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The Short and Long Run Effects of Entry on U.S. Domestic Air Routes

There has been much written in the popular and trade press recently about the entry of "low cost" carriers onto domestic air routes and the competitive responses of incumbent carriers. For example, when Southwest Airlines, "the industry's perennial low-price champ,"[1] entered the Washington/Baltimore market in 1993 with flights from Baltimore-Washington International (BWI), the *Wall Street Journal* reported that fares to be offered would be as much as 86 percent cheaper than existing fares and that incumbents Continental Airlines and USAir would compete with their own low fares.[2] *Aviation Week & Space Technology* stated that Southwest's chairman, Herbert D. Kelleher, expected total traffic on Southwest's two new BWI routes (to Cleveland and to Chicago) to double or triple within a year.[3]

An important policy question arises from these reports: Are the introductory low prices sustained past the promotional period? If the low introductory prices are not sustained past the promotional period, it may be that they are predatory, designed to drive out competition with little or no long-term benefit to the airline passenger. A recent report prepared by the Office of Aviation Analysis of the U.S. Department of Transportation found evidence that the low fares offered by Southwest may not be sustained. The authors stated:

> Without a competitive discipline, over time Southwest's fares will increase to cover cost inefficiencies that will creep in, and to extract monopoly profits. We already see Southwest's prices beginning to increase where it has forced out its competition and its load factors have attained relatively high levels.[4]

In this article we use time series analysis and econometric models to address two questions related to entry on U.S. domestic airline routes:

First, how different is the effect of the low cost carriers' entry onto routes from the entry of other carriers? Although low cost carriers such as Southwest may generate considerable publicity when they enter routes, it may be that established carriers, such as American and United, use a similar low fare entry strategy. Their entry could result in price effects and traffic generation not statistically different from that of the low cost carriers.

Second, are the price and traffic effects of new entrants, both low cost and other carriers, sustained past the initial promotional period or are they merely promotional? In answering this question, we try to address the wider public policy question as to the longer-term consumer benefits from new entry. If competition is driven out of a market by low promotional fares, and if these fares are not maintained, then there is clearly little long-term benefit from route entry.

The rest of the article is structured as follows: The next section reviews the literature on pricing, entry, and competition in the airline industry. Section three presents a time series analysis of entry during the 1991 to 1994 period. Section four presents an econometric model to analyze the effect of carrier presence on price. Finally, section five draws conclusions and discusses the public policy implications of the results.

Literature Review

There has been extensive research concern-

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ing the determinants of prices or yields on U.S. domestic air routes, including the presence of new entrants or low cost carriers on a route.[5] Common variables used to explain yields include measures of route concentration and measures of airport presence at the endpoints of a route. The research generally shows that increased concentration on routes as well as increased market share at route endpoints contributes to higher yields. In two of the papers reviewed, the researchers explicitly measured the effect of newly certified low cost carriers on yields using econometric models.[6] Bailey, Graham, and Kaplan,[7] using 1980-1981 data, and Strassmann,[8] using 1980 data, both found that newly certified carriers had a negative and significant effect on U.S. domestic yields. Two other papers, without using formal modeling, provided evidence that low cost carriers depress yields. Although the major thrust of the paper by Whinston and Collins[9] was to examine the effect of entry by the low cost carrier, People Express, on stock prices, the authors also provided some evidence that the carrier served to lower airline prices. The authors showed that mean prices fell by 34 percent on the fifteen routes People Express entered during the two-year period 1984-1985. Whinston and Collins also showed, using a small route sample, that prices did not climb back to original levels in the year following entry. Bennett and Craun[10] examined the effect of low cost carrier Southwest on yields and traffic. The authors present graphs that illustrate when Southwest entered certain California markets in 1989 and 1990, there was a dramatic increase in traffic and a major drop in yields. The graphs do not indicate any major increase in fares or drop in traffic in the periods following Southwest's entry, providing evidence that Southwest's low prices and traffic boosts are sustained past the original promotional period.

In summary, there is some econometric evidence available indicating that low cost carriers depress fares on routes in which they operate and some illustrative examples indicating that fares are not substantially increased in the periods after entry by low cost carriers. In the next section, we describe the effects of entry on prices, market concentration, and passenger traffic during the years 1991 to 1994.

Time Series Analysis

Data were collected on the top 200 U.S. domestic origin and destination pairs as of the second quarter of 1994, for the three-year period from the third quarter of 1991 to the second quarter of 1994. These data were the most recent data available at the time of analysis. A three-year period was thought long enough to generate sufficient time to determine longer-run entry effects on prices and passengers. The data were provided by Database Products, a private company that produces reports based on data originally supplied from the U.S. Department of Transportation's Database 1a, or 10 percent ticket sample. The data included origin and destination passenger traffic, yields, and average length of haul by carrier on each of the 200 routes. Other data collected included population and per capita income for each of the origin and destination cities and stage lengths for each of the city pairs.[11]

Table 1 presents means for the key variables in our analysis. The mean one-way price on a route was $135.84. The average route distance was 816 miles, providing carriers a yield of about seventeen cents per mile. The mean score on the Herfindahl Index was 4,777,

Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Price	$135.84	$72.91	$28.18	$368.77
Herfindahl Index	4,777	1,946	1,417	10,000
Distance	816	641	100	2,704
Passengers	138,949	109,416	10,380	737,680
Slot controlled	0.37	0.48	0.00	1.00
Vacation route	0.23	0.42	0.00	1.00
Intra-Hawaiian	0.02	0.14	0.00	1.00

which allows for slightly more competition than one would find on a route with two carriers, each with a 50 percent market share.[12] The average number of passengers per quarter, per route, both directions, in our sample was about 139,000. Thirty-seven percent of the routes in the sample had slot controls at one or both of the endpoints. Twenty-three percent of the routes in the sample had slot controls at one or both of the endpoints. Twenty-three percent of the routes were classified as vacation routes (with one endpoint in Florida, Nevada, Hawaii, or Puerto Rico), and 2 percent of the routes were intra-Hawaiian routes.

Table 2 provides a description of entry activity during the three-year period.[13] It can be seen that carriers entered a total of 168 routes during that period, with entry activity peaking during the second quarter of 1993 with twenty-three entries reported. Southwest and Reno Air had the most entry activity with, respectively, nineteen and eighteen routes entered, while the largest carriers had relatively few entries. Delta Airlines, for example, reported only one entry during the three-year period.

As a counterpoint, Table 3 provides statistics on exit from the 200 routes over the three-year time period.[14] As indicated in the table, there were 125 route exits during the period. Although a number of the exits were related to carriers ceasing operations (Enterprise, Midway, Pan Am), the majority of them resulted from business decisions of ongoing carriers. Among the carriers that exited from the most routes were American (14), TWA (12), and United (11).

One of the goals of this article is to examine the impact of entry by different carriers. In order to facilitate this goal, Figures 1 through 3 each contain information on the impact of entry

Table 2. Routes Entered by Airline

Airline	Year-Quarter											
	91-4	92-1	92-2	92-3	92-4	93-1	93-2	93-3	93-4	94-1	94-2	Total
Alaska	1					1	1	1				4
American Trans Air					1	4	1	1	1	2	2	12
America West	1	3			1							5
American					1			1		2		4
Carnival		1							1			2
Continental		1			1				3		4	9
Delta											1	1
Enterprise		5	3									8
Jet Express										2	1	3
Kiwi International					3			2	1			6
Mark Air		1			4	2			5	2	1	15
Morris Air							12		1	1		14
Northwest					1	1						2
Pan Am	1											1
Private Jet								2				2
Reno Air				5		1		5	2	5		18
Southwest	1	2	2				4	4			6	19
Spirit									1			1
Tower					2							2
TWA	1	4	6	1	1			2				15
Ultra Air									1	1		2
United	2		2							1		5
USAir	1	1	2				2		1			7
Valuejet										5	3	8
Westair							3					3
Total Entries	8	18	15	6	15	9	23	18	17	21	18	168

Table 3. Routes Exited by Airline

Airline	Year-Quarter											
	91-4	92-1	92-2	92-3	92-4	93-1	93-2	93-3	93-4	94-1	94-2	Total
Alaska						1						1
America Trans Air							1		1	1	2	5
America West		1			1	1		1		1		5
American					2			6	5		1	14
Carnival												0
Continental						1		1		1		3
Delta			1		1			1	1			4
Enterprise				11								11
Jet Express												0
Kiwi International						1						1
Mark Air												0
Midway	6	15										21
Morris Air									1		2	3
Northwest		1		1			1				1	4
Pan Am	7	6										13
Private Jet												0
Reno Air									1	1		2
Southwest												0
Spirit												0
Tower												0
TWA				1	3				1	1	6	12
Ultra Air												0
United			2	1		1			5	1	1	11
USAir		2			1	2	2			1	1	9
Valuejet												0
Westair						3		3				6
Total Exits	13	25	3	14	8	10	4	12	15	7	14	125

on four separate sets of air carriers. The solid bold line with squares represents the impact of all air carriers. The dashed line (long dashes) with triangles represents the impact of carriers that were in existence as interstate carriers prior to deregulation and includes American, Continental, Delta, Northwest, TWA, United, USAir, and Pan Am. The dashed line (short dashes) with ovals represents the impact of Southwest Airlines. The solid line with Xs represents the impact of all other carriers in Table 1, except those included in the previous two groups and the intra-Hawaiian carriers. The groupings are intended to show if there are differential effects of entry dependent on the identity of the entrant.

Figure 1 provides an indication as to what happens to market concentration on a route after entry. The figure shows movements in the Herfindahl Index in the four quarters before and after entry. The Herfindahl measures in the figure are indexed to 1 in the quarter before entry. One would expect that concentration on a route would fall after a carrier enters and the figure indicates that this is precisely what happens. Concentration falls, on average, by 15 percent in the quarter following entry. This is offset by a five percentage point rise during the next three quarters. As indicated in Figure 1, the decrease in the Herfindahl Index is largest when Southwest Airlines enters a route. Entry by Southwest results in a 25 percentage point drop in the quarter following entry.

Figure 2 presents data on airline prices, before and after entry. Prices are indexed to 1 in the period before carrier entry. In the quarter after a carrier enters a route, prices on that route fall 10 percent. Note that these are *average* prices for *all* carriers on a route. Prices continue to fall for the next two quarters,

Figure 1

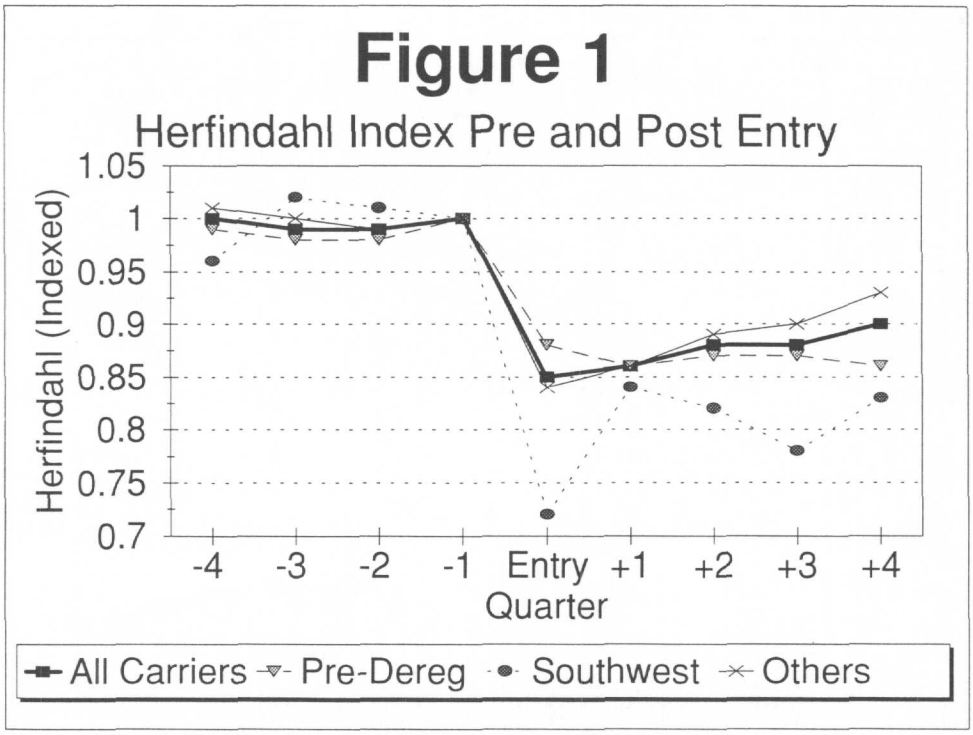
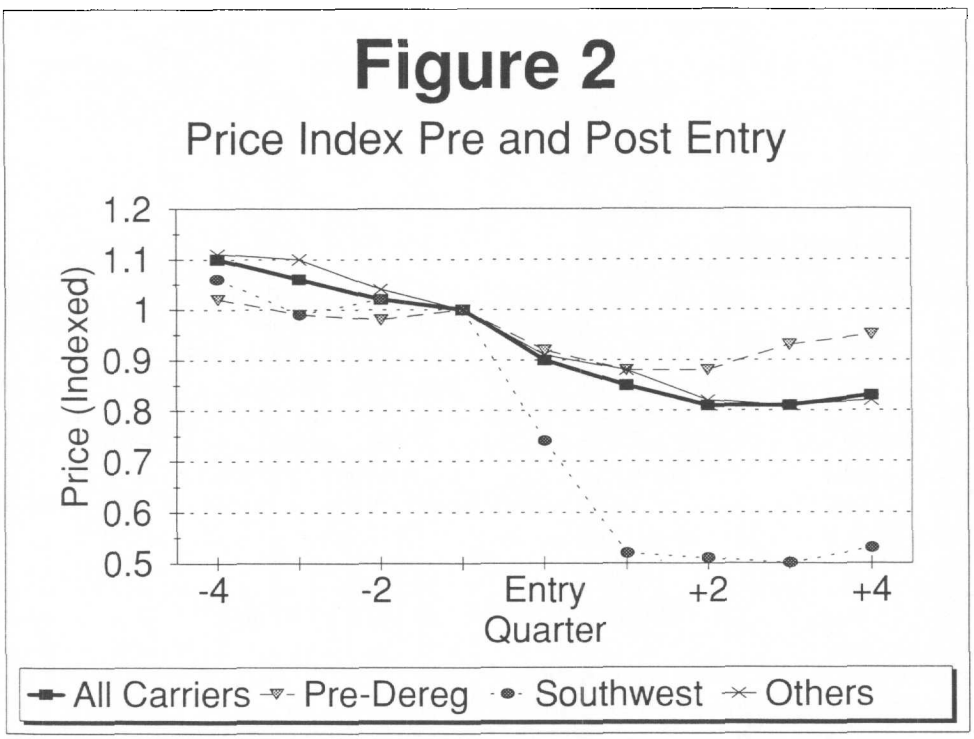


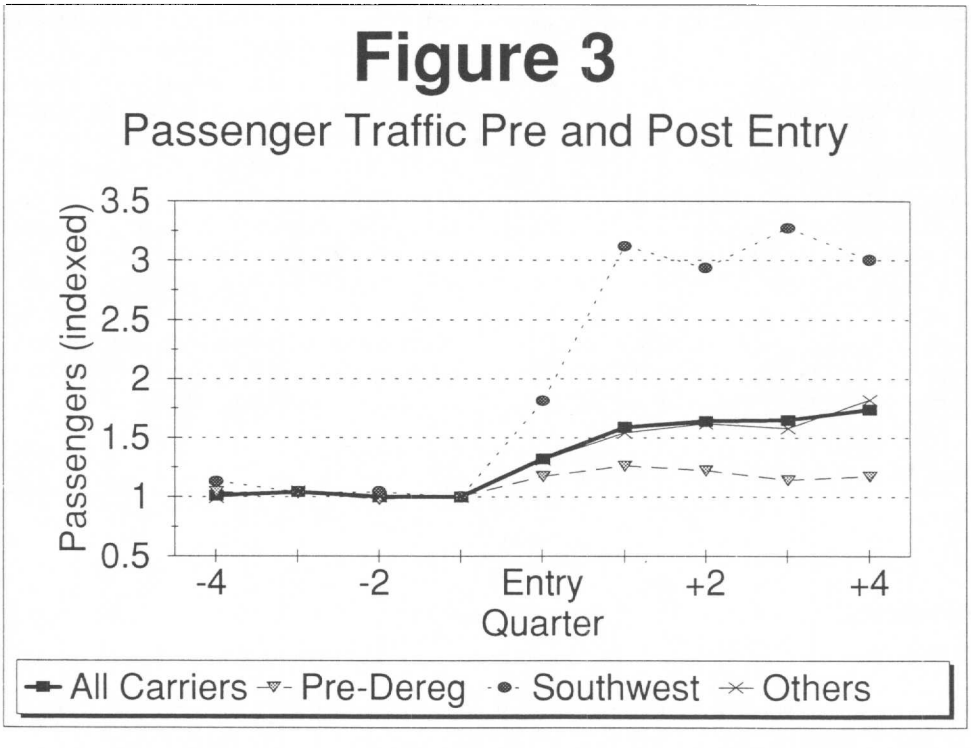
Figure 2

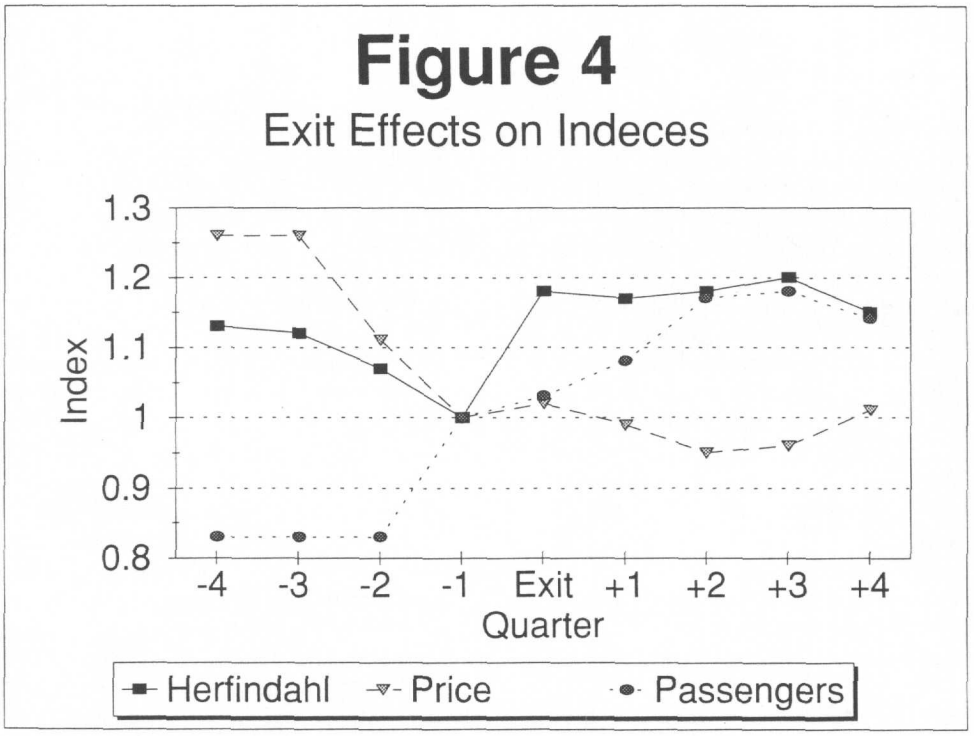


bottoming at 81 percent of the pre-entry price level in the second and third quarters after entry. Note that price changes resulting from the entry of a pre-deregulation carrier are not nearly as deep as changes resulting from the entry of Southwest onto a route. When a pre-deregulation carrier entered a route, prices declined to 88 percent of the pre-entry level by the second quarter after entry, before rising to 95 percent of the pre-entry price by the fourth quarter after entry. When Southwest entered a route, prices declined to 52 percent of the pre-entry level by the first quarter after entry and remained relatively stable at that level during the full year after entry. Price drops for the "other" carrier category fell in between those of Southwest and the pre-deregulation carriers with prices 18 percent below the entry level after one year.

Figure 3 shows passenger traffic changes on routes upon entry. On average, traffic increased by 32 percent upon entry, rising to 74 percent above pre-entry levels by the fourth quarter after entry. The results were not nearly as dramatic when a pre-deregulation carrier entered a route. Traffic was only 17 percent above pre-entry levels in the fourth quarter following entry. This compared to a traffic increase of 300 percent for Southwest and 182 percent for the "other" carriers.[15]

Figures 1 through 4 indicate that the impact of Southwest on a route differs substantially from the impact of pre-deregulation carriers. Not only is the impact different, but the type of route that Southwest enters is also different. Table 4 reports some characteristics of the routes entered by the four sets of carriers during the period from the fourth quarter of 1991 to the second quarter of 1994. As indicated in Table 4, Southwest enters shorter routes with higher levels of market concentration and fewer passengers prior to entry than the routes entered by the pre-deregulation carriers. The average Herfindahl Index on routes entered by the pre-deregulation carriers was 5,001, but the average Herfindahl Index on routes entered by Southwest was 6,461. The average distance of routes entered by the pre-deregulation carriers was 944 miles, while the average distance of the routes entered by Southwest was 373 miles. The average number of passengers carried on routes entered by the pre-deregulation carriers (prior to entry) was 114,800, while the average number of passengers on routes Southwest





entered was 68,850. Clearly Southwest enters routes markedly different from the routes entered by the pre-deregulation carriers.

Figure 4 looks at the impact of exit on prices, the Herfindahl Index, and on passenger traffic. It appears that the exit of a carrier from a route has little, if any, impact on price. While passenger traffic is up after exit, it is not growing much more quickly than the general level of passenger traffic. However, it appears that a significant change is occurring on the routes *prior* to exit. In the three quarters preceding exit, prices fall by 27 percent and the Herfindahl Index falls by 17 percent. It appears that competition becomes more heated in the time period prior to exit. This could be due to the entry of a low cost carrier or the outbreak of a fare war on the route. Concentration and prices fall dramatically prior to exit and this could be the cause of the exit event. While the exit results in an increase in concentration, prices do not rise to their former levels.

In summary, the data on entry suggest that entry leads to the following: a reduction in market concentration, as measured by the Herfindahl Index; a reduction in prices; and an increase in passenger traffic. The magnitude of the results, however, is largely dependent on the carrier that enters, with Southwest showing much larger price and passenger effects than average. Exit, on the other hand, appears to be the result of increased competition in the period prior to the exit. Exit itself has little impact on prices or passenger traffic. Our results also

Table 4. Route Characteristics Prior to Entry

Grouping	Routes Entered (91-4 to 94-2)	Route Distance (miles)	Herfindahl Index	Passengers	Price ($)
All carriers	168	804	5,054	109,390	148
Pre-deregulation	44	944	5,001	114,800	171
Southwest	19	373	6,461	68,850	105
Other carriers	105	818	4,845	115,910	145

indicate that Southwest Airlines enters routes with markedly different characteristics than those routes entered by the pre-deregulation carriers.

Modeling the Effect of Entry on Price

In the last section, the descriptive statistics showed that entry is associated with changes in market structure, price decreases, and traffic increases, and that these changes often depended on what type of carrier (pre-deregulation, Southwest, etc.) entered a route. In this section, a more formal model is developed and tested in an attempt to sort out some of these effects. In particular, we control for relevant variables influencing price in an attempt to determine whether entry itself is sufficient to lower prices on a route or whether entry must be by a particular carrier. The following two models were estimated:

(1)

$$PRICE = \beta_0 + \beta_1 HERF + \beta_2 DIST + \beta_3 DIST^2 + \beta_4 PASS + \beta_5 SLOT + \beta_6 VACATION + \beta_7 HAWAII + \sum_{t=8}^{18} \beta_t QUARTER_t$$

(2)

$$PRICE = \alpha_0 + \alpha_1 HERF + \alpha_2 DIST + \alpha_3 DIST^2 + \alpha_4 PASS + \alpha_5 SLOT + \alpha_6 VACATION + \alpha_7 HAWAII + \sum_{t=8}^{18} \alpha_t QUARTER_t + \sum_{j=19}^{46} \alpha_j CARRIER_j$$

where:

- PRICE = the average one-way fare for all carriers on a route between two cities;[16]
- HERF = the Herfindahl Index measure of market concentration for a route;
- DIST is the great circle distance between the two cities on a route and $DIST^2$ is equal to the square of DIST;
- PASS is the total number of revenue passengers for all carriers on the route;[17]
- SLOT is a dummy variable coded 1 if either or both of the two cities on a route has slot-controlled airports and 0 otherwise;
- VACATION is a dummy variable coded 1 if one of the two cities on the route is in Florida, Nevada, Hawaii, or Puerto Rico and 0 otherwise;
- HAWAII is a dummy variable coded 1 if the route is an intra-Hawaiian route and 0 otherwise;
- the $QUARTER_t$'s are dummy variables for each quarter in our sample (except the base quarter) to account for changes in prices over time; and
- the $CARRIER_j$'s in the second equation are dummy variables to account for differential pricing strategies of the carriers in our sample.

The independent variables represent a mix of demand, cost, and market structure variables that may influence price. Market concentration, as measured by the Herfindahl Index, is hypothesized to be positively associated with route prices; that is, the greater the concentration on a route, the higher the prices. Route distance and the square of route distance are cost side variables. Price is expected to increase proportionately with route distance but inversely with the square of distance; that is, as the distance of a route increases, so does price but at a decreasing rate due to the fixed costs of flights. Passengers is both a demand side and cost side variable. On the demand side, increases in passengers (a shift to the right of the demand curve, holding supply constant) should be associated with higher prices. On the cost side, higher passenger density should be associated with cost economies and lower prices. The net effect of passengers on price cannot be determined *a priori*. Slot is a market structure variable to control for supply restrictions on take-off and landing slots. These restrictions are expected to result in higher prices. The vacation variable is a market structure variable. Vacation markets are expected to attract a higher ratio of pleasure to business travellers, resulting in lower yields to carriers. The Hawaiian variable is a market structure variable for the very short, high density routes found between the Hawaiian Islands. It is not known *a priori* what will be the sign on the coefficient for this variable.

The difference between the two models is in the use of dummy variables for the airlines, with only the second model using the airline dummies. The airline firm dummies allow for firm-specific characteristics to influence the price on a route. One major firm-specific variable that is not included in our model is airline costs. The firm dummies allow airline costs to

Table 5. Regression Results

Variable	Model 1		Model 2	
	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	-145.389	-4.13[a]	134.651	2.75[a]
Herfindahl Index	0.024	4.69[a]	-0.005	-1.07
Distance	0.230	17.37[a]	0.121	11.71[a]
Distance squared (000's)	-0.048	-13.70[a]	0.019	-4.87[a]
Passengers (000's)	0.164	5.56[a]	0.018	1.01
Slot controlled	38.927	7.33[a]	16.400	6.14[a]
Vacation route	-15.979	-4.06[a]	-25.352	-12.98[a]
Intra-Hawaiian	-39.581	-3.72[a]	-45.520	-2.03[b]
1991 4th quarter	6.720	1.26	7.773	2.44[b]
1992 1st quarter	18.536	3.44[a]	21.266	6.38[a]
1992 2nd quarter	-10.348	-1.95[c]	-7.809	-2.36[b]
1992 3rd quarter	-18.172	-3.42[a]	-14.884	-4.51[a]
1992 4th quarter	2.144	0.40	7.040	2.10[b]
1993 1st quarter	17.344	3.17[a]	25.876	7.37[a]
1993 2nd quarter	0.026	0.00	10.711	3.17[a]
1993 3rd quarter	-12.532	-2.34[b]	3.266	0.92
1993 4th quarter	-6.854	-1.28	8.507	2.47[b]
1994 1st quarter	-5.657	-1.06	10.736	3.10[a]
1994 2nd quarter	-15.256	-2.86[a]	1.565	0.46
Alaska			-21.599	-2.67[a]
America TransAir			-24.685	-3.13[a]
American			-8.921	-1.46
America West			-21.160	-2.98[a]
Carnival			-36.190	-4.62[a]
Continental			-12.480	-1.98[a]
Delta			-3.108	-0.45
Enterprise			-11.946	-1.44
Hawaiian			-56.701	-6.81[a]
Jet Express			-35.763	-2.21[b]
Kiwi International			-38.659	-4.50[a]
Mark Air			-22.212	-4.00[a]
Midway			-24.693	-3.01[a]
Morris Air			-66.969	-6.04[a]
Northwest			-9.049	-1.58
Pan American			-25.321	-2.68[a]
Private Jet			-5.862	-0.44
Reno Air			-34.149	-4.18[a]
Southwest			-69.705	-8.06[a]
Spirit			-39.982	-2.15[b]

Table 5. (Continued)

Tower		-21.699	-2.34[b]
Trump Shuttle		-48.615	-2.76[a]
TWA		-16.242	-2.46[b]
Ultra Air		3.801	0.27
United		-14.954	-1.72[c]
USAir		-16.902	-2.27[b]
Valuejet		-40.251	-3.39[a]
Westair		-14.629	-1.33
No. of Observations	2,400	2400	
R^2	0.54	0.82	
Adjusted R^2	0.54	0.82	

[a]Significant at 99 percent confidence level
[b]Significant at 95 percent confidence level
[c]Significant at 90 percent confidence level

influence prices. A negative dummy implies that the carrier's presence leads to lower average prices on that route.

Table 5 provides the results of the estimation of the two models. An instrumental variable estimation was employed, instead of ordinary least squares, due to the endogeneity of two right side variables, Herfindahl Index and Passengers.[18] As expected, in both of the models the distance variable is positive and significant, indicating that longer routes have higher prices, while the distance squared variable is negative and significant, implying that prices increase with distance at a decreasing rate. The slot-controlled variable is positive and significant in both of the models, as expected, signifying that a route that has slot controls at one or both endpoints has significantly higher prices than a route with no slot controls at its endpoints. The vacation route dummy is negative and significant in the two regressions, implying, as hypothesized, that average fares on vacation routes are lower than fares in general. Finally, the dummy for intra-Hawaiian routes was negative and significant, indicating that, all other things being equal, fares on intra-Hawaiian routes are lower than on comparable routes elsewhere in the U.S.

The most interesting results were for the coefficient estimates for the Herfindahl Index and for Passengers. Both of these coefficients were positive and significant in Model 1 but not in Model 2.[19] The implication, with respect to the Herfindahl Index, is that concentration appears to be positively associated with higher prices only when individual carrier effects are not considered. When individual carrier effects are considered, as in Model 2, the effects from concentration are "swamped" by individual firm effects. Therefore, in order to lower prices on a route, it is much more important to have (for example) Southwest operating, even as a sole competitor, than it is to have low concentration. Adding a number of competitors to a route operated by Southwest (i.e., lowering concentration) will not lead to lower prices. It is the presence of Southwest itself that leads to the low prices.

The implication of the Passengers variable is not as straightforward. As outlined above, passenger traffic has both demand and cost side effects on price. From the cost side, an increase in passengers can raise densities on a route leading to cost economies and lower prices.[20] From the demand side, a surge in traffic can lead to increases in price. The net effect of the Passengers variable on price is indeterminate. The statistically insignificant coefficient for Passengers in Model 2 does not, therefore, necessarily imply that passenger traffic has no effect on price, but may imply that the positive and negative effects are in balance. The inclusion of the firm dummy variables in Model 2 controls for firm-specific cost differences. As a

result, the coefficient on Passengers in Model 2 is more likely to represent shifts of the demand curve. Its small positive sign is consistent with a relatively flat supply (marginal cost) curve.

The dummy variables for the carriers from Model 2 also produce interesting results. The entry of two of the three largest carriers onto a route, American and Delta, cannot be expected to lead to significantly lower prices, while the addition of United Airlines, the other "big three" carrier, should reduce one-way fares, on average, by about $15. On the other hand, the entry of Southwest Airlines onto a route reduces average fares for all carriers on a route by almost $70. Given that the mean fare in our sample is $136 (see Table 1), this represents a 51 percent reduction in fares and approximates the 48 percent reduction reported in the time series analysis section of this article. Other "low cost" carriers, such as Morris (recently purchased by Southwest), Valuejet, and Reno, also result in significantly lower fares upon entry.

Conclusions and Policy Implications

Two questions were posed at the beginning of this article. First, how different is the effect of the low cost carriers' entry on routes from the entry of other carriers? Second, are the price and traffic effects of new entrants, both low cost and other carriers, sustained past the initial promotional period or are they merely promotional? These questions were first addressed with a descriptive analysis using data over a three-year time period from 1991 to 1994. The results were illustrated in Figures 1 to 4. The figures clearly illustrated that the entry of low cost carrier Southwest on a route had a differential impact from the entry of other carriers, on average. These results are in agreement with earlier studies on low cost carriers by Bailey, Graham, and Kaplan[21] and Strassmann[22] and with the study on Southwest by Bennett and Craun.[23] The entry of Southwest resulted in a significantly greater price reduction and increase in traffic. Both of these impacts were sustained over a one-year period after route entry. The entry of established carriers, such as United, American, and Delta, appeared to have little or no effect on prices and passenger traffic. In addition, it was shown that the routes entered by Southwest were markedly different from the routes entered by pre-deregulation carriers. Southwest tended to enter shorter routes with a higher level of concentration and a lower level of passenger traffic.

Two regression models were estimated to determine the impact of cost, demand, market structure, and carrier presence variables on prices. The first model contained no carrier dummy variables, while the second model had a system of carrier dummies. The results indicate that route concentration and route density are not significant determinants of price on a route when carrier-specific effects are considered. In our second model, with the carrier dummies, the presence of low cost carriers significantly lowered prices on routes, while the route concentration and route density variables had insignificant impacts on price.

At least two policy implications can be derived from these results: First, public policy should encourage the expansion of low cost carriers. Their presence on routes leads to significantly lower prices than does the presence of other carriers. As an example of public policy designed to support the low cost carriers, airport operating authorities can ensure gate and slot availability to these carriers through either airport expansion or by using a competitive bidding process for available gates and slots.

Second, research results indicate that no public policy initiative is currently required to increase competition on routes currently dominated by low cost carriers, such as Southwest. The fear raised by Bennett and Craun[24] of the U.S. Department of Transportation that Southwest would raise prices after establishing dominance on a route does not, as yet, appear to be realized. Market concentration is not a significant determinant of prices on U.S. domestic routes. A highly concentrated route, served by Southwest, has significantly lower prices than a less concentrated route served by two or three higher cost carriers.

ENDNOTES

[1] See Shakira Hightower, "Southwest Airlines to Initiate Service to Baltimore with Discounted Fares," *Wall Street Journal*, July 15, 1993.

[2] *Ibid.*

[3] James Ott, "Southwest Enters East Coast Market," *Aviation Week & Space Technology*, July 19, 1993, p. 26.

[4] Randall D. Bennett and James M. Craun, "The Airline Deregulation Evolution Continues: The Southwest Effect," U.S. Department of Transportation, Office of Aviation Analysis, Washington, D.C., 1993.

[5] Papers in this stream, not discussed below, include: Thomas Gale Moore, "U.S. Airline Deregulation: Its Effects on Passengers, Capital, and Labor," *Journal of Law and Economics*, Vol. 29, April 1986, pp. 1-28; Severin Borenstein, "Hubs and High Fares: Dominance and Market Power in the U.S. Airline Industry," *Rand Journal of Economics*, Vol. 20(3), Autumn 1989, pp. 344-365; Gloria J. Hurdle, et. al., "Concentration, Potential Entry, and Performance in the Airline Industry," *The Journal of Industrial Economics*, Vol. 38(2), December 1989, pp. 119-139; Steven Morrison and Clifford Winston, "Enhancing the Performance of the Deregulated Air Transportation System," *Brookings Papers: Microeconomics 1989*, pp. 61-123; Steven T. Berry, "Airport Presence as Product Differentiation," *American Economic Review*, Vol. 80(2), May 1990, pp. 394-399; U.S. General Accounting Office, *Airline Competition: Effects of Airline Market Concentration and Barriers to Entry on Airfares*, Washington D.C.: General Accounting Office, 1991; and Margaret A. Peteraf and Randal Reed, "Pricing and Performance in Monopoly Airline Markets," *Journal of Law and Economics*, Vol. 37, April 1994, pp. 193-213.

[6] In both of these cases, it was conjectured that the newly certified carriers had lower cost structures than existing carriers.

[7] Elizabeth E. Bailey, David R. Graham, and Daniel P. Kaplan, *Deregulating the Airlines*, Cambridge, MA: The MIT Press, 1985.

[8] Diana L. Strassmann, "Potential Competition in the Deregulated Airlines," *The Review of Economics and Statistics*, Vol. 72, 1990, pp. 696-702.

[9] Michael D. Whinston and Scott C. Collins, "Entry and Competitive Structure in Deregulated Airline Markets: An Event Study Analysis of People Express," *Rand Journal of Economics*, Vol. 23(4), Winter 1992, pp. 445-462.

[10] Randall D. Bennett and James M. Craun, "The Airline Deregulation Evolution Continues: The Southwest Effect," 1993.

[11] Income and population data were gathered from U.S. Department of Commerce, *Survey of Current Business*, Volume 72(4), April 1992; and U.S. Department of Commerce, *Local Area Personal Income 1962-1992*, Department of Commerce, Economics and Statistics Administration, Bureau of Economics, 1994. These data were used in the instrumental variable estimation described in the next section of the article. Stage length data were drawn from the *Official Airline Guide*, North American Edition, January 1994.

[12] The Herfindahl Index is a measure of market concentration and takes into account both the number of competitors and the market share of each competitor. An index value of 10,000 would imply market monopolization. An index value of 5,000 could be derived from a market with two competitors, each with a 50 percent market share. The Herfindahl Index would rise to 6,250 in a two competitor market with one competitor holding a 75 percent market share and the other only 25 percent. The Herfindahl Index will approach 0 as the number of competitors in a market approaches infinity and the share of all competitors approaches equality.

[13] In order to be considered an entrant on a route in a given quarter, a carrier had to meet a two-part test. First, it had to have less than a 5 percent market share the previous quarter. Second, it had to increase its market share by at least five percentage points. No entry information is provided for the third quarter of 1991, since data were not collected for the previous quarter and, given the two-part test, entry could not be determined.

[14] In order to be considered to have exited a route in a given quarter, a carrier had to meet a two-part test. First, it had to have more than a 5 percent market share the previous quarter. Second, it had to decrease its market share by at least five percentage points.

[15] If one takes account of the generally upward trend in passenger traffic over this time period, the change in passenger traffic on routes where pre-deregulation carriers entered is even smaller.

[16] For the case of a passenger buying a round-trip ticket, the fare was divided by two to produce a one-way fare. Only revenue passengers were included in the sample. Frequent flier tickets and other zero fares were excluded from the sample.

[17] The total is for origin and destination passengers. For example, if there were 50,000 passengers who flew from New York to Chicago in a quarter and 55,000 who flew the other way, the passenger total used would be 105,000.

[18] For example, if the price on a route should increase, one might expect entry onto that route and, consequently, a decrease in the Herfindahl Index. Price increases would also be expected to lead to a passenger decline on a route, all other factors held fixed. The fact that fluctuations in the left side variable can reasonably be expected to cause changes to right side variables results in biased coefficient estimates when using ordinary least squares. Instrumental variable estimation reduces these biases in large samples, with a limit of zero bias as the sample approaches infinity. The sum of income at the two end points and the sum of population at the two end points were used as instruments. Multiplying the values of income and population at the end points together to create the instruments did not affect the results.

[19] Using data from 1981, Bailey, Graham, and Kaplan, *Deregulating the Airlines*, 1985, found that route concentration, as measured by the Herfindahl Index, positively influenced prices on U.S. domestic air routes. As with our Model 1, Bailey, Graham, and Kaplan did not include carrier dummies in their estimation. Note that the results of Borenstein, "Hubs and High Fares: Dominance and Market Power in the U.S. Airline Industry," 1989, and others, indicating that market concentration can lead to higher prices, are not necessarily in conflict with our results. Borenstein found that a carrier with a high market share on a route (his definition of market concentration) led to higher prices for *that carrier*. Our definition of concentration differs from that of Borenstein and our results focus on average prices for *all carriers* on a route.

[20] Douglas W. Caves, Laurits R. Christensen, and Michael W. Tretheway, "Economies of Density versus Economies of Scale: Why Trunk and Local Service Airline Costs Differ," *Rand Journal of Economics*, Vol. 15, Winter 1984, pp. 471-489, found that airlines face economies of density; that is, increased passenger density on a given route leads to reductions in unit costs.

[21] Elizabeth E. Bailey, David R. Graham, and Daniel P. Kaplan, *Deregulating the Airlines*, 1985.

[22] Diana L. Strassmann, "Potential Competition in the Deregulated Airlines," 1990.

[23] Randall D. Bennett and James M. Craun, "The Airline Deregulation Evolution Continues: The Southwest Effect," 1993.

[24] *Ibid.*