Effects of Airline Deregulation on Profitability

by Lee J. Van Scyoc

ABSTRACT

This paper investigates the effects of the Airline Deregulation Act of 1978 on the airline industry's profits. Since regulation diverted carrier rivalry into cost-increasing service competition, deregulation should not have affected profits significantly, provided increased carrier efficiency was reflected in sufficiently lower airline fares. Using a two-stage regression model, industry profits were not found to have been affected to any appreciable extent by deregulation.

I. Introduction

One of the functions of the Civil Aeronautics Board (CAB) was to regulate fares in such a way that the airline industry would have a "fair rate of return." A resulting concern about deregulation was its impact on profitability in the industry[1]. Without CAB oversight of the industry, would cutthroat competition lead to the bankruptcy of many carriers? If losses resulted, would carriers be driven from the industry and allow a monopolistic market structure to develop?

Table 1 provides different measures of yearly profits for the industry. Observing the table indicates, first, that airlines' profits have vacillated greatly, both before and after deregulation. A second observation is that profits increased in 1977[2] and 1978; however the profits quickly disappeared. Some placed the blame of these financial difficulties on deregulation[3]. The question explored in this paper is how has deregulation affected profits in the airline industry?

II. Models of Non-price Competition

Stigler stated that when a uniform price was set and other terms of sale were unregulated, then any economic profits would disappear in the long-run[4].

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TABLE 1
AIRLINE ANNUAL PROFITS, 1964-1985

Year	Nominal Rate of Return	Real Rate of Return	Net Profit Margin	Net Profit or Loss[a]
1964	9.8	6.251	5.3	223172
1965	12.0	8.046	7.0	367119
1966	10.9	6.019	7.4	427633
1967	7.6	3.279	6.1	415388
1968	4.9	-0.439	2.7	209952
1969	3.3	-3.377	0.6	52723
1970	1.2	-5.258	-2.2	-200503
1971	3.5	-0.848	0.0	28006
1972	4.9	0.829	1.9	214850
1973	5.1	-1.941	1.8	226693
1974	6.4	-1.486	2.2	321641
1975	2.5	-3.338	-0.5	-84204
1976	8.0	3.011	3.2	563354
1977	10.9	5.635	3.8	752536
1978	13.0	5.779	5.2	1196537
1979	7.0	-3.041	1.5	409246
1980	5.8	-5.706	0.1	17414
1981	5.3	-8.729	-0.6	-236842
1982	2.7	-7.986	-2.5	-915814
1983	5.9	-2.730	-0.5	-188051
1984	9.9	0.320	1.9	824668
1985	9.8	2.120	1.8	862715
1986	5.2	-0.780	-0.5	-234909

Source: Air Transport Association, *Air Transport,* Washington, D.C., Various Issues.
[a]/ in thousands of dollars.

Firms in the industry would compete with the non-price items, which would drive up cost and cause the economic profits to diminish.

Douglas and Miller set forth a similar model to the airline industry[5]. Three propositions emerge from an examination of their model. First, there was no price competition; carriers viewed price as given. Second, the CAB strictly controlled entry. Third, while the CAB controlled price and entry, it did not limit service competition, particularly capacity.

Douglas and Miller saw the airline market operating as an oligopoly. With the aid of the CAB, the industry acted as a cartel. Economic theory would

imply that economic profits should be made from the cartel and that the cartel could make sure no one cheated since fares had to be published and the airlines had to adhere to the published fare. In reality, however, the industry did not receive economic profits in the long run. The reason was that nonprice completion, in the form of increasing services, tended to alter the average cost per passenger carried, so that average cost tended to equal price.

To test this cartel behavior of nonprice competition, Douglas and Miller compared the actual load factor (ALF) with the break-even loan factor (B-ALF). If ALF is greater than B-ALF, then the capacity should increase which would increase carriers' average cost. The study found that ALF and B-ALF were equal to each other in the long run, while in the short-run the two measures move toward each other with ALF leading B-ALF. Thus, the airlines will operate at zero economic profits in the long run. If profits were to increase by changes in technology or by price increases, the profits would quickly be eroded away by carriers increasing capacity, which would decrease the ALF.

Using the Stigler and the Douglas and Miller models to predict the effect of deregulation, there should be no excess profits in the long run if the industry is characterized by competition. Thus, the airline industry should not experience any change in profits after deregulation. However, nonprice competition would be replaced by the more efficient price competition. There is evidence that since deregulation, carriers do compete primarily by price[6].

III. Review of Previous Studies

A study by Brenner, Leet, and Schott[7] investigated the effects of deregulation on profitability. In reporting the profits or losses[8] for the years 1950 through September 1984, they found that profits were lowest during the period of deregulation. The average profit or loss for the grouped years is summarized in Table 2. The airlines' profitability was starting to increase in mid-1983 but Brenner, Leet, and Schott did not know if this change would continue.

The following reasons were given for the low profits during the deregulation period. First, the economy was in a recession or had low economic growth during most of that deregulated period, and air travel is sensitive to the condition of the economy. A second contributing factor to the low profits was the rising fuel cost as shown in Table 3. The years 1979 and 1980 saw very large increases in fuel cost. Interest rates also increased during this period. These two factors caused the cost per seat-mile to rise rapidly. Third, the pricing policy of the airline industry could have caused profits to be low since deregulation. While costs were increasing, it would seem that fares should also

TABLE 2
AVERAGE OPERATING PROFIT/LOSS AS A PERCENT OF REVENUE

1950-1956	9.0%
1957-1962	3.6%
1963-1968	10.4%
1969-1978	3.9%
1979-1983	0.8%

Source: M.A. Brenner, J.O. Leet, and E. Schott, *Airline Deregulation,* Eno Foundation Inc., Westport, Connecticut, 1985, p. 52.

have increased so as to offset the rising costs. However, there were many fare wars causing fares to decline. After looking at profits for each carrier, the authors reported that those carriers with a higher yield did financially better.

To summarize, their study stated that the recession, fuel cost, and low fares were the major causes of the financial stress. The report further stated: "It is impossible to dissect the results and arrive at any precise methematical breakdown of the degree of contribution of each element to the overall airline result[9]."

The analysis of Gomez-Ibanez, Oster and Pickrell came to different conclusions from Brenner, Leet, and Schott. Gomez-Ibanez, Oster and Pickrell contend that deregulation really started in 1977 when airlines were given the freedom by the CAB to change fares within a given range. When fares were given some flexibility, airlines' earnings increased. It was not until the middle of 1979 that earnings declined. They attribute the decline in profits to the rapid increase in fuel cost and the recession. To test if deregulation affected the industry, they estimated a demand model for air travel. Once the demand model was estimated, they calculated what demand would have been if the economy had grown at a normal rate. With the increase in the predicted demand, they estimated what the additional cost would have been with the extra passengers. Also, in estimating cost, they controlled for the rising fuel cost by calculating what the fuel cost would have been if it had increased at the same rates as in past years.

When considering the additional revenues from the added passengers and the extra cost associated with these passengers, as well as cost saving from fuel, they predicted that the industry's financial condition would have improved. In fact, they predicted higher profits for 1979 and profits for 1980 and 1981 instead of losses that actually occurred. While these results would indicate that deregulation had not been responsible for the industry financial

TABLE 3
AIRLINE FUEL COST INDEX
(1978-1986)

Year	Fuel Index	Percent Change
1978	339.9	- 2.78%
1979	494.9	45.86
1980	770.3	55.65
1981	892.2	15.83
1982	841.8	- 5.65
1983	762.0	- 9.48
1984	729.1	- 3.04
1985	689.6	- 5.23
1986	472.4	-31.50

Source: *U.S. Statistical Abstract,* "Airline Cost Index" various issues.

problems, deregulation may have caused certain carriers' financial stress.

Studying the pattern of losses, one would expect to find carriers with the largest losses in markets that had the most price competition. The airlines that should face the most competition are the carriers in the long-haul markets. However, if there was destructive competition, pricing below average cost, caused by the fare wars, then losses should be widespread throughout the industry.

The authors compared eight short-haul carriers with seven long-haul carriers. The results indicate that the operating expense/ operating revenue ratios were lower for the short-haul carriers than the long-haul carriers. Also, operating losses were realized for the long-haul carriers in 1979 through 1981, while, during the same period, short-haul carriers showed profits. Their findings demonstrated that the financial losses were basically restricted to markets where competition was the most intense and widespread. Thus, destructive competition was not present.

A major drawback with Gomez-Ibanez, Oster and Pickrell's study was the limited available data. They used data through 1981. However, the CAB still had limited control of fares and thus it would be difficult to measure the full impact of deregulation. The limited data since deregulation caused them to speculate what profits "would have been" if the growth of the variables for the economy and fuel cost were consistent over time.

Morrison and Winston came to similar conclusion as Gomez-Ibanez, Oster, and Pickrell. They studied the welfare effects of deregulation by looking at changes in both passenger and carrier welfare. To find the change in carriers

welfare, they estimated what the industry's profits would have been in 1977 (the last regulated year) if the industry were deregulated. Using a linear regression equation to predict operating margin, they found that average wage, fuel price, cost of capital, and flight stage length were statistically significant and all had a negative coefficient. Average fare, total departures, and load factor were also statistically significant, with each variable having a positive effect on the operating margin. They found that predicted profits if deregulated in 1977 were higher than actual profits in 1977. Thus, they concluded that deregulation would increase profits.

The above studies offer different explanations of the financial condition of the industry. The Brenner, Leet, and Schott study stated that the airline industry between 1978 and 1983 has been less than profitable: "Clouded by sharply increased fuel prices and economic recession, it is impossible to determine what amount of fault can be attributed to deregulation[10]." William Leonard agrees that the difficulty of determining the effects of the Airline Deregulation Act on airline profitability is attributable to the sluggish economy and rising fuel cost[11]. Bailey, Graham, and Kaplan saw that the operating profit margin declined since 1978. They attributed part of this decline to rising fuel prices and the sluggish economy. "Thus it is not clear that industry profitability would have been substantially different had the industry remained regulated[12]."

The following is a proposed method of mathematically breaking down the factors that have affected the profitability of the airline industry. This proposed model will test the Stigler and the Douglas and Miller models to determine the effects of deregulation.

IV. The Model

Profit is defined as the difference between total revenue and total cost,

$$\pi = TR - TC \tag{1}$$

The level of profits would depend on the size of the industry. Therefore, it would be expected that the profit level has increased over time because the airline industry has increased over time. To standardize profit, net profit margin is used, which is defined as net profits divided by total revenues. Equation one now becomes,

$$\frac{\pi}{TR} = 1 - \frac{TC}{TR} \tag{2}$$

Total cost can be computed as the price of labor (w) times the amount of

labor (N) plus the price of fuel (f) times the amount of fuel used (F) plus the price of capital (i) times the amount of capital (K) plus the price of other inputs (o) times the amount of these inputs (O). Thus,

$$TC = wN + fF + iK + oO \tag{3}$$

Substituting equations 3 into 2, we can define net profit margin as

$$\frac{\pi}{TR} = 1 - \frac{N}{TR^w} + \frac{F}{TR^f} + \frac{K}{TR^i} + \frac{O}{TR^o} \tag{4}$$

Net profit margin then depends on wages, cost of capital, fuel cost, price of other factors of production, and the ratios of different inputs to TR. One factor affecting these ratios would be aggregate economic activity (GNP). It is known that the level of economic activity affects demand and thus TR. However, as demand increases, inputs may not increase as rapidly and the net profit margin will then change[13]. A second factor that could change the ratios of inputs to TR is the yield (y). Yield is defined as the average amount of revenue received per revenue passenger mile. If airlines decrease prices, for example by introducing discount fares, demand will increase. However, many of the inputs would remain constant or not increase as rapidly as TR, and this would add to the net profit margin. Thirdly, average load factor (ALF) may affect the ratios of the inputs to TR. When ALF increases, airlines are adding passengers while keeping the input, capital constant, thereby better utilizing their capital. Their profit margin should then rise.

We can now say that

$$\frac{\pi}{TR} = (w, i, f, o, y, GNP, ALF). \tag{5}$$

To estimate the model in equation 5, quarterly data are used. Since the purpose of this paper is to study the effects of deregulation on airlines' profits, a deregulation dummy variable was added to the model (D1 = 1 for deregulation[14]). To capture seasonality in the quarterly data, three dummy variables were added: (Q1 = quarter 1, Q2 = quarter 2, Q3 = quarter 3)

The Stigler model, predicts that the coefficient for D1 will not significantly differ from zero. The CAB regulated the industry to achieve fair rate of return. The airlines competed not through pricing but by offering more services which was significantly reflected in their low ALF. Because of this service competition, profits were driven to the market level. So, even if the CAB endeavored to keep profits high, realized profits would be eroded to the market level. After deregulation, profits should continue to reflect the market level as price

competition would erode excess profits. Thus, the dummy coefficient should not be significant. If deregulation did cause financial chaos, then the coefficient should be significant and negatively correlated. If deregulation caused the industry to be monopolistic then the D1 coefficient should be positive and significant.

In estimating the model, the author endeavored to use the producer price index (PPI) as a proxy for o, the price of other inputs. However, the index for fuel and PPI are highly correlated (.94). When both fuel and PPI were included in the equation their coefficients were statistically insignificant; when PPI was dropped, fuel became significant. The results reflect these variables' high collinearity. The other three inputs, labor, capital cost, and fuel account for over 60 percent of total operating expenses[15]. Therefore, in estimating the model o, the price of other inputs was dropped.

The model to be estimated is as follows (expected signs indicated in brackets):

$$\pi = b_o \cdot \underset{(-)}{b_1 w} + \underset{(-)}{b_2 f} + \underset{(-)}{b_3 i} + \underset{(+)}{b_4 GNP} + \underset{(+)}{b_7 V} + \underset{(+)}{b_8 ALF} + \underset{(\pm)}{b_9 D_1} +$$

$$\underset{(\pm)}{b_{10} Q1} + \underset{(\pm)}{b_{11} Q2} + \underset{(\pm)}{b_{12} Q3} + e \qquad (6)$$

Equation 6 has two independent variables, wage and yield, that are also dependent on profits. Since these variables are endogenous a two-stage least square model should be used in estimating equation 6[16]. Also, since the data are time series, the model will need to be tested for autocorrelation.

V. Data

Net profit margin was computed from data obtained from various issues of *Aviation Week and Space Technology*. Net profit margin is defined as net income per total revenue. Only domestic data for major, national and large regional airlines were included in the study.

The input prices for labor, capital and fuel consumption are expressed in real terms. The variable wage was the hourly wage rate and was obtained from *Employment and Earnings*. Capital cost is the nominal interest rate of Moody AAA bonds minus the inflation rate[17]. Capital cost and fuel cost are from *Survey of Current Business*.

The variable yield was computed from various issues of *Aviation Week and Space Technology*. The nominal yield was divided by the CPI to produce the

TABLE 4
VARIABLES EXPLAINING NET PROFIT MARGIN
(1964-1986)

	Method of Estimation			
	TWO-STAGE		OLS	
Variable	**Coefficient**	**T-Stat**	**Coefficient**	**T-Stat**
Fuel	-6.7864	-1.589**	-7.8584	-2.136*
Wage	-0.0347	-1.547**	0.0004	0.193
Interest	-0.0030	-1.699*	-0.0015	-0.981
ALF	0.0025	2.274*	0.0031	3.022*
GNP	8.5589	1.234***	9.7426	1.670*
Yield	0.6267	0.536	2.4859	2.484*
Q1	-0.0227	-4.425**	-0.0226	-4.401*
Q2	0.0123	1.715**	0.0124	1.769*
Q3	0.0186	2.481**	0.0200	2.792*
D_1	-0.0086	-0.385	-0.0072	-0.356
constant	-0.0129	-0.070	-0.4079	-2.402*
RHO	0.5913	6.088**	0.5109	5.124*
$\underline{R}^2$	.677		.698	

* represent significance at .05 for one-tail tests of significance.
** represent significance at .10 for one-tail tests of significance.
*** GNP is statistically significant at .11.
Two-tail test for all dummy variables.

real yield. The ALF also was compiled from data in *Aviation Week and Space Technology.*

VI. Empirical Results

The model was first estimated by two-stage least squares. The Durbin-Watson statistic was in the inconclusive range, so a two-stage, maximum likelihood method was used to estimate a rho value and then the equation[18]. The estimated autocorrelation coefficient rho was 0.591 (t-statistic of 6.088), which was statistically significant. An autocorrelation-corrected OLS model was also estimated. The results of both estimated models are set forth in Table 4.

In comparing the two-stage model and the ordinary least square model in Table 4, the coefficients, as well as the T-statistics, change noticeably for both wage and yield. This would imply that a two-stage model should be used, since the difference reflects the simultaneity bias in OLS. Note that the coefficient for ALF does not change which would imply that current profits do not affect current ALF.

The input price coefficients were negative as hypothesized and statistically

significant. Thus, the rapid increase in fuel cost after deregulation had a major impact on industry profit level. Also, rapid increases in the cost of capital caused profits to decline shortly after deregulation.

The variable GNP was positive and statistically significant. After deregulation, the economy's growth was slow or negative, which helps explain why airlines' profits have been low or negative after deregulation. The variable yield was not statistically significant. While lower fares may increase the number of passengers, their effect on total revenue may be either positive or negative.

The average load factor variable was positive and statistically significant. This would imply that the airlines are using their aircraft more efficiently. The airlines, since deregulation, have used price competition, and they have lowered their services, as is reflected in the increase in the ALF. The higher ALF demonstrates that the airlines are making better use of their aircraft. They carry more passengers while many of their costs remain constant therefore leading to higher profits as seen by the positive coefficient in the estimated equation.

While GNP, ALF, and input prices helped explain the losses shortly after deregulation, the dummy variable D1, which captures the effects of deregulation, was not statistically significant. This would imply that deregulation has not affected airlines' profitability. The airlines, thus far, have operated at the same profit level as they did during the regulated period. However, during the regulated period, the airlines competed by offering more services, which was reflected by a lower ALF. Since deregulation, the airlines have competed by offering lower fares.

VII. Summary

The model presented in this paper would suggest that it was not deregulation of airlines which adversely affected profits but, rather, the sluggish economy and rapidly rising fuel cost along with higher real interest rates. Deregulation has allowed the airlines to increase their average load factor (ALF), keeping their profits from falling even lower than they have.

ENDNOTES

1. James P. Rakowski and James C. Johnson, "Airline Deregulation; Problems and Prospects" *Quarterly Review of Economics and Business,* Winter, 1979, pp. 65-78.

2. Pricing freedom began before the passage of the Airline Deregulation Act of 1978; thus the effects of deregulation began before October, 1978. For a summary of the pricing changes in 1977 and early 1978 see Bailey, Graham, and Kaplan's text *Deregulating the Airlines,* chapter 3.

3. Jose A. Gomez-Ibanez, Clinton V. Oster, and Don H. Pickrell, "Airline Deregulation: What's Behind The Recent Losses?", *Journal of Policy Analysis and Management,* Fall, 1983, p. 75.

4. George J. Stigler, "Price and Non-Price Competition," *Journal of Political Economy,* January-February, 1968, pp. 149-54.

5. George W. Douglas and James C. Miller III, *Economic Regulation of Domestic Air Transport: Theory and Policy,* Brookings Institution, Washington, D.C., 1974.

6. Reuban Kyle III and Laurence T. Phillips, Airline Deregulation: Did Economists Promise Too Much or Too Little?" *Logistics and Transportation Review,* March, 1985, p. 8.

7. M.A. Brenner, J.O. Leet, and E. Schott, *Airline Deregulation,* Eno Foundation, Inc., Westport, Connecticut, 1985.

8. The report defines profit (loss) as the percent of operating profit (loss) of total revenue.

9. Brenner, Leet and Schott, *op. cit.,* p. 52.

10. Brenner, Leet and Schott, *op. cit.,* p. 51.

11. William F. Leonard, "Airline Deregulation: Grand Design or Gross Debacle?" *Journal of Economic Issues,* June, 1985, p. 454.

12. Elizabeth Bailey, David R. Graham, and Daniel P. Kaplan, *Deregulating the Airlines,* The MIT Press, Cambridge, Massachusetts, 1985, p. 63.

13. To show how GNP can change net profit margin, suppose current net profit is $20 and TR is $100. An increase in GNP increases passengers, causing TR to increase by $1 but profits will increase by only $.10. Then net profit margin will fall from 20/100 = .2 to 20.1/101 = .199, since the marginal profit margin (10% on the additional passengers) is below the average profit margin.

14. The beginning of the deregulation period is considered as the first quarter of 1978 even though the Airline Deregulation Act was not passed until the fourth quarter of 1978. In 1977 the airlines were given some pricing freedom so that "deregulation" began before the act was passed.

15. See *United States Statistical Abstract 1988,* "Airline Cost Index 1970 to 1986," No. 1026.

16. The Variable ALF is treated as an exogenous variable. While the ALF may affect profits, current profits levels does not affect ALF. Past profits levels may affect ALF as Douglas and Miller state.

17. Replacing this with other measures of interest rates had no significant impact on the results.

18. Jan Kmenta, *Elements of Econometrics,* Macmillian Publishing Co., Inc., New York, 1971, pp. 687-589.

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