AN ABSTRACT OF THE THESIS OF

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This paper involved the estimation of a series of fare equations in order to ascertain the effects of actual and potential competition by Southwest on markets for air travel. The results indicate that pricing strategies differ depending on Southwest's presence on a route, which is not consistent with the theory that airline markets are contestable. Concentration is not a determinant of airfares when a general specification is adopted. This indicates that other route characteristics need to be taken into account to evaluate the competitiveness of a route.

The Effect of Southwest Airlines on U.S. Airline Markets

By

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Krista Richards, Author

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The Effect of Southwest Airlines on U.S. Airline Markets

Introduction

Since deregulation of the U.S. airline industry in 1978, there has been much debate as to what structure the industry would take. Over seventeen years later, the airline industry has not yet reached a long run equilibrium (Morrison and Winston 1995). Prior to deregulation, nearly all economists agreed that deregulation of the airline industry would improve consumer welfare. Although most still do, the increase in concentration at the national level has prompted concerns as to the competitiveness of the industry.

A number of features have developed in the airline industry with the potential for increasing entry barriers, such as hub-and-spoke networks, computer reservation systems, frequent flyer programs, travel agent commission overrides, and slot restricted airports. Subsequently, many studies indicate that airline markets are not perfectly contestable (Joesch and Zick 1994; Oum, Zhang and Zhang 1993; Whinston and Collins 1992; Strassmann 1990; Morrison and Winston 1986).

Despite these findings, the experience of Southwest Airlines shows that it is possible to compete with hub-and-spoke systems by offering low-cost, no-frills, point-to-point service. Southwest was consistently profitable throughout the early 1990's, even though the industry as a whole experienced heavy losses. The low-cost, low-fare strategy of Southwest is having strong effects on the structure of the U.S. airline industry, leading some to believe that the long run equilibrium of the industry will include the Southwest model for short haul routes and hub-and-spoke systems for long haul routes (Morrison and Winston 1995; Ellig and Winegarden 1994).

The intent of this paper is to further investigate the effect of Southwest Airlines on markets for air travel.

Background

Contestability theory was influential in the early predictions of industry structure. A contestable market is one in which entry and exit are entirely costless. Thus there would be potential for competitors to enter the market at any time. The theory maintains that the threat of potential competition is sufficient to induce firms to price at a competitive level (i.e. where price equals marginal costs) even in the absence of actual competition. It was argued that airline markets would be characterized by contestability because airline capital is virtually "capital on wings" and can thus enter and exit markets easily with little sunk costs (Baumol, Panzar and Willig 1988, 7).

If airline markets are contestable, then the level of market concentration would have no relationship to airfares since airfares would already be at their competitive level[1]. A number of studies investigate this and find a positive relationship between airfares and market concentration levels, suggesting that airline markets are not contestable (Joesch and Zick 1994; Oum et al. 1993; Whinston and Collins 1992; Strassmann 1990; Morrison and Winston 1986).

Some argue that airline markets were contestable in the period immediately following deregulation but with the development of hub-and-spoke systems, frequent flyer programs, computer reservation systems, travel agent commission overrides, and slot constrained airports, there are now significant sunk costs involved in entering airline markets. Support for this idea comes from Joesch and Zick (1994) who find the relationship between market concentration[2] and airfares to be statistically insignificant in 1983, but positive and significant in 1987 and 1990.

Although there has been an increase in concentration at the national level, at the route level concentration has actually declined since deregulation (Leahy 1994). Some argue that pricing power is conferred though airport dominance, not route concentration (Evans and Kessides 1994, 1993; Borenstein 1991; Morrison and Winston 1990).

Another approach to this issue is to examine the ability of prices to signal potential entrants. Strassmann (1990) finds that future entry is influenced by current prices, whereas Joskow, Werden and Johnson (1994) find that entry is generally not induced by price levels substantially above the norm, instead both entry and exit occur most frequently on low-price city pairs. This is consistent with Morrison and Winston's (1990) findings that suggest that high fares may signal entry barriers or relatively high costs as opposed to supranormal profits. Nevertheless, entry has been observed to reduce fares and increase output (Joskow *et al.* 1990).

Although airline markets do not appear to be perfectly contestable, there is evidence to suggest that potential carriers do influence major carriers' actions (Morrison and

Winston 1986, 64; Lin 1995). Furthermore, an exception to the findings of the noncontestability of airlines markets comes from Slovin, Sushka and Hudson (1991). They found that since deregulation, changes in concentration have no positive effect on carrier returns[3], supporting the idea of the contestability of airlines markets.

Although there is much evidence to suggest that dominance on a route signifies monopoly power which contributes to higher airfares, Southwest has demonstrated that this need not be the case. Even on routes where Southwest has a large market share, it offers lower fares than were previously offered by its competitors (Ellig and Winegarden 1994). Ellig and Winegarden (1994) argue that it is because of Southwest's lower fares that they have earned high market shares. This is consistent with the findings of Oum *et al.* (1993) that the carrier using the more aggressive pricing strategy tends to secure a higher market share.

Notes

1. It is acknowledged that there could be other reasons why an airline may choose to price competitively, such as a Bertrand pricing strategy.

2. Measured at the route level.

3. This result may be due to the different methodology used by Slovin *et al.* (1991). They looked at the changes in excess returns around airline acquisition announcements to test whether excess returns are functions of concentration or hub dominance.

Model Specification

To investigate the effect of Southwest Airlines on markets for air travel, a series of fare equations is estimated. Fare equations are estimated by many authors[1] to see how various aspects of competition affect fares. Such estimations usually involve regressing the fare or yield on a route on various cost variables, demand variables, and markup variables.

Lin (1995) estimated a model with intercept dummy variables used to capture the autonomous effects of Southwest's presense on yields. But such a specification may be too restrictive because the relationship between some of the explanatory variables, such as concentration, and airfares may also differ depending on whether Southwest is an actual or potential competitor on a route. Thus, to allow for a more general specification, three separate equations are estimated, one where Southwest serves the route (SW), another in which Southwest serves at least one of the endpoints of the route (SWPOT), and a control system of equations in which Southwest does not serve either endpoint of the routes in the sample (NOSW). A finding that there is no difference between the equations in which Southwest is an actual competitor, a potential competitor, or neither an actual nor potential competitor would lend support to the theory that airline markets are contestable.

For each of the three groups, the fare equation is estimated as part of a system of supply and demand. The model, derived from Joesch and Zick (1994) and Peteraf and Reed (1994), consists of a supply relation estimated in its inverse form with yield used as a proxy for price and a passenger demand equation. The yield or fare on a route is assumed to be a function of cost variables, passenger demand variables, and market structure variables. The number of passengers on a route is assumed to be a function of the fare on the route, the market size, and income. The structural model can be expressed as follows,

$$Y_i = f(C_i,\ P_i,\ M_i)$$
$$P_i = f(Y_i,\ I_i,\ R_i)$$

where Y_i is the average yield per passenger mile on route i, C_i is a vector of cost variables for route i, P_i is a vector of passenger demand variables for route i, M_i is a vector of market characteristic variables that affect pricing on route i, I_i is a variable to reflect the income level of the cities served by route i, and R_i is a vector of route characteristics variables that affect passenger demand on route i. The variables used in the estimation and their predicted effects follow.

Average length of haul is used as a measure of the cost of serving a route. Because of the fixed costs associated with takeoff, the length of haul is expected to have a negative relationship to yield per mile. The number of passengers is also expected to be negatively related to yield because higher load factors lead to declining unit-costs in serving additional passengers.

Several variables are utilized to determine the effects of various market characteristics on airfares. A Herfindahl-Hirschman Index (HHI) is calculated for each route included in the yield equation. If an increase in HHI leads to an increase in the average airfare, *ceteris paribus*, this is considered to be an indication that the market is not perfectly contestable.

A dummy variable is included to capture the effect on airfares that arises from one the endpoints being a major carrier's hub airport. Some studies have indicated that higher airfares are associated with hub airports (Evans and Kessides 1994, 1993; Borenstein 1991). This is to be expected if hub airports represent a barrier to entry. Likewise, slot-restricted airports have also been shown to have a positive relationship to airfares (Lin 1995). Therefore, a dummy variable is included to control for this effect as well.

A vacation dummy variable is included to account for the lower proportion of business travelers on routes that are considered vacation oriented. The cities coded vacation oriented are listed in the Appendix. It is expected that airfares will be lower on routes in which one of the endpoints is vacation oriented.

For the passenger demand equation, it is assumed that the number of passengers on a route is a function of the average yield, the income and population of the areas served by the route, and route characteristics, i.e. whether the route is vacation oriented and whether substitute transportation modes were likely available for the route.

The system of equations is estimated using the two-stage-least-squares (2SLS) method. Yield and passengers are treated as endogenous and all of the exogenous variables are used as instruments. The model is specified in equations (1) and (2).

$$\ln(Y_i) = \alpha_{1j} + \alpha_{2j}\ln(AVHAUL_i) + \alpha_{3j}\ln(PASS_i) + \alpha_{4j}HHI_i + \alpha_{5j}VAC_i + \alpha_{6j}HUB_i + \alpha_{7j}SLOT_i + \epsilon_{1ij} \quad (1)$$

$$\ln(PASS_i) = \beta_{1j} + \beta_{2j}\ln(Y_i) + \beta_{3j}\ln(POP_i) + \beta_{4j}\ln(INC_i) + \beta_{5j}SUB_i + \beta_{6j}VAC_i + \gamma_{2ij} \quad (2)$$

where:

Y_i = average passenger revenue (in cents) per mile on route i

$AVHAUL_i$ = average miles traveled by a passenger on route i

$PASS_i$ = total number of passengers per day on route i

HHI_i = Herfindahl-Hirschman Index for route i

VAC_i = dummy variable equal to 1 if one of the endpoints of the route is vacation oriented, and 0 otherwise

HUB_i = dummy variable equal to 1 if one of the endpoints is a hub of a major carrier, and 0 otherwise

$SLOT_i$ = dummy variable equal to 1 if either one of the endpoints of route i is a city with a slot restricted airport, and 0 otherwise

POP_i = sum of the population of the two endpoints of route i

INC_i = sum of the total income of both endpoints of route i divided by the total population of both endpoints to give per capita income of route i

SUB_i = dummy variable to indicate the competition from substitute transportation modes, equal to 1 for routes less than 300 miles, and 0 otherwise

i = 1,...,I route observations

j = 1,...,J Southwest's presence-specific equations.

Notes

1. See Evens and Kessides (1993); Joesch and Zick (1994); Peteraf and Reed (1994); Lin (1995); Morrison and Winston (1995).

Data

The primary source of data is from the Department of Transportation's Origin-Destination (O-D) Survey of Airline Passenger Traffic for the top 1000 routes of the second quarter of 1995. The data in the O-D survey result from a continuous survey of ten percent of all the tickets sold in the United States. Because Southwest serves primarily short-haul routes, only routes of less than 1000 miles are used, resulting in a sample of 588 city-pair markets. Southwest serves 203 of the routes and is a potential competitor on 225 of the routes. The O-D survey includes data on average yields, length of haul, number of passengers, and on the market share of each carrier on a route. Information on Southwest's potential entry and the Herfindahl-Hirschman Index are derived from this data.

Income and population data were collected from *Local Area Personal Income 1969-1992* (U.S. Department of Commerce). Metropolitan area data are used for most cities. County area data are used for smaller cities in which metropolitan area data are not available. Information on income and population in Puerto Rico, the Virgin Islands, and Guam is not available from this source, therefore the model is estimated without those observations with endpoints in the aforementioned locales. Income and population data from 1992 are the most recent available and are thus used as a proxy for 1995 income and population data.

Descriptive statistics of the variables used in the estimations are shown in Tables 1-4. The mean average yield per mile is 15.459, 25.6787, and 33.506 for the SW, SWPOT, and NOSW samples respectively, which equates to one-way average fares of $80.81, $168.86, and $167.82.

Table 1

Descriptive Statistics
Pooled Sample
(N = 588)

Variable	Mean	Standard Deviation
Y	23.463	13.448
AVHAUL	561.804	257.269
PASS	390.662	483.580
HHI	.556	.199
POP	5195.75	2838.26
INC	22136.68	2372.12
SUB	.172	.378
VAC	.245	.430
HUB	.757	.429
SLOT	.202	.402

Table 2

Descriptive Statistics
SW Sample
(N = 203)

Variable	Mean	Standard Deviation
Y	15.459	5.860
AVHAUL	522.714	226.958
PASS	479.513	465.211
HHI	.535	.187
POP	4598.57	2777.21
INC	20991.47	2136.16
SUB	.192	.395
VAC	.187	.391
HUB	.621	.486
SLOT	.084	.278

Table 3

Descriptive Statistics
SWPOT Sample
(N = 225)

Variable	Mean	Standard Deviation
Y	25.677	12.64
AVHAUL	657.64	244.706
PASS	313.585	402.299
HHI	.571	.202
POP	5426.54	2800.20
INC	22491.18	1934.09
SUB	.076	.265
VAC	.204	.404
HUB	.827	.379
SLOT	.204	.404

Table 4

Descriptive Statistics
NOSW Sample
(N = 160)

Variable	Mean	Standard Deviation
Y	30.506	16.133
AVHAUL	550.125	284.507
PASS	386.323	584.697
HHI	.561	.209
POP	5628.88	2859.27
INC	23091.13	2633.92
SUB	.281	.451
VAC	.375	.487
HUB	.831	.376
SLOT	.350	.478

Results

The results of the regressions are shown in Table 5. Most of the coefficients have the expected sign, with the exception of the LNPASS coefficient in the pooled equation. The coefficients on LNPASS in the SW, SWPOT, and NOSW equations are negative, as expected, but are not significant. The coefficient on LNAVHAUL is negative and significant in all of the equations indicating that yields per mile fall as the length of haul increases. The vacation dummy variable has a negative and significant effect on yields in all of the equations implying that vacation oriented routes tend to have lower airfares, all else constant. Hub airports are shown to have a positive and significant effect on yields in all of the equations estimated. The coefficient on HHI is positive and significant in the pooled equation, yet is not significant in the other equations, implying that concentration has a positive effect on airfares only when these other route characteristics are not taken into account.

An F-statistic[1] is calculated to test the hypothesis that the parameters in the SW, SWPOT, and NOSW equations are equivalent to the parameters in the pooled equation, i.e. H_0: $\alpha_{pooled}=\alpha_{SW}=\alpha_{SWPOT}=\alpha_{NOSW}$, for each of the parameters. The hypothesis is rejected at the 1 percent level.

A series of t-tests on individual coefficients are then performed to ascertain the differences between the equations. Specifically, the following hypotheses are tested for each of the parameters: H_1: $\alpha_{SW}=\alpha_{SWPOT}$; H_2: $\alpha_{SW}=\alpha_{NOSW}$; H_3: $\alpha_{SWPOT}=\alpha_{NOSW}$.

Table 5

2SLS Coefficient Estimates
(Dependent Variable=lnYIELD)

Variable	Pooled	SW	SWPOT	NOSW
INTERCEPT	3.856***	6.230***	5.727***	9.608***
	(.908)	(.486)	(.825)	(2.745)
LNAVHAUL	-.391***	-.544***	-.416***	-.651***
	(.053)	(.046)	(.063)	(.084)
LNPASS	.182*	-.038	-.049	-.419
	(.106)	(.037)	(.130)	(.374)
HHI	.644***	-.043	.187	-.212
	(.142)	(.091)	(.159)	(.560)
VAC	-.093**	-.089***	-.259***	-.387***
	(.048)	(.036)	(.079)	(.077)
HUB	.288***	.079***	.290***	.221**
	(.048)	(.031)	(.073)	(.097)
SLOT	.229***	.171***	.190**	.121
	(.060)	(.058)	(.095)	(.104)
Adjusted R^2	.34	.61	.36	.55

SW=sample in which Southwest serves the route.
SWPOT=sample in which Southwest serves at least one of the endpoints of the route.
NOSW=sample in which Southwest does not serve either endpoint of the route.
Standard errors are in parentheses.
*** Indicates significance at the 1 percent level.
** Indicates significance at the 5 percent level.
* Indicates significance at the 10 percent level.

The intercept in the SW equation and the intercept in the SWPOT equation are significantly lower than the intercept in the NOSW equation indicating that actual or potential competition by Southwest has a negative impact on yields, all else constant. Furthermore, the intercepts in the SW and SWPOT equations are not significantly different than one another. This result lends support to the contestability theory.

There are some differences in the effect of average haul on yields between the three equations. This may be due to the differences in costs faced by different carriers or it may reflect differences in the costs of serving different routes.

Vacation oriented routes have a significantly greater (negative) effect on yields for the SWPOT and NOSW equations than for the SW equation. Likewise, the coefficients on HUB are significantly greater in the SWPOT and NOSW equations than in the SW equation. This may be because Southwest offers consistently low fares overall such that the differential between fares on vacation oriented and non-vacation oriented routes (or between fares on routes that involve a hub airport and routes that do not) would be less on routes in which Southwest is a competitor. The differences in the effects of these market characteristic variables on yields suggest that the pricing strategy on a route depends in part on the carrier present on the route.

Slot restricted airports have a positive effect on yields in all of the equations and the effect is not significantly different between the three equations.

Notes

1. $F_{(21,560)} = 36.86$.

Conclusion

This paper involved the estimation of a series of equations in order to ascertain the effects of actual and potential competition by Southwest on markets for air travel. The results indicate that pricing strategies differ depending on whether Southwest is an actual competitor, a potential competitor, or not a competitor at all on the route. Although some of the differences appeared to be due to differences in costs, the differences in the effects of the market characteristic variables on yields suggest that the pricing strategy on a route depends in part on the actual or potential carrier that is present on the route. This is not consistent with contestability theory which assumes that prices are a function of sunk costs. Yet, the results indicate that potential competition does have a negative impact on yields, suggesting that airline markets are to some degree contestable.

The differences between the equations indicate that the more general specification is preferred to the restricted specification using the pooled sample. The finding that concentration does not have a significant impact on yields when a more general specification is adopted suggests that the positive relationship between concentration and yields found in previous studies may have been spurious. Although such a finding would tend to support the theory that airline markets are contestable, the differences that exist between the markets in which Southwest is an actual or potential competitor do not support such a theory.

The implication of these results is that high concentration by itself is not an indicator that a route is not competitive. Other route characteristics, such as whether a low cost carrier serves the route, need to be taken into account to evaluate the competitiveness of a route.

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APPENDIX

Vacation Oriented Cities

Aspen, Colorado
Fort Lauderdale, Florida
Fort Myers, Florida
Hilo, Hawaii
Honolulu, Hawaii
Indio/Palm Springs, California
Jacksonville, Florida
Kahului, Hawaii
Kona, Hawaii
Las Vegas, Nevada
Lihue, Hawaii
Melbourne, Florida
New Orleans, Louisiana
Orlando, Florida
Reno, Nevada
Tampa, Florida
West Palm Beach, Florida