

**THE EFFECTS OF AIRLINE DEREGULATION ON
NORTH DAKOTA FARES AND SERVICE:
AN ECONOMIC ANALYSIS PREPARED FOR THE
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**Denver D. Tolliver, Research Associate
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UGPTI Staff Paper No. 18

March 1982

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**DENVER D. TOLLIVER, RESEARCH ASSOCIATE
DENNIS R. MING, RESEARCH ASSOCIATE**

**UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA STATE UNIVERSITY
P. O. BOX 5074
FARGO, NORTH DAKOTA 58105**

MARCH 1982

ACKNOWLEDGMENT

The completion of this study in a timely fashion was made possible, to a large extent, by the cooperation and assistance of Mr. Harold G. Vavra, Director of the North Dakota Aeronautics Commission. To Mr. Vavra, for his prompt replies for data and assistance, the authors wish to express their heart-felt gratitude and appreciation.

SUMMARY AND CONCLUSIONS

This report examines changes which have occurred in North Dakota airline fares and services since deregulation. The findings and summary conclusions of the analysis are presented below.

AirLine Fares

North Dakota airline fares were examined just subsequent to deregulation and again at February 1982 levels. Inflationary indices were constructed for comparable time-periods in order to isolate the effects of inflation on North Dakota fares. In addition, rates were developed for Minneapolis flights to similar destinations at 1978 and 1982 levels. These were compared to inflationary cost indices as well as to North Dakota fares. This three-way comparison allowed the identification of inflationary-justified increases in both markets, as well as a comparison of how rates had increased in one market as opposed to the other.

Airline Fares Have Increased More Than Proportionate to Inflation

Comparisons of North Dakota and Minneapolis fares to the Consumer Price Index indicates that fares in both markets have increased at a considerably higher rate than inflation. In the aggregate, North Dakota air fares from Bismarck and Fargo to major destinations have increased approximately 100 percent since deregulation. The 1978 rates, indexed to current levels to account for inflation, reflect only 40 percent of that increase. The remainder cannot be explained by inflation and must be assumed to constitute other pricing considerations.

North Dakota Fares Have Increased More Than Proportionate to Minneapolis Fares

Minneapolis fares, as well, have increased more rapidly than inflation. Again, the difference is considerable. Minneapolis fares, however, have increased less-than proportionate to North Dakota fares for similar destinations. Increases in the Minneapolis market, rather, have been considerably below increases in North Dakota fares, on the average (78 percent as compared to 106 percent and 99 percent for Bismarck and Fargo respectively). For major east coast destinations, the difference has been much more substantial as indicated by Table A.

SUMMARY TABLE A			
INCREASES IN NORTH DAKOTA AND MINNEAPOLIS FARES TO EAST COAST DESTINATION.			
	Percent Increase in Airline Fares From:		
	Bismarck	Fargo	Minneapolis
Washington, D.C.	118	111	79
New York	117	117	22
Miami	116	110	15

North Dakota Fares are Higher on a Per-Passenger-Mile Basis than Major Markets

North Dakota air fares were compared to fares from Minneapolis, Houston, Chicago, and Los Angeles, to 42 similar destinations. The fares were placed on a per-passenger-mile basis to account for distance differentials. The results indicate that North Dakota and Minneapolis markets may be disadvantaged relative to Houston, Los Angeles, or Chicago.

Coach fares from Houston and Los Angeles to the 42 destinations were considerably lower than either North Dakota or Minneapolis fares (Summary Table B). Discount fares, in addition, were lower from all three markets as compared to North Dakota or Minnesota fares. Coach fares from Houston and Los Angeles were, in fact, lower than discount fares from Bismarck, Fargo, or Minneapolis.

SUMMARY TABLE B		
PER-PASSENGER-MILE COSTS TO 42 MAJOR DESTINATIONS AT MARCH 15, 1982 LEVELS.		
Costs in Dollars per Passenger Mile		
	Coach Fare	Discount Fare
Bismarck	.231	.168
Chicago	.259	.106
Fargo	.245	.182
Houston	.162	.099
Los Angeles	.137	.099
Minneapolis	.250	.170

Different carriers are involved, and the densities of the routes are perhaps different. This comparison serves to illustrate, nevertheless, the relative position of North Dakota and Minneapolis routes as opposed to other markets, particularly in the area of discount fares which have evolved since deregulation.

Analysis of Coach and Discount Fares

Coach and discount fares were analyzed statistically for all six origins. Regression analysis was used to establish the relationship between fares and distances. Results of the analysis indicate that coach fares from Fargo, Minneapolis, and Bismarck are strongly

correlated to distance, while coach fares from Houston, Los Angeles, and Chicago are correlated considerably less to distance, and are probably more the result of route competition, densities, etc., rather than distance (Summary Table C).

SUMMARY TABLE C	
CALCULATED REGRESSION COEFFICIENTS FOR COACH FARE EQUATIONS FROM SELECTED ORIGINS.	
	R² (Coefficient of Determination)*
Bismarck	.77
Chicago	.34
Fargo	.84
Houston	.57
Los Angeles	.39
Minneapolis	.83

*The R² can range from a potential 0.00 to 1.00. The higher the R², the stronger the correlation, either positively or negatively. A zero R² indicates zero correlation between fares and distance. An R² of .999, on the other hand, indicates a very strong correlation between fares and distances. The R² value for the various origins indicates the relative degree of dependency between fares and distances for each.

Airline Service

Part II of the analysis concerns itself with the service-related impacts of airline deregulation. Here, changes in the frequency of service, the number of seats available, and the level of trunk-line service to North Dakota communities are considered.

The Frequency of Service has Increased for the State as a Whole

The frequency of service, as measured by the number of daily arrival and departure flights, has increased for the State as a whole. Including the newly-established service at Dickinson, flights have increased by 17 percent on a daily basis. Counting only those cities which had established airline service in November of 1978, the State has still gained in the frequency of flights: a 10 percent increase since deregulation.

Major Hub Service has Increased while Service at Intermediate Points has Declined

While the frequency of service has increased for the State as a whole, various routes and cities have been impacted differently. The number of daily arrival and departure flights between Fargo and Minneapolis has increased from 10 to 17 during the period from November 1, 1978 to February 1, 1982. Flights between Bismarck and Minneapolis were also increased. The number of flights between Fargo and Bismarck, however, declined considerably, dropping from 8 to 4 flights daily, a 50.0 percent decrease in service.

The analysis of North Dakota service levels supports, in general, the conclusion of earlier studies: that a rearrangement of route service patterns has occurred. Direct service to major hubs has been maintained or increased. Service at intermediate points, however, has declined. Back-and-forth accessibility has been diminished as more "fly-overs" or direct service to major hubs are evident.

The Number of Seats Per Day Has Declined Slightly Since Deregulation

The amount of available capacity, as measured by the number of seats per day, has declined since deregulation (Summary Table D). This decline, however, has not been precipitous, and may have been off-set, to a certain extent, by the increase in the

frequency of flights which has occurred. Thus, although capacity has declined, the greater frequency of flights may have resulted in a more desirable distribution of capacity than before.

SUMMARY TABLE D				
CHANGES IN CAPACITY AND THE FREQUENCY OF SERVICE SINCE DEREGULATION FOR COMMUNITIES WITH ESTABLISHED AIRLINE SERVICE.				
	November 1978	February 1982	Absolute Change	Percentage Change
Number of Seats Available	11,566	11,293	-273	-2.36
Daily Arrival and Departure Flights	122	135	+13	+10.65

SOURCE: North Dakota Aeronautics Commission.

Major Trunk-Line and Regional Airline Services has Declined

Prior studies have concluded that deregulation has hastened the withdrawal of certificated carriers from small communities and lesser-density routes. This contention appears to hold true in North Dakota, based on the data available.

Summary Table E depicts the changes in major trunk-line and regional air service to North Dakota communities which have occurred since deregulation. As the Table indicates, service by major trunk-line and/or regional carriers has decreased by over 28 percent since deregulation.

SUMMARY TABLE E				
CHANGES IN TRUNK-LINE AND REGIONAL AIR SERVICE TO NORTH DAKOTA COMMUNITIES AS MEASURED BY THE NUMBER OF DAILY ARRIVAL AND DEPARTURE FLIGHTS.				
	November 1978	February 1982	Absolute Change	Percentage Change
Northwest	24	28	+4	+16.67
Republic	56	30	-26	-46.62
Frontier	40	28	-12	-30.00
Total	120	86	-34	-28.33

SOURCE: North Dakota Aeronautics Commission.

In addition, two North Dakota communities have lost trunk-line or regional airline service altogether. Republic Airlines has pulled-out of Devils Lake, where service was provided in 1978, and Northwest has pulled-out of Jamestown. In both instances, however, commuter airline service has been established in these markets vacated by certificated carriers.

Commuter Airline Service Has Expanded Since Deregulation and Has Replaced Trunk-Line and Regional Air Service in Most Markets

The growth of commuter airline service has, to a great extent, served to off-set the withdrawal of certificated airline service and the retraction of route frequencies. Big Sky Airlines has established 51 flights in North Dakota since deregulation, including the origination of service at Dickinson. Big Sky has moved to replace the certificated carriers in the Grand Forks and Jamestown markets and to increase, in general, the degree of accessibility between North Dakota and the State Capitol.

The Effects of Deregulation on North Dakota have been Mixed

In conclusion, the effects of deregulation on North Dakota communities have been mixed, at best. In the aggregate, service levels appear to have been maintained. A shakeout, of sorts, has occurred, however, with more direct flights from Bismarck and Fargo to Minneapolis, but with diminished service between Bismarck and Fargo. This is consistent with the "consolidation of traffic through major hubs" theory, which was an expected result of deregulation. Commuter airline service, however, has helped to off-set the contraction of major trunk-line and regional airline service to smaller communities, and has heightened, in fact, the degree of accessibility between certain portions of the State.

The frequency of flights, in general, has increased but the amount of capacity has declined. This is due, in part, to the effect of commuter airline service, where more frequent flights but smaller aircraft are common.

With respect to airline fares, North Dakota appears to be negatively affected by deregulation. Fares have risen at a greater pace than inflation and have increased proportionately higher than have fares from Minneapolis to comparable destinations. Both North Dakota and Minneapolis, however, are disadvantaged relative to long-haul, higher-density markets such as Los Angeles and Houston. Coach fares from these cities are lower than discount fares from North Dakota origins to similar destinations.

Deregulation, in general, has not had a positive effect on North Dakota. Certain quality aspects of service may have improved. Others, however, have declined. Consumers may feel strongly about airline service one way or the other, depending upon the circumstances at their particular community. For the State as a whole, however, the gains and losses have somewhat off-set each other.

The major impact is in the area of rates. Here, the benefits of deregulation do not appear to be equally distributed among routes or regions of the country. Should this trend towards density or market pricing continue, areas of less-density such as North Dakota may find themselves at an increasing disadvantage relative to other markets.

The Lack of Certainty

One impact of deregulation which cannot be quantified is the lack of certainty involved. Just as there was no surety at the time deregulation was enacted regarding the distribution of its effects, there is no surety today concerning future airline rates and service levels. This lack of stability creates logistical uncertainties, in turn, for both public and private agencies which are heavily-dependent upon airline services and connections.

The future for these users cannot be predicted totally on the basis of past performance. As a consequence, these uncertainties will have to be internalized into the decisions of private firms and agencies.

I. INTRODUCTION

Deregulation of the airline industry, which occurred with the passage of the Airline Deregulation Act of 1978, was part of a broader movement to deregulate the transportation industries. In spite of this common bond, however, airline deregulation had its own specific set of goals and objectives, and associated industry-wide problems, which made it distinct from either motor carrier or railroad deregulation.

Although concerned with the financial viability of the industry, airline deregulation was primarily oriented towards the user of the system. Enhanced consumer welfare in the form of increased price competition and greater consumer choice between carriers, routes, and service levels was the major impetus for regulatory reform, not the economic well-being of the carriers themselves (although this was certainly a consideration).¹ Critics of industry regulation charged, in fact, that the Civil Aeronautics Board has been overly-protective of the industry and had helped to sustain inefficient carriers and inefficient operations, much to the detriment of the consuming public, which paid dearly for such costly service competition and route protection in the form of artificially high airline rates.

At the time of deregulation, it was not known exactly how rates and service levels in various markets would be affected. The whole or sum of the consumer benefits was projected in terms of greater price competition and reduced fares. Most of these projections, however, were geared towards the total benefits derived or benefits accruing in major markets. Although certain precautions were taken in terms of determining essential airline service, the degree of service benefits and/or rate reductions which were

¹This position was advanced by Martin T. Farris in an article entitled "The Multiple Meanings and Goals of Deregulation: A Commentary", Transportation Journal, Winter 1981, Vol. 21, No. 2.

achieved on the "spokes" of the route structure as opposed to the hubs, or at smaller communities which were off major airline routes, was not known. The framers of the legislation, in fact were only marginally-concerned with distribution of consumer benefits or the effects of deregulation on various parts of the country. The total of benefits or the primary markets were the major consideration.

Objectives of the Study

This analysis will attempt to isolate the effects of airline deregulation on North Dakota communities and surrounding territories. The study will attempt to assess both the absolute effects of deregulation on North Dakota communities as well as the relative effects which deregulation has had on North Dakota routes in comparison with air fares elsewhere.

Overview of the Analysis

The study consists of two major components. Part I of the study deals with the changes in airline fares which have occurred since deregulation and with the comparative level of airline fares along major air corridors. Here, North Dakota fares are compared to rates in other markets in order to establish some sort of comparative standards for North Dakota rates.

Part II of the analysis is concerned with the service-related impacts of deregulation. Here, changes in the frequency of service and the amount of available capacity at various cities are discussed.

Data Sources

The information used in this analysis was obtained from three primary sources: (1) the North Dakota Aeronautics Commission, which maintains service and rate statistics for routes within the State, (2) the Official Airline Guide, which contains flight and rate information for most airlines and cities, and (3) from the airlines themselves and/or local travel agencies.

The data consists primarily of: (1) the number of arrival and departure flights, (2) the type of equipment used, from which the number of available seats may be determined, and (3) rate and mileage information between origin and destination pairs. From this latter data, the number of revenue passenger miles along each route may be calculated.

II. AIRLINE PASSENGER FARES

This section contains analyses of various airline fares. A comparative analysis is presented that includes 1979 and 1982 air fares from both Bismarck and Fargo, North Dakota to several destinations. The analysis includes: (1) examining actual increases between 1979 and 1982; (2) indexing 1979 fares to December 1981 levels with both the CPI and PPI; and (3) comparing per passenger mile costs to the consumer for selected discount and coach fares. In addition, regression analysis was used to determine the statistical relationship between air fares and mileages for selected movements between Bismarck, Fargo, Chicago, Houston, Los Angeles, and Minneapolis to various destinations. Also, both coach and discount fares were compared between the six origins on a per passenger mile basis.

Data

Data used in the analyses consisted of air fares and mileages to various, but similar, destinations from Bismarck, Fargo, Chicago, Houston, Los Angeles, and Minneapolis. Fares used in the analyses were supplied by the North Dakota Aeronautics Commission and First International Travel, Fargo, North Dakota, and were supplemented with fares published in the Official Airline Guide.

Data pertinent to flights departing from Chicago, Houston, Los Angeles, and Minneapolis were included in the analyses for purposes of comparison. It was felt that these data would be representative of fares from high density markets and would provide a basis for comparison with light density routes characteristic of the Bismarck and Fargo markets.

Mileages were obtained from three sources. First, distances from Chicago, Houston, Los Angeles, and Minneapolis to the destinations examined were collected from a mileage schedule based on certified airline routes compiled in the Office Airline Guide. Second, mileages to various destinations for Bismarck and Fargo flights were supplied in part by the North Dakota Aeronautics Commission and were supplemented with mileages provided by the various airlines. In some instances, airline mileages were adjusted to take into account the specific routing of a particular airline.

Changes in North Dakota Airline Passenger Fares

Air fares from both Bismarck and Fargo to various destinations increased substantially from January 1979 to February 1982 (Table 1). Actual increases in one-way passenger fares from Bismarck varied from a low of eight percent for flights to Winnipeg, Manitoba, to a high of 134 percent for flights to both Fargo and Seattle. Flights leaving from Fargo increased from a low of 28 percent to Seattle, to a high of 134 percent to

Bismarck. As indicated in Table 1, a substantial portion of the fares increased by more than 100 percent. In fact, 13 out of 19 fares from Bismarck more than doubled between January 1979 and February 1982. Similarly, four additional fares were increased by more than 85 percent. Fares for nine of the 11 flights departing from Fargo increased by more than 100 percent during this same time period. Average fare increases for the Bismarck flights were 106 percent compared to 99 percent for Fargo flight.

TABLE 1. COMPARISON OF ACTUAL, CONSUMER PRICE INDEXED, AND PRODUCER PRICE INDEXED, ONE-WAY AIR FARES¹ FOR BISMARCK AND FARGO, NORTH DAKOTA, JANUARY 1979 AND FEBRUARY 1982.

WAY AIR FARES ¹ FOR BISMARCK AND FARGO, NORTH DAKOTA, CHICAGO							
		Dec. 1981*	Dec. 1981**		CPI/ 1-1-79	2-1-82/ CPI	2-1-82/ 1-1-79
		PPI	CPI		1-1-79	CPI	1-1-79
	1-1-79	Indexed	Indexed	2-1-82	Increase	Increase	Increase
Destination	Fare	Fare	Fare	Fare	(Decrease)	(Decrease)	(Decrease)
	DOLLARS				PERCENT		
From Bismarck to:							
Fargo ²	19	27	27	44	44	63	132
Fargo	38	54	55	89	44	62	134
Minneapolis	58	82	84	133	44	58	129
Chicago	87	124	125	193	44	54	122
Washington, D.C.	133	189	192	290	44	51	118
New York City	140	199	202	304	44	50	117
Miami	177	252	255	382	44	50	116
Billings	58	82	84	136	44	62	134
Seattle	110	156	159	253	44	59	130
Seattle ³	110	156	159	199	44	25	72
Denver	85	121	122	181	44	48	113
Phoenix	142	202	205	283	44	38	99
Phoenix ⁴	142	202	205	265	44	29	87
Dallas	136	193	196	269	44	37	98
Dallas ⁴	136	193	196	266	44	36	96
Winnipeg	52	74	75	56	44	(25)	8

TABLE 1. COMPARISON OF ACTUAL, CONSUMER PRICE INDEXED, AND PRODUCER PRICE INDEXED, ONE-WAY AIR FARES¹ FOR BISMARCK AND FARGO, NORTH DAKOTA, JANUARY 1979 AND FEBRUARY 1982.

		Dec. 1981*	Dec. 1981**		CPI/ 1-1-79	2-1-82/ CPI	2-1-82/ 1-1-79
	1-1-79	Indexed	Indexed	2-1-82	Increase	Increase	Increase
Destination	Fare	Fare	Fare	Fare	(Decrease)	(Decrease)	(Decrease)
	DOLLARS				PERCENT		
Kansas City, MO	92	131	133	189	44	42	105
Omaha	77	109	111	160	44	44	108
St. Louis	100	142	144	214	44	49	114
AVERAGE INCREASE						43	106
From Fargo to:							
Bismarck ²	19	27	27	44	44	63	312
Bismarck	38	54	55	89	44	62	134
Minneapolis	42	60	61	96	44	57	129
Chicago	75	107	108	167	44	55	123
Washington, D.C.	120	171	173	253	44	46	111
New York City	126	179	182	274	44	51	117
Miami	165	235	238	346	44	45	110
Billings	75	107	108	175	44	62	133
Seattle ⁴	161	229	232	206	44	(11)	28
Seattle	161	229	232	285	44	23	77
Denver	91	129	131	198	44	51	118
AVERAGE INCREASE						38	99

¹ Standard Fares

³ Special Fare

² 50% Discount

⁴ Via Minneapolis

* Calculated by multiplying December 1981 PPI (142.2) times individual 1-1-79 fares.
PPI was calculated using 1978 as the base year (1978 = 100).

** Calculated by multiplying December 1981 CPI (144.1) times individual 1-1-79 fares.
CPI was calculated using 1978 as the base year (1978 ÷ 100).

Inflationary Increases

Both the consumer price index (CPI) and producer price index (PPI) for transportation equipment were used to index January 1979 fares to December 1981 levels (Table 1). The index numbers were 144.1 and 142.2 for the CPI and PPI, respectively, using 1978 as the base year (1978 = 100). Since the CPI was only 1.33 percent higher than the PPI for transportation equipment, the subsequent analysis will focus principally on CPI indexed fares.

Flights departing from Fargo and Bismarck (with the exception of the Winnipeg flight), were subject to fares 23 to 62 percent higher in February 1982 compared to fares suggested by the CPI indexing procedure. In other words, if the airlines serving Fargo and Bismarck had increased air fares relative to the CPI, 1979 rates would have increased roughly 44 percent in all instances. However, actual increases in air fares averaged roughly 50 percent above indexed fares using the CPI. For example, the Bismarck to New York City one-way fare was \$140 in January 1979. If this fare had been increased concurrent with changes in the CPI, the fare would have been \$202 in February 1982. Actual increases in air fares resulted in a February 1982 fare of \$304, which was 50 percent above the CPI indexed price and 117 percent above the original fare. Consequently, the air fares examined from Bismarck and Fargo to the various destinations had been raised disproportionately compared to normal inflationary increases. These increases therefore, may be attributed, in part, to the fact that Bismarck and Fargo are light density markets compared to other major metropolitan centers in the United States such as Minneapolis.

Increases in Air Fares from Minneapolis

Air fares were also examined for various flights departing from Minneapolis. Destinations used in the analysis were the same destinations used in the Bismarck/Fargo analysis. However, the time series data are for October 15, 1978 and March 15, 1982 compared to January 1, 1979 and February 1, 1982 for the Bismarck/Fargo analysis. Since there are some "time" discrepancies with the two data bases, some caution should be exercised in drawing conclusions. However, since the time period differences are slight, basic relationships may be conclusive to a certain degree.

As was the case with both Bismarck and Fargo air fares, Minneapolis fares increased substantially between the two periods (Table 2). Rates increased 78 percent between October 1978 and March 1982 for the destinations examined. While these increases may be substantial, they were considerably less compared to increases in air fares for flights from Bismarck and Fargo (106 and 99 percent, respectively). Actual increases in air fares for the Bismarck and Fargo flights averaged 43 and 38 percent above the CPI indexed fares, respectively. Flights from Minneapolis on the other hand, increased 24 percent above CPI increases.

TABLE 2. COMPARISON OF ACTUAL AND CONSUMER PRICE INDEXED ONE-WAY AIR FARES FOR MINNEAPOLIS, MINNESOTA, OCTOBER 15, 1978 AND MARCH 15, 1982.

FARES FOR MINNEAPOLIS, MINNESOTA, CLEVELAND,						
		Dec. 1981		CPI/	3-15-82/	3-15-82/
		CPI		10-15-78	CPI	10-15-78
	10-15-78	Indexed	3-15-82	Increase	Increase	Increase
Destination	Fare	Fare	Fare	(Decrease)	(Decrease)	(Decrease)
	DOLLARS			PERCENT		
From Minneapolis to:						
Bismarck	58	84	133	44	58	129
Fargo	42	61	96	44	57	129
Chicago	54	78	115	44	47	113
Washington, D.C.	103	148	184	44	24	79
New York City	111	160	135	44	(16)	22
Miami	148	213	170	44	(20)	15
Billings	89	128	197	44	54	121
Seattle	140	202	302	44	50	116
Denver	85	122	171	44	40	101
Phoenix	131	189	200	44	6	53
Dallas	98	141	120	44	15	22
Winnipeg	59	85	119	44	40	102
Kansas City, Mo	59	85	125	44	47	112
Omaha	48	69	97	44	41	102
St. Louis	65	94	133	44	41	105
AVERAGE INCREASE					24	78

* Calculated by multiplying December 31, 1981 CPI (144.1) times individual 10-15-78 fares. CPI was calculated using 1978 as the base year (1978 = 100).

Differential Pricing

Regular air fares are typically based on a class system with many airlines offering fares for both "coach" and "first class" service. However, in an attempt to utilize unused capacity, many airlines offer additional rates that are substantially lower than either coach or first class. These promotional fares are a form of multi-part pricing based on demand or value of service and theoretically are offered in an attempt to tap sources of traffic that are on the lower portion of the demand curve. However, in order for the fares to work effectively (raise revenues), they must not divert too much traffic from first class and/or coach. Thus, in order to qualify for discount fares, passengers must frequently purchase tickets well in advance of the flights and abide by certain restrictions.

Discount fares often offer passengers substantial savings relative to standard coach fares. These savings were examined for flights departing from the six origins based on March 1982 data (Table 3). Savings on discount fares were fairly equal for all locations with the exception of Chicago. Passengers boarding at Fargo, Bismarck, and Minneapolis saved 25, 27, and 32 percent, respectively, on discount fares compared to coach fares. Passengers from Chicago, on the other hand, saved an average of 56 percent on discount fares. It should be noted that while discount fare savings from Houston and Los Angeles were comparable with savings at Bismarck and Fargo, the coach fares from Houston and Los Angeles were at lower "per passenger mile" levels (see later section on Per Passenger Mile Costs of Air Fares). Consequently, passengers from Bismarck and Fargo may not be receiving discount fare savings at comparable levels to the other origins.

TABLE 3. PERCENT SAVINGS, DISCOUNT FARES VERSUS COACH FARES, MARCH 1982.

Origin	n	Mean Value	Minimum Value	Maximum Value
	PERCENT			
Bismarck	42	27	-4	65
Fargo	42	25	-8	65
Chicago	41	56	-4	70
Houston	39	26	-5	59
Los Angeles	41	22	-9	60
Minneapolis	42	32	0	60

Statistical Analysis of Rates

Regression analysis was used to determine the statistical relationship between air fares and mileage. Representative air fares from the six origins were regressed against distances to selected cities in the United States. Coach and discount fares were examined. It was hypothesized that coach fares from all six origins would be equally dependent on distance. By this, it is meant that coach fares should increase proportionately with distance regardless of origin. On the other hand, however, it was hypothesized that discount fares from the six locations would not be as dependent on distance. In other words, exogenous factors such as market elasticity, traffic density, etc., and not distance, may become increasingly important explanatory variables. Intuitively, this is logical since economies may be gained on longer hauls and higher density routes versus shorter hauls and lower density routes. Obviously, a nonstop flight from Los Angeles to Washington, D.C., would be more cost effective than a similar flight with an intermediate stop in Chicago. Similarly, a flight from Fargo to Washington, D.C., with a stop in Minneapolis would not be as cost effective as a nonstop transcontinental flight.

The general form of the linear regression model was:

$$AF = a + b (D)$$

where: AF = air fare (regular or discount)

D = distance of the flight

a = constant regression parameter

b = slope regression parameter

If air fares (AF) are statistically dependent on distance (D), the coefficient of determination (R^2) will approach one. For example, an R^2 equal to one would indicate that distance is the sole factor contributing to the variation in air fares. Conversely, an R^2 equal to .50 would indicate that other factors contribute to the variation in air fares. Stated differently, R^2 is the proportion of the total variation in AF explained by the regression of AF on D. Therefore R-squares of one and .50 indicate that 100 percent and 50 percent of the variation in air fares are explained by distance, respectively.

Statistical Results

It was originally hypothesized that coach fares from the six origins would be largely dependent on distance. In other words, a particular coach fare would be expected to increase proportionately with distance. Discount fares, on the other hand, were hypothesized to be less dependent upon distance and were thought to result from other forms of pricing considerations.

Results of regression analysis indicated that coach fares were more dependent on distance than discount fares for Bismarck, Fargo, and Minneapolis flights (Table 4). Coach fares for flights from Chicago, Houston, and Los Angeles proved to be less dependent on distance than discount fares. For example, regressions on fares from

Bismarck, Fargo, and Minneapolis yielded R-squares of .77, .84, and .83, respectively for coach fares and .37, .28, and .53, respectively for discount fares. R-squares for coach rates from Chicago, Houston, and Los Angeles were .34, .33, and .39, respectively, and .65, .57, and .54, respectively, for discount fares. These results indicate that coach fares from North Dakota and Minneapolis may be priced based largely on cost of service (assuming the cost of air service is related to distance), while coach fares from the other three origins may be priced based on other factors such as competition and traffic density. These low coach fares, therefore, may be priced below the cost of service and may be subsidized by other routes where fares may be priced considerably above costs. A good indication of this cross-subsidization may be identified by examining fares on a per passenger mile basis. Although not conclusive (especially since air costs for the different routes were not available), routes that have high per passenger mile costs may, in part, subsidize routes with low per passenger mile costs.

TABLE 4. CALCULATED REGRESSION COEFFICIENTS OF VARIOUS AIR FARE EQUATIONS FOR FLIGHTS ORIGINATING IN BISMARCK, FARGO, CHICAGO, HOUSTON, LOS ANGELES, AND MINNEAPOLIS, 1982.

Equation Number	Origin	Type of Fare	Regression Parameters*		R ²
			Intercept	Slope	
1	Bismarck	Coach	89.7 (15.6)	0.150 (0.013)	.77
2	Bismarck	Discount	76.8 (25.0)	0.099 (0.021)	.37
3	Fargo	Coach	84.4 (11.6)	0.156 (0.010)	.84
4	Fargo	Discount	93.4 (22.9)	0.085 (0.021)	.29
5	Chicago	Coach	87.1 (13.8)	0.075 (0.017)	.34

TABLE 4. CALCULATED REGRESSION COEFFICIENTS OF VARIOUS AIR FARE EQUATIONS FOR FLIGHTS ORIGINATING IN BISMARCK, FARGO, CHICAGO, HOUSTON, LOS ANGELES, AND MINNEAPOLIS, 1982.

Equation Number	Origin	Type of Fare	Regression Parameters*		R ²
			Intercept	Slope	
6	Chicago	Discount	39.6 (7.0)	0.071 (0.008)	.65
7	Houston	Coach	71.5 (23.1)	0.089 (0.020)	.33
8	Houston	Discount	43.6 (10.3)	0.063 (0.009)	.57
9	Los Angeles	Coach	34.0 (42.8)	0.115 (0.023)	.39
10	Los Angeles	Discount	71.6 (13.4)	0.05 (0.007)	.54
11	Minneapolis	Coach	66.1 (10.6)	0.158 (0.012)	.83
12	Minneapolis	Discount	61.2 (12.2)	0.088 (0.014)	.53

* Standard errors of the estimated coefficients are listed in parentheses.

Per Passenger Mile Costs of Air Fares

Air fares from the six origins to 42 destinations were compared on a per passenger mile basis (Table 5). Per passenger mile figures did not vary significantly between Bismarck, Fargo, and Minneapolis. However, coach fares from Houston and Los Angeles and discount fares from Chicago, Houston, and Los Angeles were all considerably lower compared to North Dakota and Minneapolis fares. In fact, coach fares from Houston and Los Angeles were lower on a per passenger mile basis, than discount fares from Bismarck, Fargo, and Minneapolis.

Los Angeles had the lowest per passenger mile costs of any origin for both coach and discount rates. This may be partially due to the fact that these flights were generally longer in distance. If economies of longer haul exist in the airline industry, these lower rates may be an indication of this relationship.

TABLE 5. MEAN, MINIMUM, AND MAXIMUM PER PASSENGER MILE COSTS FOR 42 FLIGHTS* FROM BISMARCK, FARGO, CHICAGO, HOUSTON, LOS ANGELES, AND MINNEAPOLIS 1982.								
	Coach Fares				Discount Fares			
Origin	Mean Value	Minimum Value	Maximum Value	n	Mean Value	Minimum Value	Maximum Value	n
	\$/PASSENGER MILE				\$/PASSENGER MILE			
Bismarck	.231	.170	.344	42	.168	.089	.231	42
Fargo	.245	.174	.310	42	.182	.094	.283	42
Chicago	.259	.051	.932	42	.106	.028	.396	41
Houston	.162	.066	.255	42	.099	.060	.267	39
Los Angeles	.137	.051	.218	42	.099	.060	.267	41
Minneapolis	.250	.137	.386	42	.170	.102	.296	42

* The number of observations (n) will not always total 42 since discount fares were not available for all flights.

It is obvious to see that consumers in the North Dakota and Minneapolis markets are disadvantaged relative to consumers in the Chicago, Houston, and Los Angeles markets based on per passenger mile costs of air service. While reasons for this disparity may vary, it is apparent that the Chicago, Houston, and Los Angeles markets are characterized by high density traffic and a large number of competing firms. Conversely, the North Dakota markets are lower density routes and do not have a large number of competing firms.

The fact that per passenger mile costs from Bismarck and Fargo did not vary significantly compared to the Minneapolis market is some-what surprising. However, since the majority of these flights ultimately are routed through Minneapolis it is apparent that the fares are highly correlated to the Minneapolis fares.

Summary

Air fares from Bismarck and Fargo increased substantially from January 1979 to February 1982. Fares increased approximately 100 percent for both Bismarck and Fargo flights. These increases were considerably higher than inflationary increases. Based on CPI indexed prices, actual increases were 43 and 38 percent above inflationary increases for Bismarck and Fargo flights, respectively. Increases in fares for similar flights from Minneapolis were not as substantial. For example, actual increases were 78 percent for the time period analyzed and were 24 percent above CPI indexed fares.

Regression analysis indicated that coach fares from Bismarck, Fargo, and Minneapolis were predominately dependent on distance. Discount fares, on the other hand, were less dependent on distance indicating that some form of differential pricing was used in setting these fares. Both traffic density and competition were likely variables contributing to the level of these discount fares.

Coach fares for flights from Bismarck, Chicago, Fargo, and Minneapolis were fairly consistent on a per passenger mile basis. Similarly, discount fares were fairly uniform for Bismarck, Fargo, and Minneapolis flights. Houston and Los Angeles had substantially lower coach and discount fares compared to the North Dakota and Minneapolis routes. Also, discount fares from Chicago were relatively low. Consequently, airline deregulation

has not been disadvantageous to the North Dakota markets relative to the Minneapolis market. However, high density markets such as Chicago, Houston, and Los Angeles, offer substantially lower rates (coach and/or discount) in terms of per passenger mile costs.

A limitation of the analyses presented in this section is that many of the North Dakota flights examined are routed through Minneapolis. Fares from Bismarck and Fargo may be highly correlated to Minneapolis fares. Hence, in order to effectively compare the routes, specific data should be gathered on flights that are not routed through the Minneapolis market.

III. SERVICE-RELATED EFFECTS OF DEREGULATION

In addition to price-related effects, airline deregulation may have resulted in service-related changes for the State as a whole or for various classifications of cities within the State. This section of the analysis will concern itself with these changes, and attempt to measure, to the extent possible, the service trends which have developed since deregulation.

Background

Much of the recent concern which has surfaced over deregulation centers on the effects which deregulation may have on service levels to small towns and lighter-density routes. In general, it has been hypothesized that capacity, as measured by the number of available seats may have declined, in addition to the absolute frequency of service. A comparative study, however, of the changes in service levels to small communities through March of 1980 showed more of mixed-bag of results, than any major disintegration of airline service.

In a study conducted by Stephenson and Beier (1981),² 102 Communities were studied, representing a cross-section of small towns which had either major trunk-line or local airline service prior to deregulation. The Stephenson-Beier study concluded that: (1) there was an absolute decline in the existing level of airline service to small towns and communities as measured by the number of direct flights per week, (2) the amount of capacity provided, as measured by the number of available seats per week, declined, (3) service to hub airports has been maintained, (4) deregulation has accelerated the withdrawal of certified trunk-line carriers from small communities, and (5) that the emergence of commuter airlines appears to have facilitated competition at small towns and intermediate points.

The conclusions of the study in general were that while airline service to small communities has been negatively impacted by deregulation, the impacts were not considered to be major in scale, and the positive effects of commuter airlines have off-set, to a certain extent, the negative changes in service levels and capacity.

Methodology

This analysis will look-at the service-related impacts of deregulation on North Dakota communities along the same general lines as those pursued in the Stephenson-Beier study. The frequency of service, airline capacity, the type of carrier providing the service, as well as the number of carriers serving the market will all be considered.

²Stephenson, Frederick, J. and Frederick J. Beier, "The Effects of Airline Deregulation on Air Service to Small Communities", Transportation Journal, Summer 1981, Vol. 20, No. 4.

Changes in airline service are generally not as readily quantifiable as changes in the rate structure. There are certain measures of service levels or proxies, however, which may be used to gauge the changes in service levels which have occurred.³ The first of these is the frequency of service.

The Frequency Variable

The frequency of service is the most thought-of variable in terms of measuring airline service. The frequency variable, admittedly, cannot measure certain quality aspects of service, such as the time-attractiveness of flights or the range of destinations served. Together with the amount of available capacity, however, the frequency variable may be used as a suitable proxy for the absolute level of airline services to each community.

Table 6 shows the number of daily arrival and departure flights at each North Dakota city, just subsequent to deregulation and again at February 1982 levels. As Table 6 indicates, most North Dakota communities have enjoyed an increase in the number of arrival and departure flights since November 1978.

TABLE 6. DAILY ARRIVAL AND DEPARTURE FLIGHTS FOR NORTH DAKOTA CITIES.				
	November 1978	February 1982	Absolute Change	Percentage Change
Bismarck	34	38	+4	+11.76%
Devils Lake	4	8	+4	+100.00%
Fargo	32	32	0	0
Grand Forks	24	20	-4	-16.67%

³In analyzing time-series changes, it is impossible to isolate in totality the effects of deregulation from other changes brought-about by broader economic forces. The effects of inflation may be controlled-for in rate structure analyses. Changes in service levels, however, may be influenced by changes in technology, managerial policy, and general economic conditions which may or may not have occurred in the absence of deregulation. While this is recognized, it cannot be controlled-for.

TABLE 6. DAILY ARRIVAL AND DEPARTURE FLIGHTS FOR NORTH DAKOTA CITIES.				
	November 1978	February 1982	Absolute Change	Percentage Change
Jamestown	4	8	+4	+100.00%
Minot	14	10	-4	-28.57%
Williston	10	19	+9	+90.00%
TOTAL ALL CITIES	122	135	+13	+10.65%

Devils Lake and Jamestown have doubled the number of arrival and departure flights. Dickinson, which did not have established airline service in 1978, now has 8 daily arrival and departure flights. Williston, as well, has enjoyed a substantial increase in the number of flights per day, with Bismarck showing a smaller percentage increase and Fargo maintaining the same number of arrival and departure flights since 1978.⁴

Of the North Dakota communities with established airline service, only two have suffered a decline in the number of daily arrival and departure flights since 1978 (Grand Forks and Williston). For the State as a whole, the number of daily arrivals and departure flights has increased by 17 percent. Excluding the newly-established service at Dickinson, the State has realized a gain of over 10 percent in the number of daily arrival and departure flights at locations which were served prior to deregulation.

As noted above, however, the frequency of service does not, in and of itself, paint a complete picture regarding changes in service levels which have occurred. The number of available seats must still be considered. In addition, there is the question of which sets of destinations are served and how accessibility between city pairs has been affected.

⁴This comparison does not reflect changes in service which may have occurred since February 1982.

Changes in Service Levels Along Various Routes

Stephenson and Beier concluded that service between small cities and major hubs had been relatively maintained. They suggest that a "shakeout" of sorts had occurred where there was a "general consolidation" of traffic through major hubs.⁴

The data for North Dakota are generally-supportive of this conclusion. Service appears to have improved, in fact, between North Dakota's major airports and Minneapolis. Service along the "spokes" of the hub, however, has been impacted in a different manner.

Fargo, for example, has retained the same level of service, as measured by the number of daily arrival and departure flights. The number of flights between Fargo and Minneapolis, both arrival and departure, has increased from 10 to 17 during the period from November 1, 1978 to February 1, 1982. Bismarck, as well, appears to have maintained its previous level of service to and from the Minneapolis market. Service levels between Bismarck and Fargo, however, have declined over the 40-month period. The number of arrival and departure flights has been dropped from 8 to 4 daily and time schedules have been rearranged as well.

The trend thus appears to be one of market consolidation resulting from a shakeout as suggested by Stephenson and Beier. Direct service to Minneapolis has increased along North Dakota's major air corridors. Service at intermediate points has declined. Back-and-forth accessibility has diminished. More "fly-overs" or direct flights to the major market are evident.

⁴This comparison does not reflect changes in services which may have occurred since February 1982.

Available Capacity

The number of seats available is one measure of capacity provided to various communities. The number of available seats is not a utilization factor. The measure says nothing of the amount of seats filled or whether or not in fact, capacity is adequate or inadequate. The number of seats available is simply a proxy for monitoring the changes in the amount of capacity made available at various locations since November 1, 1978.

Stephenson and Beier's concluded the number of available seats at the 102 Communities studied had declined since deregulation. This conclusion was hedged, however, because the frequency of flights in some instances had increased. Stephenson and Beier's felt that this resulted in a better distribution of capacity throughout the week for some of those communities studied. So the usefulness of this conclusion is somewhat limited.

Data with respect to the amount of seats available at North Dakota communities have been provided by the State Aeronautics Commission. This data, presented in Table 7, tends to support the original conclusion of Stephenson and Beier's that the amount of available capacity has declined in lighter-density markets subsequent to deregulation. For the State as a whole, those cities which had established airline service in November of 1978 lost collectively 273 available seats, or 2.36 percent of their previous capacity. With the addition of service at Dickinson, however, the loss becomes less apparent. Including the 136 seats added, existing capacity declined by only 1.18 percent, however, over the 40-month period under study.

TABLE 7. CHANGES IN CAPACITY AVAILABLE AT NORTH DAKOTA CITIES				
	1978 Seats Per Day	1982 Seats Per Day	Absolute Change	Percentage Change
Bismarck	3,122	3,324	+202	+6.47%
Devils Lake	192	136	-56	-29.17%
Fargo	3,624	3,944	+320	+8.83%
Grand Forks	2,624	2,266	-358	-13.64%
Jamestown	512	136	-376	-73.44%
Minot	1,322	1,156	-166	-12.56%
Williston	170	331	+161	+94.7 %
TOTAL FOR STATE	11,560	11,293	-273	-2.36%

This seems compatible with the results of the Stephenson-Beier's study. North Dakota cities appear to have suffered a decline in existing capacity. The decline, however, is not of major proportions when viewed in the aggregate. Also, it must be noted that North Dakota cities collectively realized a gain in daily arrival and departure flights. Thus, capacity may be somewhat more appropriately distributed over a greater number of flights, as suggested by Stephenson and Beier's.

Withdrawal of Certificated Carriers

Stephenson and Beier's found that deregulation had "accelerated" the withdrawal of certificated carriers from small cities and lesser-density routes. This conclusion was couched by the suggestion that withdrawal would have occurred anyway. Deregulation only served to speed-up the process.

Looking at North Dakota communities, this thesis appears to hold true as well. North Central (Republic) has pulled-out of Devils Lake, where service was provided in 1978, and Northwest has pulled-out of Jamestown. This was an anticipated result of relaxed exit controls and does appear to have disrupted service connections as in both instances, Big Sky Airlines has moved to replace trunk-line carrier service in these markets.

One result of the loss of trunk-line service has been a loss of capacity at both locations (Table 8). However, the number of flights daily has increased. As a consequence, the amount of capacity may be better distributed across a greater number of flights, as suggested earlier. If capacity is indeed adequate at these two locations then the additional frequency of flights should somewhat offset the decline in capacity.

TABLE 8. CHANGES IN FLIGHT FREQUENCIES AND CAPACITY AT COMMUNITIES LOSING TRUNK-LINE AND/OR REGIONAL AIR SERVICE.		
	Change in Flight Frequency	Change in Seats Available
Devils Lake	+4	-56
Jamestown	+4	-376

The Emergence of Commuter Airline

Since deregulation, the growth of commuter airline service to small communities has increased substantially. Commuters have replaced certificated carriers in many small communities, and, as Stephenson and Beier's noted, have increased the frequency of flights at specific locations. This is particularly true of North Dakota, where Big Sky Airlines has established 51 flights since November 1975: 13 at Williston, 12 at Bismarck, 8 each at Devils Lake and Jamestown, and 2 at Grand Forks.

The most notable route addition has been the establishment of daily service between Bismarck and Dickinson. Big Sky Airlines has instituted a flight schedule consisting of 3 arrival and departure flights daily. Big Sky, in general, has moved to increase the degree of accessibility between Western North Dakota and the State Capitol since deregulation.

Summary of Service-Related Impacts

Service-related impacts are more difficult to quantify than changes in the rate structure. Based on the data available, however, certain conclusions may be drawn.

Existing capacity has declined for the State as a whole. The frequency of flights, however, has risen, tending to off-set, to a certain extent, capacity declines. This is explained, in part, by the growth of commuter airline service, which is characterized by more frequent flights in smaller aircraft.

Deregulation appears to have accentuated the withdrawal of certified carriers from markets of less-density. Both Jamestown and Grand Forks have lost certificated carrier service. The number of certificated carrier daily arrival and departure flights for the State, as a whole, has decreased. Commuter airline service has moved to supplement certificated carrier service in these markets.

In general, access to major hubs has been maintained or enhanced since deregulation. Back-and-forth accessibility between intermediate points has diminished on the spokes, however, a consolidation of traffic through major hubs appears to be occurring.

IV. OTHER CONSIDERATIONS

This report has attempted to assess the impacts of deregulation on North Dakota markets. Based on the data available, certain conclusions have been drawn regarding changes in airline service and rate levels since deregulation.

Certain areas were not addressed in this analysis because of data accessibility and time-constraints involved. Airline costs for route segments were not developed, nor were measures of utilization, such as load-factors, considered. Segment densities, the type of aircraft operated, the load factors and the airlines involved, can all affect the cost-of-service, and, as such, influence the rate structures which have evolved. Such data, however, were beyond the scope of this study, and to the extent which they are relevant, must be considered as limitations on the study.

Certain quality aspects of service, as well, could not be included in the study. The time-attractiveness of flights; the percentage of non-stop as opposed to route flights, which stop at intermediate destinations; and factors such as space, comfort, and in-flight service were not considered. Safety-related aspects, in addition, were not included. To the extent that these are relevant service criteria, they must also act as constraints against the scope of the analysis.

Because of these other considerations, the present study must be considered limited in certain of its aspects. The study shows the need, however, for further, more detailed research in this area, particularly in the analysis of specific route densities and airline costs. It is only through the establishment of route-specific costs that the presence or absence of cross-subsidization and/or differential pricing may be conclusively established.