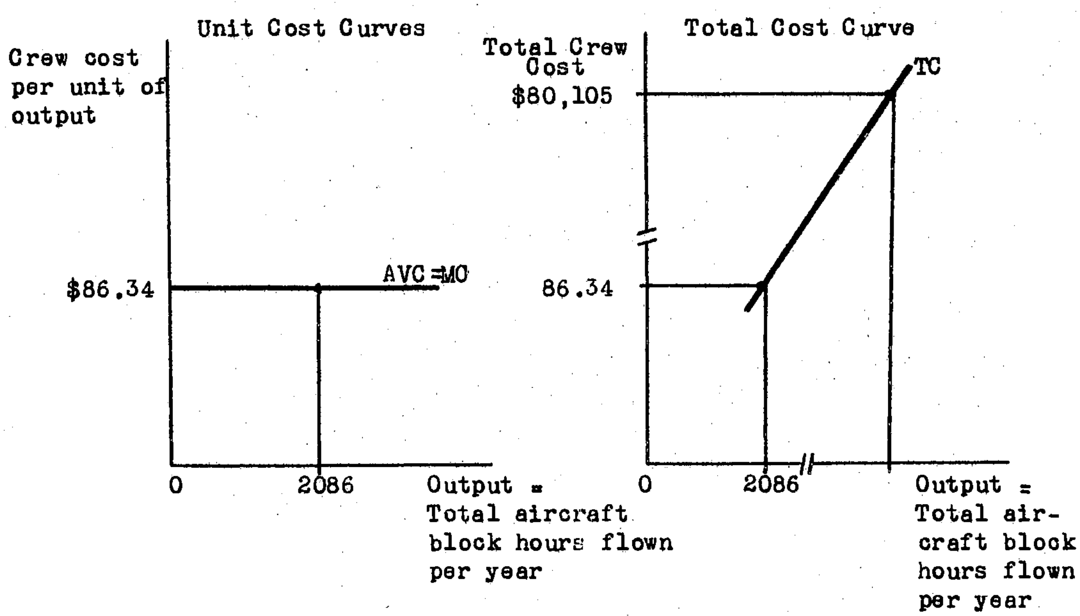
1. Crew Cost. The B-727 crew cost is estimated at $86.34 per total aircraft block hour. Thus, the total added B-727 crew cost attributable to the proposed service is $86.34 x 2,086 total B-727 aircraft block hours = $180,105. The estimate for total added B-727 aircraft block hours is found in Table VI; the crew cost per aircraft block hours is estimated as shown in Table VIII. The relationship between crew costs and "output" is considered by Frontier to be linear, where output is measured in terms of total aircraft block hours. This linear relationship is thought to hold true regardless of the level of total aircraft block hours flown, provided there is little or no idle crew capacity employed. In the event that pilots, copilots and flight engineers are idle and could be used on additional flights, output

TABLE VIII

ESTIMATED CREW COST FOR BOEING 727
PER TOTAL AIRCRAFT BLOCK HOUR

	Cost per Total Aircraft Block Hour	Basis for Estimate
Crew Costs		
Pilots and Copilots	$ 50.11	Frontier's contract provisions with pilots
Trainees and Instructors	1.00	At 2% of pilot salaries
Other flight Personnel (Flight Engineers)	15.00	At 30% of pilot salaries, based on the 1964 B-727 experience of the Big Four (AAL, EAL, TWA, UAL)
Personnel Expenses	4.42	Based on Frontier's 1964 system unit cost plus 60% allowance for extra crew member
Insurance-Employee Welfare	10.58	Frontier's 1964 relationship to crew salaries
Taxes, Payroll	1.12	Frontier's 1964 relationship to crew salaries
Total Crew	$ 82.23	
Plus 5% adjustment for inflation from 1964 to 1967	4.11	
Total Crew Cost	= $ 86.34	

could be increased without as large an increase in crew costs as would occur if new, additional crew were needed. This is due to the fact that members of the crew are paid a base salary plus a rate directly related to total aircraft block hours flown. If idle crew can be allocated to added flights, there would be no increased cost of base salaries of course, but there would be increased costs due to increased flight pay. But in this proposal, Frontier figures it will need new, additional crews, since it does not normally have sufficient idle crews to allocate to such a market. Therefore, the relevant relationship between crew cost and output may be depicted as follows:



2. Fuel, Oil, and Taxes. Boeing 727 cost of fuel, oil and taxes per total aircraft block hour is related to the average aircraft stage distance, the average distance flown between stops. The shorter this distance, the more costly are fuel and oil per total aircraft block hour due to the "voraciousness" of jets during take-off, climb, and acceleration toward cruising speed. This unit cost tends to decrease as the average aircraft stage distance increases since the aircraft can operate longer at its more efficient cruising speed. The Boeing Company made the cost analysis for Frontier, and estimates the cost per total aircraft block hour to be $140.37. The total added cost for B 727 fuel, oil, and taxes is

   2,086 total aircraft block hours x $140.37 = $292,812.

3. Insurance. A complete Boeing 727 airplane, including airframe, three engines, and electronic equipment, costs $4.5 million. Frontier has three B 727s in its fleet, making a total fleet cost equal to $13.5 million, excluding cost of spare equipment. Frontier estimates total aircraft insurance cost at 2 per cent of the B 727 fleet cost or $270,000 per year. Frontier anticipates that each jet will average 3,650 annual revenue block hours utilization, or 10,950 annual revenue block hours for the fleet. Non-revenue block hours are estimated at 2 per cent of revenue block hours, making the total block hours for the fleet equal to 11,169.

Aircraft insurance cost per total aircraft block hour is $270,00 total insurance cost per year ÷ 11,169 total aircraft block hours = $24.17. Total B 727 insurance cost allocated to the proposed service to Las Vegas is

2,086 total aircraft block hours x $24.17 insurance cost per block hour = $50,419.

4. Other Costs. This cost category includes such items as supplies, professional and technical fees, injuries, loss, damage, and other miscellany. For Boeing 727 equipment, these accumulated costs are estimated by Frontier to be $1.07 per total aircraft block hour. This figure is based on the historical relationship of these "other costs" to all crew costs, as experienced by Frontier in 1964. Total added B 727 "other costs" as a result of the decision is

2,086 total aircraft block hours x $1.07 = $2,232.

Direct Maintenance--Flight Equipment. This cost category includes necessary repairs, and overhauls of the aircraft, including airframe, engines, and other flight equipment. Unit cost of this service on Boeing 727 equipment is estimated by Frontier to be $90.23 per total aircraft block hour, based primarily on the experience of four major trunklines as shown in Table IX. The change in total cost for direct maintenance on B 727 flight equipment is

2,086 total aircraft block hours x $90.23 = $188,220.

Applied Maintenance Burden--Flight Equipment. This function includes all overhead or general expenses used directly in the activities

TABLE IX

ESTIMATED B 727 UNIT COST OF DIRECT MAINTENANCE--FLIGHT EQUIPMENT, PER TOTAL AIRCRAFT BLOCK HOUR

	Cost per Total Aircraft Block Hour	Bases for Estimate
Airframes		
Labor	$ 14.74	Simple average of Big Four costs for 4th quarter of 1964
Materials	10.99	
Outside Repairs	9.53	Eastern's 1964 4th quarter cost since they alone reported a reserve provision
Sub-Total	$ 35.26	
Engines		
Labor	$ 8.57	Average of American and Eastern for 4th quarter 1964 since the reporting by these carriers indicate use of outside engine overhaul
Materials	10.82	
Outside Repairs	26.42	
Sub-Total	$ 45.81	
Other Flight Equipment		
Labor	$ 4.08	Simple average of the Big Four costs for 4th quarter of 1964
Materials	1.36	
Outside Repairs	.42	
Sub-Total	$ 4.86	
Total Direct Maintenance	85.93	
Plus 5% for inlation from 1964 to 1967	$ 90.23	

involved in periodic flight equipment maintenance operations. It includes expenses related to the administration of maintenance stocks and stores, the keeping of pertinent maintenance operations records, and the scheduling, controlling, planning and supervision of maintenance operations. In Frontier's experience in 1965, the applied maintenance burden was costed at 159 per cent of direct maintenance labor. Frontier elected to use this same percentage in estimating the appropriate applied maintenance burden for Boeing 727 as well as Convair 580 equipment.

For Boeing 727 equipment the sum of direct maintenance labor for the total aircraft, including airframes ($14.75), engines ($8.57), and other flight equipment ($4.08), equals $27.39 per total aircraft block hour. The applied maintenance burden per total aircraft block hour is

$27.39 x 159% + 4% for inflation = $45.73.

Thus, the total B 727 applied maintenance burden--flight equipment is estimated to be

2,086 total aircraft block hours x $45.73 = $95,393.

Depreciation--Flight Equipment. This cost category includes all charges to account for losses suffered through current exhaustion of the serviceability of flight equipment due to wear and tear from use and the action of time and the elements, which are not replaced by current repairs. For Frontier's new fleet of three Boeing 727 jets, the annual depreciation charge per aircraft is estimated on a time basis to be $345,000, calculated as shown in Table X. To put B 727 annual depreciation charges on a cost per total aircraft block hour basis, the following conversions are necessary:

TABLE X

ESTIMATED BOEING 727 FLIGHT EQUIPMENT
INVESTMENT AND DEPRECIATION

	Cost per Unit	Total cost of 3 Aircraft Fleet
Complete Airplane (000)		
Airframe	$ 3,693	$ 11,079
Three engines at $239,000 each	717	2,151
Electronics	90	270
Subtotal	$ 4,500	$ 13,500
Spare Costs (000)		
Airframe (at 11% of airframe cost)		$ 1,219
Engines (a quantity of four)		956
Engine parts and miscellany (at 10% of total engine costs)		311
Electronics (at 23% of electronics)		62
Total Fleet Cost (000)		$ 16,048
Residual Values (000) After 12 Years		
Airframes and spares at 15%		$ 1,845
Engines and spares at 15%		513
Electronics and spares at 15%		498
Built-in overhaul at $150,000 per airframe		450
at $25,000 per engine		325
Total Residual Value of Three Aircraft Fleet		$ 3,631

Total Fleet Annual Depreciation (Straight Line Basis) =

$$\frac{\text{Total Fleet Cost-Total Residual Value}}{\text{Expected Life of Fleet}} = \frac{\$16{,}048{,}000 - \$3{,}631{,}000}{12 \text{ years}}$$

$= \$1{,}035{,}000$

Annual Depreciation per aircraft $= \frac{\$1{,}035{,}000}{3} = \$345{,}000$

3,650 revenue block hours per aircraft x 3 aircraft

+ 2% non-revenue hours of revenue block hours

= 11,169 total aircraft block hours for fleet

$$\frac{\text{Total fleet depreciation charge}}{\text{Total fleet block hours}} = \frac{\$1,035,000}{11,169}$$

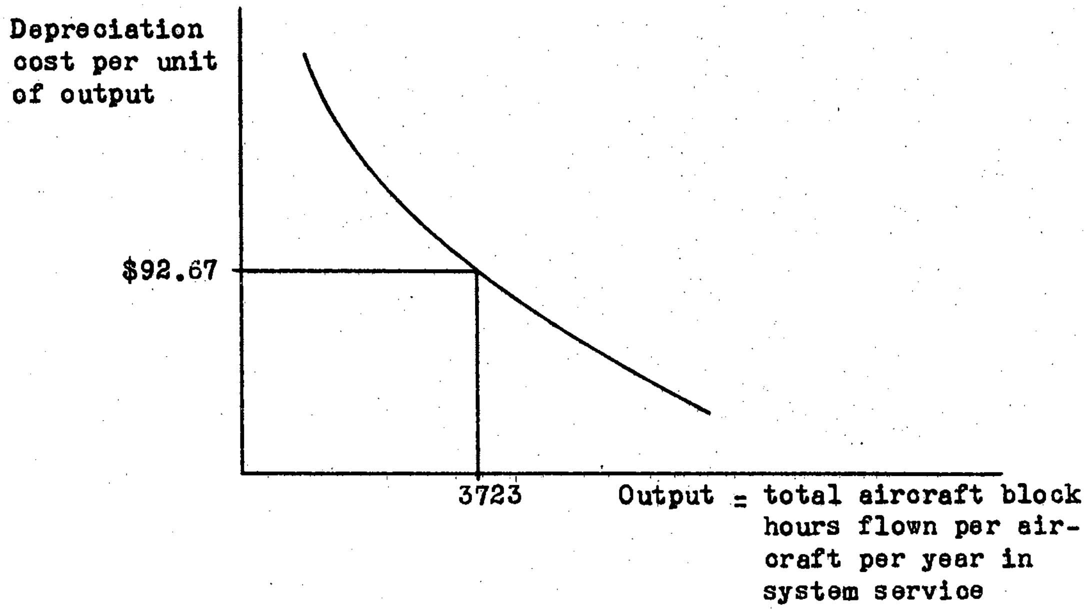
= $92.67 depreciation cost per total aircraft block hour.

The total annual B 727 flight equipment depreciation charge attributable to the proposed service to Las Vegas is

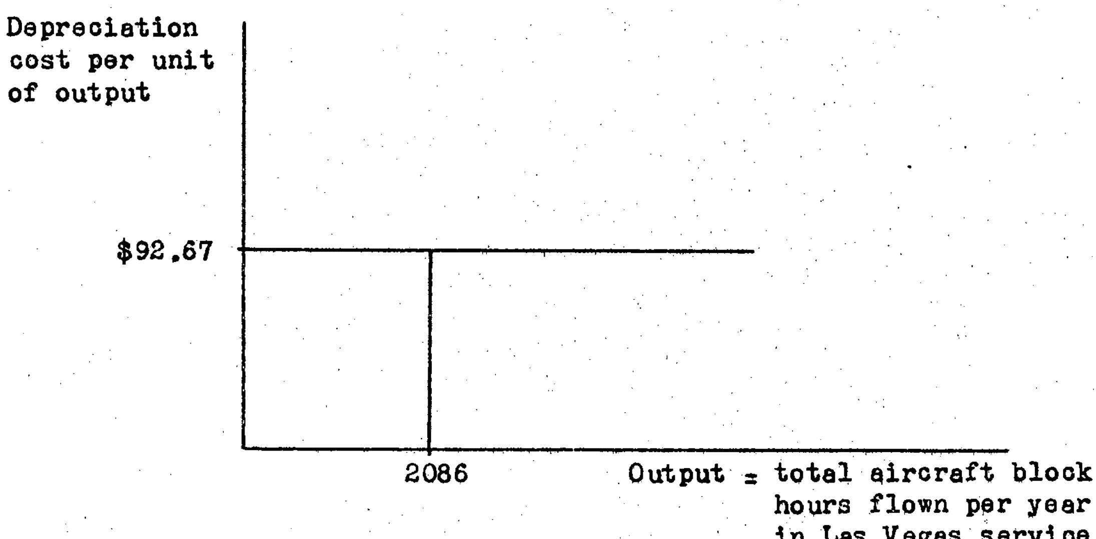
2,086 total aircraft block hours x $92.67 = $193,310.

As shown in Table X, depreciation cost per year is $345,000 per aircraft and is a function of time, not output. Therefore, the greater the output of the aircraft in terms of total aircraft block hours flown, the smaller the depreciation cost per unit of output. Frontier estimates it will fly each jet in revenue service an average of ten hours per day, 365 days per year, plus 2 per cent non-revenue service, giving total aircraft block hours flown per year per aircraft of 3,723. The general relationship between unit depreciation cost and aircraft output can be generalized as shown below.

The diagram shows, of course, that for this decision, depreciation cost per unit of output will not vary as output varies. If Frontier's actual output experience in the Las Vegas service is different than that forecast, the unit cost rate of $92.67 will still apply, given that Frontier does in fact achieve its expected system utilization of aircraft. The amount of total depreciation not absorbed by the Las Vegas service would simply be allocated to the alternative which makes up the difference between the projected 3,723 total aircraft block hours flown per year and the output actually experienced in the



For the Las Vegas service, Frontier expects an output of 2,066 total aircraft block hours flown; the depreciation cost per unit of output can be illustrated as shown below.



Las Vegas service. These same relationships hold true for aircraft insurance since this cost is likewise fixed per aircraft per year.

The total decrease in depreciation charges for Convair 580 flight equipment is based on Frontier's system experience in the Third Quarter of 1965 when it had an average depreciation cost per total aircraft block hour of $20.03. During this quarter, Frontier had 10 aircraft in service with 9 committed to the schedule. In 1967, 17 will be in service with 15 in the schedule. Therefore, the ratio of total to scheduled will increase from 1.111 to 1.133, for a 2 per cent increase in cost. Frontier, thus, estimates depreciation cost per total aircraft block hour to be $20.43. The total decrease in CV 580 flight equipment depreciation charges is, then,

(-)322 total aircraft block hours x $20.43 = (-)$6,578.

<u>Indirect Costs: Servicing Expenses</u>

Indirect costs have been identified previously, using the functional classification required by the CAB for carrier reporting. In order to clarify the meaning of a major portion of costs attributable to the Las Vegas service, each of these cost categories is briefly defined as follows (32):

1. Direct Ground Equipment Maintenance. This category includes the costs of labor, materials, and outside services consumed directly in periodic maintenance operations and repair of ground equipment of all types. This is Frontier's smallest expense for a major category, averaging approximately 1.4 per cent of total indirect cost.

2. Applied Maintenance Burden--Ground Equipment. Like applied maintenance burden--flight equipment, this category includes all overhead or general expenses directly involved in periodic maintenance operations and repair of ground equipment.

3. Ground Equipment Depreciation. This category includes all charges to record losses suffered through current exhaustion of the serviceability of ground equipment due to wear and tear which are not replaced by current repairs.

4. General Services and Administration. When applied aircraft maintenance burden is included in direct cost instead of in indirect cost, approximately 95 per cent of total indirect costs are included in the subcategories comprising this major cost category. The subcategories are

   a. Passenger Service, which includes all expenses chargeable directly to activities contributing to the comfort, safety and convenience of passengers while in flight and when flights are interrupted. Included are such costs as stewardess expenses, food and beverage expenses, and hotel accommodations. This function accounts for approximately 12 per cent of Frontier's total indirect costs.

   b. Aircraft and Traffic Servicing, which includes

      (1) the compensation of ground personnel and

other expenses incurred on the ground incidental to the protection and control of the in-flight movement of aircraft,

(2) the expenses of scheduling and preparing aircraft operational crews for flight assignment,

(3) the cost of handling and servicing of aircraft while in line operation,

(4) the cost of enplaning and deplaning passengers,

(5) the in-flight expenses of handling and protecting all nonpassenger traffic including passenger baggage, and

(6) aircraft landing fees.

This function constitutes approximately 52 per cent of Frontier's total indirect cost.

c. Promotion and Sales, which includes expenses incurred in promoting and creating public preference for the air carrier and its services, and in stimulating the general development of the air transport market. It further includes:

(1) compensation of personnel and other expenses incidental to documenting sales,

(2) expenses incidental to controlling and confirming aircraft space for

traffic sold (reservations),

(3) expenses incurred in direct sales solicitation and selling of aircraft space, and

(4) expenses incurred in developing tariffs and schedules for publication.

For Frontier this function accounts for approximately 18 per cent of total indirect cost.

d. General and Administrative, which includes expenses of a general corporate nature, and expenses incurred in performing activities which contribute to more than a single operating function such as general financial accounting activities, purchasing activities, lawyers' salaries and fees, management salaries, and so forth. The cost of this function for Frontier averages approximately 13 per cent of total indirect cost.

In 1965, Frontier's indirect cost for all operations totalled approximately $9 million, 95 per cent of which were accounted for by the subcategories comprising the General Services and Administration cost category described above.

For purposes of decision making, Frontier rearranges the indirect cost categories into three classifications which it labels "Servicing Expenses" as shown in Table V (page 93). These are:

1. Stewardess Expense
2. Regional and System Servicing Expense
3. Local Station Servicing Expense.

Frontier attempts to allocate indirect costs to individual local stations on its system according to the degree to which each local station generates these costs or can be directly identified with specific costs. Those indirect costs which are not generally identifiable with any particular local station but are, instead, primarily incurred due to service provided to a region of local stations or to Frontier's entire system are allocated to the cost category of Regional and System Servicing Expense. Both of the servicing expense categories contain costs from each of the functions comprising total indirect cost. For example, some of Frontier's total system Promotion and Sales Expenses will be identified with specific local stations since advertising outlays in the Phoenix-Tucson area tend to benefit those local stations but not the Kansas City station. On the other hand, some advertising will benefit a given region and Frontier's system as a whole and, therefore, will be allocated to regional and system expenses. In Frontier's 1965 system experience, total Local Station Servicing Expense amounted to $4,297,000 and Regional and System Servicing Expense amounted to $4,585,000, for a total indirect cost, excluding Stewardess Expense of $8,882,000.

By the use of statistical analyses, Frontier has sought to specifically relate Local, and Regional and System Servicing Expenses to measures of output in order to estimate changes in these costs as output changes. Details of these procedures are analyzed and demonstrated below, as is the procedure by which Stewardess Expense attributable to the Las Vegas service is estimated.

<u>Stewardess Expense</u>. In 1965 Frontier flew 24,128 total revenue aircraft block hours with Convair 580 equipment. Total stewardess

expenses amounted to $209,918, making the cost per stewardess per revenue block hour $8.70. To estimate the added stewardess expense for Boeing 727 equipment, Frontier uses the CV 580 experience of $8.70 per stewardess per revenue block hour, plus $.35 per stewardess per revenue block hour for extra compensation. The cost for three stewardesses, plus 4 per cent inflation, is

$9.05 cost per stewardess per revenue block hour x 3 stewardesses x 1.04 = $28.24 per revenue aircraft block hour.

Total added B 727 Stewardess Expense is

2,045 revenue aircraft block hours flown x $28.24 = $57,751.

The total decrease in Stewardess Expense for Convair 580 equipment is determined similarly. A cost per stewardess per revenue aircraft block of $9.05 is calculated by adding an inflation cost of 4 per cent to the base figure of $8.70. Thus,

(-)316 revenue aircraft block hours x $9.05 = (-)$2,860.

Regional and System Servicing Expense. Frontier computes its estimate of the added Regional and System Servicing Expense attributable to the proposed service to Las Vegas from a regression equation based on domestic trunk and local service industry experience for 1965. This regression equation was derived by relating Regional and System Servicing Expense per revenue ton mile to revenue ton miles per departure. These data and the resultant regression equation are shown in Figure 9. As is indicated, Regional and System Servicing Expense per revenue ton mile responds to changes in the revenue ton mile per departure index in that increases in the index result in decreases in regional and system unit costs.

The CAB formula generally required for costing the regional and

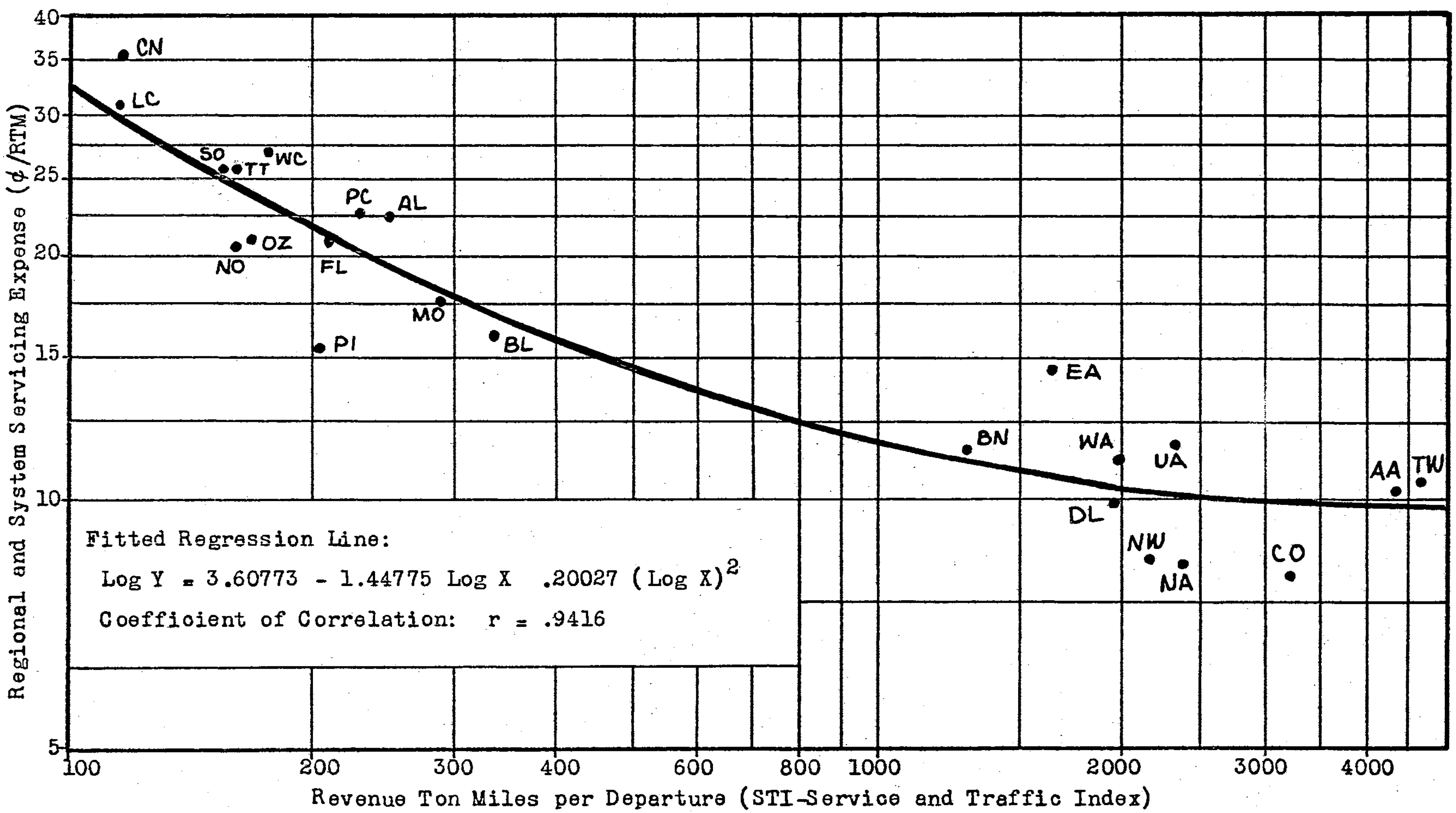


Figure 9. 1965 Industry Experienced Unit Costs for Regional and System Servicing Expense Per Revenue Ton Mile Versus Revenue Ton Miles Per Departure

system portion of expenses for local service carriers bases regional and system unit cost on each carrier's past long-term system added cost per added ton mile of traffic. In essence, this assumes no new route, no matter how different it may be in economic characteristics, can be operated at a more favorable unit cost than has been averaged in the past over a carrier's system.

For the proposed service to Las Vegas, Frontier's revenue ton miles per departure for the added operation would be 1,838, compared with its 1965 system experience of 215 revenue ton miles per departure. Obviously, because of the nature of the proposed route and its differences from Frontier's present system, this is a situation which will result in a much more favorable regional and system unit cost.

Table XI summarizes relevant historic and forecast operating statistics used in computing added Regional and System Servicing Expense.

TABLE XI

SUMMARY OF OPERATING STATISTICS USED IN COMPUTING ADDED REGION AND SYSTEM SERVICING EXPENSE, LAS VEGAS SERVICE

	Present System in 1965	Added by Proposed Service	Resultant System
Revenue Ton Miles (000)	22,027	3,994	26,021
Aircraft Departures Performed	102,536	2,146	104,682
Revenue Ton Miles per Departure	214.82	1837.84	248.57

To determine the net increase in total Regional and System (R and S) Servicing Expense attributable to the proposed Las Vegas service, it is necessary to calculate Frontier's total system R and S Servicing Expense before and after introduction of the proposed service and take the difference.

Frontier's accounting records show total Regional and System Servicing Expense for 1965 to be \$4,585,000. R and S Servicing Expense per revenue ton mile (RTM) for Frontier's present 1965 system is, therefore, equal to

$$\frac{\text{Total R and S Servicing Expense, present system}}{\text{Total Revenue Ton Miles, present system}} = \frac{\$4,585,000}{22,027,000}$$

$$= \$.2082 \text{ (actual).}$$

From Figure 9, a "computed" value for R and S Servicing Expense per RTM for the present system is found by measuring along the horizontal axis to Frontier's 1965 average system experience of 215 RTM per departure, tracing upward to the regression line, and reading the value of \$.2092 off the vertical axis. The "actual" R and S Servicing Expense for the present system as a percentage of the "computed" is 99.52 per cent.

With the addition of the proposed service, Frontier's resultant system shows, in Table XI, an increase in RTM per departure from 215 in 1965 to 249 in 1967. From Figure 22, the new "computed" R and S Servicing Expense per RTM for the resultant system is found by again measuring along the horizontal axis to Frontier's resultant system experience of 249 RTM per departure, and tracing upward to the regression line. Frontier's resultant system R and S Servicing Expense per RTM can be read off the vertical axis to be \$.1945, "computed". Since the "actual" as a percentage of the "computed" R and S Servicing

Expense per RTM is 99.52 per cent, the "actual" is calculated to be $.1936. The total Regional and System Servicing Expense for the resultant system is then:

26,021,000 Revenue Ton Miles x $.1936 R and S Servicing Expense per RTM = $5,038,000.

The Regional and System Servicing Expense added by the proposed Las Vegas service is equal to the expense of the resultant system minus the present system, or $453,000. Dividing the added R and S Servicing Expense by the added revenue ton miles gives an R and S Servicing Expense per RTM of $.1148 for the added output.

In the foregoing analysis, it was shown that an increase in total system output from 215 to 249 revenue ton miles per departure results in a decrease in total system R and S Servicing Expense per RTM from $.2082 to $.1936. Thus, a 15.4 per cent increase in total system output results in a 7.2 per cent decrease in system cost per unit, indicating a more efficient use of all facilities. More importantly, the unit added cost of the added service is calculated at $.1148 per added RTM, considerably below Frontier's present system as well as resultant system unit costs, both of which are fully allocated cost bases. But rather than use traditional fully allocated cost, Frontier believes that the appropriate cost here is the unit incremental cost of $.1148 per RTM or an added R and S Servicing Expense of $453,000 for 3,994,000 added revenue ton miles. A fully allocated cost approach would have employed Frontier's historic regional and system unit cost experience of $.2082 per revenue ton mile, for a resulting addition to R and S Servicing Expense of $830,000. The two approaches to route costing involve very substantial differences in expected additional cost and, therefore, expected additional profit of the Las Vegas route decision.

Local Station Servicing Expense. Frontier computes its estimate of added Local Station Servicing Expense attributable to the proposed service to Las Vegas from an estimating equation based on domestic trunk and local service industry experience for the year 1965. This estimating equation was derived by relating Local Station Servicing Expense per 100 departures to tons originated per 100 departures. The resultant estimating equation and fitted regression line are shown in Figure 10. As is indicated, Local Station Servicing Expense per 100 departures responds to changes in the tons originated per 100 departures index in that increases in the index result in increases in Local servicing unit costs.

Table XII summarizes relevant historic and forecast operating statistics used in computing added Local Station Servicing Expense. Added tons originated by the proposed service (7,262) is calculated by dividing total added revenue ton miles (3,994,000) by the average passenger haul (41.9).

TABLE XII

SUMMARY OF OPERATING STATISTICS USED IN COMPUTING ADDED LOCAL STATION SERVICING EXPENSE, LAS VEGAS SERVICE

	Present System Year, 1965	Added by Proposed Service	Resultant System
Ton Originated	73,979	7,262	81,241
Aircraft Departures Performed	102,444	2,146	104,590
Tons Originated per 100 Departures	72.21	338.4	77.68

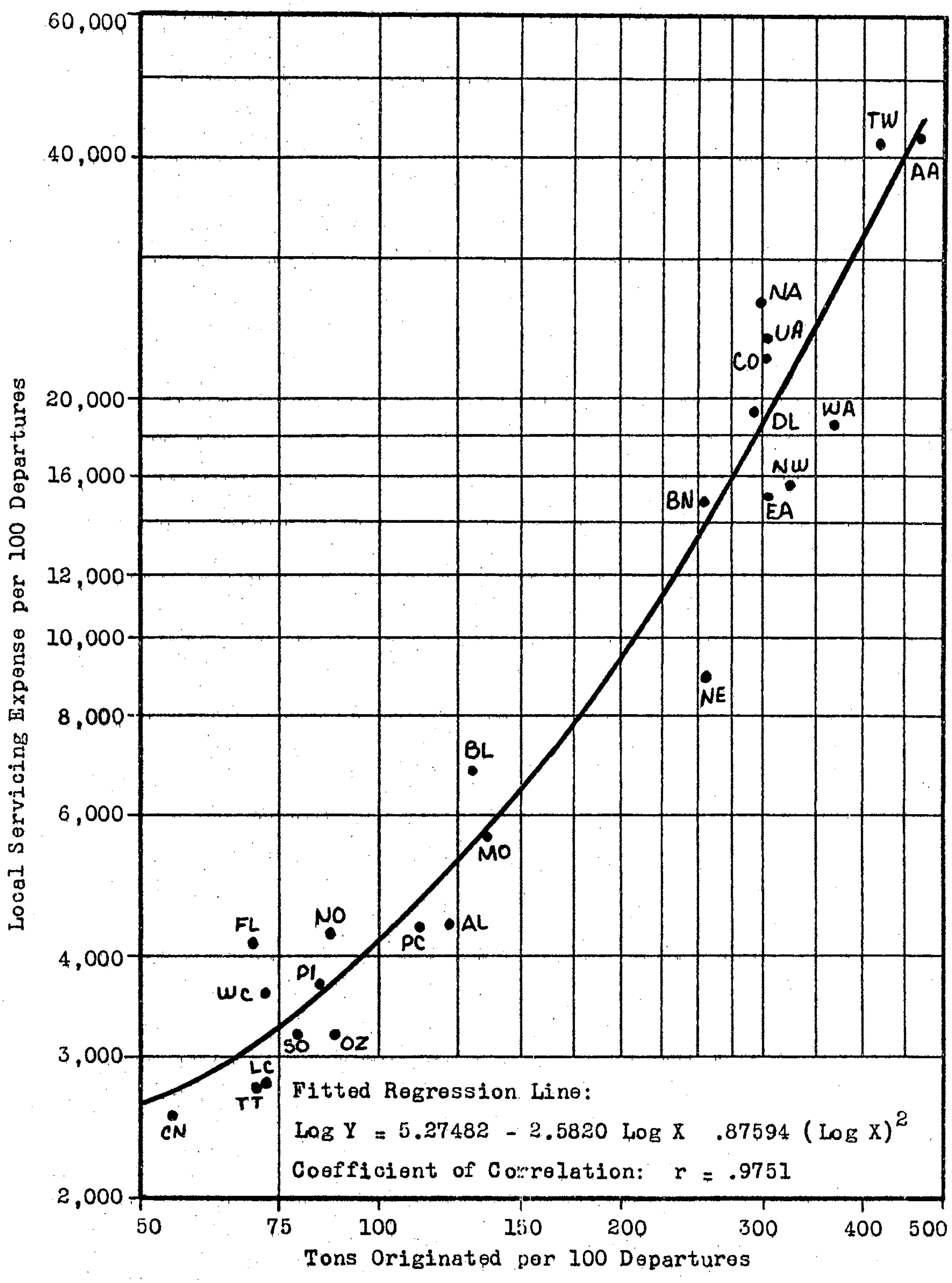


Figure 10. 1965 Industry Experienced Local Station Servicing Expense Per 100 Departures Versus Tons Originated Per 100 Departures

To estimate Frontier's total Local Station Servicing Expense added by the proposed service, it is again necessary to find the resultant system expense and subtact the present system expense from it.

Frontier's accounting records show Local Station Servicing Expense for 1965 to be $4,297,000. The "actual" Local Station Servicing Expense per 100 departures for the present system is equal to

$$\frac{\text{Local Station Servicing Expense, present system}}{\text{Aircraft Departures Performed, present system}} \times 100 =$$

$$= \frac{\$4,297,000}{102,444} = \$4,194 \text{ (actual).}$$

From Figure 10, a "computed" value for Local Station Servicing Expense per 100 departures for the present system is found by measuring along the horizontal axis to Frontier's 1965 average system experience of 72.21 tons originated per 100 departures, tracing upward to the regression line, and reading the value of $3,175 off the vertical axis. The "actual" Local Station Servicing Expense as a percentage of the "computed" is 132.09 per cent.

Due to the proposed service, Frontier's resultant system shows, in Table XII, an increase in tons originated from 72.21 in 1965 to 77.68 in 1967. From Figure 10, the new "computed" Local Station Servicing Expense per 100 departures for 77.68 tons originated per 100 departures is $3,342. Since the "actual" as a percentage of the "computed" is 132.09 per cent, the "actual" Local Station Servicing Expense per 100 departures for the resultant system is calculated to be $4,414. The total Local Station Servicing Expense for the resultant system is then

$$\frac{104,590 \text{ Aircraft Departures performed}}{100} \times \$4,414 \text{ "actual" Local Station Servicing Expense per 100 departures} = \$4,617,000.$$

The Local Station Servicing Expense added by the proposed Las Vegas service is equal to the expense of the resultant system minus the present system or $320,000. Dividing total Local Station Servicing Expense added by the proposed service by the added departures (times 100) gives a Local Station Servicing Expense per 100 departures of $1,492 for the added output, as compared to Frontier's 1965 system experience of $4,194.

As in estimating Regional and System Servicing Expense, Frontier estimates Local Station Servicing Expense on an incremental cost basis, rather than on a fully allocated cost basis. With 2,146 added departures, a fully allocated cost approach would estimate the added Local Station Servicing Expense at $900,000, nearly three times greater than Frontier's estimate using the added cost approach.

Figure 9 shows that Regional and System Servicing Expense per revenue ton mile substantially decreases at a decreasing rate, as output, measured in revenue ton miles per departure, increases up to a level of approximately 2000-2500 revenue ton miles per departure. Since the local carriers have much shorter hops and lower load factors than the trunk lines, this unit cost is typically much greater than that of the trunks. Greater efficiencies in the use of regional and system facilities, coupled with the sheer force that greater distances have on unit cost per some measure of distance, generally explain the differences in this unit cost between locals and trunks. But in Figure 10, unit cost is shown to increase as output increases. Local Station Servicing Expense per 100 departures increases at a rapidly increasing rate as output, measured in tons originated per 100 departures, increases. For instance, United Airlines has an output of 305 tons originated per 100 departures, and a resulting Local Station Servicing Expense per 100 departures of $23,908. By contrast, Frontier's 1965 experience was 72.21 tons originated per 100 departures and a Local Station Servicing Expense per 100 departures of $4,194. United's output was 4.35 times greater than Frontier's, but its unit cost was 5.78 times greater.

At first glance, these relative local station cost-output values would seem paradoxical. One might think a priori that the greater traffic volumes handled per flight per local station would give the trunklines advantages in cost efficiencies which would reduce their Local Station Service Expense per 100 departures below that of most local carriers since the locals must maintain and provide ground services at many relatively smaller stations producing comparatively little traffic (tons originated) in relation to the fixed costs required. But apparently such is not the case. The indirect cost of promoting, selling, and servicing traffic identifiable with a specific local station differs significantly between classes of carriers. Compared to the trunklines, local service carriers generally seek to operate local stations on a least-cost-possible basis. With lower average fares per passenger, higher line-haul costs and pressure to hold down subsidy needs, they must keep all controllable servicing and overhead costs at practical minimums; in-flight passenger services are modest, local station facilities are minimal, and so forth. In contrast, the trunks, with much higher average fares per passenger, can afford to provide a higher level of local station service per passenger and competition adds to the pressure to do so. Comparatively elaborate station facilities, expensive downtown sales offices, complete meals and other passenger amenities, and substantial advertising all contribute to the trunks relatively higher Local Station Servicing Expense per 100 departures.

Return on Investment and Subsidy Reduction

A summation of total added Aircraft Operating Expenses and total added Servicing Expenses results in a change in Frontier's total Operating Expenses attributable to the proposed service to Las Vegas of $1,764,492. Thus, the increase in Operating Profit of Frontier due to the decision is:

Incremental Commercial Revenue	=	$ 2,830,292
minus Incremental Operating Cost	=	(-)1,764,492
Total Incremental Operating Profit	=	$ 1,065,800.

In the original proposal, Frontier encourages CAB approval by requesting the route extension on a non-subsidy basis. In fact, Frontier further strengthens its case by offering to apply $624,800 of the revenue earned toward reduction of its present yearly subsidy payment. This is a significant part of the over-all decision because the CAB, if it approves the route application, will in fact reduce Frontier's subsidy by the stated amount, regardless of Frontier's actual revenue-cost experience in operating the Las Vegas route.

The provision for net additional return on investment and taxes is calculated to be $441,000. The procedures used and the bases for determining this value are specified and discussed in Table XXXV in Appendix D. Given a total forecast added operating profit of $1,065,000, this permits Frontier to earn a "fair" return while at the same time reducing its present subsidy need by $624,800.

Conclusion

If the fully allocated cost method had been employed in Frontier's estimates of added Local Station Servicing Expense and added Regional and System Servicing Expense, Frontier's total expected added cost of the proposed service would have been almost $1 million greater than that calculated using the added cost approach. Such an added cost value would turn the expected net profit in Table V into a loss of almost $0.5 million, considering the need for return on investment and taxes. Instead of reducing subsidy, it would be necessary to increase it if Frontier is to receive a "just" return for its service. Thus, the importance of employing relevant cost concepts can readily be seen in this decision.

Frontier's attempt to determine the added total cost and revenue of the Las Vegas service relies heavily on projections of historic data, judgments, and formulas. Given Frontier's accounting system and size of operation, this approach, though undoubtedly subject to improvement, provides a "satisfactory" basis for decision making. Frontier admits it may not be the best basis, but a "best" way, assuming there is one, might well cost more than is justifiable. Frontier officials do have confidence in these procedures and if the over-all estimate is within 5 to 10 per cent of actual experience, they will be quite satisfied.

Frontier's Douglas, Arizona Route Decision

Introduction to Incremental Analysis

In his book, Engineering Economy, Professor Thuesen (33) says:

> Where incremental costs are to be considered, the question is: Will it be profitable to add a certain activity or subtract a certain activity from the total activities now in progress?

In a recent issue of Business Week, an article dealing with decision-making states (34):

> Getting management to accept and apply the marginal concept probably is the chief contribution any economist can make to his company. Put most simply, marginalists maintain than a company should undertake any activity that adds more to revenues than it does to costs--and not limit itself to those activities whose returns equal average or "fully allocated" costs.

Haynes (28), in his managerial economics text, defines the marginal (or incremental) concept in a relevant and practical form as follows: a decision is sound if it increases revenue more than costs or reduces costs more than revenue. He further states that application of the incremental concept, "...involves estimating the impact of decision alternatives on costs and revenues, stressing the changes in total cost and total revenue that result..."

These quotations succinctly present one of the most fundamental and important concepts of economic theory. Theory states that if, when output increases, the resulting marginal revenue exceeds marginal cost, the action is profitable in the short-run. Short-run analysis does not take into account fixed costs associated with production, as they are irrelevant for the decision.

Insufficient studies have been conducted to ascertain if and how firms use the marginal (or incremental) concept in decision-making. One of the objectives of analyzing this and the following decision of Frontier is to document the degree to which, and how, actual decisions made employ incremental reasoning. By way of further introduction, incremental practices of Continental Airlines are discussed to establish some of the decision areas where application of the concept has proven profitable.

Continental Airlines is a recognized leader in the air transportation industry in new innovations. In product differentiation, Continental was the first airline to seek to establish a distinct corporate image by color-coding its flight equipment, ground personnel and traffic-handling equipment. It has on several occasions startled the industry with rate decreases in passenger fares, insisting that the action was justified on pure elasticity of demand considerations. Only recently, in August, 1966, Continental "broke the ice" for trunklines on adult standby fares, setting them one-third below economy fares on late night flights.

Continental has likewise led the industry in application of the marginal concept to improve net corporate profit. In fact, when this writer first contacted Frontier Airlines for permission to analyze its use of certain economic concepts, he was encouraged to, instead, "talk to Continental" because of Continental's advanced "stage" as an implementer of such concepts. Subsequent correspondence with the Vice President for Corporate Planning of Continental Airlines revealed that certain practices to improve profits, which are discussed below, are continuing to be used by Continental. He replied, "In reviewing your information requests, I do not find too much that could be added... other than some additional (comparable) illustrations..." He was referring to Continental's use of marginal analysis in flight scheduling (34).

The bulk of Continental's flights are scheduled on a fully allocated cost basis since the firm cannot, of course, make a profit unless average total costs are covered. But for any given flight, Continental maintains that fully allocated cost should not be the basis for decision-making, since such reasoning would distort the "real" cost of the flight and result in foregone opportunities to add to corporate net profit. So, once the basic schedule has been determined, Continental puts on extra flights if the additional revenue exceeds the additional cost, where the latter is estimated on, as Continental calls it, an "out-of-pocket" basis. Out-of-pocket costs mean the actual dollars that must be paid out to run a flight and include no costs that do not vary directly with the flight. A proposed schedule is circulated to every operating department concerned which then in turn estimates the additional cost it incurs in handling the flight. For example, if a plane can be serviced by a ground crew already on duty, the flight is not allocated any of their salary expense, since no additional dollar-outlay is incurred.

The same marginal analysis is likewise applied to individual flights with poor records to determine if they should be discontinued. Again, if revenues from dropping the flight decrease more than out-of-pocket costs decrease, the flight is kept on since there is a positive contribution to corporate net profit.

Continental's practice has been to run these marginal flights at off-peak periods such as late at night, or early in the morning. Its adult standby fare, for example, is applicable only during such times of usually low load-factor.

Closely connected with marginal cost analysis is the concept of opportunity cost--the net revenue foregone by choosing one alternative over another. The "best" alternative is that which results in least opportunity cost. For instance, in a decision made by Continental to add a flight to Kansas City on a marginal basis, Continental found that, coincidentally, two planes would be arriving at the same time, requiring service simultaneously. This would require additional service facilities costing $1800 per month. Continental was faced with the alternatives of having two planes on the ground in Kansas City at the same time or rescheduling its flights departing from other cities to avoid the double landing. The latter alternative entailed selecting less desirable hours, with the result that customers would switch to competitive flights leaving at more popular hours. Continental estimated that loss of this traffic would reduce revenues by $10,000 per month. In this instance, the opportunity cost of choosing one alternative over another was quite clear, once the relevant "cost" estimates were made.

A similar example of Continental's use of the marginal and opportunity cost concepts involved a late evening flight from Colorado Springs to Denver and an early morning return flight; the aircraft had to be in Colorado Springs later on in the morning each day for scheduled flights originating there. Nevertheless, Continental returned the aircraft to Denver each night, often empty except for some cargo, because the net cost of the round trip flight was less than the rent for overnight hanger space in Colorado Springs.

This kind of reasoning has resulted in enviable profit records for Continental, even though certain measures of performance involving "averages", such as load factors, appear inferior.

Summary of Douglas Route Proposal

In January, 1966, Frontier submitted a proposal to the CAB for new certification to serve Douglas, Arizona, with six daily flights using Frontier's fleet of 52 passenger, jet-powered Convair 580 equipment. Figure 11 is a map of Frontier's present system and proposed route to Douglas. Air travelers to and from Douglas will be benefited by Frontier's promotional fare programs such as its Family Plan, Youth Fare, Military Standby Fare, Clergy Fare, Vacationland Area Fare, and Visit U.S.A. Fare. Frontier further proposes to offer the El Paso-Tucson/Phoenix passengers its new 50 per cent Standby Fare.

The proposed service to Douglas has a strong integration with Frontier's existing system and requires the addition of only one station, Douglas. Frontier service can be provided by the extension of present flights now operating into El Paso and Tucson, thereby requiring no additional aircraft.

A summary of first-year (1966) estimated financial results attributable to the proposed service to Douglas is shown in Table XIII. Of particular interest is Frontier's route costing method used in the decision. Frontier uses what it calls an added (or incremental) cost approach in determining expected profit or loss, in contrast to the CAB allocated cost method. The procedure used by Frontier in estimating total change in revenue attributable to the Douglas decision is similar to that used in the Las Vegas route proposal. An abbreviated analysis of this procedure is made to illustrate how the revenue-basis for the Douglas decision was determined. Then, Frontier's added cost method is analyzed and the results contrasted with those of the CAB allocated cost method.

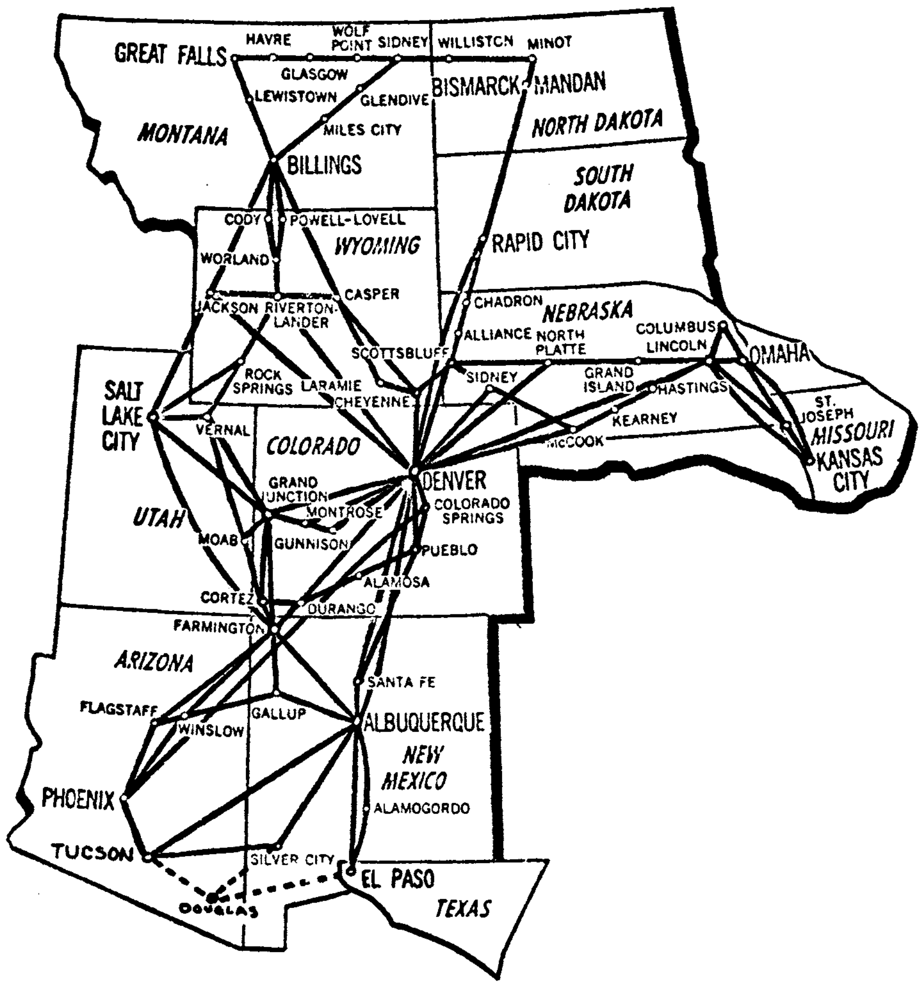


Figure 11. Frontier Airlines Present System and Proposed Route to Douglas, Arizona

TABLE XIII

SUMMARY OF ESTIMATED FINANCIAL RESULTS ATTRIBUTABLE TO PROPOSED SERVICE TO DOUGLAS, YEAR 1966

	Frontier Method, Added Cost	CAB Method, Allocated Cost
Financial Results:		
Commercial Revenues:		
Passenger	$295,414	$295,414
Mail and Property	25,320	25,320
Total	$320,734	$320,734
Operating Expenses:		
Flying Operations	$140,175	$140,175
Direct Maintenance-Flight Equipment	84,798	84,798
Applied Maintenance Burden-Flt. Equip.	15,102	29,393
Depreciation and Obsolescence-Flt. Equip.	-0-	28,736
Stewardess Expense	12,152	-0-
Subtotal	$252,227	$283,102
Local Station Servicing Expense	82,890	82,890
Regional and System Servicing Expense	115,000	114,372
Total	$450,117	$480,364
Operating Break-Even Need	$129,383	$159,630
Return Element	-0-	82,865
Subsidy Requirement	$129,383	$242,495
Subsidy Payment	$131,170	$131,170
Operating Gain or (Loss)	$ 1,787	($111,325)

Incremental Revenue Attributable to Douglas Service

A summary of the estimated service and traffic results of Frontier's proposed service to Douglas is given in four parts in Table XIV. The forecasts were made using basically the same procedures analyzed in the Las Vegas decision.

Part I. New Douglas Markets. In Part I, Frontier estimates the total local and connecting passengers expected to travel between Douglas and 17 area cities in Frontier's system south of Denver, such as Grand Junction, Pueblo, Santa Fe, Tucson, and so forth. These estimates are calculated by taking CAB traffic surveys made in 1961, 1962, and 1963, and projecting them to 1966 to obtain the size of the total market expected before Frontier service improvements.

In these 17 new Douglas markets, Frontier's service improvements consist primarily of code A and code B. Cade A is a service improvement where a local service carrier replaces a trunk carrier and code B is a service improvement where there is first one-carrier, one-plane service replacing two-carrier service. In either type, there is a resulting traffic stimulation, and the degree of stimulation is related to the extent to which the local carrier has increased service frequency over that provided by the trunkline. A service improvement factor is estimated for each market by use of Figure 7 discussed in the Las Vegas proposal. Frontier then estimates the total passenger market after Frontier service improvements. The forecasting procedure is summarized as follows:

> Take the CAB historic passenger surveys for each market involved, and project these to determine traffic for the forecast year before Frontier service improvements. Multiply the forecast traffic times the appropriate traffic stimulation factor for Frontier service improvements to determine

TABLE XIV

SUMMARY OF ESTIMATED SERVICE AND TRAFFIC RESULTS, DOUGLAS SERVICE

	PART I New Douglas Markets	PART II Other New Markets	Total New Markets	PART III Effect on Through Traffic	PART IV Effect of Standby Fare	Net Total
Revenue passengers	12,004	4,621	16,625	(1,623)	1,296	16,298
Revenue passenger miles (000)	2,937.8	1,826.3	4,764.1	(753.4)	466.7	4,477.4
Revenue ton miles:						
Passenger /a			452,590	(71,573)	44,336	425,353
Mail and property /b			57,026			27,026
Total			509,616	(71,573)	44,336	482,379
Aircraft departures performed						2,760
Revenue miles per departure						174.78
Commercial Revenues (Net)						
Passenger	207,700	114,874	$322,574	$(41,709)	$14,549	$295,414
Mail and Property /c			25,320			25,320
Total			$347,894	$(41,709)	$14,549	$320,734

/a At .095 tons per passenger.

/b At 12.6% of passenger ton miles per Frontier system experience in 1965. It is estimated that the addition of Douglas to existing flights would not adversely affect the existing mail and property load. It is estimated that the standby fare would not affect the mail and property load.

/c At $.4440 per ton mile, Frontier's system experience in 1965.

> the total market <u>after</u> Frontier service improvements. Estimate Frontier's percentage participation in the resulting total market to determine the number of passengers in each market Frontier expects to carry in the forecast year.

Once the number of passengers Frontier expects to carry in each market has been estimated, it is a relatively simple matter to determine expected revenue and other important statistics.

Since Frontier offers many types of fare discounts, the published one-way, first class fare does not always apply to all passengers carried in a given market. On the basis of past experience, Frontier estimates the applicable average system discount according to interstation distance, and uses the average discount to adjust forecasted gross revenues for each new market. For example, consider the Douglas-Tucson market. Frontier expects to carry 665 passengers in 1966 between these two cities which are 92 miles apart. The first class, one-way fare is $9.00, resulting in an expected gross revenue of $5,985. But, based on past experience, Frontier estimates that for city-pairs with an interstation distance of 125 miles or less, there will be an 8 per cent average discount that is applicable as passengers take advantage of various special fare plans offered by Frontier. Thus, the expected net revenue is $5,506.

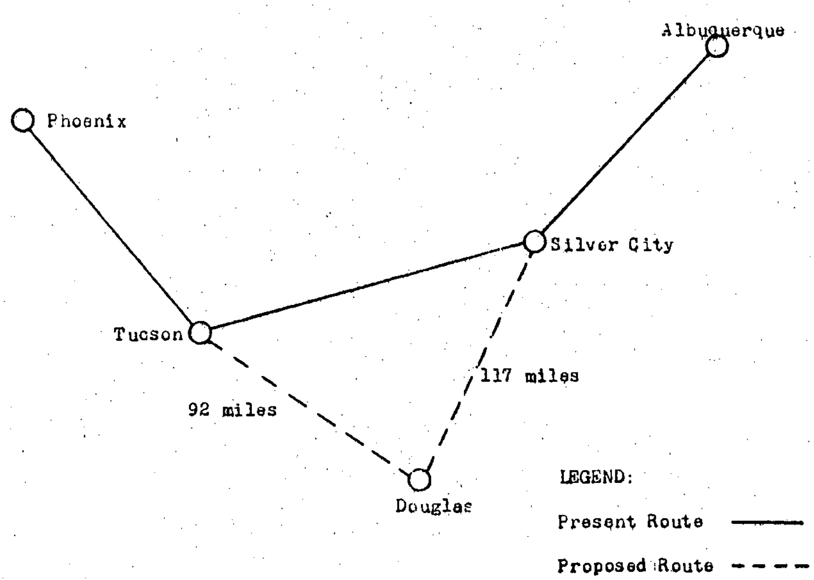
An operating statistic of primary importance is revenue passenger miles (RPM). It is found by multiplying the number of passengers traveling between two cities times the interstation mileage. For example, 665 passengers are expected to travel between Douglas and Tucson, a distance of 92 miles. Thus, the revenue passenger miles are equal to 665 passengers times 92 miles, or 61,200 RPM. The total number of additional Frontier passengers traveling between Douglas and 17 area cities is estimated to be 12,004 in 1966, for a total of

29,378,000 added RPM; one-half the total are considered to originate at Douglas.

Part II. Other New Markets. The forecast made in Part I is of expected passengers whose origin or destination is Douglas. In Part II, the forecast is of expected passengers traveling between Phoenix/Tucson and El Paso/Alamogordo, via Douglas. Again, to determine the expected number of additional passengers Frontier will carry in the forecast year and the resulting net added passenger revenue, the same procedure outlined about is used. The total number of Frontier passengers traveling both directions in "other new markets" in 1966 is estimated to be 4,621, for a total of 18,263,000 added RPM.

Summing the revenue passengers forecast in Part I and Part II for 1966 results in total additional Frontier revenue passengers expected in "new markets" of 16,625 as shown in Table XIV.

Part III. Through Traffic Affected by Douglas Stop. Passengers traveling between Phoenix/Tucson and Silver City, Albuquerque and beyond are expected to be adversely affected by the "detour" through Douglas, as illustrated below.



Service to Douglas will delay the arrival time of these passengers by requiring an additional stop and over-all greater mileage. Frontier estimates that due to the inconvenience for some passengers, 10 per cent to 40 per cent, depending on origin and destination, will transfer to other flights, resulting in a net loss of present Frontier passengers of 1,623 for the forecast year.

Part IV. Effect of Standby Fare. Since Frontier will offer the 50 per cent Standby Fare to El Paso-Tucson/Phoenix passengers, it is desirable to forecast separately the expected effect of the standby fare on traffic and revenues. In the following analysis, it is evident that the economic concepts of price and cross elasticity of demand underlie Frontier's reasoning.

In Part II, Other New Markets, Frontier estimates the total market after Frontier service improvement to be:

Phoenix-El Paso: 18,242 total passengers.
Tucson-El Paso: 7,685 total passengers.

Frontier estimates that it will have a 6 per cent participation in the Phoenix-El Paso market, and a 9 per cent participation in the Tucson-El Paso market. The forecast added local Frontier passengers at regular fares would, thus, be 1,095 and 692, respectively, in the two markets.

As a result of the 50 per cent standby fare, Frontier estimates an additional 5 per cent stimulation of the total market, all of which would be added Frontier passengers. Thus, the added new Frontier passengers will be

Phoenix-El Paso: 18,242 total passengers x 5% stimulation = 912
Tucson-El Paso: 7,685 total passengers x 5% stimulation = 384.

Frontier also expects that 20 per cent of the forecast Frontier passengers will transfer from existing Frontier fares to the standby fare. Thus, diverted Frontier passengers will be

Phoenix-El Paso: 1,095 forecast Frontier passengers x 20% diversion = 219
Tucson-El Paso: 692 forecast Frontier passengers x 20% diversion = 138.

The total number of Frontier standby passengers is equal to the number of new passengers attracted into the market by the standby fare, plus the number of existing Frontier customers diverted from regular fares. Thus, the total standby passengers estimated is

Phoenix-El Paso: 912 added Frontier passengers + 219 diverted Frontier passengers = 1,131
Tucson-El Paso: 384 added Frontier passengers + 138 diverted Frontier passengers = 522.

The computation of net added revenue attributable to the standby fare as a result of Douglas service is summarized in Table XV.

Table XVI is a summary of the estimated aircraft operating data and service and traffic data attributable to the proposed service to Douglas. Each statistic is estimated by using the exact procedure analyzed in the Las Vegas decision. The totals are given due to their importance in estimating operating expenses.

Incremental Cost Attributable to Douglas Service

For each cost category, Frontier's 1965 Convair 580 system unit cost experience summarized in Appendix F is used to estimate total added operating cost of Douglas service. In the following analysis, Frontier's "added cost" method, which employs incremental reasoning, is contrasted with the CAB's "allocated cost" method, which employs the fully allocated accounting cost approach. For some cost categories, however, the results are equivalent.

TABLE XV

SUMMARY OF NET ADDED REVENUE ATTRIBUTABLE TO THE STANDBY FARE AS A RESULT OF DOUGLAS SERVICE

	Passengers	Fare	Revenue	Inter-station Mileage	RPM (000)
Phoenix-El Paso					
Total Standby	1,131	$14.40	$16,286		
Diverted from Existing Fares	(219)	22.71 /a	(4,973)		
Net	912		11,313	393	358.4
Tucson-El Paso					
Total Standby	522	$10.65	$ 5,559		
Diverted from Existing Fares	(138)	16.83 /a	(2,323)		
Net	384		3,236	282	108.3
Total Added	1,296		$14,549		466.7

/a Frontier's experience shows that all passengers do not pay full fare; but instead, some take advantage of various special fares available to them. In competitive city-pair markets with an interstation distance between 250 and 500 miles, Frontier's average discount has been 21 per cent. The fares shown above reflect this average reduction.

TABLE XVI

SUMMARY OF AIRCRAFT OPERATING DATA AND SERVICE AND TRAFFIC DATA, DOUGLAS SERVICE

	Number or Amount
<u>Aircraft Operating Data</u>	
Revenue Aircraft Miles Flown	288,230
Revenue Aircraft Departures Performed	2,760
Revenue Aircraft Block Hours Flown	1,370
Total Aircraft Block Hours	1,397
<u>Service and Traffic Data</u>	
Revenue Passengers	16,298
Revenue Passenger Miles (000)	4,477.4
Available Seat Miles (000)	14,988
Revenue Ton Miles	482,379
Average Passenger Load	15.5
Passenger Load Factor (%)	29.9
Revenue Ton Miles Per Departure	174.78

Flying Operations. This cost category includes crew costs, fuel costs, insurance costs, and "other costs", and is estimated to be $100.34 per total aircraft block hour. Total added cost of flying operations for Douglas service is:

1397 added total aircraft block hours x $100.34 = $140,175.

The estimate using Frontier's added cost method is the same as that using the CAB's allocated cost method since total cost of flying operations vary directly with changes in output.

Direct Maintenance-Flight Equipment. This cost category includes all labor, materials, and outside repairs necessary to maintain the airframe, engines, and other flight equipment. The estimated cost per total aircraft block hour is $60.70, resulting in a total change in cost of $84,798 for Douglas service, using either costing approach.

Applied Maintenance Burden-Flight Equipment. This cost category includes all overhead expenses incurred due to periodic flight equipment maintenance operations. In Frontier's 1965 Convair 580 average system experience, this expense amounted to 159 per cent of Direct Labor cost of Direct Maintenance-Flight Equipment, or $21.04 per total aircraft block hour. On this basis, the CAB allocated cost method estimates the change in total maintenance burden expense to be:

1397 added total aircraft block hours x $21.04 = $29,393.

Frontier contends that only a portion of the applied maintenance burden may be considered variable with small changes in the volume of operations, the rest remaining fixed and, thus, not applicable to the decision. The sub-accounts of this major cost category considered variable with small changes in volume of operations, as in the Douglas service, include those shown in Table XXXVI in Appendix E. In 1965, these items accounted for 51.4 per cent of Frontier's total applied maintenance burden of $12.04 per total aircraft block hour. On this basis Frontier estimates the added maintenance burden-flight equipment attributable to Douglas service to be:

$21.04 per total aircraft block hour x 51.4% = $10.81 applicable unit cost

1397 added total aircraft block hours x $10.81 = $15,102.

Depreciation and Obsolescence-Flight Equipment. In the third quarter of 1965, Frontier's total depreciation and obsolescence expense for its Convair 580 fleet was $186,120 for 9,292 total aircraft block hours flown. The resulting allocated cost per total aircraft block hour was $20.03. The Convair 580 fleet size was then 10 aircraft in service with 9 committed to the schedule; in 1966, Frontier will have 16 in service with 14 in the schedule. Therefore, the ratio of total to scheduled will increase from 1.11 to 1.14, for a 3% increase in cost to $20.57 per total aircraft block hour. The CAB allocated cost method applies this average unit cost to the added total aircraft block hours expected and calculates an increase in total cost of $28,736.

Frontier, using the added cost method, assumes no added flight equipment depreciation and obsolescence expense because the proposed services will be operated with existing aircraft.

Stewardess Expense. Frontier uses its 1965 experience to estimate stewardess expense at $8.87 per total aircraft block hour, or a total added cost of $12,152 for the proposed service. An estimate of zero is shown under the CAB method in Table XIII because the Board includes this cost category in Regional and System Servicing Expense, rather than estimating it separately.

Local Station Servicing Expense. To estimate total added Local Station Servicing Expense for Douglas-origin traffic Frontier again uses past average system experience. Computations of this cost category were made for all intermediate stations in Frontier's system with between 3,000 and 10,000 passengers originated in 1965; a total of 18 stations had this characteristic. For 18 stations, the average servicing cost per station was $49,356, the average number of passengers originated was 6,114, and the average number of employees per station was 4.9.

Since stations other than Douglas are affected, Frontier also made an estimate of added Local Station Servicing Expense per added passenger generated as a result of the new Douglas service, but who did not originate at Douglas. The estimated added cost per added passenger is based on historic cost experience; the reasoning and data used are summarized in Table XVII.

Using the 1965 average servicing cost per station of $49,356 and the historic average added station expense per added passenger of $2.70, Frontier estimates total added Local Station Servicing Expense attributable to Douglas service to be $82,890. Cost estimating bases and computations are summarized in Table XVIII.

Regional and System Servicing Expense. Frontier's computational procedure for estimating Regional and System Servicing Expense attributable to the proposed service to Douglas is again identical to that described in the Las Vegas analysis. A summary of the computed results is shown in Table XXXVII in Appendix E. As one can readily see, the R and S Servicing Expense per RTM added by the proposed service, excluding the standby factor portion ($.2511 per RTM), is considerably

TABLE XVII

COMPUTATION OF SYSTEM ADDED LOCAL STATION SERVICING EXPENSE PER ADDED PASSENGER

	For the Year				Three Year Avg.
	1962	1963	1964	1965	
FRONTIER SYSTEM:					
Local Servicing Expense	$3,375,141	$3,589,303	$4,108,292	$4,297,262	
Passengers Originated	359,406	491,130	624,826	698,464	
Expense per Passenger Originated	$9.39	$7.31	$6.58	$6.15	
Added Expense		$214,162	$518,919	$188,970	
Added Passengers		131,724	133,696	73,638	
Added Expense per Added Passenger		$1.63	$3.88	$2.57	$2.70

TABLE XVIII

COMPUTATION OF LOCAL STATION SERVICING EXPENSES
ATTRIBUTABLE TO PROPOSED SERVICE TO DOUGLAS

			Total
I.	Douglas Station:		
	Passengers originated /a	6,002	
	Local station personnel	6	
	Estimated local station expenses:		
	A. Basic cost per station, 1965 average on 18 stations		$49,356
	B. Extra costs:		
	Salary, one additional agent	$4,920	
	Employee welfare and payroll taxes at 7.6%	374	
	Split shift travel expenses, 2 per day	2,190	
	Total		7,484
	Total Douglas		$56,840
II.	All Other Frontier Stations:		
	Added passengers on existing fares /b	9,000	
	Estimated expenses at $2.70 per added passenger		$24,300
	Passengers added by proposed standby fares	1,296	
	Estimated expenses at $1.35 per added passenger /c		1,750
	Total Local Station Expenses		$82,890

/a At ½ the number estimated in both directions in Part I, New Douglas Markets, Table XIV.

/b Includes, from Table XIV: Part I--6,002 passengers whose destination is Douglas, plus Part II--4,621 passengers from "other new markets", less Part III--1,623 through-passengers affected by Douglas stop.

/c Estimated that the standby passengers can be served at one-half the historic added cost of $2.70 per added passenger because they will be carried on flights that already will be operating and, therefore, will be a small addition to the basic passenger volume for which costs have been provided.

higher than Frontier's present system experience ($.2082 per RTM). This is due to the fact that the Service and Traffic Index (STI) for the present system (214.82) is much more favorable than that of the added service (158.70). The relatively greater number of added departures with respect to added RTM flown accounts for the relatively higher cost. The R and S Servicing Expense of $5,000 for the standby fare traffic is actually only a nominal charge since few added costs will be incurred because of this traffic.

The CAB allocated cost method is based on local service air carrier's R and S unit costs for 1965 of $.2371 per revenue ton mile, as compiled by the CAB. The CAB estimated increase in R and S Servicing Expense of the Douglas service is calculated to be:

482,379 added RTM x $.2371 = $114,372.

This value compares to Frontier's added cost estimate of $115,000, but includes a charge for stewardess expense not included by Frontier.

Return Element. Frontier's added cost method estimates total incremental operating cost attributable to Douglas service at $450,117, compared to the CAB's allocated cost estimate of $480,364. With estimated incremental revenue of $320,734, Frontier shows an operating breakeven need of $129,383, as compared to the CAB's $159,630, to cover the cost of the service, excluding a provision for return on investment and taxes.

Frontier estimates a zero return requirement on investment on the basis that there is no added return needed since the proposed services will be operated with existing aircraft. The CAB allocated cost method, however, charges a full share of calculated return requirement to the proposed service. Computations for full return on investment and tax allowance are summarized in Table XXXVIII in Appendix E.

Subsidy Requirements. If awarded the Douglas route, Frontier will be eligible for additional subsidy payments at a specified rate per standard available seat mile flown. For the proposed service, this will amount to additional subsidy payments by the CAB of $131,170, calculated as shown in Table XXXIX in Appendix E.

Incremental Profit Attributable to Douglas Service

A summary of the two conflicting forecasts of financial results attributed to the Douglas service are reproduced below from Table XIII.

	Frontier Method, Added Cost	CAB Method, Allocated Cost
Operating Breakeven need	$129,383	$159,630
Return element	00	82,865
Subsidy Requirement	$129,383	$242,495
Subsidy Payment	$131,170	$131,170
Operating Gain or (LOSS)	$ 1,787	($111,325)

Frontier's added cost method results in an estimated incremental profit, after subsidy, of $1,787, compared to a forecast operating loss of $111,325, after subsidy, using the CAB's allocated cost approach. It is clear that the expected financial result of the decision is greatly dependent not only on the accuracy of necessary traffic and service forecasts, but also on the costing procedure used. If Frontier had employed the allocated cost method, it may very well have rejected the possibility of providing service to Douglas on the basis that it would lose nearly a quarter-million dollars the first year. Instead, Frontier's decision, using incremental cost concepts, will add nearly $2,000 to the firm's net profit in the forecast year.

To date, no official CAB decision on Frontier's proposal has been given.

Conclusion

The primary conclusion to be drawn from the foregoing analysis is that Frontier did in fact make reasonable quantitative approximations to theoretical functions.

In Part IV of the incremental revenue analysis, the effect of the 50 per cent standby fare on El Paso-Tucson/Phoenix traffic was evaluated. Two variables had to be quantified; namely, the response of new traffic to the "price decrease" (price elasticity of demand), and the transfer of existing Frontier traffic to the lower fare service (cross elasticity of demand). The discussion in this section (see Table XV) presented the assumptions and procedures used by Frontier in quantifying the variables necessary to make a practical application of theoretical economic principles.

In estimating the incremental cost attributable to the Douglas service, Frontier, in keeping with economic theory, includes only those costs which vary directly with "output". Thus, only the portion of maintenance burden-flight equipment expense variable with small changes in total aircraft block hours is included; no additional depreciation and obsolescence expense for flight equipment is included since no additional aircraft are required.

Of particular interest is Frontier's estimate of the added Local Station Servicing Expense of each additional passenger generated as a result of the new Douglas service, but who did not originate at Douglas (see Tables XVII and XVIII). Frontier's system experience shows average local station cost per passenger to be in excess of $6. But Frontier is concerned with the marginal, not average cost. Thus, for 9,000 added reservation passengers, Frontier estimated an added cost per passenger of $2.70, less than one-half the fully allocated, average system cost. For 1,296 standby passengers, the estimated cost per added passenger is even less ($1.35) since they will be carried in otherwise empty seats on flights for which most costs have already been incurred. Frontier's reasoning here manifests marginalistic practices prescribed by traditional economic theory.

Frontier's estimate of added Regional and System Servicing Expense also shows evidence of marginal cost reasoning. Instead of using the present system average cost of $.2082 per RTM, Frontier calculated a marginal cost applicable to this added output of $.2511 per RTM. This relatively higher unit cost reflects the fact that the average STI for the present system is better than that of the added service due to the relatively greater number of added departures with respect to added RTM flown.

This case analysis, as in the Las Vegas case, has focused generally on the reasoning, assumptions, and analytical procedures employed by Frontier in making an incremental cost and revenue analysis. Though both are new route decisions, the relationship of some costs to output changes were significantly different. In the Douglas decision, additional output incurred only 49 per cent of the usual unit cost of maintenance burden-flight equipment, and no additional expense of depreciation and obsolescence-flight equipment or additional return on investment. But in the Las Vegas decision, each of these categories was considered variable with output and substantial dollar amounts for each were computed. Hence, costs that are variable for one decision may not be variable for another. One cannot break down all operating costs into predetermined fixed/variable classifications; the classification depends on the conditions peculiar to the decision.

Frontier's Service to Jackson, Wyoming Decision

Introduction

In 1965, city officials of Jackosn, Wyoming, besought Frontier to serve their city with flights originating in Denver. The purpose was to develop the Jackson Hole skiing area by attracting Denver area skiing enthusiasts. Jackson representatives finally persuaded Frontier's management to give the route a chance and Frontier sought and won the CAB's approval to serve the city.

The winter months of late 1965 and early 1966 did not produce particularly surprising results for Frontier, in that traffic was light and the economic return questionable. Nevertheless, Frontier stayed with the route throughout these months on a "wait and see" basis, giving the route time to develop. By the beginning of April, 1966, however, the president of Frontier was greatly concerned over the route because traffic, though never very heavy, had greatly fallen off in March. In fact, he wanted to cancel service to the city. Others in the organization did not want to drop the route without looking into its economic performance in more statistical detail. The president agreed and Frontier's department of Economic Planning prepared relevant cost and revenue data pertinent to the decision facing Frontier. The following analysis presents facts and figures used in arriving at the decision finally reached by Frontier's management.

Flight Scheduling Characteristics

Jackson was served by simply extending Frontier's existing route from Denver to Casper, Wyoming, on to Jackson, Wyoming. Originally, aircraft used to service the existing Casper route would come into Denver from other service and remain idle for a few hours, waiting to depart on a round trip to Casper. After making the Casper run, the aircraft would then remain idle at Denver, awaiting departure time for another city in Frontier's system. Since there was no alternative way to effectively utilize the idle aircraft, Frontier was amenable to servicing Jackson, provided, of course, it could be done on an economic basis. So, the flight schedule to Casper was modified to permit service to Jackson and reduce otherwise idle aircraft time. The original and modified schedules are illustrated in Figure 12.

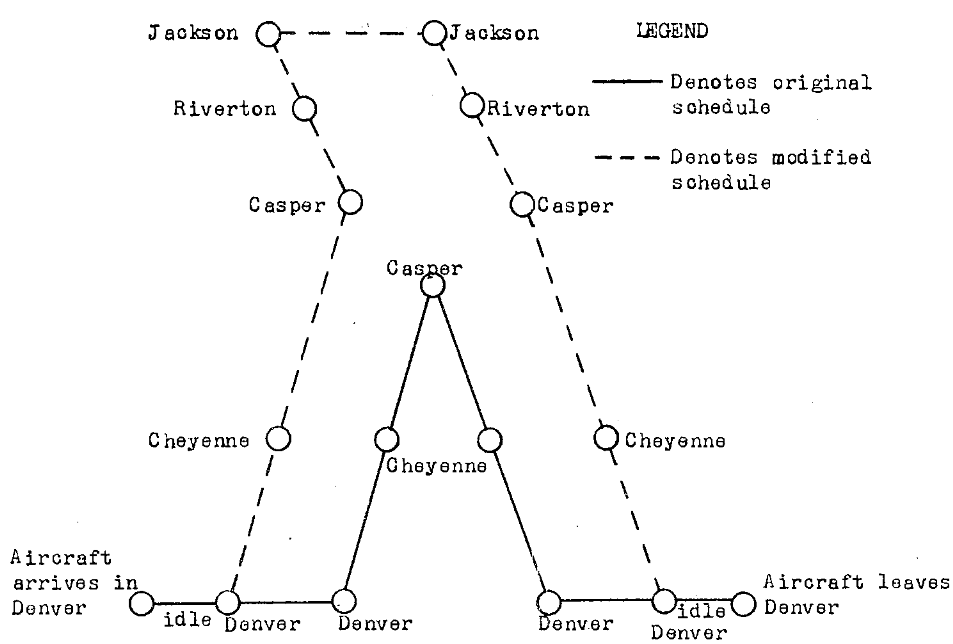


Figure 12. Frontier Service to Jackson via Casper, Original and Modified Schedules

In the modified schedule, the flight for Casper left earlier, made its run to Jackson and returned to Denver via Casper and Cheyenne. The flight left Denver about 1:15 p.m. and after stopping in Cheyenne, arrived in Casper about 2:45 p.m. After a very brief stop in Casper, it continued to Jackson, arriving at 3:40 p.m. The elapsed time from Casper to Jackson was 54 minutes. After a 20 minute stop in Jackson, the aircraft, a Convair 580, began its return flight at 4:00 p.m., arriving in Casper at 4:48 p.m., for an elasped time of 48 minutes for the 220 mile hop. The flight then continued on to Denver via Cheyenne, arriving in Denver about 6:00 p.m. The flight was originally scheduled to be non-stop between Casper and Jackson and was so listed in flight schedules. However, it did, on an unscheduled and irregular basis, stop at Riverton to enplane and deplane passengers.

Some, but not all, of the idle time incurred with the original Casper schedule was eliminated, as shown in Figure 12. Even though equipment and crew utilization increased, the president of Frontier was concerned that the additional service to Jackson might not be "paying its own way".

Operating Characteristics

In order to assess the "profitability" of the Jackson service, appropriate service, traffic, revenue, and cost data were estimated for the 35 days between March 1 and April 4, 1966. Actually only 30 days operating results were used since service was not provided on 5 days of that period.

Frontier was concerned, of course, with only the incremental revenue and cost attributable to the extended service from Casper to

Jackson. In its incremental revenue estimate Frontier counted all added traffic between Denver, Cheyenne, Casper, Riverton, and Jackson whose origin or destination was Jackson since none of this traffic would have been carried without the new service. But in its incremental cost estimate, the added operating expense was calculated only on the basis of the Casper-Jackson segment since the aircraft would be making the Denver-Casper round trip anyway. Table XIX is a summary of calculated service and traffic data attributable to the Casper-Jackson service during March 1-April 4, 1966.

Incremental Revenue, Jackson Service

Table XX is a summary of added passenger traffic and added revenues, both passenger and mail and property, attributable to the Casper-Jackson service.

Incremental Cost, Jackson Service

The estimated additional cost of the Casper-Jackson service was based on Frontier's system unit cost experience for Convair 580 equipment during 1965. Table XXI is a summary of added operating costs attributable to the Casper-Jackson service.

Incremental Profit, Jackson Service

In its incremental cost and revenue estimates, Frontier was mainly concerned over whether or not the added revenue from the Casper-Jackson service covered the added cost of providing it. Though not used, estimates were made for added Local Station and System and Regional Servicing Expenses, the so-called indirect costs, using the same

TABLE XIX

SUMMARY OF SERVICE AND TRAFFIC DATA ATTRIBUTABLE TO CASPER-JACKSON SERVICE DURING MARCH 1-APRIL 4, 1966

City Pair	Interstation Mileage	No. of Passengers	RPM	Passenger RTM at .095 RPM	Mail and Property at 9.1% Psgr. RTM /a	Total RTM
Jackson-Riverton	121	37	4,477			
-Casper	220	85	18,700			
-Cheyenne	368	53	19,504			
-Denver	464	191	91,408			
TOTAL		372	134,089	12,738	1,159	13,897

Added Revenue Aircraft Miles Flown (Miles between Casper and Jackson x No. trips/day x No. days x Mileage Completion Factor):
220 miles x 2 trips/day x 30 days x 97% mileage completion = 12,764

Added Aircraft Departures Performed /b (No. scheduled per flight x No. days):
2 departures x 30 days = 60

Added Revenue Aircraft Block Hours flown (Scheduled Time per flight x No. Flights per day x No. days)
54 minutes/flight per day Casper to Jackson + 48 minutes/flight per day Jackson to Casper x 30 days = 51

/a Mail and Property Revenue Ton Miles was estimated, as shown, at 9.1% of Passenger Revenue Ton Miles, based on Frontier's average experience on the Jackson route for the months preceding March-April. Frontier's over-all system experience for 1965 was a ratio of Mail and Property RTM to Passenger RTM of 12.6%, but the resort-nature of the Jackson service results in less-than-average mail and property carried.

/b The departures between Denver and Casper do not apply, of course. The only added departures are those from Casper to Jackson and from Jackson back to Casper, or 2 per day.

TABLE XX

SUMMARY OF ADDED PASSENGER TRAFFIC AND REVENUES ATTRIBUTABLE TO CASPER-JACKSON SERVICE DURING MARCH 1-APRIL 4, 1966

City Pair	Published Full Fare	No. of Passengers	Full Revenue	% Discount from Full Revenue	Net Added Passenger Revenue
Jackson-Riverton	$14	37	$ 518	16%	
-Casper	21	85	1,785	16 /a	$3,448
-Cheyenne	34	53	1,802	16	
-Denver	40	197	7,880	22.6 /b	6,099
TOTAL		372	$11,985		$9,547

Added Mail and Property (M and P) Revenue

Added Mail and Property RTM attributable to the Casper-Jackson service were estimated to be 1,159 as shown in Table XIX. On the basis of Frontier's experience in 1965, the revenue from this traffic was estimated at $.45 per RTM. Thus, the total added M and P revenue resulting from the service was estimated to be

1,159 M and P RTM x $.45 per RTM = $522.

/a This average discount from full-revenue is based on Frontier's system experience for 1965. The availability of various promotional fare schemes on Frontier's system permit many passengers, including whole families, to travel at significant fare reductions.

/b This discount reflects Frontier's actual Denver-Jackson experience.

TABLE XXI

SUMMARY OF ADDED OPERATING COSTS ATTRIBUTABLE TO CASPER-JACKSON SERVICE DURING MARCH 1-APRIL 4, 1966

Expense Category		1965 CV 580 Unit Cost per Block Hour	Estimated No. of Added Block hours, Casper-Jackson Service	Added Cost
I.	AIRCRAFT OPERATING EXPENSES			
	1. Flying Operations	$101.94 /a	51	$5,255
	2. Direct Maintenance--Flight equipment	50.75 /b	51	2,616
	3. Applied Maintenance Burden--Variable	11.36 /c	51	586
	Total AOE--Excluding Depreciation			$8,457
II.	STEWARDESS EXPENSE	8.70	51	448
	Total AOE and Stewardess Expense			$8,905

/a The 1965 cost of $99.30 per block hour is adjusted for inflation.

/b Frontier's actual experience with CV 580's was limited during 1965 and Frontier commonly used a unit cost of $60.15 in its cost estimates. This figure was a simple average of the 1964 experience of three other carriers using similar equipment. As Frontier gained experience, it found that the highest unit cost experienced was $57.00 and the lowest $53.00. The estimate used here of $50.75 is now considered to be too low. At the time of the study, however, it was thought to be realistic.

/c The 1965 total unit cost of applied maintenance burden was $21.54. Frontier considers that small changes in the volume of operations affects only 51.4% of this unit cost. The specific cost subcategories were previously identified in the Douglas analysis.

approach described in the Las Vegas analysis. These expenses totaled approximately $5300.

It should be emphasized that Frontier was not altogether sure that additional servicing expenses of $5300 were in fact incurred, or that they were not! At any rate, the decision to continue or discontinue the Casper-Jackson service was made on the basis of the added revenue versus the added direct cost shown in Table XXI; the indirect cost as well as the customary return element were excluded as irrelevant for the decision. Table XXII summarizes the incremental revenue-incremental cost data ultimately used.

TABLE XXII

SUMMARY OF INCREMENTAL REVENUE-INCREMENTAL COST DATA USED IN CASPER-JACKSON DECISION

ADDED REVENUE		
Passenger	$ 9,547	
Mail and Property	522	
Total		$ 10,069
ADDED DIRECT EXPENSES		
Aircraft Operating	$ 8,457	
Stewardess	448	
Added Landing Fee	85	
Total		8,990
Contribution to "Overhead and Profit"		$ 1,079

On the basis of the calculated "contribution" of approximately

$1,000 made by the Casper-Jackson service during the 30 day operating period between March 1-April 4, 1966, the president of Frontier decided to retain the service rather than cancel it. The director of Economic Planning helped jell this decision by pointing out that although traffic had indeed sharply fallen off due to the decline of the skiing season, it would likely sharply pick up again in May due to increasing travel and preparation for the coming summer tourist season.

Conclusion

Although the service from Denver to Jackson via Casper was new, the Jackson station was already in existence and operating. Frontier serves Jackson from the south via Salt Lake City and from the north via Billings. Therefore, the question of "Does the new service pay its own way?" would appear simple indeed to answer since no new stations or additional aircraft are needed; basically an existing flight just leaves earlier and flys, round trip, 440 miles further. And, the estimate of incremental revenue is rather straightforward. But the estimate of incremental cost is far more difficult and uncertain. Frontier's approach to the problem is based on historic cost experience and operating data, and assumes these statistics are applicable to the present situation. It is also significant to observe that one-half the cost of Flying Operations (see Table XXI) is for "crew expenses", which one might think would not be added cost since the crew appears otherwise idle; the same is true of Stewardess Expense. But Frontier does not view it this way. It assumes that due to tight scheduling, any allocation of crew and stewardesses to an added flight will always result in removing them from some other existing service, thus requiring additional personnel. Existence of idle time for the aircraft in Denver does not mean idle (that is, cost free) time for personnel. Still, as demonstrated in the case discussion, Frontier does employ incremental analysis, reflecting its general propensity to adhere to marginalist precepts in decision-making, when applicable, to the extent possible.

CHAPTER V

SUMMARY AND CONCLUSIONS

In Chapter I it was asserted that literature in managerial economics, while well developed in its theoretical and admonitory content, is incomplete by way of description of managerial decisions analyzing wherein, how, and the environment in which traditional economic theory of the firm has been made operational in practice in a given industry and firm. To further narrow the void between theory and practice, this study proposed to demonstrate that economic theory is applied in the airline industry in general and by Frontier Airlines in particular not only when all that is possible is reasonable quantitative approximations of theoretical functions, but also when it is impossible to quantify any salient variables. It was further proposed that in the process of validating the thesis, a more realistic picture of economic theory in action would be presented by describing important environmental factors, necessary modifications of theory, sources of input data, assumptions, and analytical procedures relevant to decision-making and, where possible, actual results of decisions.

It was assumed that if the logic of fundamental concepts comprising the theory of the firm is applied by management in decision-making, then analysis of economic decisions would yield incisive evidence and information. Thus, decisions of the airline industry and Frontier Airlines were chosen as objects of study by which to verify the thesis, and the theoretical concepts summarized in Appendix A, which include demand, revenue, price and cost analysis, were taken as benchmarks around which the basic study was conducted. In order to accomplish the objective of the study, a two-phase analysis of airline management decisions was made.

First, a search of recent literature was conducted in order to:

1. Develop a portrait depicting important aspects of the political, economic, and social environment of the domestic air transportation industry and of Frontier Airlines as it functions generally in that industry.
2. Discover evidence of the prevalence of managerial application of economic theory, both subjectively and quantitatively, in decision-making throughout the industry.

This initial phase was subsequently pursued in Chapters II and III.

Chapter II discusses industry environmental characteristics such as economic aspects of governmental regulations which circumscribe the areas for corporate economic actions, important distinctions between classes of commerical air carriers which have significant bearings on competitive conditions and, thus, greatly influence the economic decisions of individual firms, and product, marketing and operating cost characteristics which further identify major constraints within which individual firms must operate.

Chapter III delves into economic facts of demand analysis in air transportation and the kind and amount of attention given by the industry to determinants of demand, price elasticity of demand and pricing practices. It was found that industry demand for air service is growing rapidly and is exceedingly difficult to forecast. In addition to reaping the benefits of rapid industry growth, individual carriers actively seek to increase their sales by product differentiation (including reduced flight times, increased frequencies, equipment superiority, and special in-flight amenities), and extensive product advertising to create a distinctive corporate image and to build customer loyalty. Price decreases are generally eschewed, either because firms are denied or prefer to avoid the use of this competitive means of increasing quantity sold. In the latter case, airlines generally believe demand to be price inelastic, although some firms have sought price reductions on the basis of expected increases in total profits. Recently, the new chairman of the CAB strongly encouraged airlines to epxeriment with fare reductions aimed especially at pleasure travelers due to their alleged sensitivity to fare levels. Thus, during 1965-66, the industry introduced and expanded its promotional fare plans, based largely on price elasticity of demand considerations. The chapter demonstrated that firms in search of added profits formulate policies within the framework of economic theory and, thus, make theory practical and useful though lacking statistical measurements of important variables.

The second phase of the study, contained in Chapter IV, consists of detailed case analyses of selected economic decisions made by Frontier Airlines in 1966. The basic objective of case analysis is to determine how the logic of economic theory is made applicable in practice, both when reasonable quantitative approximations of theoretical functions can be calculated and when they cannot. This objective is accomplished by demonstrating the mechanics of analytical procedures used by Frontier, identifying sources of input data, specifying underlying assumptions, and noting environmental conditions. Theoretical economic concepts providing the rational foundations for the decisions include price elasticity of demand, cross elasticity of demand, price discrimination, marginal (incremental) cost, and marginal (incremental) revenue.

Four decisions of Frontier selected for analysis are reviewed below.

50 Per Cent Standby Fare Decision. The case analysis dealt with the role of economic theory in inspiring the decision, environmental factors bearing on the decision, the content of the fare proposal, Frontier's reasoning in making the decision, and the revenue results of six months operation in markets where the fare is applicable.

Though acclaimed a "unique venture in rate making", this decision did not occur in a vacuum; ample precedent existed, as did CAB encouragement. Furthermore, lack of acceptable alternatives to generate significant increases in traffic and revenue more or less dictated this particular action. In this decision, Frontier definitely formulated its policy within the framework of theoretical economic concepts. Particularly germane were considerations of the amount of transfer passengers from its existing traffic (cross elasticity of demand), the degree of potential new customer response to the price decrease (price elasticity of demand), and the economics of price discrimination. But an exact, formal application of theory requires quantification of all relevant variables, implying perfect knowledge. Yet Frontier had no such information. Officials, using subjective criteria, did not "expect" significant transfers of traffic from regular to standby fares, "believed" potential pleasure travelers are significantly motivated by price, and "felt" a price decrease must be dramatic to bring the kind of results desired. Nevertheless, theoretical principles were employed as tools (of logic and reasoning) with which to organize and qualitatively evaluate pertinent economic variables. Thus, theory was practically applied and the impossibility of deriving statistical revenue and cost functions did not negate its usefulness in formulating a major decision.

Las Vegas Route Decision. It is one thing to assert that a decision is profitable if the resulting incremental revenue exceeds incremental cost and another thing to make accurate estimates of either. The case analysis disected this major route application decision into its many component parts in order to ascertain just how Frontier makes such an evaluation. Particular attention is given to methods of cost and revenue analysis, data sources and assumptions. Cost-output relationships are examined and Frontier's use of marginal costing is also noted and illustrated.

In this decision Frontier is faced with the task of establishing a need for additional service in the general Denver-Las Vegas market and proving the ability of Frontier to provide it on an economic basis.

In revenue estimates, the need for adequate input data is readily apparent since the accuracy of the forecast substantially depends on it. Frontier used as its major source of traffic data historical studies of individual markets made by the CAB, and then projected calculated trend lines to estimate the total size of city-pair markets affected by the decision, before Frontier service improvements, in the forecast year. The use of statistically and judgmentally determined market stimulation factors arising from certain types of service improvements was analyzed in order to demonstrate how Frontier estimates the total market traffic expected in the forecast year after Frontier service improvements. Frontier's percentage participation in a market is determined solely on the bases of experience, judgment, and speculation. Once the market participation factor is established and the breakdown in Frontier traffic between first class and coach is estimated, the calculation of incremental revenue is routine, since appropriate fares are equivalent to existing fares of competitors, or are already in force in Frontier's system.

The procedures for making incremental cost estimates were explained and illustrated. Aircraft operating data on number of flights scheduled, distance flown, elaspsed flight time, and number of aircraft departures were calculated and converted into measures of output, including the principal one of total aircraft block hours flown. With the use of adjusted historical aircraft operating costs and stewardess expense per block hour flown, estimates were made of added aircraft operating and stewardess expenses attributable to the proposed service. Added Regional and System Servicing Expense and Local Station Servicing Expense were calculated from estimating equations based on domestic trunk and local service industry experience for 1965. For each category, Frontier calculates only the added or incremental cost of these indirect expense categories and avoids the error of including an average, prorated share of company fixed costs not arising as a result of the decision. In cost estimates, Frontier, in compatibility with economic theory, uses marginal costs rather than average costs;

frequently, however, the relationship between unit costs and output is linear and the results are identical. Cost estimating bases were historical experiences of Frontier and other carriers and the assumption is clear that Frontier expects its future cost experience to follow past company and industry patterns.

Douglas Route Decision. This new route application is considerably less important economically than the Las Vegas proposal, but basically the same revenue and cost estimating procedures are utilized. In this decision, Frontier explicitly uses an added cost approach to route costing. That is, Frontier's route cost forecast, in keeping with economic theory, is based on the marginal cost of added service, rather than and in contrast to the average, fully-allocated cost approach typically used by the CAB. On part of the new route, the 50 per cent standby fare will be made available. Thus, in its revenue forecasts, Frontier, while not computing price and cross elasticity of demand coefficients, does quantify the extent to which the price decrease stimulates additional sales (E_p) and the effect of the price decrease on quantity sold of other service offered (E_c). Some categories of cost variable with output in the Las Vegas case were estimated to be fixed in this case, emphasizing that fixed/variable classifications depend on conditions peculiar to a given decision situation.

Service to Jackson Decision. The question here is whether a new flight between two existing Frontier stations, Casper and Jackson, is "paying its own way". Since no new stations or aircraft are required to provide the service, the problem is obviously one of comparing incremental revenue attributable to the added flight with incremental cost incurred. The estimate of incremental revenue is rather straightforward but the estimate of incremental cost is far more difficult and uncertain. Frontier's approach to the problem is based on historic cost experience and operating data, and assumes these statistics are applicable to the present situation. Still, as demonstrated in the case discussion, Frontier does employ incremental analysis, reflecting its general propensity to adhere to marginalist precepts in decision-making, when applicable, to the extent possible. The calculated contribution to overhead and profit served as the deciding factor in the decision to maintain the service in the short run.

In summary, the study did establish the fact that firms in the airline industry and Frontier Airlines in particular do indeed make use of basic economic concepts in decision-making, notably price and cross elasticity of demand, product differentiation, price discrimination, and appropriate revenue and cost analysis. Environmental conditions surrounding important decisions were established, and sources of input data and assumptions underlying their use were identified. And, perhaps most significantly, actual methods and procedures used to make the economic analyses pertinent to the decisions were examined and illustrated. It was also shown that, unlike theoretical price, cost, and revenue analysis, economic analysis for decision-making, despite detailed traffic forecasts and elaborate cost estimating procedures, is in fact frought with uncertainty and highly dependent on experience and judgment. For instance, in the standby fare decision, elasticity of demand coefficients could not be quentified; in other decisions reasonable quantitative approximations to theoretical functions were made and used with confidence. Thus, economic theory was shown to play a major role in the reasoning used in the decisions analyzed; but pure theory was tempered by the realities of uncertainty, lack of errorless data, and the mechanics of making concepts operational.

CHAPTER VI

RECOMMENDATIONS FOR FURTHER INVESTIGATION

The analyses in preceding chapters automatically suggest studies into similar decision areas of other carriers to provide further insight into the anatomy of decisions and to compare procedures and reasoning used by different airlines. During the course of this study, several topics came up for discussion which suggest areas for meaningful investigation within Frontier Airlines itself.

Added Cost Standby Fare Passengers

At the time of this study, cost statistics relevant to Frontier's 50 per cent standby fare traffic were not available. Given that the plane is going anyway, the cost of handling standby passengers is less than that of reservation passengers due to the elimination of reservation services for standbys; but other costs of enplaning, of inflight services, and of deplaning are likely to be the same for standby as for reservation passengers. There may also be other costs peculiar to standby traffic that would make actual cost per passenger handled equivalent to that of reservation traffic. Thus, an important area for further study would be that of determining the over-all profitability of Frontier's 50 per cent standby fare by determining the extent to which Frontier's total costs have increased due to standby traffic. Since Frontier does not put on extra flights due to standby traffic, the only added costs expected would be indirect servicing costs, those pursuant to handling passengers on the ground. Further analysis would also determine how Frontier estimates the amount of these added costs.

Pricing Practices in Competitive Versus Non-Competitive Markets

Frontier serves 59 cities in a system containing approximately 6500 route miles, 5000 of which are not served by competing airlines. On competitive routes, Frontier usually matches the fares of its competition. But on a few routes where Frontier is not a truly effective competitor with the trunklines, it charges a slightly higher fare than its competition. The president of Frontier believes that Frontier is not losing customers to competition on these routes due to higher fares, nor would Frontier gain a significant amount of additional passengers if its fares were competitive. Thus, in an attempt to maximize revenues from the traffic carried, Frontier charges higher fares since passengers have not apparently been sensitive to the fare differentials.

On routes where Frontier has no competition from other airlines, Frontier "tends" to charge higher fares than on competitive routes. No formal study has been made to prove this conclusively; and, therefore, the degree of price differential is not known.

Further study into Frontier's pricing practices would further establish the degree to which Frontier considers price elasticity of demand in decision-making, and the extent to which the presence or absence of competition influences pricing decisions. Such a study would also reveal whether or not Frontier is practicing price discrimination in its monopoly routes by analyzing price differentials and cost differentials with respect to competitive routes.

Scheduling Practices

Scheduling aircraft over its system is a continuous task for an airline management. In scheduling the fleet, the problem may be simply stated as that of allocating the right aircraft to the right routes, with the right frequencies at the right time so as to secure maximum economic advantage. But providing an optimum solution to the problem requires the simultaneous consideration of many variables, including:

1. For the whole route structure
    a. The total number, sizes, and types of aircraft in the fleet.
    b. Seating configurations.
    c. Maintenance schedules.
    d. Needs for standby aircraft.
2. From route-to-route
    a. Demand for passenger seats and space for freight.
    b. Demand for various classes of travel.
    c. Demand for a certain frequency of service.
    d. Demand for certain arrival and departure times.
    e. Amount and type of competition from other carriers.
    f. Tariffs and rates.
    g. Operating costs.
    h. Available crews.
    i. Capacities of traffic handling facilities.

The operational problems of reconciling all variables so as to optimize fleet scheduling are undoubtedly legion. For example, demand may be heavy at the same time of day on a number of routes, but the airline's fleet is inadequate to handle all the traffic. Or, allocation of aircraft to a certain route in the short-run may render them unavailable for seemingly more profitable business, but the long-run potential of the route must be considered and the decision facing management is one of balancing short-run profit against long-run potential profit.

Once a basic schedule is determined and operated, management must continually consider the effects on cost and revenue stemming from possible changes that might be made in the schedule. Further study into the way carriers calculate these revenue and cost changes and the reasoning behind their procedures would shed light on airline management's use of important economic concepts, including applications of marginal analysis, considerations of opportunity cost and recognition of the relevant time periods. To illustrate the kinds of scheduling decisions into which further study could well be made, the following examples are presented.

Scheduling New Jets

In the latter part of 1966, Frontier bought three new Boeing 727 jets at $4.5 million each. One immediate problem was to phase them into Frontier's existing system so as to insure the maximum economic benefit from their use. At least two philosophies exist within the company as to how this objective might be accomplished, often resulting in conflicting schedules.

1. Replace older aircraft with the new jets on existing Frontier schedules which are currently the most profitable. This tends to optimize the chances of economic success.
2. Schedule the jets on routes where the total traffic per flight is greatest. In certain city-pairs where Frontier faces strong competition, (for example, Denver-Salt Lake City where United and Western fly non-stop on coast-to-coast routes) there often exists a disparity between total traffic and existing services of the major carriers. That is, the amount of traffic per flight, the load factor, is great. Therefore, Frontier, in an attempt to break into these markets, should schedule its jets where the traffic is heaviest.

The immediate question is which philosophy, if either, results in optimum use of the equipment. Further study would identify relevant variables and methods of evaluation.

Scheduling to Keep Out Competition

In the Lincoln-Kansas City market, Frontier is a monopolist; no other airlines are currently certified to serve the market. Frontier flys 14 flights daily between this city-pair with an approximate average load factor of 35 per cent. This is 5 per cent below its average system load factor of 40 per cent.

In the short-run, Frontier could significantly increase its load factor, reduce its operating costs and probably increase its net profit over this route by reducing its frequency of flights. But, looking to the long-run, Frontier is very anxious to provide more than enough service to keep the public happy. This prevents potential competition from claiming and successfully proving to the CAB that Frontier is not providing adequate service. Thus, Frontier hopes to maintain its monopoly position and keep competition out. The short-run gain in over-all profits from reduced frequency would, in Frontier's estimation, be far lower than the long-run loss due to sharing the market with a competitor. However, excessive allocation of equipment and crews to this market prevents their use in alternative markets, resulting in opportunity costs to Frontier.

Additional research into scheduling practices such as this would bring out how management uses flight scheduling as a competitive tool, and how management maintains the "right" balance between short-run and long-run objectives.

Scheduling and Market Forecasting

In 1962, United Airlines decided to cancel one of its two daily non-stop flights between Denver and Lincoln, Nebraska because the flight was not profitable and United had a better alternative use for the aircraft. Frontier, though certified to serve this market non-stop, had never used its certification. However, when United dropped a flight, Frontier decided to put one on to see what it would do. According to one of Frontier's vice-presidents, it "... looked like a hole." Initially, the non-stop flight did not even cover direct cost, but did show signs of agonizingly slow growth. (He emphasized that the growth was so slow as to be almost imperceptible, but it did grow!)

The president of Frontier decided to "stay with it" in spite of the apparent fruitlessness of the decision. While others were convinced of the impracticality of keeping the flight on, he was "led on by the spark of life that grew ever so faintly brighter." Today, Frontier has put on two daily non-stop flights between Denver and Lincoln due to the increasing traffic and profitability of the route, and will put on a flight using Boeing 727 jet equipment as soon as possible.

Frontier "nursed" this market along with good service, and watched it grow. The "appropriate economic analysis" which accompanied the heuristic decision-making of the president was little more than the playing out of a hunch and a "feel" for the market. A Frontier official said that this route, which was at the time "small potatoes" for United, is now "big potatoes" for Frontier.

In making this scheduling decision, Frontier did, as the results now testify, make the "right" long-run forecast. By suffering short-run losses, Frontier maximized long-run profit by allocating aircraft to a market which eventually proved highly profitable. Even though in the short-run Frontier incurred not only revenue losses below direct costs, but also opportunity cost from failure to use the aircraft elsewhere, its decision was a good one. Further analysis of this kind of decision would identify factors relevant to the process of decision-making in an environment of uncertainty. Of equal significance would be the identification of procedures used by management in weighing expected profits from a given allocation of resources versus the expected profits from alternative allocations, taking into account the relevant time periods.

Scheduling and Operations Research

In scheduling, the number of variables is large and the amount of uncertainty is great. For example, when Frontier introduced Convair 580 jet-powered equipment on routes in Nebraska and Missouri, traffic increased threefold. When the same type of service was introduced in Montana, there was no appreciable increase in traffic. Frontier is unable to account for the difference in customer response. Given the complexities of scheduling, an interesting and important question arises as to the possible usefulness of Operations Research in scheduling decisions. When this possibility was proposed to a vice-president of Frontier, he stated that a representative of one of the nation's largest consulting firms had just recently contacted him to "sell" him on O.R. approach to scheduling. After talking with the representative, he concluded that the areas of uncertainty which plague a scheduler using Frontier's present approach are just those factors which greatly affect the successfulness of a schedule. But, since there is no way to quantify and integrate these into a scheduling procedure, there is no way for a computer program to help Frontier do any better. The "known" factors and data available can just as readily be assimilated by conventional techniques as by a computer model; the unknowns remain unknown and judgment based on experience serves as well as a more sophisticated computer-model approach and without the added high cost of outside "expertise"!

A study made to establish the procedures used by Frontier in scheduling and to ascertain the success of Operations Research approaches used by other carriers would be quite beneficial to students of management and potentially profitable to smaller airlines.

Aircraft Maintenance

The need for aircraft maintenance is twofold, preventive and remedial. Management's main objective is to control maintenance in such a way that it has the least adverse effect on the productive capacity of equipment.

Formerly, maintenance scheduling took priority over commercial needs. The maintenance function was organized first and flying hours were a residual activity. Increasingly, maintenance is becoming the residual activity as managements adopt the philosophy that maintenance should be done in the hours left over after aircraft have flown the best commercial hours. Since most passengers prefer to fly by day, this normally means maintenance should be performed more expensively at night, during the off-peak hours. Even if the concentration of maintenance in off-peak hours gives rise to increased costs due to, say, poorer production flow, but at the same time gives rise to increased revenue because more capacity is available at the "right" time, the relative position may be better. A maintenance schedule which minimizes the over-all cost of maintenance may not be the best alternative open to the firm. The technical optimum for maintenance must give way to the marketing optimum due to opportunity costs incurred.

Continental Airlines keeps its jets in the air more hours per day, on the average, than any other carrier (35). One reason is its flight scheduling policy, previously discussed, of putting on flights whenever the additional revenue exceeds the additional cost. Another reason is its maintenance policy, which it calls "continuous maintenance." Other airlines periodically take their jets out of service for overhauls requiring five days. Continental, on the other had, has each jet inspected and worn parts replaced with spares during a thirteen-hour check made every fifth day. This permits using the plane in scheduled service while repairs are being made in the maintenance shops. Being able to replace worn parts with spares means that large inventories of parts must be maintained, with the result that costs higher than those of conventional maintenance scheduling are incurred. But on the basis of comparative costs, Continental estimates the profit lost from failing to adopt continuous maintenance is greater than the additional cost incurred from using this approach. So, on the basis of opportunity cost reasoning, Continental has selected the maintenance alternative resulting in <u>least</u> opportunity cost.

As part of its "new look", Braniff International has recently increased its aircraft utilization from an average of eight hours per day to over ten hours per day (14). This is in part attributed to a new maintenance philosophy. Like many carriers, Braniff regularly took its planes out of service for several days for complete maintentenance checks. This practice has been abandoned for a system whereby each aircraft is checked over section-by-section between each scheduled flight. The maintenance costs are higher but the additional revenue earned from increased aircraft utilization more than makes up the difference.

A study into the maintenance policy of Frontier would indicate how comparative cost and revenue estimates are made and whether or not profit might be increased with the adoption of an alternative maintenance policy.

Equipment Replacement and Investment

The depreciation policy of an airline, like any other firm, is an attempt to spread the acquisition cost of an asset over the number of years the asset is to be used. During this time period, the firm expects to accumulate sufficient revenue to equal the original or expected replacement cost. This number of years is usually based on what is regarded as the "normal life" of an asset, which is a function of wear and tear.

The number of years an airline can continue to use a particular type of aircraft profitably, however, is not likely to be determined simply by the time it takes to wear out, since aircraft do not wear out! Due to rigid maintenance schedules, their efficiency is not allowed to diminish. More importantly, aircraft are rendered "uneconomic" by a new invention or other improvement, rather than (or before) the completion of the normal life period. Thus, due to obsolescence, an airline's rate of depreciation for a given aircraft may suddenly and abruptly be invalidated by the introduction to service of a new competitive aircraft. Though the given aircraft is still perfectly usable in the physical sense, it can become non-usable in the economic sense for a particular airline.

Broadly speaking, an aircraft becomes obsolete as soon as it becomes less profitable to fly than the aircraft that could be bought as its replacement. For instance, an aircraft may become comparatively unprofitable by a decline in earning powers because traffic is attracted to alternative aircraft. Once obsolescence occurs, of course, the remedy of disposing of aircraft does not involve considerations of initial acquisition cost or depreciation. The only relevant cost for the decision facing management is opportunity cost. Of course, it is not always immediately apparent that one aircraft type has become less profitable than aother. Making the appropriate economic analysis is as much an art as a science due to the uncertainties and assumptions involved.

As previously mentioned, one rule-of-thumb in the airline industry is that traffic tends to vary directly with the frequency of flights. The importance of available capacity was emphasized by the president of the Air Transport Association in a recent speech, when he was quoted as saying (36):

> Capacity provided an improvement in quality of the service reflect the business judgments of vigorous competitors on the market opportunities available. Given large additions to capacity, airlines mount massive efforts to sell additional seats. The ready availability of capacity results in a convenient service. Thus, plenty of capacity is in itself a creative force resulting in faster traffic growth, better service to the public and higher profits. A restrictive attitude toward capacity is the most effective means of depressing both growth and profits.

But "plenty of capacity" means purchasing additional aircraft which are quite expensive, even though the airline industry is not one with particularly high capital cost. For example, as shown in Appendix F, Frontier had a total system aircraft operating cost on its Convair 580's in 1965 of over $5 million, but its depreciation and obsolescence expense was not quite 10 per cent of the total.

Given the competitive impact of equipment superiority and the market impact of increased frequency of service, management decisions to replace and/or increase fleet size with upgraded equipment greatly influence the profitability of the firm. In the past, decisions to purchase a specific number of given types of aircraft seemingly depended on few, if any, precise calculations. Decisions on the amount of equipment to order has rested with top management men who are prone to operate on an intuitive basis. By way of illustration, the story is told of an airline president who, when asked why the airline had ordered seven planes of a certain type, thundered, "I knew we needed seven. That's why I'm president!" Of course, one of the many problems confronting management is the exceeding difficulty of forecasting future demand for its particular service in an environment in which even industry demand cannot confidently be forecast. Nevertheless, investment decisions must be and are made.

As was brought out in the Las Vegas analysis, Frontier has bought three Boeing 727 jets at a cost of $4.5 million per aircraft, excluding spare parts. But, as far as Frontier is concerned, it is not ready for jets on its system at this time. Still, these new jets "had" to be purchased for competitive reasons. Since Frontier competes with trunklines over several important east-west routes, Frontier believes it must offer comparable quality service to keep its share of the market or to improve it, and to project the image of a progressive airline. From a short-run viewpoint, Frontier lowers its profit by buying expensive jets it really neither needs nor wants. But in these situations, short-run profit maximizing behavior by Frontier must, to some extent, be subjugated to long-run considerations.

The whole realm of investment decision-making would be a fruitful area for detailed economic analysis. Such a study would delve into the reasoning behind decisions to buy specific quantities of additional aircraft, how the competitive and market economic impacts are evaluated, and how management gives proper consideration to long-run versus short-run effects of its decisions.

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APPENDIX A

ECONOMIC THEORY OF THE FIRM

ECONOMIC THEORY OF THE FIRM

A conventional presentation of the traditional economic theory of the firm can be found in any managerial economics or intermediate price theory text. The following partial treatment is taken largely from Leftwich (1).

Demand

There are two basic reasons why demand analysis is important to decision making:

1. It provides the basis for analyzing and subsequently adjusting to external market influences on the firm's sales.
2. It provides guidance for internal attempts to manipulate demand.

Demand for a product is defined as the various maximum quantities of it which consumers will take off the market at all possible alternative prices during a given time period, other things constant. Besides price, the most important determinants of quantity taken are:

1. Consumers' tastes and preferences.
2. Consumers' income.
3. The prices of related goods.
4. The number of consumers in the market.

A demand function identifies the relationship between possible alternative prices and the resulting quantities taken during some moment in time, assuming the other determinants of quantity taken remain unchanged. The "law of demand" states that as price decreases, quantity demanded by consumers will increase. This inverse relationship between price and quantity taken is shown in Figure 13, curve d_1.

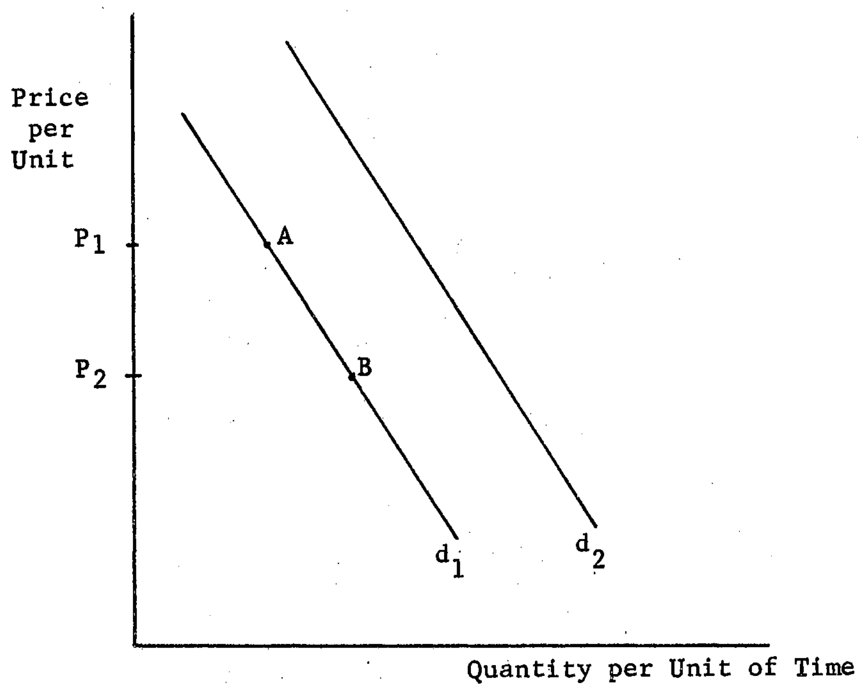

Figure 13. Demand Curves

A movement along a given demand curve, such as from A to B on d_1 in Figure 13, is a <u>change in quantity demanded</u> resulting from a change in price, assuming all other conditions affecting quantity taken remain unchanged. A <u>change in demand</u>, such as a shift in the demand curve from d_1 to d_2, results when the conditions held constant in defining a given state of demand change.

Revenue

From the firm's viewpoint, demand indicates revenue per unit of sales and is the firm's average revenue curve. Total revenue for each level of sales is determined by multiplying the price times the corresponding quantity demanded. The demand curve for an imperfectly competitive firm slopes downward and to the right, indicating that the firm must accept a lower price to achieve a larger volume of sales. But, whenever a firm is considering lowering its price to increase its sales, it will be concerned with how its total revenue will change as a result of the decision.

Marginal revenue is the addition to total revenue which results from the sale of one additional unit of output. In an imperfectly competitive firm, marginal revenue decreases faster than does price (average revenue) because when the firm decreases price to increase its volume of sales, the lower price will apply not only to the extra unit sold but also to all other units of output which otherwise could have been sold at a higher price.

The general relationships between total revenue, average revenue, and marginal revenue of an imperfectly competitive firm are illustrated in Figure 14.

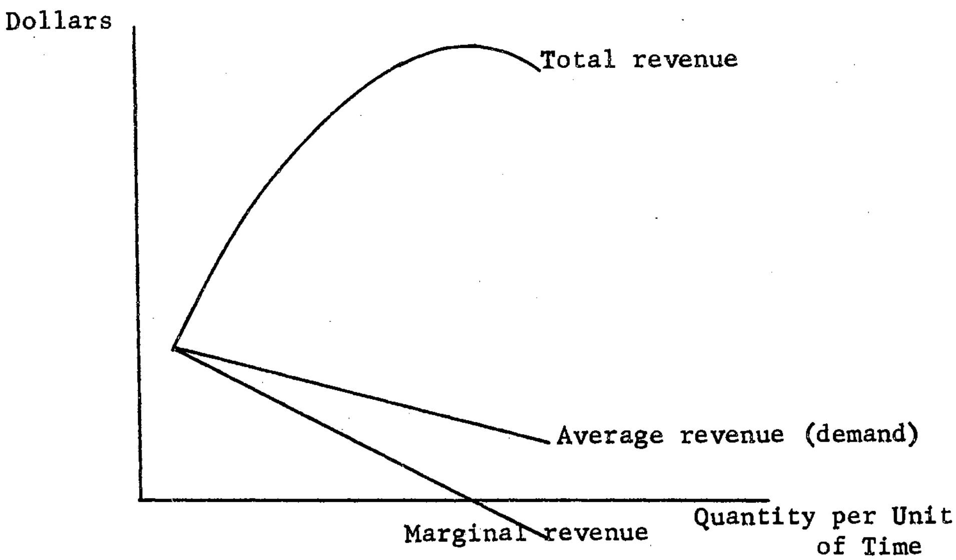

Figure 14. Revenue Curves of an Imperfectly Competitive Firm

Price Elasticity of Demand

The "law of demand" states that consumers will respond to a price decrease by buying more of a product. Price elasticity of demand refers to the responsiveness of the quantity of a product which consumers are willing to take to changes in its price, given the demand curve for the product. The degree of consumer response is measured by the price elasticity of demand coefficient, which is the ratio of the percentage change in quantity demanded divided by the percentage chance in price, when the price change is small. The simplest expression for price elasticity of demand (Ep) is

$$Ep = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}} = \frac{\frac{Q_2 - Q_1}{Q_1}}{\frac{P_2 - P_1}{P_1}}$$

when P_1/Q_1 represent original price and quantity, and P_2/Q_2, final price and quantity.

Demand is elastic if a given percentage change in price results in a larger percentage change in quantity demanded. The absolute value of Ep is greater than 1 and a price decrease will result in an increase in the firm's total revenue. If a given percentage change in price is accompanied by a relatively smaller change in the quantity demanded, demand is inelastic. The absolute value of Ep is less than 1 and a price decrease will result in a decrease in the firm's total revenue. Figure 15 summarizes the relationship between revenue curves and price elasticity of demand.

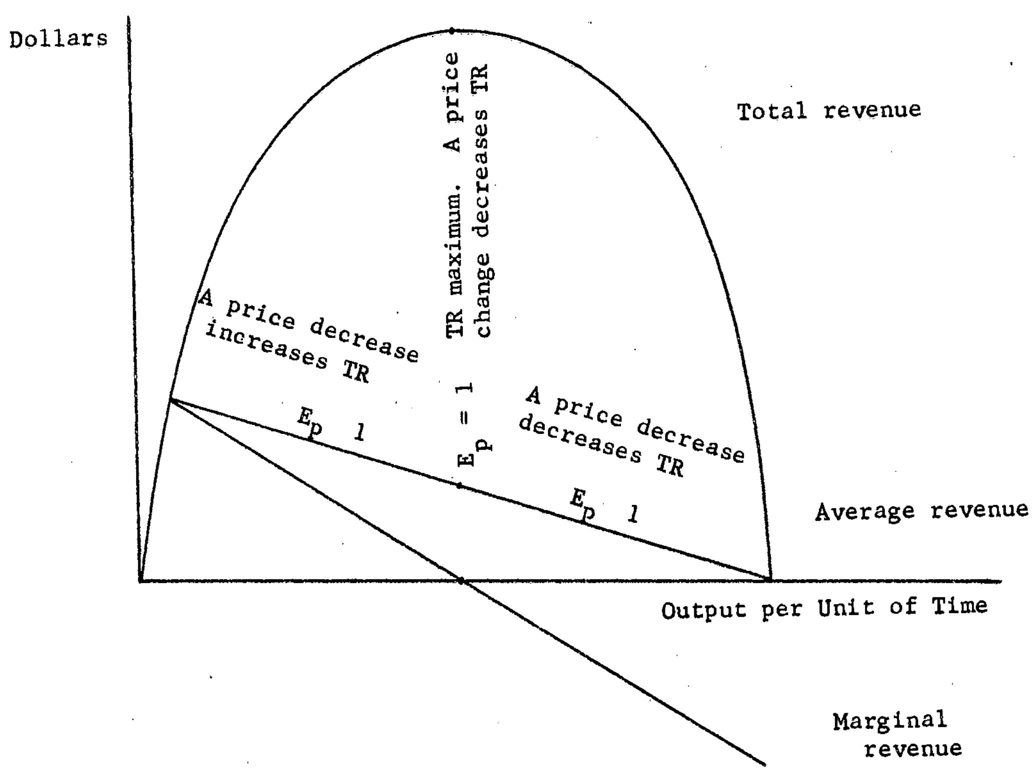

Figure 15. Relationships Between Revenue Curves and Price Elasticity of Demand

Two major factors influencing price elasticity of demand are:

1. The availability of good substitutes for the product.
2. The price of the product relative to consumers' incomes and whether or not the product is regarded as a luxury item (and, therefore, dispensable) or as a necessity.

Cross Elasticity of Demand

When the quantity of sales of one product is directly affected by a change in the price of another product, there is an interrelationship between the products. The nature and extent of this demand relationship is measured by the <u>cross elasticity of demand</u>.

For example, for two products, A and B, the cross elasticity of demand of A with respect to B equals the percentage change in the quantity of A taken divided by the percentage change in the price of B. A simple formula for cross elasticity of demand (E_c) is

$$E_c = \frac{\text{percentage change in quantity taken of A}}{\text{percentage change in price of B}} = \frac{\frac{QA_2 - QA_1}{QA_1}}{\frac{PB_2 - PB_1}{PB_1}}.$$

Two products are <u>substitutes</u> for each other, if, when the price of one decreases, the quantity taken of the other decreases. This is illustrated in Figure 16, where a decrease in the price of B results in a decrease in demand and, thus, quantity taken of A.

Two products are <u>complementary</u> to each other, if, when the price of one decreases, the quantity taken of the other also increases. This is illustrated in Figure 17, where a decrease in the price of B results in an increase in demand and, thus, quantity taken of A.

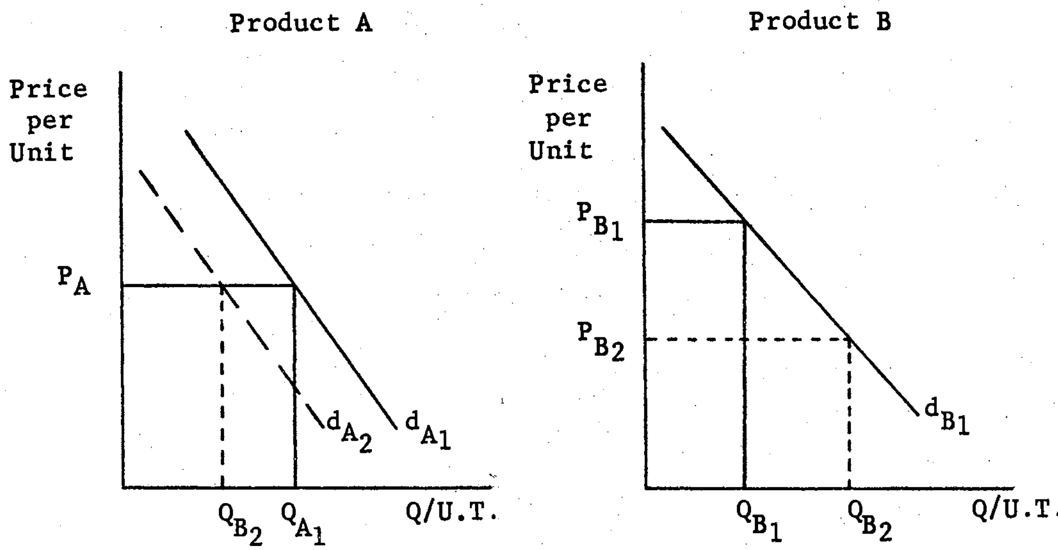

Figure 16. Cross Elasticity of Demand: Substitute Products

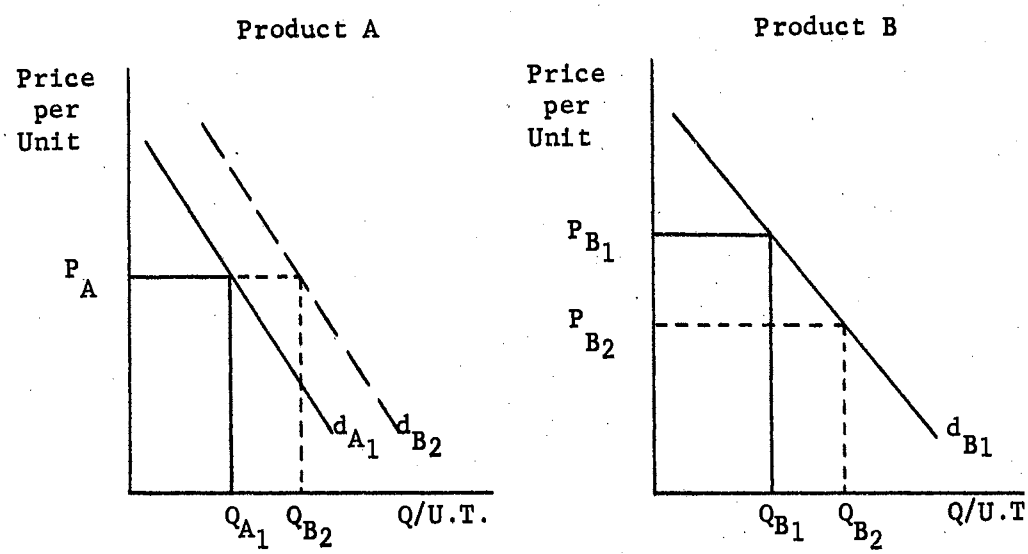

Figure 17. Cross Elasticity of Demand: Complementary Products

Production Function

The principles of production provide the foundation for analysis of costs of production and supplies of particular products. The term production function is applied to the physical relationship between a firm's inputs of resources and its output of products per unit of time. The simplest production function relates one output to two inputs. If q represents the quantity of the output, and x_1 and x_2 the quantities of the inputs, q is a function of x_1 and x_2; that is,

$$q = f(x_1, x_2).$$

This function assumes that a given quantity of x_1 and x_2 produces a single quantity of output, which is the maximum quantity possible from those amounts of inputs.

The output which a firm can produce depends of course upon the quantities of resources used. The firm can vary its output by varying the quantities of all resources used or by varying the quantities of one resource while holding the quantities of the other resource fixed. The way in which output varies as the firm varies the quantities of resources used depends upon the period of time under consideration. In production and subsequent cost analysis, a distinction is made between the time period called the short-run and that called the long-run. The short-run is a time period so short that the firm is unable to vary the quantities of some resources used, such as capital, but long enough to allow variation in the quantities of resources such as labor. In the long-run, the firm can vary the quantities of the variable resource with the fixed resource.

The law of diminishing returns describes the general direction and the general rate of change which the firm's output takes when the input of one resource only is varied. It states that if the input of one resource is increased by equal amounts per unit of time while the inputs of other resources are held constant, total output will increase, but beyond some point the resulting output increases will become smaller and smaller. If input increases of the variable resource are carried far enough, total product will reach a maximum and may then decrease. Figure 18 illustrates a production function of initially increasing returns to the variable resource up to some level of resource utilization, after which diminishing returns set in.

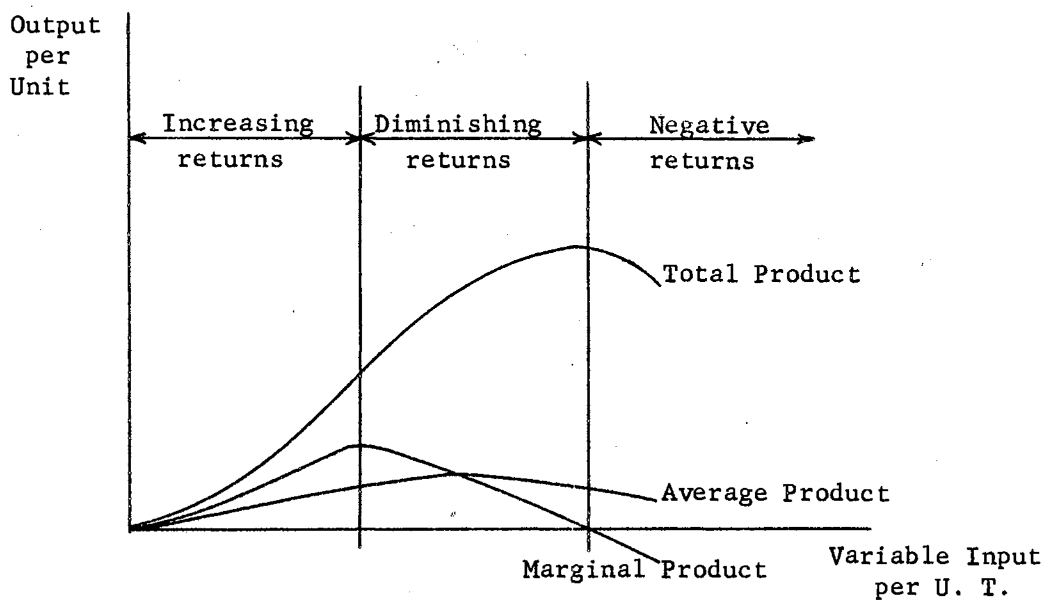

Figure 18. Production Function of Increasing, Then Diminishing Returns

The marginal physical product of a resource is defined as the increase in total product resulting from a one-unit increase in the quantity of variable resource used per unit of time. The average product for any given quantity of variable input is found by dividing total output produced by the quantity of variable input used.

Total Costs

The costs of production incurred by a firm are the explicit expenditures which the firm must make for the resources used to produce its output. In addition to explicit costs, economic theory also includes implicit costs of production such as market value payments for self-owned, self-employed resources to determine total economic costs of production.

Total cost at each output level depends upon:

1. The amount the firm must pay for resources.
2. The efficiency with which the firm uses resources.

Since resources are classified in the short-run as "fixed" and "variable", their costs are likewise classified as "fixed costs" and "variable costs". Three concepts of total cost are important for short-run price and output analysis. These are:

1. Total fixed cost. This includes the expense incurred by the firm for fixed resources. Since the firm in the short-run does not have time to vary the quantities of fixed resources used, total fixed cost does not change as output varies.
2. Total variable cost. This expense must necessarily increase as the firm's output increases (and vice-versa) since larger outputs acquire larger quantities of

variable resources.

3. Total cost. This expense is the sum of total fixed and total variable cost for any given level of output.

The shape of the total variable cost curve results directly from increasing and diminishing returns of the variable resource and, therefore, reflects the nature of the firm's production function. Initially, increasing the quantities of the variable resource to produce more output increases the efficiency with which it is used in combination with fixed resources. Thus, for output increases in the range of increasing returns, the total variable cost curve will be concave to the origin. As larger quantities of the variable resource are used with the fixed resources to produce still more output, the law of diminishing returns sets in, meaning there is a decrease in the efficiency of the variable resource. For output increases in the range of diminishing returns, the total variable cost curve will be convex to the origin. The level of maximum output in the short-run is ultimately determined by the quantities of fixed resources and when this maximum capacity is reached, the total variable cost curve will become vertical. Figure 19 illustrates the total cost curves, assuming a production function of increasing and then diminishing returns to the variable resource.

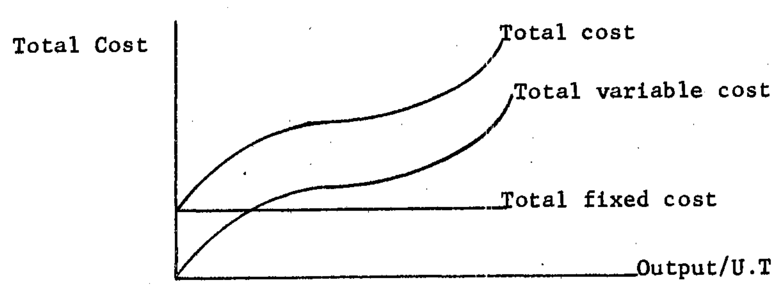

Figure 19. Total Cost Curves

Unit Costs

Although they essentially present the same kind of information, per unit cost curves are normally used for price and output analysis instead of total cost curves. The per unit cost curves are:

1. Average fixed cost, obtained by dividing total fixed cost by any given quantity of output.
2. Average variable cost, obtained by dividing total variable cost for a given quantity of output by that quantity of output.
3. Average total cost, obtained by adding average fixed cost to average variable cost for a given quantity of output.
4. Marginal cost, obtained by calculating the change in total cost resulting from a one unit change in output. Marginal cost varies with output and, therefore, is in no way dependent upon fixed cost in the short-run.

Figure 20 illustrates unit cost curves derived from total cost curves.

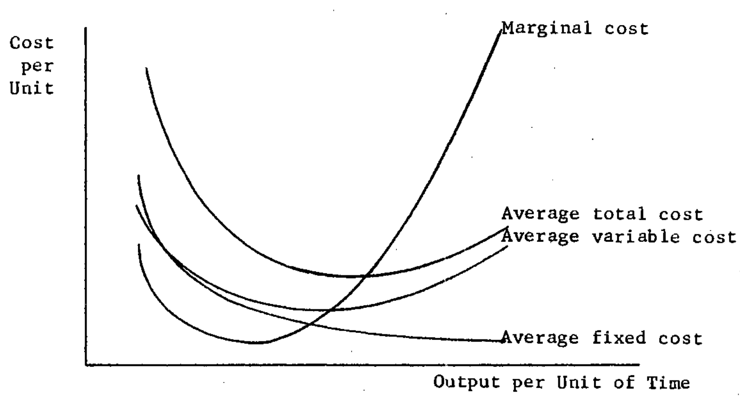

Figure 20. Unit Cost Curves

Figure 21 depicts the general relationships between the firm's short-run production function and the resulting cost curves, assuming the variable resource is purchased at a constant price per unit.

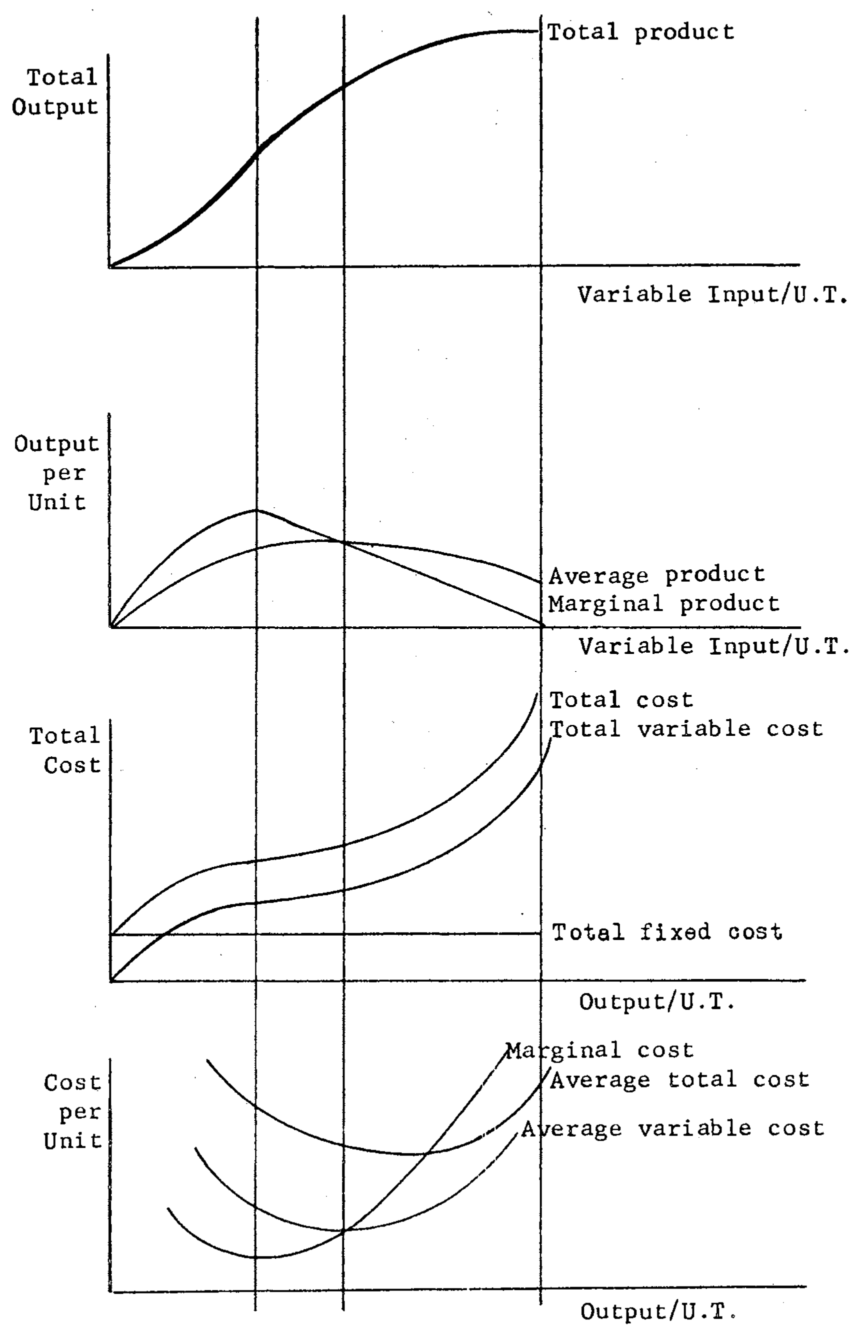

Figure 21. General Relationships Between a Short-Run Production Function and Cost Curves

Price and Output Analysis

In the short-run the firm, given a fixed scale of plant, will attempt to maximize its profits or minimize its losses by adjusting output through changes in the amounts of variable resource employed. Faced with a downsloping demand curve, the firm must simultaneously select price and output. The output and corresponding price which the firm chooses will be that combination where the resulting difference between total revenue and total costs is the greatest, as illustrated in Figure 22.

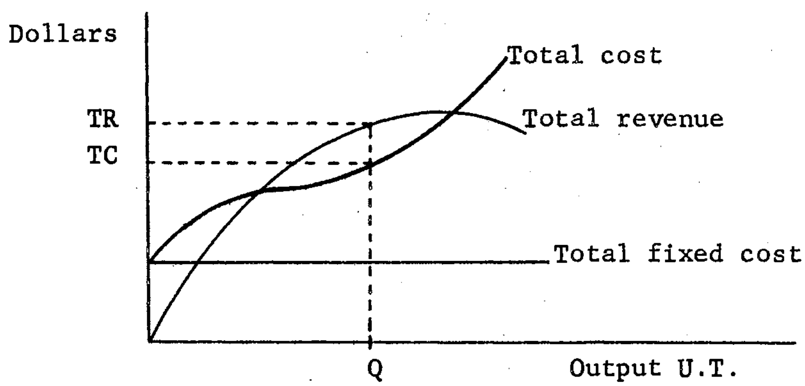

Figure 22. Profit Maximization: Total Revenue and Total Cost Curves

An alternative method for determining the amount which the firm will produce to maximize profits is for the firm to compare the amount that each additional unit of output will add both to total revenue and to total cost. That is, the firm should compare the marginal revenue and the marginal cost of each successive unit of output. Any unit whose marginal revenue exceeds its marginal cost should be produced, because on each such unit the firm is gaining more in revenue from its sale than it adds to cost in producing that unit. Similarly, if the marginal cost of a unit of output exceeds its marginal revenue, the firm should not produce it since it will add more to total cost than to total revenue. Thus, the firm will maximize profits or minimize losses by producing at that level of output where marginal revenue is equal to marginal cost and by charging the price which consumers are willing to pay for that output. Unit cost and revenue analysis is illustrated in Figure 22.

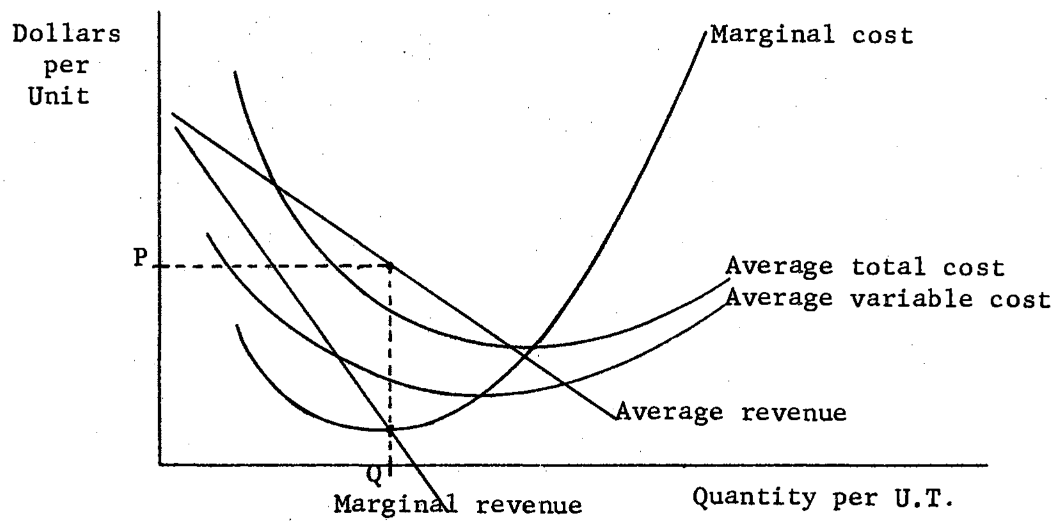

Figure 23. Profit Maximization: Unit Revenue and Unit Cost Curves

In the short-run, the firm will always produce if there is any level of output which can be sold at a price which exceeds average variable cost, even though average total costs are not covered. To minimize losses in this situation, the firm will still produce at that level of output where marginal revenue is equal to marginal cost.

If, at a given level of output, the firm finds that the marginal revenue from the last unit sold exceeds the marginal cost of producing it, the firm will, to maximize profit, decrease price and increase output until the optimum combination of price and quantity is established.

Haynes (28) cites several studies of cost functions which suggest that another pattern of costs is common in industry.

> "Since the time of (Joel) Dean's work, the preponderance of statistical studies has supported the conclusion that total costs are linear and marginal costs are constant in the short-run."

The unit revenue and cost curves would then appear as shown in Figure 23. The firm would still employ the same marginal reasoning to determine the price and quantity which maximizes profit.

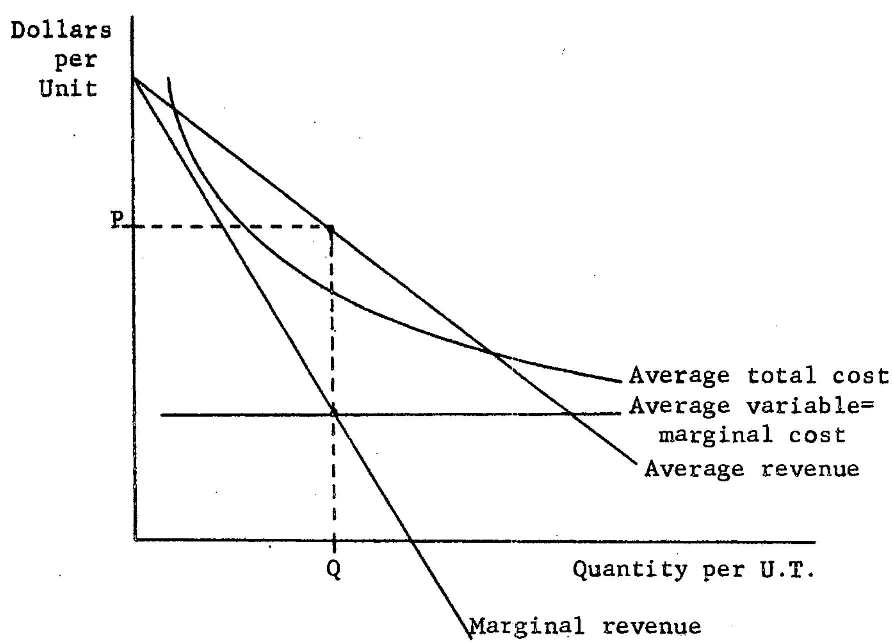

Figure 24. Unit Cost Curves With Constant Marginal Costs

Price Discrimination

Sometimes a firm may find it possible and profitable to divide the total market for its product into two or more segmented markets. The firm will then charge a different price for its product in each of the markets. In economic theory, price discrimination is defined as:

1. The practice of charging different prices to different segments of the market for the same product, or
2. The practice of charging prices that are not proportional to the marginal costs of slightly differentiated products.

Two conditions ar necessary for price discrimination to be profitable:

1. The firm must be able to keep the markets segmented and
2. The price elasticities of demand at each price level must differ among the market segments.

To present the analysis of price discrimination, it is desirable to assume a homogenous product to be sold in two segmented markets, with all units produced at a constant marginal cost. The initial objective is to determine the way in which the firm should allocate its total sales between the two markets. For any given volume of total sales, the firm should always sell in the market in which an additional unit of sales adds the most to total revenue. Total revenue will be maximized when the firm has allocated its total sales among the markets in such a way that marginal revenue from the last unit sold in one market is equal to marginal revenue from the last unit sold in the other market. Figure 24 illustrates the concept.

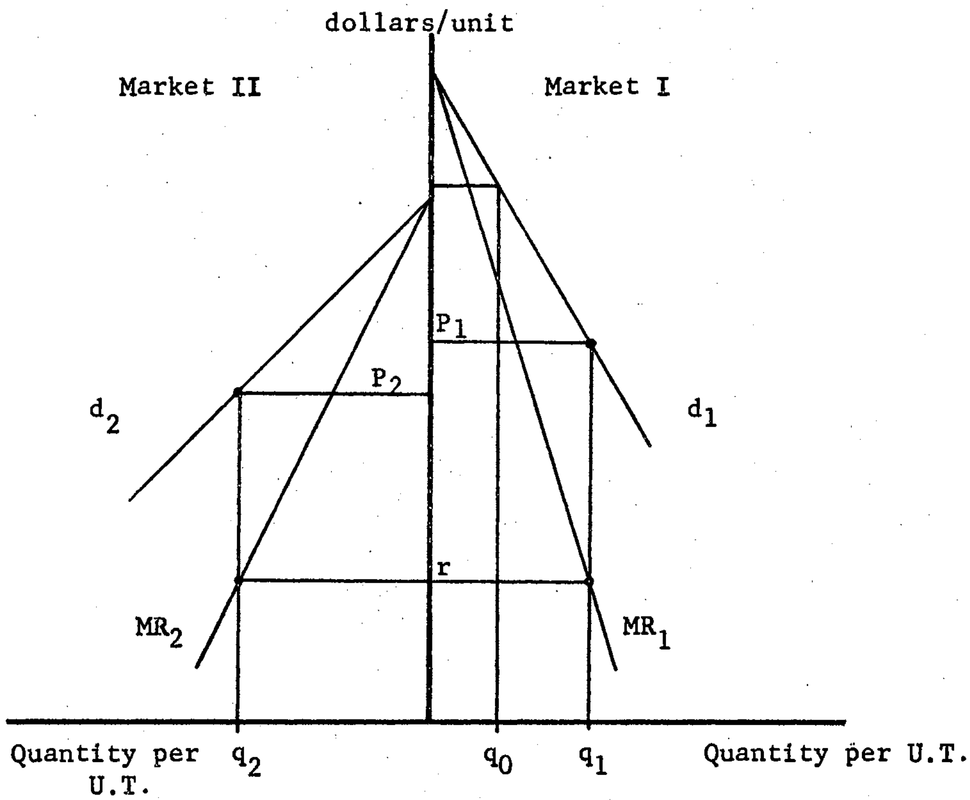

Figure 25. Price Discrimination With Two Market Segments

If the volume of total sales is below q_0, the firm should sell the entire amount in Market I, since the added revenue from sales in that market will exceed any added revenue made from selling in Market II. If the total volume of sales equals q_1 plus q_2, the firm should sell q_1 in Market I and q_2 in Market II so that marginal revenue from the last unit of sales in Market I equals marginal revenue from the last unit of sales in Market II. The level of marginal revenue will be r in each market, with the price in Market II equal to P_2 and the price in Market I equal to P_1. P_1 exceeds P_2 for the same product and the last units sold in both markets are produced for the same marginal cost.

Product Differentiation

A firm may actively influence the quantity sold of its product in two fundamental ways:

1. Decrease the price of the product to increase quantity demanded, and/or
2. Differentiate its product in an attempt to increase demand.

Liebhafsky (37) states: "The term <u>product differentiation</u> is defined as the existence of a preference, real or fancied, in the mind of the buyer for the product of a given seller."

An oligopolistic-type firm is usually reluctant to engage in price competition in an effort to increase individual firm sales, but prefers instead to use other means. Since price decreases are the easiest forms of competitive action to duplicate, product differentiation by an individual firm offers a more subtle and a much safer method of accomplishing approximately the same results.

Attempts at product differentiation take two major forms:

1. Advertising.

2. Variation in design and quality of product.

The primary purpose of both is to shift to the right the demand curve faced by an individual firm and to make it less elastic. This will enable the firm to sell a larger volume at the same or perhaps a higher price without the danger of starting a price war. Thus, each firm tries to enroach upon the markets of others through product differentiation instead of through price decreases.

Product differentiation in either form is expected, of course, to add more to the firm's total revenue than to its total cost. However, it is to be expected that beyond some point, additional expenditures add successively smaller amounts to total revenue. To maximize profits with respect to product differentiation, the firm should spend funds on advertising and/or product variations up to the point at which the added profit attributable to the expenditure is equal to the amount of the expenditure.

Value of Marginal Product

When a firm employs additional units of a variable resource in order to produce additional output, the resulting additions to total revenue are called the _value of marginal product_ of the resource. Each additional unit of the variable resource used adds some amount of product to the firm's total output which can then be sold at its market price. Thus, the additional output multiplied by its market price per unit is the value of the marginal product of a unit of variable resource.

A profit maximizing firm will seek to allocate any given resource among alternative uses in such a way as to obtain greatest economic efficiency. Units of a resource are most efficiently allocated among alternative uses when the value of marginal product of the last unit allocated to one alternative is equal to the value of marginal product of the last unit allocated to all other alternatives.

APPENDIX B

FRONTIER AIRLINES 1965 SYSTEM FINANCIAL, OPERATING, AND TRAFFIC STATISTICS (SELECTED)

TABLE XXIII

FRONTIER AIRLINES 1965 SYSTEM OPERATING AND TRAFFIC STATISTICS (SELECTED)

Operating and Traffic Statistics	Number or Amount
Revenue Plane Miles	13,223,146
Originating Passengers	737,375
Revenue Passenger Miles	218,139,000
Available Seat Miles	547,006,000
Originating Passenger Journey	296
Average Passenger Load	16.5
Average Available Seats	41.4
Passenger Load Factor (%)	39.9
Scheduled Miles	13,397,890
Completion Factor (%)	98.1
Revenue Hours	62,014
Daily Aircraft Utilization	6:28
Number of Departures	105,399
Average Hop Length (Miles)	125.5
Average Hop Duration (Minutes)	35.3
Revenue Ton Miles (Total)	23,312,875
Passenger	20,723,826
U. S. Mail	568,881
Freight, Express and Excess Baggage	2,020,168
Available Ton Miles	60,796,352
Over-All Load Factor (%)	38.3
Average Number of Employees	1,292
Number of Aircraft (Total)	26
Douglas DC-3	10
Convair 440	3
Convair 580	13
Number of Stations Operated	59

TABLE XXIV

FRONTIER AIRLINES 1965 SYSTEM
FINANCIAL DATE (SELECTED)

Financial Data	Dollar Amount	
Total Current Assets		$ 6,663,235
Total Property and Equipment		14,692,308
Total Assets		21,864,739
Long-Term Debt		10,801,238
Stockholders' Equity		5,935,735
Operating Revenues:		
Passenger	$ 16,285,344	
Express	104,093	
Freight	695,913	
Excess Baggage	64,232	
U. S. Mail Service Pay	302,468	
Other Commercial	375,210	
Total Commercial	17,827,260	
Federal Subsidy	6,878,148	
Total Operating Revenue		24,705,408
Operating Expenses:		
Flying Operations	6,288,012	
Direct Maintenance	2,904,492	
Depreciation--Flight Equipment	1,049,521	
Total Direct	10,242,025	
Maintenance Burden	1,803,801	
Passenger Service	1,067,072	
Aircraft and Traffic Servicing	5,179,729	
Promotion and Sales	1,941,434	
General and Administrative	1,329,152	
Depreciation--Ground Equipment	192,215	
Total Indirect	11,513,403	
Total Operating Expenses		21,755,428
Operating Profit		2,949,980

APPENDIX C

DATA APPLICABLE TO FRONTIER'S 50 PER CENT STANDBY FARE DECISION

TABLE XXV

ONE WAY STANDBY FARES

City-Pairs		One-Way Standby Fare	Routing Number
Albuquerque, N. M.	Phoenix, Ariz.	14.05	7
Albuquerque, N. M.	Tucson, Ariz.	13.55	7
Alliance, Neb.	Denver, Colo.	11.00	4
Billings, Mont.	Denver, Colo.	21.50	2
Billings, Mont.	Great Falls, Mont.	10.00	1
Caspter, Wyo.	Denver, Colo.	11.50	2
Chadron, Neb.	Denver, Colo.	13.00	4
Denver, Colo.	Great Falls, Mont.	28.00	1
Denver, Colo.	Kansas City, Mo.	22.70	3
Denver, Colo.	Lincoln, Neb.	18.00	3
Denver, Colo.	Omaha, Neb.	19.00	3
Denver, Colo.	Phoenix, Ariz.	26.00	5
Denver, Colo.	Phoenix, Ariz.	29.00	11
Denver, Colo.	Rapid City, S. D.	16.00	3
Denver, Colo.	Salt Lake City, Utah	17.50	9
Denver, Colo.	Tucson, Ariz.	29.00	5
Great Falls, Mont.	Salt Lake City, Utah	21.00	2
Kansas City, Mo.	Lincoln, Neb.	10.00	4
Kansas City, Mo.	Omaha, Neb.	10.00	4
Phoenix, Ariz.	Salt Lake City, Utah	27.00	13
Salt Lake City, Utah	Tucson, Ariz.	32.00	14

TABLE XXVI

STANDBY FARE ROUTINGS

Application of Routings

1. Routings are applicable only to fares which make specific reference to them.

2. Locate in the routing the point of origin and the point of destination between which the fare applies. Apply only the portion of the routing which connects the origin and destination points by a line or a series of city codes and dashes, always reading continuously in the same general direction. The applicable portion of the routing may be traveled via the cities named between the origin and destination points in the order named.

3. Where a routing includes more than one option applicable between the origin and destination or between any two intermediate points, any one of the options may be used.

4. The cities shown at the head of the fare columns and the cities at the side of the fare columns, between which the fares are published, are referred to as the headline and sideline points, respectively. The routings via which the fares apply are shown from the point named at the head of each group of fares to the point named within such group. When passage is in the opposite direction, the routing specified should be read in reverse order.

TABLE XXVI (Continued)

Explanation of Routing Numbers		
Rg. No.	Read Odd Numbers from Left to Right-- Even Numbers from Right to Left	Rg. No.
1	COD DEN-CYS-LAR-CPR-RIW-WRL-POY-BIL-LWT-GIF VEL-RKS SLC — JAC	2
3	CDR-RAP OMA DEN-CYS-BFF-AIA-LBF-GRI-LNK — STJ-MKC SNY-MCK-EAR-HSI-OLU	4
5	SAF SVC DEN-COS-PUB-ALS-DRO-FMN-GUP-ABQ-GUP-INW-FLG-PHX-TUS	6
7	SVC — TUS ABQ-GUP-FMN-GUP-INW-FLG-PHX	8
9	DEN-CYS-LAR-CPR-RIW-RKS-VEL-SLC GUC-MTJ-GJT-CNY	10
11	SAF DEN-COS-PUB-ALS-DRO-FMN-GUP-ABQ-SVC-TUS-PHX	12
13	SVC — ABQ TUS-PHX-FLG-INW-GUP-FMN-CEZ-CNY-GJT-CNY-VEL-SLC	14

TABLE XXVII

EXPLANATION OF ABBREVIATIONS IN STANDBY FARE ROUTINGS

Abbreviations			Abbreviations		
ABQ	-	Albuquerque, N.M.	LNK	-	Lincoln, Neb.
AIA	-	Alliance, Neb.	LWT	-	Lewistown, Mont.
ALS	-	Alamosa, Colo.	MCK	-	McCook, Neb.
Ariz.	-	Arizona	MKC	-	Kansas City, Mo.
BFF	-	Scottsbluff, Neb.	Mo.	-	Missouri
BIL	-	Billings, Mont.	Mont.	-	Montana
CEZ	-	Cortez, Colo.	MTJ	-	Montrose, Colo.
CDR	-	Chadron, Neb.	Neb.	-	Nebraska
CNY	-	Moab, Utah	N.M.	-	New Mexico
COD	-	Cody, Wyo.	OLU	-	Columbus, Neb.
Colo.	-	Colorado	OMA	-	Omaha, Neb.
COS	-	Colorado Springs	O.W.	-	One Way
CPR	-	Casper, Wyo.	PHX	-	Phoenix, Ariz.
CYS	-	Cheyenne, Wyo.	POY	-	Powell, Wyo.
DEN	-	Denver, Colo.	PUB	-	Pueblo, Colo.
DRO	-	Durango, Colo.	RAP	-	Rapid City, S. D.
EAR	-	Kearney, Neb.	RG.NO.	-	Routing Number
FLG	-	Flagstaff, Ariz.	RIW	-	Riverton, Wyo.
FMN	-	Farmington, N. M.	RKS	-	Rock Springs, Wyo.
GJT	-	Grand Junction, Colo.	SAF	-	Santa Fe, N. M.
GRI	-	Grand Island, Neb.	S.D.	-	South Dakota
GTF	-	Great Falls, Mont.	SLC	-	Salt Lake City, Utah
GUC	-	Gunnison, Colo.	SNY	-	Sidney, Neb.
GUP	-	Gallup, N. M.	STJ	-	St. Joseph, Mo.
HSI	-	Hastings, Neb.	SVC	-	Silver City, N. M.
INW	-	Winslow, Ariz.	TUS	-	Tucson, Ariz.
JAC	-	Jackson, Wyo.	VEL	-	Vernal, Utah
LAR	-	Laramie, Wyo.	WRL	-	Worland, Wyo.
LBF	-	North Platte, Neb.	Wyo.	-	Wyoming

TABLE XXVIII

ANALYSIS OF HALF FARE PLAN MARKETS FIVE MONTHS ENDED JUNE 30, 1966
AND SEPTEMBER 1966 VS. SAME PERIOD 1965

	Feb-June and September, 1966							Comparison with Feb-June and Sept., 1965			
	Passengers				Revenue					% Increase	
	Total	Half Fare Plan	All Other Fares	% Half Fare of Total	Total	Half Fare Plan	% Half Fare of Total	Psgrs.	Revenue	Psgrs.	Revenue
Albuquerque-Phoenix	10,399	3,262	7,137	31	$208,448	$ 45,834	22	4,624	$107,208	125	94
Albuquerque-Tucson	5,412	1,209	4,203	22	104,755	16,363	16	3,942	88,320	37	19
Alliance-Denver	1,224	424	800	35	19,282	4,653	24	762	14,431	61	34
Billings-Denver	1,824	1,081	743	59	47,125	23,216	49	965	31,978	89	47
Billings-Great Falls	3,194	2,304	890	72	34,112	23,109	67	889	11,822	259	189
Casper-Denver	8,961	3,058	5,903	34	152,091	35,185	23	4,198	87,919	113	73
Chadron-Denver	1,718	508	1,210	30	33,284	6,622	20	997	22,222	72	50
Denver-Great Falls	794	545	249	69	21,882	15,250	70	134	4,557	493	380
Denver-Kansas City	9,009	2,369	6,640	26	282,217	53,433	19	4,125	128,880	118	119
Denver-Lincoln	10,354	2,030	8,324	20	285,619	36,401	13	6,287	187,915	65	52
Denver-Omaha	5,090	2,823	2,267	55	113,496	53,526	47	1,078	27,387	372	314
Denver-Phoenix	7,326	3,436	3,890	47	223,137	90,481	41	3,176	101,269	131	120
Denver-Rapid City	13,433	954	12,469	7	340,345	15,280	4	9,762	258,992	38	31
Denver-Salt Lake City	5,427	3,267	2,160	60	106,129	56,843	54	2,100	50,890	158	109
Denver-Tucson	6,203	1,777	4,426	29	241,775	51,520	21	3,450	149,102	80	62
Great Falls-Salt Lake	1,817	714	1,103	40	50,803	14,991	30	875	31,030	108	64
Kansas City-Lincoln	19,993	1,054	18,939	5	280,331	10,512	4	14,671	213,603	36	31
Kansas City-Omaha	8,471	882	7,589	10	112,495	8,814	8	4,026	54,404	110	107
Phoenix-Salt Lake City	627	315	312	50	18,181	8,512	47	205	7,768	206	134
Salt Lake City-Tucson	684	189	495	28	27,969	5,980	21	181	9,283	278	201
Total Half Fare Segments	121,950	32,201	89,749	26%	$2,703,476	$576,525	21%	66,447	$1,588,980	83%	70%
Total Other Segments	366,827				7,750,416			274,432	5,985,604	34%	29%
Total System	488,777				$10,453,892			340,879	$7,574,584	43%	38%

APPENDIX D

DATA APPLICABLE TO FRONTIER'S

LAS VEGAS ROUTE DECISION

TABLE XXIX

HISTORIC LOCAL AND CONNECTING PASSENGER TRAFFIC IN MAJOR MARKETS
AND ESTIMATED 1967 PASSENGERS BY MARKET

	Local Passengers per CAB Survey /a								
	1959	1960	1961	1962	1963	1964	1965	Forecast Passengers 1967 /b	% 1967 Over 1964
Local									
Kansas City-Las Vegas	4,890	4,450	4,410	5,430	6,570	8,130	8,370	10,340	27%
Lincoln-Las Vegas	120	240	250	310	490	310	360	590	90
Omaha-Las Vegas	1,690	2,000	2,660	3,050	3,410	3,980	4,510	6,190	56
Grand Island, Hastings, Kearney-Las Vegas	60	--	60	170	180	160	270	460	
Colorado Springs-Las Vegas	230	280	240	430	410	560	610	840	
Denver-Las Vegas	18,340	20,160	22,520	28,620	30,670	31,640	33,940	44,060	39
Grand Junction-Las Vegas	930	760	1,150	1,670	2,050	2,110	2,240	3,490	65
Other Frontier Points Beyond Denver-Las Vegas	1,000	840	920	1,100	2,140	2,560	2,410	3,740	
Colorado Springs-Denver	6,670	6,560	7,820	8,220	11,680	13,690	14,780	17,740	
Colorado Springs-Grand Junction	40	30	90	140	320	710	950	2,710	
Denver-Grand Junction	14,420	15,680	17,490	18,510	22,050	25,230	29,290	35,120	39
Denver-Los Angeles	102,760	119,990	127,470	133,600	159,290	168,320	172,550	213,470	27
Connecting									
Colorado Springs-Denver	28,170	27,040	35,090	40,860	38,150	45,630	50,460	61,950	
Grand Junction-Los Angeles	2,580	3,100	3,920	3,960	5,910	6,490	6,910	10,020	
Grand Junction-San Francisco	980	890	990	1,210	1,610	2,010	2,020	2,910	
Grand Junction-So. California points	410	330	570	780	1,060	1,450	1,520	2,080	
Lincoln-Los Angeles	1,590	2,470	2,980	2,260	3,200	3,120	3,150	4,480	
Lincoln-San Francisco	980	1,310	1,440	1,570	2,050	2,610	2,790	3,520	
Lincoln-So. California points	470	730	910	860	830	990	1,170	1,410	

/a 10% sample passengers expanded by a factor of 10.
/b Average of constant rate and constant increment extrapolations of least squares lines on 1959-1965 data.

TABLE XXX

HISTORIC LOCAL PASSENGER TRAFFIC IN MINOR MARKETS AND ESTIMATED 1967 PASSENGERS BY MARKETS

City Pair	Sample Passengers in CAB Surveys/a 1963	1964	1965	Three-Year Average	Forecast Sample Passengers 1967
Group I					
Las Vegas-					/b
Casper	670	830	720	740	1170
Cheyenne	250	320	270	280	440
Rapid City	690	730	730	720	1140
Alamosa	20	70	60	50	80
Alliance	10	10	20	10	20
Bismarck	60	180	220	150	240
Chadron	60	10	10	30	50
Laramie	10	-	20	10	20
McCook	-	-	10	-	-
Minot	80	90	70	80	130
North Platte	10	30	30	20	30
Pueblo	150	190	190	180	280
Scottsbluff	60	70	60	60	90
Sidney, Nebr.	20	-	-	10	20
Williston	50	30	-	30	50
Total	2140	2560	2410	2370	3760
Group II					
Las Vegas-					/c
Moab	-	-	30	10	20
Cortez	20	-	-	10	20
Montrose	40	-	10	20	30
Gunnison	-	-	20	10	20
Vernal	40	30	30	30	50
Farmington	40	220	260	170	260
Total	140	250	350	250	400

Footnotes:

/a Per CAB Survey, sample expanded by a factor of 10.

/b Sample traffic in base period increased by 58% to forecast year, based on estimate of composite growth of all markets listed.

/c Sample traffic in base period increased by 50%, based on Grand Junction-Las Vegas growth in this period of 65%.

TABLE XXXI

HISTORIC CONNECTING TRAFFIC, ADJUSTED TO EXCLUDE TRAFFIC IN MINOR MARKETS, AND ESTIMATED 1967 PASSENGERS BY MARKET

	Connecting Point	1964 Passengers /a		% Growth to 1967	Est. 1967 Psgrs.
Kansas City-Las Vegas Connecting			2,400		
less Las Vegas-Omaha	Kansas City	130			
-Lincoln	Kansas City	50	-180		
Total			2,220	27	2,820
Omaha-Las Vegas Connecting			450		
less Las Vegas-Kansas City	Omaha	0			
-Lincoln		20	-20		
Total			430	56	670
Denver-Las Vegas Connecting			6,680		
less Las Vegas-Kan. City	Denver	550			
-Lincoln		10			
-Omaha		0			
-Grand Island		70			
-Hastings		20			
-Kearney		20			
-Colo. Springs		480			
-Casper		40			
-Cheyenne		260			
-Rapid City		10			
-Alamosa		40			
-Alliance		0			
-Bismarck		60			
-Chadron		10			
-Laramie		0			
-McCook		0			
-Minot		30			
-No. Platte		30			
-Pueblo		160			
-Scottsbluff		60			
-Sidney, Nebr.		0			
-Williston		10	-1,860		
Total			4,820	39	6,700

TABLE XXXI (Continued)

	Connecting Point	1964 Passengers /a		% Growth to 1967	Est. 1967 Psgrs.
Colorado Springs-Denver Connecting			45,630	38	62,910
less Colo. Springs-					
-Grand Junction	Denver	200			
-Las Vegas	Denver	540	-740		
Total			44,890	38	61,950
Denver-Grand Junction Connecting			7,900		
less Colo. Springs-					
-Grand Junction	Denver	200	-200		
Total			7,700	39	10,700
Denver-Los Angeles Connecting			42,240		
less Lincoln-Los Angeles	Denver	1,130			
-Bakersfield		10			
-Indio		20			
-Riverside		20			
-San Diego		60			
-Santa Barbara		10			
-Visalia		10	-1,260		
Total			40,980	27	52,040

/a Per 1964 CAB Competition Study.

TABLE XXXII

FORECAST OF ADDED PASSENGER TRAFFIC AND REVENUES ATTRIBUTABLE TO PROPOSED SERVICE TO LAS VEGAS

	Estimated Passengers Year 1967			Traffic Stimulation for FL Service Improvements		1967 Total Market After FL Service Improvement	Frontier			
	Local	Connecting	Total	Type	Factor		% Partici-pation	Passengers	Rev. Psgr. Miles (000)	Passenger Revenue
Kansas City-Las Vegas	10,340	2,820	13,160	E	1.20	15,792	20	3,158	3,859	248,029
Lincoln-Las Vegas	590	/a	590	E	1.65	914	60	548	579	38,771
Omaha-Las Vegas	6,190	670	6,860	F	1.05	7,203	5	360	400	28,678
Grand Island/Hastings/ Kearney-Las Vegas	460	0	460	D	1.30	598	S	138	136	10,246
Colorado Springs- Las Vegas	840	0	840	C	2.00	1,680	60	1,008	691	52,779
Denver-Las Vegas	44,060	6,700	50,760	E	1.45	73,602	45	33,121	20,535	1,485,477
Grand Junction-Las Vegas	3,490	/a	3,490	E	2.50	8,725	75	6,544	2,748	210,128
Casper-Las Vegas	1,170	0	1,170	F	1.05	1,228	S	58	51	3,330
Cheyenne-Las Vegas	440	0	440	F	1.80	792	S	352	251	19,128
Rapid City-Las Vegas	1,140	0	1,140	F	1.50	1,710	S	570	529	40,880
Alamosa-Las Vegas	80	0	80	C	3.50	280	S	200	163	11,964
Alliance-Las Vegas	20	0	20	C	8.00	160	S	140	117	9,275
Bismarck-Las Vegas	240	0	240	C	2.30	552	S	312	358	29,865
Chadron-Las Vegas	50	0	50	C	4.90	245	S	195	174	13,611
Laramie-Las Vegas	20	0	20	D	2.40	48	S	28	21	1,608
McCook-Las Vegas	0	0	0	D	/b	28	S	28	24	1,799
Minot-Las Vegas	130	0	130	C	2.80	364	S	234	293	24,270
North Platte-Las Vegas	30	0	30	D	2.40	72	S	42	39	2,824
Pueblo-Las Vegas	280	0	280	C	2.20	616	S	336	242	17,593
Scottsbluff-Las Vegas	90	0	90	C	3.30	297	S	207	164	12,886
Sidney, Nebr.-Las Vegas	20	0	20	D	2.40	48	S	28	21	1,659
Williston-Las Vegas	50	0	50	C	4.90	245	S	195	266	21,411
Cortez-Las Vegas	20	0	20	D	2.40	48	S	28	15	1,274
Farmington-Las Vegas	260	0	260	C	2.25	585	S	325	190	15,766
Gunnison-Las Vegas	20	0	20	D	2.40	48	S	28	15	1,246
Moab-Las Vegas	20	0	20	D	2.40	48	S	28	14	1,162
Montrose-Las Vegas	30	0	30	D	2.25	68	S	38	18	1,539
Vernal-Las Vegas	50	0	50	D	1.80	90	S	40	21	1,780
Grand Junction-Los Angeles		10,020	10,020	F	1.50	15,030	GJT-LAS 50	7,515	3,156	243,862
Grand Junction-San Francisco		2,910	2,910	F	1.50	4,365	GJT-LAS S	1,455	611	47,215
Grand Junction-So. Calif.		2,080	2,080	F	1.25	2,600	GJT-LAS 25	650	273	21,092
Lincoln-Los Angeles		4,480	4,480	F	1.10	4,928	LNK-LAS S	448	473	32,104
Lincoln-San Francisco		3,520	3,520	F	1.05	3,696	LNK-LAS S	176	186	12,612
Lincoln-So. California		1,410	1,410	F	1.05	1,480	LNK-LAS S	70	74	5,016
Denver-Los Angeles	213,470	52,040	265,510	F	1.00	265,510	DEN-LAS 0.5	1,328	823	49,468

TABLE XXXII (Continued)

	Estimated Passengers Year 1967			Traffic Stimulation for FL Service Improvements		1967 Total Market After FL Service Improvement	Frontier			
	Local	Connecting	Total	Type	Factor		% Partici-pation	Passengers	Rev. Psgr. Miles (000)	Passenger Revenue
Colorado Springs-Denver										
before	17,740	61,950	79,690		1.00	79,690	22	17,532		
after				F	1.02	81,284	28	22,760		
added								5,228	345	41,563
Colo. Springs-Grand Junction										
before	2,710	0	2,710		1.00	2,710	75	2,032		
after				F	1.25	3,388	90	3,049		
added								1,017	271	19,791
Denver-Grand Junction										
before	35,120	10,700	45,820		1.00	45,820	88	40,322		
after				F	1.10	50,402	90	45,362		
added								5,040	1,008	98,078
								71,216	39,154	$2,879,779
									NET /c	$2,706,992

/a Connecting traffic forecast separately below.
/b Estimated same as Sidney.
/c Net revenue estimated at 94% of gross.

TABLE XXXIII

PROPOSED FARES, LAS VEGAS SERVICE

Between/and:	Jet First Class	Jet Coach
Las Vegas-		
Grand Junction	$ 37.55	$ 30.75
Denver	53.45	42.70
Lincoln	85.35	67.10
Kansas City	93.50	74.80
Grand Junction-		
Denver	22.05	18.60

	Jet First Class Las Vegas-Denver & Prop 1st Class Denver-Dest.	Jet Coach Las Vegas-Denver & Prop 1st Class Denver-Dest.
Las Vegas-		
Alamosa	$ 62.30	$ 59.20
Alliance	72.45	64.70
Bismarck	98.20	95.10
Casper	59.90	56.80
Chadron	74.20	68.70
Cheyenne	59.90	52.95
Colorado Springs	59.20	50.65
Grand Island	80.45	72.70
Hastings	79.45	71.70
Kearney	76.45	68.70
Laramie	59.90	56.80
McCook	70.45	62.70
Minot	106.20	103.10
North Platte	73.45	65.70
Omaha	85.65	80.70
Pueblo	59.20	50.65
Rapid City	74.20	71.10
Scottsbluff	68.45	60.70
Sidney, Nebr.	65.45	57.70
Williston	114.20	108.70

	Jet First Class Las Vegas-Grand Junction & Prop 1st Class Grand Junction-Dest.	Jet Coach Las Vegas-Grand Junction & Prop 1st Class Grand Junction-Dest.
Las Vegas-		
Cortez	$ 48.55	$ 44.75
Farmington	51.55	47.75
Gunnison	47.55	43.75
Moab	44.55	40.75
Montrose	43.55	39.75
Vernal	47.55	43.75

TABLE XXXIV

ADDED AIRCRAFT MILES, HOURS AND DEPARTURES ATTRIBUTABLE
TO PROPOSED SERVICE TO LAS VEGAS

Equipment Flight Number	Points Served		Annual Flights Sched.	Revenue Aircraft Miles: Sched. per Flt.	Revenue Aircraft Miles: Annual Sched.	Revenue Aircraft Miles: Annual Flown @ 98%	Revenue Aircraft Block Hours: Sched. per Flt.	Revenue Aircraft Block Hours: Annual Sched.	Revenue Aircraft Block Hours: Annual Flown	Revenue Aircraft Departures: Sched. per Flt.	Revenue Aircraft Departures: Annual Sched.	Revenue Aircraft Departures: Annual Flown @ 98%
<u>B-727</u>												
1	Denver-Grand Junction-Las Vegas	a/	365	620			1:46			2		
2	Las Vegas-Grand Junction-Denver	a/	365	620			1:40			2		
3	Grand Junction-Las Vegas	b/	365	420			1:06			1		
4	Las Vegas-Grand Junction	b/	365	420			1:01			1		
Total B-727				2,080	759,200	744,016	5:33	2,025.8	2,045 c/	6	2,190	2,146
<u>CV-580</u>												
3	Colorado Springs-Denver	d/	365	66			:22			1		
4	Denver-Colorado Springs	d/	365	66			:22			1		
	Subtotal			132	48,180	47,216	:44	267.7	273 e/	2	730	715
	Denver-Grand Junction	a/	365	(200)			(:50)			(1)		
	Grand Junction-Denver	a/	365	(200)			(:45)			(1)		
	Subtotal			(400)	(146,000)	(143,080)	(1:35)	(577.9)	(589)b/	(2)	(730)	(715)
Total CV-580					(97,820)	(95,864)		310.2	(316)		-0-	-0-

a/ To account for the net addition of miles, hours and departures by the replacement of a CV-580 round trip with a B-727 round trip in the Denver-Grand Junction market.
b/ The Kansas City-Denver and Denver-Grand Junction portions of these B-727 flights will be operated in 1967, and therefore are not additional operations herein.
c/ At mileage completion factor of 98% plus factor for in-flight and ground maneuver delays estimated at 3%.
d/ Additional round trip Denver-Colorado Springs to provide direct on-line connection to Las Vegas.
e/ At mileage completion factor of 98% plus factor for in-flight and ground maneuver delays estimated at 4%.

TABLE XXXV

COMPUTATION OF RETURN ELEMENT FOR PROPOSED SERVICE TO LAS VEGAS

	Amount (000)				
	B-727	Basis	CV-580	Basis	Net
Added Investment per Aircraft					
1. Flight equipment	$4,500	See Table XXII	$937	Based on Frontier's equipment cost experience	
2. Related spare flight equipment, expendable parts, ground equipment, and working capital:					
-% of Flight Equipment	33.3%	Based on a detailed analysis of capital requirements	50%	per CAB costing method	
-Amount	$1,500		$468		
3. Total Investment per Aircraft	$6,000		$1,405		
Provision for Return on Investment and Taxes per Aircraft					
4. Added Debt	$4,500	Assumes a ratio of 25% equity and 75% debt for the added investment for the proposed services.	$907	Debt is 64.53% of investment as reported to CAB in 1965	
5. Interest rate per annum	6.00%	Estimated cost of B-727 debt	5.25%	Actual cost of CV-580 debt	

TABLE XXXV (Continued)

	Amount (000)				
	B-727	Basis	CV-580	Basis	Net
6. Return Requirement @ 9% of added investment (9% X line 3)	$540		$126		
7. Annual interest cost of debt (line 5 X line 4)	$270		$ 48		
8. Net return after interest and taxes (line 6 minus line 7)	$270		$ 78		
9. Provision for taxes @ 51% (48% Federal and 3% State)	$281	Requires taxable return of $551 in order for a net return of $270 (line 8) to be realized (X-.51X=$270)	$81	Requires taxable return of $159 in order for a net return of $78 (line 8) to be realized (X-.51X=$78)	
10. Return Element (line 6 plus line 9)	$821		$207		
Estimate for Proposed Service to Las Vegas					
11. Revenue Aircraft Block Hours	2,045	See Table XVII	(316)	See Table XVII	
12. Annual Revenue Aircraft Blk. Hour Utilization per Aircraft	3,650	Utilization estimated at 10 hours per day for B-727	3,394	Utilization estimated at 9.30 hours per day for CV-580	
13. Number of aircraft required (line 11 line 12)	.560		(.093)		
14. Provision for Return on Investment and Taxes (line 13 X line 10)	$460		$(19)		**$441**

APPENDIX E

DATA APPLICABLE TO FRONTIER'S DOUGLAS,

ARIZONA ROUTE DECISION

TABLE XXXVI

MAINTENANCE BURDEN-FLIGHT EQUIPMENT, VARIABLE PORTION

Sub-Account		Description
Trainees and Instructors	--	Compensation for personnel in a training status.
Unallocated Shop Labor	--	Pay of direct maintenance personnel which has not been assigned to profit and loss account Maintenance Labor for time spent on specific maintenance projects, and vacation or sick leave pay of direct maintenance personnel.
Record Keeping and Statistical Personnel	--	Compensation, including vacation and sick leave pay, of personnel whose primary duties relate to maintaining records or conducting economic or other analyses required for general management controls, such as accountants, economists, statisticians, maintenance record clerks, stores records clerks, stores receiving and issuing clerks and file clerks.
Other Services: Outside	--	Charges for maintenance and repair of ground property and equipment of all types and classes and other charges for services performed by others not provided for elsewhere--such as the operation of traffic offices or other facilities used jointly with the air carrier which do not represent reimbursement of specific expense elements incurred expressly for the benefit of the air carrier.
Shop and Servicing Supplies	--	Cost of supplies and expendable small tools and equipment used in maintaining, servicing and cleaning property or equipment, the cost of which cannot be directly assigned to a specific job or type of work.
Insurance: Employee Welfare	--	Cost of purchased insurance and provisions for self-insurance covering liability for the benefit or protection of employees, and contributions of the air carrier to employee pension or other welfare plans.
Taxes: Payroll	--	All taxes levied against the air carrier based upon or directly related to compensation of personnel.

TABLE XXXVII

COMPUTATION OF REGIONAL AND SYSTEM SERVICING EXPENSE
ATTRIBUTABLE TO PROPOSED SERVICE TO DOUGLAS

	Present System, 1965	Added by Proposed Service Without Standby Fare	Resultant System	Added Traffic With Standby Fare	Resultant System With Standby Fare
Revenue Ton Miles (000)	22,027	438	22,465	44	22,509
Aircraft Departures Performed	102,536	2,760	105,296	-0-	105,296
Service and Traffic Index (STI) Revenue Ton Miles per Departure /a	214.82	158.70	213.35	Inf.	213.77
Regional and System Servicing Expense (000)	$ 4,585	$ 110 /f	$ 4,695 /e	$ 5 /f	$ 4,700 /e
Regional and System Servicing Expense per Revenue Ton Mile					
Actual	$ .2082 /b	$.2511 /b	$ .2090 /d	$.1136 /b	$ .2088 /d
Computed	.2092 /c		.2100 /c		.2098 /c
% Actual of Computed	99.52%		99.52%		99.52%

/a Revenue Ton Miles divided by Departures Performed.
/b Regional and System Expense divided by Revenue Ton Miles.
/c Per R and S Formula based on industry data for 1965.
/d % actual of computed X computed.
/e Revenue Ton Miles X Actual R and S Expense per RTM.
/f Resultant System minus present system.

TABLE XXXVIII

COMPUTATION OF RETURN ON INVESTMENT AND TAX ALLOWANCE, DOUGLAS SERVICE

1.	Aircraft type		CV-580
2.	Cost of aircraft including full overhaul	/a	$936,930
3.	Number of aircraft units required	/b	0.404
4.	Aircraft investment allocated to proposal		$378,520
5.	Total investment allocated to proposal @ 1.50 of aircraft		$567,780
	System investment as of September 30, 1965:		
6.	Long term debt		$9,900,000
7.	Equity		5,413,226
8.	Total		$15,313,226
9.	Ratio of debt to total		.6465
10.	Ratio of equity to total		.3535
11.	Investment requirement conformed to debt-equity ratio:		
12.	Debt		$367,070
13.	Equity		200,710
14.	Return on debt @ 5.75%		$ 21,107
15.	Return on equity @ 16.00%		32,114
16.	Return on investment		$ 53,221
17.	Provision for taxes on equity return	/c	29,644
18.	Return element	/d	$ 82,865

/a Average of Frontier's accumulated experience on CV-580's.
/b Added revenue aircraft block hours 1,370 divided by 3,394 estimated future annual utilization per aircraft.
/c Line 15 divided by 0.52; then subtract line 15 from this figure.
/d Line 16 plus line 17.

TABLE XXXIX

SUBSIDY ATTRIBUTABLE TO PROPOSED SERVICE TO DOUGLAS

	Present System	Added by New Route	Resultant System
Revenue Aircraft Miles Flown			
DC-3 Total	2,096,601		2,096,601
CV-580 Total	12,773,141	288,230	13,061,371
Less Ineligible Miles /1	94,444		94,444
Eligible CV-580 Miles	12,678,697		12,966,927
Total, Revenue Aircraft Miles Eligible	14,775,298		15,063,528
Departures Performed			
DC-3 Total	24,927		24,927
CV-580 Total	92,584	2,760	95,344
Less Ineligible Departures /1	242		242
Eligible CV-580 Departures	92,342		95,102
Total Departures Eligible	117,269		120,029
Weighted Departures DC-3 @ 1.0	24,927		24,927
CV-580 @ 1.2	110,801		114,122
Total	135,737		139,049
Stations Served	60	1	61
Number of Days	365		365
Station Days	21,900		22,265
Less one station x number of days	365		365
Stations less one station x days	21,535		21,900
Weighted departures/station-1/day	6.30		6.35
Length of hop	125.99		125.50
Length of hop adj. factor (75% of deviation from 100)	1.1949		1.1912
Density Factor	7.53		7.56
Standard Available Seat Miles Flown Eligible 24+40 (000)	557,466		568,996
Rate per Standard Available Seat Mile Flown	$.014288		$.014229
Subsidy before Profit Sharing	$7,965,074	$131,170	$8,096,244

/1 Salt Lake City-Billings.

APPENDIX F

FRONTIER'S 1965 OPERATING EXPENSES OF

CONVAIR 580 AIRCRAFT

Frontier's 1965 Operating Expenses of
Convair 580 Aircraft

	Total Amount	Cost per Total Aircraft Block Hours
Operating Data		
Total aircraft flight hours	21,298	
% Block of flight	116.3	
Total aircraft block hours	24,770	
Flying Operations		
Crew Costs	$1,276,839	$51.55
Fuel Costs	990,733	40.00
Insurance	166,661	6.73
Other	25,464	1.03
Total	$2,459,697	$99.30
Depreciation and Obsolescence-Flight Equipment	$ 502,705	$20.29
Stewardess Expense	$ 209,918	$ 8.70
Direct Maintenance-Flight Equipment		
Airframe		
Labor		$ 8.61
Materials, Outside Repairs, Reserves		10.34
Engines		
Labor		2.83
Materials, Outside Repairs, Reserves		29.90
Other Flight Equipment		
Labor		1.59
Materials, Outside Repairs		6.88
Subtotal		
Labor		$13.03
Materials, Outside Repairs, Reserves		47.12
Total		$60.15
Applied Maintenance Burden-Flight Equipment (% of Direct Labor: 159%)	$ 533,474	$21.54

VITA

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