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ENTRY, CONTESTABILITY, AND DEREGULATED AIRLINE MARKETS: AN EVENT STUDY ANALYSIS OF PEOPLE EXPRESS

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ABSTRACT

A number of recent papers have studied the relationship between price and market structure in the deregulated airline industry through a cross-sectional analysis of city-pair markets. Yet, while interesting, several potential difficulties underlie the inferences drawn in these analyses. In this paper, we consider an alternative approach that uses stock price reactions to entry announcements to shed light on the nature of competitive behavior in this industry. The analysis sheds light on three issues. First, it offers a clean test of contestable market theory. Second, it provides evidence on the level of profits or sunk costs present in these markets. Third, it sheds light on the degree of competitive "localization" existing in the industry. The particular entry events that we focus on are those involving People Express Airline in 1984 and 1985. To provide a more complete picture of the effects of these entry events, we also examine the price and quantity changes that occurred following entry.

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I. Introduction

The domestic airline industry has undergone dramatic changes in the last decade. The passage and implementation of the Airline Deregulation Act of 1978 led to the entry of a large number of new carriers, a dramatic change in existing carriers' route and fare structures, and a notable increase in the use of air transportation services. More recently, the industry has seen a highly publicized and controversial wave of consolidation through merger. To evaluate these changes, and to devise proper public policy toward the industry in the future, an understanding of the nature of competition in the industry is essential. At the same time, however, the industry possesses a number of features that make achieving such an understanding difficult.

One of the important features of the industry, for example, is that, because of economies of scale at the route level, many markets are inevitably served by only one or two carriers. Thus, the performance of these deregulated markets will often depend heavily on the constraint of potential rather than actual competition. The degree to which the threat of entry contrains price–setting by firms active in a market, however, is one of the least well understood issues in industrial organization. Recent theoretical models differ widely in the strength that they give to this effect, and relatively little is known empirically about either the process of entry or the impact that its threat has on actual competition.[1] In approving the series of recent mergers in the industry, policymakers have adopted the view that potential competition would prove sufficient to prevent supranormal profits from being earned.

The underlying premise for this belief finds its clearest formal expression in the theory of contestable markets of Baumol, Panzar, and Willig [1982]. They demonstrate that in the absence of sunk costs associated with entry, scale economies *per se* need not prevent

[1]Compare, for example, the theoretical models of Baumol, Panzar, and Willig [1982], Milgrom and Roberts [1984], and Mankiw and Whinston [1986]. A recent paper by Berry [1989] provides the first empirical examination of entry in the airline industry.

markets from achieving efficient outcomes. Rather, if potential entrants have access to the same technology as incumbent firms, then under these conditions potential competition can fully constrain incumbents' pricing, allowing them only a competitive return. While the strong assumptions required for this result may not be reasonable in many circumstances, the theory's proponents cited the airline industry, with its "capital on wings" as being a prime example of such a market.

Another notable aspect of the industry that makes understanding the determination of competitive outcomes difficult is the complex multiproduct nature of its firms. A typical carrier offers service on hundreds of routes. Yet, each of these is really part of an interrelated network of routes that the carrier serves. This fact naturally gives rise to a number of difficult questions regarding the nature of competition. For instance, to what extent is competition "localized" so that competitive outcomes can be thought of on a route–by–route basis? Is the level of concentration on a route meaningful, or should we only focus on regional, or even national, measures of concentration? Questions of this sort were of particular importance during the recent merger wave, for example, as carriers with relatively modest national market shares proposed mergers that led to substantial regional and route–specific increases in concentration.[2,3]

A number of recent studies have examined pricing behavior in the deregulated airline industry.[4] All of these studies have a similar structure. Each seeks to explain the cross–sectional variation in fares over various city–pair routes. The explanatory variables

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[2]To some degree, this issue is related to that of potential competition. In particular, if with a sufficient number of potential entrants incumbent pricing is constrained, and if the most viable potential entrants for a route are those airlines already operating elsewhere, then regional or national measures of concentration may be most important.

[3]Some other characteristics of the airline industry that make understanding competitive outcomes difficult are the tremendous ability to segment demand (price discriminate), carrier control over airport facilities, and computer reservation system ownership.

[4]See, for example, Graham, Kaplan, and Sibley [1983], Call and Keeler [1985], Bailey, Graham, and Kaplan [1985], Morrison and Winston [1987], and Borenstein [1988]. For an interesting, more informal examination of the nature of competition in the airline industry see Levine [1987].

include proxies for demand and cost conditions, as well as measures of market structure (e.g., the route's Herfindahl index). A finding that these traditional measures of a route's market structure are significant predictors of its fares is taken as evidence that local market structure matters and that contestability theory is inapplicable. Most of these studies (though not all) have reached this conclusion.[5]

Nevertheless, these studies suffer from several problems that could potentially undermine their inferences. For example, all of these studies treat their sample as a set of unrelated routes, when in fact (as we have discussed above), they are really all part of an interrelated network. Another problem is the lack of effective controls for variations in cost and demand conditions across markets. This problem is in part related to the networking issue, since the effective marginal cost of flying a plane on a particular city–pair route will depend upon where the plane can fly from the destination city. It can lead to particularly misleading results in testing contestability theory. For instance, suppose that the theory is valid, but that important elements of cost are omitted from the regression. When true costs are lower than the estimated level of costs we expect to see both unusually low prices <u>and</u> unusually low concentration (typically, more firms will be able to serve the market profitably), leading to the measurement of a spurious positive correlation between price and concentration.[6]

In this paper, we consider an alternative approach to examining the nature of competitive interaction in the deregulated airline industry. This approach follows recent studies of regulation in using stock price data to shed light on competitive structure. In

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[5]Some studies also try to examine whether potential entry has any effect on pricing (a hypothesis of "imperfect contestability" according to Morrison and Winston [1987]) by including measures of the number of "viable" potential entrants.

[6]In some papers the authors utilize an instrumental variables technique in response to the potential endogeneity of concentration (e.g., Graham, Kaplan and Sibley [1983]). Though in principle this procedure should solve this problem, in practice it is difficult to find convincing instruments. Typically the authors utilize measures related to a route's position in the network (e.g., endpoint airport size) that we have just argued are themselves proxies for unmeasured costs of service that should really already be in the pricing equation.

particular, we examine airline stock price reactions to announcements of entry into airport–pair markets.

Examination of these reactions sheds light on three aspects of competitive interaction in deregulated airline markets. First, it offers a clean test of contestability theory that avoids many of the complications inherent in studying pricing behavior (such as controlling for network effects) and that also focuses on what is in some sense the central prediction of the theory. Second, it provides evidence on the extent of profits or sunk costs present in these markets. Third and finally, by relating the pattern of value changes to firms' competitive positions, we are able to shed light on the degree to which competitive effects are localized.

The basic idea behind our test of contestable market theory is very simple. In a contestable market, the absence of sunk costs or cost advantages across carriers and the presence of free entry leads carriers to earn no economic profits. Furthermore, to the extent that we see entry and exit in a contestable market, these instances are caused by generalized cost or demand shifts and continue to leave carriers earning no economic profits. Thus, when an incumbent carrier faces entry into its market, this occurance should not be associated with any significant change in value for that firm. A similar proposition holds for the entrant as well; since he faces a future of zero economic profits, no change in value should be associated with entry events.

The particular entry events that we focus on here are those involving People Express airlines during the years 1984 and 1985. For these events, the stock price reactions that we report below lead us to reject this implication of the contestable market model. In particular, an average incumbent carrier on a route entered by People Express loses roughly three to six million dollars in value when entry is announced. On a pre–tax basis, this corresponds to a loss of roughly sixty to one–hundred percent of the "average" discounted value of operating profits that can be attributed to these routes and is equivalent to the loss that would arise were the incumbent forced to fly its planes completely empty for roughly three to five months.

Since many industry observers would characterize People Express during this period as embodying demand and/or cost innovations, it is natural to question exactly what this rejection means.[7] In particular, do we learn any more from this rejection of the contestable market model (with its assumption of identical costs among firms) than that People Express did have a different technology?

In fact, we do. In particular, if incumbents on a route suffer value losses because of People Express' entry, then one of two things must be true. First, these incumbents could have been earning positive profits prior to entry. Alternatively, they must have had sunk costs that kept them in the market despite taking these losses. The significant losses from entry that we measure therefore provide a lower bound on the extent of either profits or sunk costs existing in these markets prior to entry. In the presence of either of these elements, however, we would not expect the contestable market model to hold even in the absence of People Express' innovation. Furthermore, while this finding does not necessarily imply an inefficient market outcome (e.g., if firms act as price–takers and earn profits due to cost advantages, then efficiency will still result), it does suggest some basis for concern and further study.

Finally, these same changes in value allow us to shed light on the issue of competitive localization. We do find an important element of localization. In particular, the value loss that we measure for incumbents on an entered route is not felt equally by other carriers. Indeed, neither carriers with departures at other airports serving the same city–pair, nor carriers with departures at the newly entered airport suffer losses that are of similar

[7]In this view People Express' demand–side innovation was the introduction of low frill air travel, while its cost–side innovations involved changes in operating procedures and labor costs that were, to some extent, lower than the formerly regulated carriers. Of course, it could be argued that the existing carriers were potentially able to duplicate these service and operations procedures. In addition, it is unclear how much of People Express' lower labor costs were attributable to lower quality workers.

magnitude to those suffered by the entered route's incumbents. At the same time, however, we do detect evidence of significant value changes on other carriers. While only twenty percent of the loss suffered by the average incumbent on the entered route can be attributed to these general "network" effects, these effects amount to roughly eighty percent of the aggregate effect on the industry. Thus, while there is a unique local effect, the impact of entry appears to permeate more generally through the system.

To provide a more complete picture of the effects of these entry events, we also examine the price, (sales) quantity, and schedule changes that incumbents in these markets undertook in response to entry. The responses to these events paint a picture similar to that emerging from our analysis of changes in value. As expected, incumbents on the entered route dramatically reduced their prices in response to People Express' entry: on average, the mean of incumbents' prices fell by roughly thirty–five percent. A smaller price reduction of fifteen percent occurred on the routes involving other airports in the same cities. Interestingly, though, the incumbents on the entered route seem, if anything, to have increased both their scheduled service and their sales quantity following entry. Thus, it appears that the value losses suffered by incumbents were not merely temporary losses incurred while they scaled back their operations in these markets.

The paper is organized as follows. We begin in Section 2 by discussing our empirical methodology for examining the value changes associated with our entry events. In Section 3, we discuss the data used in this investigation. Section 4 then presents our empirical findings on valuation responses to entry announcements. That section begins with an examination of a relatively simple specification for examining the issues raised here and then successively considers more elaborate analyses of these value changes. In Section 5, we then present evidence on the price, sales quantity, and schedule responses to entry. Finally, Section 6 concludes.

2. <u>Methodology</u>

The basic approach that we use to identify value changes caused by People Express entry events is the event study.[8] Here we use daily stock price data. Unlike the typical event study, however, here it makes more sense to model the events as causing some abnormal <u>dollar</u> change in value as opposed to an abnormal <u>return</u>. The reason is that the dollar loss attributable to being an incumbent in a particular entered market is likely to be largely independent of the overall size of the carrier. Letting $\Delta_i(Z_t)$ be the expected dollar change in the value of firm i when entry events with characteristics Z_t occur (Z_t could include the number of events, who are the incumbents, etc.), we can derive the following return process for firm i from the CAPM model of security prices (see <u>Appendix C</u> for a formal discussion):

$$(R_{it}-R_{ft}) = \alpha_i \left[\frac{1}{V^i_{t-1}}\right] + \beta_i(R_{mt}-R_{ft}) + \delta_t \left[\frac{\Delta_i(Z_t)}{V^i_{t-1}}\right] + \epsilon_{it} \qquad (1)$$

where

R_{it}	$\equiv$	the rate of return on a share of firm i on day t (including any dividend payments)
R_{ft}	$\equiv$	the risk–free rate of interest on day t
R_{mt}	$\equiv$	the rate of return on the market portfolio on day t
δ_t	$\equiv$	an indicator variable equal to 1 if <u>some</u> event occurs on day t
V^i_{t-1}	$\equiv$	the value of firm i's equity on day t–1
ϵ_{it}	$\equiv$	a serially uncorrelated random error term.

[8]See, for example, Schwert [1981] and Rose [1985] for other examples of the use of this methodology in industrial organization.

A central feature of the analysis presented below is that we use differences in carriers' relative positions to isolate the sources of value changes. For example, one question that we are particularly interested in examining is whether carriers that are incumbents in the specific route that People Express enters suffer value losses, and equally important, whether these value losses are significantly larger than those for carriers that are not incumbents. In general, this leads us to model the dollar change in value from a particular event k for carrier i as some function:

$$f(Z_i^k, \Lambda)$$

where Z_i^k are measurable characteristics of carrier i relevant to event k and Λ is some parameter vector that we estimate.[9] For example, Z_i^k could be the number of seats that carrier i offered in the entered market for event k and Λ might then be the dollar change in value per seat (a parameter to be estimated). Then, the total value change due to entry is taken to be

$$\Delta_i(Z_t) = \sum_{k \epsilon E_t} f(Z_i^k, \Lambda), \tag{2}$$

where E_t is the set of events occurring on day t.

Below, a number of different specifications for $f(\cdot\cdot)$ are investigated. In each case, however, the basic form of our estimating equations is the same and is derived by substituting (2) in for $\Delta_i(Z_t)$ in (1). Since $\delta_t = 1$ if and only if $E_t \neq \phi$, this yields:

[9]Note that Λ can include individualized parameters (i.e., firm specific fixed effects).

$$(R_{it}-R_{ft}) = \alpha_i\left[\frac{1}{V^i_{t-1}}\right] + \beta_i(R_{mt}-R_{ft}) + \sum_{k\in E_t}\left[\frac{f(Z^k_i,\Lambda)}{V^i_{t-1}}\right] + \epsilon_{it}. \qquad (3)$$

Then, since $f(\cdot\cdot)$ is assumed to be linear in each of these specifications (i.e., $f(\cdot\cdot) = Z^k_i \bullet \Lambda$), (3) can be written as

$$(R_{it}-R_{ft}) = \alpha_i\left[\frac{1}{V^i_{t-1}}\right] + \beta_i(R_{mt}-R_{ft}) + \left[\frac{\overline{Z}^k_i}{V^i_{t-1}}\right] \bullet \Lambda + \epsilon_{it}, \qquad (4)$$

where $\overline{Z}^k_i \equiv \sum_{k\epsilon E_t} Z^k_i$.

We also examine the change in People Express' value from its entry announcements. For People Express we simply replace $f(\cdot\cdot)$ in (3) with some function $g(X^k,\Theta)$ where X^k are measurable characteristics of the event and Θ are parameters to be estimated.

We simultaneously estimate a system of M equations of the form (4) and one equation for People Express, where M is the number of carriers other than People Express in our panel, allowing the $\{\epsilon_{it}\}$ to be contemporaneously correlated across the firms.[10,11]

Note that by estimating the average dollar effect of entry (as a function of characteristics), equation (4) controls for differences in debt–equity ratios across firms by implicitly imposing the assumption that equity is the full residual claimant to all entry–induced value changes.[12]

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[10]Estimations were performed using the Seemingly Unrelated Regression (SUR) procedure in SAS SYSNLIN.

[11]We also ran the specifications considered below including a (firm–specific) constant in equation (4) to allow for misspecification in the asset pricing model. The estimated value changes for this specification were nearly identical to those reported below.

[12]This is essentially the same assumption used in Rose [1985] to control for differing debt–equity ratios. Rose [1985], however, estimates the event effect in percentage terms, and so uses the ratio of the book value of equity to total book value of the firm to control for differing debt equity ratios.

Finally, up to this point, we have not been very specific about the choice of the "window" over which the event response is to be measured. For example, if we want a three–day window with the actual announcement date of the entry at the end of this period, then event k will be an element of E_t if and only if day t is the announcement date of event k or one of the two trading days immediately prior to that date. Below we examine several such windows. Note, though, that when we do so, the estimates for $\underset{\sim}{\Lambda}$ correspond to the daily average effect over the window: to get our estimate of the total effect of the event we then multiply by the number of days in the window chosen.

3. Data

Four sorts of information are required for our study of value responses to entry: event identification, market information for these events, stock data for a panel of airlines, and general information about these airlines' operations.

3.1 Events

The first data issue concerns the definition and identification of relevant events. For this study, we focus on non–stop domestic entry events into non–slot–constrained airport–pairs.[13] Non–slot–constrained entry events are the appropriate ones to focus on for an analysis of contestability because, if entry is restricted at these airports, zero operating profits need not hold. Similarly, international flights are subject to regulation. The time period covered here is 1984 and 1985. The choice of these years has several advantages: first, by 1984, six years had passed since the Airline Deregulation Act; second, by 1984,

[13]During the period of this study, four airports faced government–regulated take–off and landing slot restrictions (New York's LaGuardia and John F. Kennedy Airports, Washington D.C.'s National Airport, and Chicago's O'Hare Airport).

nearly all of the flight restrictions due to the 1981 PATCO strike had been lifted;[14] and third, these years come prior to the recent merger wave.

The set of People Express entry events were identified using Aviation Daily, The Wall Street Journal, and The New York Times.[15] The date associated with a particular event was the date of publication of the earliest report which made it clear that People Express was entering that route (dates are referred to below in a year/month/day format; e.g., 850717 is July 17, 1985).[16] Most often this date corresponded to the date on which People Express' announcement of entry was first reported. In three cases, the date used was based on an Aviation Daily "Intelligence Column" that reported that People Express would enter the market in question. In total, 24 events were identified. These events are summarized in Appendix A. As can be seen there, 22 of these 24 events involved Newark Airport.

3.2 Market Information

For each entry event, information about the set of incumbents operating in the entered route needed to be collected. This information was obtained by examining the edition of the Official Airline Guide issued just prior to the event date.[17] The Official Airline Guide provides information on all flights offered between two airports by each carrier and the type of plane used. For this study, two types of flight information were collected. First, each carrier's number of non–stop flights per week between the entered airport pair by plane

[14]Only two non–slot constrained airports were still subject to these IFR Constraints in 1984: Denver and Los Angeles. These constraints were removed in February in Denver and in August in Los Angeles. None of our events involve these airports while they were subject to these constraints (or even shortly after their removal).

[15]The New York Times/Wall Street Journal Index was used to identify entry announcements in these publications. For Aviation Daily, all 1984 and 1985 issues were examined for relevant events.

[16]Aviation Daily is received in New York in the morning of the date of publication.

[17]The Official Airline Guide is published bi–weekly. A complete set of back issues is available at Northwestern University's Transportation Library.

type.[18] Second, each carrier's number of non–stop flights per week (by plane type) for all other airport pairs in the city–pair entered (thus, this number will be zero when the cities in question each have only one airport). This information was then converted into the number of seats offered by each carrier using plane capacity information.[19]

Table 1 summarizes some of the characteristics of the airport–pair routes entered by People Express. In order to provide some perspective on these numbers, Table 1 also reports the same characteristics for all non–slot constrained entry events by other carriers during this period, as well as a breakdown into the former trunk airlines, regional airlines, and all other airlines (newly certified carriers other than People Express, former intrastate carriers, and carriers that previously went bankrupt).[20] As can be seen there, the People Express entry events are characterized by relatively low numbers of incumbents, high distance, and large numbers of offered seats per incumbent compared to the average of all other entry events. Former trunk and regional carriers tended to enter smaller and shorter markets than People Express which represented extensions off of their existing hubs (and often entered markets with no incumbents), while the "other" carriers entered less concentrated routes; all three types of carriers entered markets with much lower numbers of seats per incumbents than did People Express.[21]

3.3 Stock Data

[18]Actually, only flights using jet aircraft were counted. The only effect of this decision is that in the 850717 EWR–Albany and EWR–Providence events, Delta Airlines would have been an incumbent had we counted non–jet flights.

[19]This capacity information was provided by AVMARK, Inc. (a Washington area consulting firm) and Official Airline Guide, Inc.

[20]The People Express data used in this study was collected as part of a larger dataset containing information on all entry event announcements in 1984 and 1985.

[21]The t–statistics for these comparisons are (i) For People Express vs. All Others (d.f.=179): # of incumbents (–1.0), Seats per Incumbent (2.5), Distance (1.4); (ii) People Express vs. Trunks/Regionals (d.f.=92): Total Seats (1.5), Seats per Incumbent (3.0), Distance (2.7); (iii) People Express vs. Others (d.f.=105): # of incumbents (–1.6), Seats per Incumbent (1.8).

Table 1

Event Statistics	People Express	Entrant: All Others	Trunks*	Regionals**	Others
Events with no incumbents	5	107	35	38	34
Events with incumbents	19	162	44	30	88
Averages for events with incumbents: (standard deviations in parentheses)					
# of incumbents	1.68 (0.78)	2.03 (1.44)	1.73 (1.17)	1.77 (1.57)	2.27 (1.51)
Herfindahl	.722 (.249)	.718 (.284)	.782 (.270)	.808 (.267)	.654 (.496)
Total Seats	12,000 (7,761)	11,500 (13,500)	8,800 (7,600)	9,000 (14,600)	13,600 (15,600)
Seats per incumbent	7,100 (3,283)	5,100 (3,300)	5,200 (3,000)	4,100 (2,900)	5,500 (3,550)
Distance miles	892 (549)	706 (534)	565 (364)	595 (488)	814 (601)

*Braniff and Continental are counted as an "other" due to bankruptcy.
**Frontier is counted as an "other" due to bankruptcy.

A panel of airlines was constructed from two sources. First, the CRSP daily price tape was used to gather the price, number of shares outstanding, and dividends for all airline stocks traded on the New York and American Stock Exchanges.[22] To the set of sixteen carriers from this source that were traded every day in our sample period were added four carriers that were traded on the Over–the–Counter Exchange (and were also traded every day). The final panel of airlines used in this study is listed in Appendix B. In all but one case nearly all of these companies' operations were in the air transportation business.[23]

3.4 Airlines' Operations

At points below we utilize information about a carrier's operations in a given year or at particular airports (such as the number of scheduled departures performed). All of this information was obtained from the FAA publication, Airport Activity Statistics of Certificated Route Air Carriers.

4. Empirical Findings on Value Responses

In this section we present and discuss the results of our analysis of value responses. The presentation starts with discussion of a relatively simple specification of the stock price reaction to entry into an airport–pair market. This simple specification reveals a strong drop in value for incumbents on the route in question. To allay a number of plausible concerns about the interpretation of this finding, and to investigate more thoroughly the sources of value changes, we then consider successively more elaborate specifications in the subsections that follow.

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[22]The share data was corrected in several instances to conform to known dates of stock splits.

[23]The only exception was United. Even for United, however, over five–eighths of its assets during the sample period were identified with its airline operations (source: 1986 Annual Report).

4.1 The Simplest Specification

In attempting to explain the value changes caused by People Express' entry into a non–stop airport–pair market, the simplest place to start is to model the changes for any particular firm as being related to the extent to which that firm was an incumbent on the entered route. For any given event, it is natural to model each incumbent's effect as being proportional to its share of the seats in service on that route. A more difficult question is how to achieve comparability across events. We model the aggregate effect on incumbents in a given event as a function of observable market characteristics prior to entry. In much of what follows, we model this effect as being proportional to the total number of seatmiles offered in the entered market prior to entry. This choice reflects two considerations. First, it seems reasonable to think that the aggregate effect on incumbents in a given event might be related to market size as measured by available seats. At the same time, since both customer value and costs increase with distance, it seems unlikely that the total dollar value change per seat would be equal for a 200 mile market and a 2,000 mile market.[24] Given this choice for modeling the aggregate effect on incumbents in an event, the effect on a particular incumbent is therefore captured by the number of seatmiles offered by that incumbent. Thus, we take the function $f(\cdot\cdot)$ discussed in Section 2 to be

$$f(\cdot\cdot) = \gamma SM_i^k$$

where SM_i^k is carrier i's number of seatmiles per year in the non–stop airport–pair entered in event k and where γ, a parameter to be estimated, measures the dollar change in value for firm i per (annualized) seatmile (we switch to an annualized basis here to simplify some comparisons that we will make below).[25] To capture the dollar change in People Express'

[24]This choice is also consistent with standard industry reporting practices which typically report values of such items as "operating profit per available seatmile."

[25]That is, the variable SM measures the total number of seatmiles that an incumbent would have flown in a year based on the number that it was flying during the period just

value we simply set $g(\cdot\cdot) = \theta$, a parameter to be estimated.

One can, of course, think of reasons why alternative ways of capturing this aggregate incumbency effect might be superior. For example, longer non–stop routes might be more competitive because of the greater substitutability of connecting competition, leading value losses to be decreasing rather than increasing in distance. Likewise, if People Express' scale of entry is independent of market size, then we might see the aggregate value loss from an event be roughly independent of the number of seats in service on a route. For this reason, we explore alternative representations of this aggregate effect in Section 4.5. As we shall see there, the basic insights from our seatmile formulation turn out to be fairly robust.

This basic specification was estimated for three different event windows: a one day window, a two day window with the announcement day at the end of the period, and a three day window with the announcement day at the end.[26] The results are reported below in Table 2 (standard errors are in parentheses).

Table 2

Total Dollar Value Response to People Express Entry

Variable	Window 1 Day	Window 2 Day	Window 3 Day
Incumbent Effect per Annualized Seatmile (SM)	–.0109 (.0035)	–.0147 (.0049)	–.0191 (.0061)
People Express Effect (1,000's)	–354 (1,103)	440 (1,548)	–1,293 (1,914)

prior to the entry announcement.

[26]In earlier work we also examined a three day window with the announcement day in the middle. This was done to check whether significant information was incorporated into stock prices after the announcement day. Our results indicated no such effect.

The results in Table 2 paint a clear picture concerning the effect of entry on incumbents. Incumbents experienced a total drop in value whose point estimate ranges, depending on the window employed, between –.0109 and –.0191 per seatmile (the estimates in Table 2 are the total value change; that is, the number given for the two day effect is twice the estimated daily average change during the event window). The estimates all allow one to reject the hypothesis of no effect with very high levels of confidence (t statistics between –2.98 and –3.15).

In addition to being statistically significant, the estimated value changes in Table 2 are also significant in economic terms. On average, these point estimates imply a total dollar loss of between 6.2 and 10.9 million dollars per event for all incumbents combined and of between 3.7 and 6.5 million dollars per incumbent. At the forty–six percent tax rate prevailing in these years, this would correspond to a pre–tax loss of between 6.8 and 12.0 million dollars per incumbent.

Some comparisons may also help give a feel for the size of this loss. The (weighted) average of annual operating income per seatmile for our incumbents over 1984 and 1985 is .0042.[27] Using the weighted average estimated value of beta for our incumbents (1.53) and the (post–war) average risk–free and market returns, this implies a risk–adjusted discounted value of operating income of .034 per seatmile. Thus, our point estimates, which reveal a pre–tax loss of between .0202 and .0354 per (annualized) seatmile, correspond to a range of pre–tax loss of roughly 60 to 100 percent of the risk–adjusted discounted value of operating income that can be attributed in this way to the entered route.[28]

In assessing this comparison, several points should be kept in mind. On one hand, operating income overstates the conceptual quantity of interest, and thus understates the relative importance of the measured losses, because it includes income attributable to

[27]The weights used for each airline correspond to that airline's share of the total seatmiles People Express entered against.

[28]We can also compare the loss with the average equity value per seatmile per year of .0178. Thus, incumbents lose a similar fraction of this value.

imputed rents on planes owned by the carriers while the economic profits of interest to us are only those associated with operations. On the other hand, at least three factors may cause the importance of these losses to be overstated in this comparison. First, these markets may not be "average markets" in terms of profitability since People Express may elect to enter routes that are relatively more profitable for incumbents. Second, this operating income figure gives average income while we are interested in the incremental profits associated with serving a route. If, for example, carriers have substantial (non–route–specific) fixed costs, then incremental profits will exceed average profits. Third, this comparison may not shed much light on the absolute value of the loss as operating income may be small under certain theories (e.g., under contestability, if a carrier rents all of its planes, it has an operating income of zero).

Another comparison that does give some sense of the absolute loss from entry arises from comparing our estimated declines in value to the (weighted) average of annual revenue per seatmile for our incumbents, which is .081. On a pre–tax basis, then, the measured loss is between 25 and 43 percent of this quantity. Put differently, an average incumbent's pre–tax loss is comparable to that arising from it being forced to fly its planes completely empty for roughly three to five months.[29]

Finally, there are a number of reasons why the estimates in Table 2 may either over or underestimate the true effect of entry on incumbents. The next several sections will be considering several possibilities that might lead to overestimates. On the other hand, at least three effects might bias our results toward obtaining underestimates. First, we could be misdating events. Second, the market may partially anticipate these events and therefore capitalize some of the losses attributable to entry prior to our event window.[30] Third, some value changes may also be felt by debt–holders or workers (if there is rent–sharing).

[29]Of course, the actual decline in annual revenue implied by this figure depends on how long People Express was expected to be in the market (or how long it was expected to be pricing aggressively) and on the effect of entry on incumbents' costs.

[30]See Appendix C for a discussion of this point.

Turning to the estimated value changes for People Express, we see that these are small (below one million dollars in absolute value), imprecisely estimated, and of inconsistent sign. One possible interpretation of these estimates is that while the market did not know where People Express would expand, the general scale of People Express' expansion was essentially fully anticipated. This would lead to little effect on People Express' stock value assuming they made an optimal choice (from among some set of largely equivalent options), but a (potential) drop in value for the firms it entered against. One problem with this view, however, lies in its prediction that the expected value change for the entire set of possible incumbents should be zero, a prediction we find falsified in the next section.[31] A second interpretation of these stock reactions arises from viewing People Express during this period as being largely a "spoiler," lowering incumbents' returns while making little itself. In fact, the beginning of our sample period roughly coincides with what is perceived to have been a shift in People Express' strategy toward entering larger markets served by the major airlines – a strategy that some observers feel was a mistake for the airline.[32]

4.2 Controlling for General Effects

While the results above demonstrate that airport–pair incumbents experienced a drop in value, they do not identify whether these value changes are unique to these firms or are instead part of a more general reaction to a People Express entry announcement that is felt by all firms in the industry. Investigating whether there is such a differential impact on airport–pair incumbents is of interest for two reasons. First, in examining the localization issue, we are interested in the extent to which economic outcomes on a route are uniquely sensitive to that route's market structure. Second, in examining the contestability

[31]Admittedly, we do not have all possible incumbents in our panel, but the only notable one missing is Frontier.

[32]One analyst described the history of People Express to us has having "two periods: before Minneapolis and after."

hypothesis, and in identifying the degree of losses due to incumbency on an entered route, we want to distinguish route–specific value changes from several more indirect effects. For example, even if the contestability model is generally applicable, our entry events may indirectly affect values in those areas where regulation leads to carrier rents: international flights and flights from slot–constrained airports. A second concern arises from the recognition that carriers are not only providers of air transportation services (the arguably contestable market) but also are owners of airplanes. If People Express entry events are correlated with changes in the values of these airplanes, then carriers may generally be observed to experience value declines coincident with entry announcements.[33]

To control for such a general effect, we introduced firm specific fixed effects into the specification discussed above.[34] More specifically, the function $f(\cdot\cdot)$ now takes the form for firm i of:

$$f(\cdot\cdot) = \alpha_i + \gamma SM_i^k$$

For example, in the case of value losses due to indirect effects on slot–constrained departures, the α_i would be related to the level of slots that each carrier possessed. The results for this specification are presented below in Table 3.

[33]That is, contestability predicts zero operating profits given the rental rate on airplanes. As owners of airplanes, however, carriers may experience value changes. Such a correlation could potentially arise from two different effects. First, a decline in the value of airplanes (which leads to lower rental rates) could cause new entry opportunities to develop. Second, if the stock of planes is fixed in the short–run, then People Express entry events could potentially either increase the price of planes (by increasing demand for air travel) or decrease their price (by leading to travel with higher load factors). Admittedly, both of these effects seem somewhat unlikely, the former because of our use of daily data and the latter because of the small size of People Express relative to the worldwide market for used planes.

[34]Further controls for slot effects are discussed below in Section 4.3.

Table 3

Total Value Response to Entry: Fixed Effects Specification

	Window		
Variable	1 Day	2 Day	3 Day
Incumbent Effect per per Annualized Seatmile(SM)	−.0127 (.0040)	−.0168 (.0057)	−.0221 (.0070)
People Express Effect (1,000's)	−256 (1,144)	147 (1,606)	−1,460 (1,986)
Sum of Fixed Effects (1,000's)	−30,841 (17,621)	−35,008 (17,621)	−28,212 (17,806)

As can be seen in Table 3, allowing for these effects has little effect on our previous conclusions and, if anything, slightly increases the point estimates of the size of the incumbent effects (while slightly increasing their standard errors).

The third row in Table 3 reports the sum of the estimated fixed effects and the standard errors of these estimates. While their standard errors are large (the hypothesis that the sum is zero can be rejected at critical values between .05 and .11), these estimates reveal two interesting points. First, for the average firm, the loss suffered when an event occurs is roughly four times larger (at the mean of the estimated ranges) when it is an incumbent (6.8 million) than when it is not (1.7 million).[35] Thus, the losses attributable to the specific market entered are a large share of value loss for an incumbent firm. At the same time, at an industry level, the losses attributable to these other sources make up (at the mean of the estimated ranges) roughly 80 percent of the total value loss (31.6 million versus 8.6 million), indicating that there are important effects felt elsewhere in the network.

[35]A weighted average of these fixed effects based on carrier's extent of incumbency (as done earlier) reveals a loss of 3.2 million for the "average incumbent." Thus, as would be expected, these generalized effects were felt more heavily by those carriers who were more likely to be entered.

4.3 Controlling for Slot Effects

The concern that the effects we are measuring could be due to effects on departures at slot–constrained airports raises another issue. Twenty–two of the 24 events in this study involved Newark International Airport which, to some extent, may compete with two slot–constrained airports (LaGuardia and Kennedy) for New York area air traffic. If there is a positive correlation between those carriers serving Newark and those carriers serving LaGuardia and Kennedy airports, then we may have merely been picking up effects on these slot–constrained departures in the results above.

We took two approaches to control for this effect. First, we included variables, OSM_i^k, that measured the number of seatmiles that a carrier i flew between the city–pair involved in event k at airport combinations other than the entered airport–pair (e.g., if the airport pair entered was Newark–Cleveland, we now measure all other flights between airports in Cleveland and the New York metropolitan area). If slot–constrained departure effects are fully explaining the estimates above, then we should now see all of the value change be captured by the OSM variable. In addition, the estimate of the OSM effect is of independent interest as it provides a measure of the importance and effect of substitution between airports within a city. Thus, we now let the function f(··) be,

$$f(\cdot\cdot) = \alpha_i + \gamma SM_i^k + \phi OSM_i^k$$

In our sample of events, nearly all of these other (i.e., OSM) seatmiles involve slot–constrained departures from New York area airports to the same destination airport. In fact, only two of our 24 events involved flights to an airport other than Kennedy or LaGuardia that was not part of the airport–pair entered by People Express. Compared to the average total number of seatmiles on the airport–pair entered (8,718,000 per week), the number at other airports in the city–pair (21,860,800 per week) was roughly two and a half times as large. Most of this difference is explained by the larger number of incumbents serving these other airports, an average of 2.71 compared to 1.33 for the entered airport–pair (these are averages over all of our events).[36] Quite often the carrier serving the entered airport–pair (usually involving Newark) also served the other airports in the city–pair: the probability that $OSM_i^k > 0$ given $SM_i^k > 0$ was .719 over all events and .793 for New York area events. Thus, our ability to distinguish between the main airport–pair route effect (SM) and the effect due to routes involving these other airports (OSM) stems largely from the difference in the value changes for these dual operating carriers compared to the value changes for those operating only at the other airports.

The results for this specification are presented in Table 4.

Table 4

Total Value Response to Entry: Including Other Airport Seatmiles

	Window		
Variable	1 Day	2 Day	3 Day
Incumbent Effect per per Annualized Seatmile (SM)	–.0158 (.0053)	–.0203 (.0075)	–.0200 (.0092)
Other Airports Incumbent Effect(OSM)	.0025 (.0028)	.0028 (.0039)	–.0017 (.0048)
People Express Effect (1,000's)	–262 (1,144)	140 (1,606)	–1,456 (1,986)

Inclusion of the OSM variables does little to change our earlier findings. The point estimates of the SM effect for the one and two day windows grow slightly larger in absolute size while that for the three day window falls a bit. The standard errors of all three estimates increase, but we may still reject the hypothesis of no effect on the entered

[36]Thus, the average number of seatmiles per incumbent was 6,539,000 per week for the entered airport–pair compared to 8,072,000 at the other airports (note that these averages include events with no incumbents).

airport–pair with a high degree of confidence. The estimates of the other airport effect, on the other hand, are small (approximately an order of magnitude smaller than those for the entered airport pair), imprecisely estimated, and of inconsistent sign. Thus, there appears to be little evidence of a marked drop in value for airlines operating on these other routes, but we continue to see evidence of a strong effect on those airlines operating on the entered route.[37]

Even if all value changes are due to departures at New York slot–constrained airports, however, one might still see little of this effect being picked up in the OSM variable if these effects were felt generally by all carriers at the slot–constrained airport. For example, if the basic hypotheses of contestability about the ease of entry into a route held true for carriers with operations at slot–constrained airports (that is, if any carrier could could easily change the use of a slot to serve another market), we would expect to see the profit level of all departures at that airport equalized (though not to zero). Thus, entry would lead to general adjustments in all carriers' flights at that airport and each carrier would bear an equal loss in value per slot.[38] If the SM variable were more correlated with the levels of these effects (the ownership of slots in our example) than was the OSM variable, then our SM effect may still be picking up these slot effects. While our use of firm specific fixed effects already largely controls for this possibility (since 22 of 24 events were Newark

[37]It is worth noting, however, that the usual intuitions regarding the value effects on substitute airports (a drop in value,but a smaller one than at the entered airport) need not hold here. One reason arises from the importance of demand segmentation in this industry and from People Express' role as a niche carrier serving low willingness–to–pay travelers. People Express' entry at Newark puts the Newark incumbent at risk of losing a large share of his discount fare travelers. If this causes this incumbent to cut back service, or take other actions to decrease its attractiveness to business travelers, the benefits to a carrier at LaGuardia of gaining the Newark incumbent's business travelers could more than compensate for any losses he suffers in discount fare travelers. Thus, not finding a negative effect on value at the other airports does not necessarily imply a lack of substitution between airports.

[38]This statement assumes that the distribution of each carrier's slots by the time–of–day is the same. Note also that one can equivalently think of this point as imputing a value to slots which changes with entry (while operating profits net of this implicit slot rental rate remain at zero for all airlines at the airport).

events), our second approach allowed for separate fixed effects for New York area and non–New York area events. The results of this estimation are presented in Table 5.

Table 5

Total Value Response to Entry:
Separate New York Area Fixed Effects

Variable	Window 1 Day	2 Day	3 Day
Incumbent Effect per per Annualized Seatmile (SM)	–.0144 (.0054)	–.0189 (.0077)	–.0172 (.0094)
Other Airports Incumbent Effect(OSM)	.0020 (.0028)	.0019 (.0040)	–.0038 (.0049)
People Express Effect (1,000's)	–268 (1,144)	121 (1,606)	–1,486 (1,986)

Again, this change has little effect on our estimates of the SM and OSM effects. In general, these effects grow slightly smaller in absolute magnitude when these separate fixed effects are included. A quasi–likelihood ratio test of the difference between the New York and non–New York fixed effects (not reported in Table 5) comes nowhere near rejecting equality for the two and three day windows (significance levels between .90 and .75) and could reject for the one day window at a significance level of approximately .20.

4.4 Examining Airport Effects

While the results of the previous section cast doubt over the view that the declines in value realized by airport–pair incumbents upon People Express' entry were attributable to losses due to regulated slot constrained departures, it is still of considerable interest to explore other alternative sources of rent whose value declines may be picked up by our SM variable. A possibility of particular interest is the extent to which People Express has effects on other carriers operating at the new airport that it has begun to serve. This could happen for a number of reasons. First, People's flights to Newark often connected with other flights and thus would offer some competition to non–stop flights originating at the new airport destined for a third city (which People Express flew to from Newark). Alternatively, People Express' presence at the airport may, by lowering its cost of entry into other markets emanating from that airport, have constrained existing carriers' pricing to some degree.

To examine this effect, we constructed a set of variables, $EPORT_i^k$, which measured the number of departures that carrier i had at the airport that People Express entered in event k in the year of that event.[39] Typically, the incumbent carriers (SM>0 and OSM>0) in an event had disproportionately large shares at the new airport. For example, carriers with SM>0 accounted for, on average, 44.3 percent of all new airport departures, while those with either SM>0 or OSM>0 accounted for an average of 59.1 percent of new airport departures.[40] The average numbers of departures are described below in Table 6.

Table 6

Average Number of Departures at the Newly Entered Airport

	All carriers	SM>0 carriers	OSM>0 carriers
All events	3,444	29,616	19,936
New York events	3,652	31,400	20,327

These numbers suggest that if an airport effect is present, our incumbency variable

[39]In all cases except the 841114 MSP–PIE event, People entered an airport that it did not yet serve. In that case EPORT was set equal to zero for all carriers.

[40]These figures are conditional on the set of events with some incumbents (either SM or OSM) and exclude the 841114 MSP–PIE event.

SM may be picking it up. At the same time, however, the close relationship between the two variables may make it difficult to distinguish between the two effects. The estimates from this procedure, which also included separate New York and non–New York firm specific fixed effects, are reported in Table 7.

Table 7

Total Value Response to Entry:
Including Entered Airport Departures

Variable	Window: 1 Day	2 Day	3 Day
Airport–Pair Incumbent Effect (SM)	–.0126 (.0058)	–.0154 (.0082)	–.0142 (.0101)
Other Airports Incumbent Effect (OSM)	.0026 (.0029)	.0029 (.0041)	–.0029 (.0050)
Entered Airport(EPORT) Departures Effect	–33.8 (38.2)	–63.9 (54.3)	–55.4 (66.5)
People Express Effect (1,000's)	–262 (1,144)	132 (1,606)	–1,477 (1,986)
Test of SNS=OPORT=0: (approx. probability of statistic > χ^2 under null)	$\chi^2(2)=7.9$ (.025)	$\chi^2(2)=7.5$ (.025)	$\chi^2(2)=4.0$ (.15)
Sum of New York Area Fixed Effects (1,000's)	–36,238 (19,136)	–34,622 (19,054)	–24,534 (19,209
Sum of NY less Sum of non–NY Fixed Effects (1,000's)	41,518 (85,381)	–24,640 (85,534)	–13,629 (85,872)

Inclusion of the EPORT variables lowers the point estimate of the airport–pair incumbent (SM) effect for each of our estimates while also slightly decreasing the precision of our estimates. Indeed, it is no longer possible to reject the hypothesis of no SM effect for the three day window (t–statistics for the three windows are –2.18, –1.89, and –1.43 respectively). Relative to our initial findings reported in Table 2, however, this stems largely from the decreases in precision caused as we added more variables; the point estimates here are of roughly equal magnitude to those we started with. The estimates of the EPORT effect, on the other hand, provide some weak evidence of a negative effect on carriers operating at the entered airport: for all three windows the point estimate is negative, although in none of the cases can we reject the hypothesis of no effect at conventional significance levels. Table 7 also reports the quasi-likelihood ratio statistics for the joint hypothesis that there is no effect from entry on either entered airport-pair incumbents or airlines operating at the newly entered airport. This hypothesis can be rejected at a significance level of .025 for the one and two day windows, but only at a .15 level for the three day window. Using these estimates we can also compare the dollar losses due to the SM and EPORT effects. Table 8 presents these dollar losses.

Table 8
Average Losses Due to Route Incumbency Versus Presence at Newly Entered Airport

Loss due to:	Average over	1 Day	2 Day	3 Day
EPORT	All carriers	$116,367	$220,062	$190,755
EPORT	SM>0 carriers	1,000,674	1,892,379	1,640,356
SM	SM>0 carriers	4,294,680	5,248,099	4,839,491

Table 8 offers two basic facts. First, for an average carrier, the total dollar loss due to the EPORT effect is relatively modest. Second, even for airport-pair incumbents –who have much larger than average EPORT effect losses –the loss due to route incumbency far outweighs the estimated losses due to the EPORT effect.

Finally, Table 7 also reports both the sum of the New York area fixed effects and the difference in the sums of the New York area and non-New York area fixed effects. The New York area estimates are similar to those seen in Section 4.2; as would be expected with only two non–New York events, the differences in the New York and non–New York effects are very imprecisely estimated.

4.5 Alternative Specifications

As we noted in Section 4.1, one can readily come up with arguments for alternative specifications of the aggregate effect on incumbents from an entry announcement. To examine the robustness of our conclusions, we therefore estimated for the one–day event window a model that allowed this effect to be a more general function of seats and distance. In particular, we replaced our seatmile measure SM_i^k with a specification of the form:

$$[\omega + \varphi * SEATS_k + \mu * DIST_k + \gamma * DIST_k * SEATS_k] * SH_k^i \qquad (5)$$

where $SEATS_k$ and $DIST_k$ are the level of total available seats and distance in event k and SH_k^i is firm i's share of the seats in service for that event. Note that SM_k^i, our earlier measure corresponds to the case where $\omega=\varphi=\mu=0$.

We also replaced the seatmile measure for the other airport–pairs, OSM_k^i, with a form parallel to (5) but where the SEATS and SH variables correspond to these other airport pairs. Thus, six additional parameters were estimated.

A test for the significance of these additional six parameters comes no where close to rejecting our previous specification, producing a χ^2 statistic of 3.4 [prob $(\chi^2>3.4)\approx.75$].[41] Of the three additional terms in expression (5), the most important one seems to be that involving DIST. For example, if we pick one of these three new terms as our maintained hypothesis instead of the DIST*SEATS term and perform a similar test for significance of the other terms, the χ^2 statistics are 4.5 for the DIST term, 6.8 for SEATS, and 7.5 for just a constant. Likewise, if we start with the DIST and DIST*SEATS terms and test the

[41]This test was run using the specifications in Table 7.

inclusion of the two remaining terms in (5), the χ^2 statistic is only 2.4 [Prob $(\chi^2>2.4)\approx.65$]. In contrast, reversing this procedure to test the null hypothesis that only the constant and SEATS terms are needed gives a χ^2 statistic of 6.5 [prob $(\chi^2>6.5)\approx.16$].

Given these results, we examined more fully a specification involving both the DIST and the DIST*SEATS terms. In general, collinearity makes it difficult to say much about the separate effects of these terms. Despite this fact, however, we can still get a reasonably precise estimate of the overall value response attributable to the entered and other airport pairs. To aid in comparison with our earlier results, Table 9 describes the implied effect per seatmile for both the entered and other airport–pairs for the various specifications considered earlier.[42]

Table 9

Implied Value Response per Seatmile at Sample Means
(1 Day Window)

	Specification in Table #:				
	(2)	(3)	(4)	(5)	(6)
Entered Airport–Pair	–.0114 (.0035)	–.0130 (.0040)	–.0141 (.0055)	–.0122 (.0058)	–.0118 (.0059)
Other Airport–Pairs	–	–	–.0009 (.0037)	–.0017 (.0041)	–.0009 (.0047)

As can be seen in Table 9, this specification yields results for the entered airport–pair that are very close to those we obtained earlier; the point estimates are slightly larger when the other airport–pair terms are not included, and slightly smaller when they are. The other airport–pair effect, on the other hand, is now uniformly negative and quite small. Thus, our previous conclusions seem robust with respect to more elaborate modelling of the aggregate

[42]In each case, this was computed as $(\frac{\mu}{\text{AVSEATS}} + \gamma)$ where AVSEATS is the sample mean of SEATS.

incumbency effect.

5. Price and Quantity Responses to Entry

To get a more complete sense of the effects of our entry events, we also examined the price, sales quantity, and schedule responses that accompanied them. The evidence from this investigation broadly corroborates the conclusions from our examinations of value responses and also provides some interesting additional insights.

Table 10 provides information on the year to year percentage changes in the mean coach class price (μ_p), standard deviation of coach prices (σ_p), and total quantity of coach tickets sold (Q) of airlines other than People Express for our New York area events from 1984 to 1985 and from 1985 to 1986.[43] Since our interest is in examining the effect of entry, Table 10 breaks these events into two groups, those markets entered in 1984 and those entered in 1985, with the aim of using the set of markets not entered in a given year as a control group for those that were.

Our data comes from the DOT Origin and Destination Survey for the first quarters of 1984, 1985, and 1986.[44] Thus, to compute the yearly percentage change from say 1984 to 1985, we compare the 1st quarters of these years. This forces us to exclude two events that occurred in the first quarter of 1985 from consideration as we are unable to identify a single year as the year of entry. Also excluded from Table 10 are two other events, one which did not have a Newark incumbent in the first quarter of 1984 (Nashville), and the other in which People Express switched to another airport–pair within the same city–pair before a year elapsed (San Francisco). Finally, this data is for all direct flights between Newark airport and the new city; that is, in contrast to our analysis above, both non–stop and multi–stop tickets are included as long as no change of plane occurred.

[43]We restrict attention to New York area events to increase the similarity of the markets under consideration.

[44]This data was very kindly provided to us by Severin Borenstein. It arises from a 10 percent sample of tickets.

Table 10

Year to Year % Price/Quantity Changes of Newark Incumbents

Markets Entered in:	Mean Price 84/85	Mean Price 85/86	Sales Quantity 84/85	Sales Quantity 85/86	Stnd.Dev. of Price 84/85	Stnd.Dev. of Price 85/86
1984 (#=7)	–33 (26)	0 (15)	+108 (101)	+12 (22)	–28 (21)	+21 (29)
1985 (#=8)	+2 (24)	–35 (21)	+36 (40)	+86 (107)	+27 (48)	+1 (44)
t statistic for differences in means (d.f.=13)	2.5	3.5	0.6	0.6	2.6	1.0

The striking fact about Table 10 is that the results for those markets entered in 1984 and those entered in 1985 are almost mirror images of each other. As is the popular perception, there was a dramatic fall of roughly 35 percent in the average price of incumbents in markets entered by People Express in a given year. In contrast, almost no change in average price occurred in markets not entered in a given year. These price reductions were presumably necessitated by People Express' dramatically lower fares. For this sample of markets, People Express' average fare in the first quarter of the year following entry was an average of 19 percent below the incumbent airlines' mean fare even after the price reductions noted in Table 10. In addition to these declines in mean price, People Express entry seems to be associated with a decrease or lower increase in price dispersion though to a greater extent in 1984/85 than in 1985/86. This difference between years could in part reflect airlines' increasing sophistication in the use of yield management systems over this period, so that by 1985/86 an airline could more effectively target price reductions where they were most effective.

Finally, the change in tickets sold by incumbents following entry is notable. Though there is a high degree of variation evident in the data, it appears that entry by People

Express is associated with, if anything, an increase in incumbents' number of tickets sold.[45] To investigate the causes of this sales increase further, we also examined incumbents' schedule changes following entry (increases in scheduled capacity can increase sales holding price fixed by increasing flight frequency and by lowering the likelihood of turning away customers when flights are full). We did this by comparing the number of (non–stop) seats offered by incumbents on the entered route exactly one year following the entry announcement to the number calculated for the time of announcement (we again used the Official Airline Guide). The average change for the markets examined in Table 10 was a 25 percent increase in seats (standard deviation of 42 percent). This is to be contrasted with the average annual increase over 1984–86 in domestic seats offered at Newark airport by carriers other than People Express of 11 percent.[46] Thus, People Express entry seems to be associated with, if anything, increases in incumbents' scheduled capacity. To get a fuller picture of these capacity changes, we also examined the extent to which they were due to increases in flight frequency as compared with increases in the number of seats available per flight (again calculated using the Official Airline Guide). In fact, nearly all of the change in capacity was due to changes in flight frequency; the average number of seats per flight in the entered markets increased only 6 percent (standard deviation of 20 percent) compared to a 1984–86 average increase at Newark airport for carriers other than People Express of 3 percent.

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[45]Indeed, these quantity increases made revenue fall by much less than might have been expected given the price reductions. The average revenue change in 1984/85 for 1984 entered markets was +21 percent (s.d. = 22 percent) while 1985 entered markets experienced a revenue change of +33 percent (s.d. = 28 percent) in that year; in 1985/86 the change for entered markets was +3 percent (s.d. = 29 percent) while it was +10 percent (s.d. = 16 percent) for non–entered markets. Note, though, that incumbents' losses were likely to be larger than this both because an increase in passengers carried raises costs holding capacity fixed and because, as we document in the text, incumbents' seem to have increased their capacity on these routes following entry. Finally, it should be noted that only effects on coach class are documented here.

[46]In fact, this comparison understates the difference since the data yielding the 11 percent figure (from the FAA's Airport Activity Statistics) include the entered markets. The same point applies below, where we make similar comparisons.

One must be somewhat careful in interpreting these changes, since they may not only reflect direct responses to People Express entry but may also reflect the results of changes in underlying demand and cost conditions in the entered markets. Indeed, in principle these exogenous changes (demand increases or generalized cost decreases) could be the very factors causing entry in these markets.[47] Nevertheless, given the magnitude of the changes observed here, it may not be unreasonable to assume that much of what we are observing is a direct response to People Express' entry.[48] If so, then the observed changes in sales and capacity in response to entry are particularly interesting. These responses indicate that incumbents' losses did not arise during a temporary period of adjustment toward a lower scale of operations. This would seem to rule out at least some models of market behavior. It is difficult, for example, to imagine any simple model of competitive behavior giving rise to both price reductions and quantity increases by incumbents following entry.[49] In addition, in most commonly used static models of oligopoly, the typical response of incumbents to entry involves <u>decreases</u> in capacity and sales along with decreases in price (e.g., Kreps and Scheinkman [1983]). While one can write down static models in which this is not true (e.g., if the slope of demand significantly flattens as own price falls), these responses at least raise the possibility that incumbent airlines may have been following some more complicated dynamic strategy. In particular, as some industry observers claim, incumbents may have elected to respond aggressively in the hope of spurring exit or at least discouraging entry

[47]This point, combined with the difficulty of measuring these demand and cost conditions (especially cost), is one reason why it is difficult to draw conclusions about contestability from observed price and quantity changes following entry.

[48]While we do not have the data to confirm it, we suspect that a large fraction of these observed changes occurred in a short period following entry. Though not determinative, this would also suggest that much of these changes is a direct response to the entry event.

[49]It also seems to run counter to the view that the contestable model held prior to People Express' entry. The difficulty here, though, lies in specifying exactly what the model with People Express looks like. If one specifies a Bertrand–like pricing mechanism (which generates the standard contestable outcome absent People Express), the entry of a more efficient firm should generally lead to quantity reductions for incumbents (consider, for example, the case where there is a single monopolist incumbent).

into other of their markets.[50]

We also performed a similar exercise for the other airport–pairs (typically trips between the newly entered airport and either Kennedy or LaGuardia airports in New York). Table 11 provides the results for these airport–pairs:

Table 11

Year to Year % Price/Quantity Changes of Other Airport–Pair Incumbents

	Mean Price		Sales Quantity		Stnd.Dev. of Price	
Markets Entered in:	84/85	85/86	84/85	85/86	84/85	85/86
1984 (#=7)	–14 (22)	+1 (13)	+12 (34)	+1 (27)	+2 (28)	+6 (16)
1985 (#=8)	+9 (18)	–15 (12)	–5 (16)	+2 (21)	+52 (42)	–12 (11)
t statistic for differences in means (d.f.=13)	2.1	2.3	1.2	0.1	2.5	2.6

Once again the 1984 and 1985 events contrast notably depending upon the year of entry; we again see declines in the mean of prices and, if anything, quantity increases for incumbents associated with entry. Consistent with our value response finding, however, these changes are much smaller than those for the entered airport–pair. Analysis of schedule data also again reveals increases in capacity on these routes: the average change in incumbent capacity in the year following announcement is 11 percent (standard deviation of

[50]In this regard, it is interesting to note that the capacity increases were significantly larger in 1984 than in 1985 (an average of 48 percent versus 5 percent with standard deviations of 52 percent and 14 percent); by 1985 it may have been clearer that People Express' future was likely to be short.

30) in comparison to an average annual change at Kennedy and LaGuardia airports during this period of minus 1 percent. More than all of this increase in capacity can be attributed to changes in flight frequency; seats per flight fell by 4 percent (standard deviation of 9 percent) versus a 1984–86 decrease at these airports of only 2 percent.[51] Finally, as in Table 10, entry is associated with a reduction or lower increase in the standard deviation of prices, which is again larger in 1984 than in 1985.

6. Conclusion

Our analysis of the value changes caused by People Express' entry sheds light on three aspects of competitive interaction in the deregulated airline industry. First, the significant losses incurred by incumbents in markets entered by People Express lead us to reject the contestable market model. Second, these same estimated losses provide a lower bound on the extent of profits or sunk costs present in these markets prior to entry. Aside from its more general interest, this evidence of pre–entry profits or sunk costs suggests that the contestable market model was unlikely to be valid as a model of competitive behavior even in the absence of People Express' innovation (that is, among the established carriers). Third, the pattern of value changes across carriers provides insight into the extent of competitive localization in the industry. This pattern reveals an important element of localization: over eighty percent of the loss suffered by incumbent carriers is attributable to their presence on the entered route. At the same time, we do detect a significant general "network" effect that accounts for roughly eighty percent of the industry's value change when an event occurs. Moreover, the price and quantity responses to entry that we document, in addition to being interesting in their own right, also seem broadly consistent with the view that emerges from these estimated value changes.

We find these conclusions to be of considerable interest, and think they affirm the

[51]It is interesting to note the (weak) evidence of somewhat different flight frequency versus seats per flight responses at these airports as compared with Newark airport.

analysis of stock data as a potentially fruitful avenue for learning about competitive behavior in industries. Nevertheless, two caveats should be made in closing. First, there are clearly limits to the ability of the methods used here to answer many natural questions about the sources of market power in the industry and the resulting forms of competitive interaction. To answer these questions, other techniques, involving detailed direct examination of pricing and other strategic choices of the airlines, are necessary. Unfortunately, as our earlier discussion has indicated, we feel that correctly modeling the complexity of these choices is likely to be a very difficult task.

The second caveat concerns our approach's strong reliance on the assumption that the market is correctly evaluating the competitive effects we are examining, as well as on the other assumptions of the event study method (e.g., see Appendix C). No doubt, this is a qualification that should be kept in mind in evaluating our results. Yet, we feel that it is important to think of this concern in the context of the existing literature. Our findings are valuable in part, we think, because their potential weaknesses differ dramatically from those that arise in nearly all of this literature.

Appendix A

Event Date*	Airport–Pair**	Source	Remarks
840510	EWR–Minneapolis	AD	
840817	EWR–Miami	AD, NYT, WSJ	
840817	EWR–Detroit	AD, NYT, WSJ	
840910	EWR–San Francisco	WSJ	"probably also Cleveland and New Orleans"
840910	EWR–Denver	WSJ	
841003	EWR–Cleveland	AD, NJT, WSJ	
841026	EWR–Orlando	AD	"Intelligence Column" report that People's had secured a gate
841114	Minneapolis–Tampa (PIE)	WSJ	
841128	EWR–Greensboro	AD, NYT, WSJ	
850111	EWR–Rochester	AD	
850208	EWR–Cincinnati	AD	
850410	EWR–Ft. Lauderdale	AD	
850411	EWR–Birmingham	AD	"Intelligence Column" report that People's would begin service
850417	EWR–Raleigh Durham	AD	
850417	EWR–Charlotte	AD	article saying People's was finalizing plans to serve these markets
850417	EWR–Dayton	AD	
850618	EWR–Nashville	AD, NYT	
850627	EWR–Dallas/ Ft. Worth	AD	"Intelligence Column" report that People's would begin service
850710	EWR–Atlanta	AD	"Intelligence Column" report that People's would begin service

850717	EWR–Albany	AD, NYT
850717	EWR–Providence	AD, NYT
850828	Denver–San Diego	AD, NYT, WSJ
850828	EWR–New Orleans	AD, NYT, WSJ
850828	EWR–St. Louis	AD, NYT, WSJ

*Dates are given by year/month/day
**EWR stands for Newark

Appendix B

	Airline	Stock Exchange
Former Trunks:		
	American	NYSE
	Continental*	AMEX
	Delta	NYSE
	Eastern	NYSE
	Northwest Orient	NYSE
	Pan Am	NYSE
	Trans World	NYSE
	United	NYSE
	Western	NYSE
Former Regionals:		
	Alaska Air	NYSE
	Ozark	AMEX
	Piedmont	NYSE
	Republic	NYSE
	US Air	NYSE
Former Intrastates:		
	Air California	OTC/AMEX
	Pacific Southwest	NYSE
Newly Certified:		
	Midway	OTC
	People Express	OTC
	Texas Air**	AMEX

*Is classified as a formerly bankrupt carrier in Table 1
**Actually held the stock of Continental and New York Air. In the analysis, all event variables for Texas Air are linear combinations of those for Continental and New York Air using the percentage ownership levels that held during the sample period.

Appendix C

In the stationary Capital Asset Pricing Model, returns for firm i on day t satisfy,

$$E[R_{it}-R_{ft} \mid I_{t-1}] = \beta_i \, E[R_{mt}-R_{ft} \mid I_{t-1}] \qquad (C.1)$$

where I_{t-1} is the information set at time t–1 and $\beta_i \equiv [Cov(R_{it}, R_{mt})/Var(r_{mt})]$ is assumed to be independent of both I_{t-1} and t. This leads to a model for observable returns,

$$(R_{it}-R_{ft}) = \beta_i \, (R_{mt}-R_{ft}) + \tilde{u}_{it}, \qquad (C.2)$$

where $E[\tilde{u}_{it} \mid I_{t-1}] = E[(R_{mt}-R_{ft}) \, \tilde{u}_{it} \mid I_{t-1}] = 0$.[52] Letting $\tilde{d}_{it} \equiv \tilde{u}_{it} \cdot V_{it-1}$ denote the dollar abnormal return, (C.2) becomes,

$$(R_{it}-R_{ft}) = \beta_i \, (R_{mt}-R_{ft}) + \left[\frac{\tilde{d}_{it}}{V^i_{t-1}} \right] \qquad (C.3)$$

To derive equation (1) in the text, which is the dollar–based analog of the standard returned–based event study estimating equation, suppose that the occurrence of events is an i.i.d. process: some event will occur on each day t with probability q and the characteristics Z_t of events occurring on day t, conditional on some event occurring, have density $g(Z_t)$.[53] From (C.3) we can write:

$$(R_{it}-R_{ft}) = \beta_i (R_{mt}-R_{ft}) + E[\tilde{d}_{it} \mid I_{t-1}, \delta_t, Z_t] \left(\frac{1}{V^i_{t-1}}\right) + \tilde{\epsilon}_{it} \qquad (C.4)$$

---

[52]The fact that $E[(R_{mt}-R_{ft})u_{it} \mid I_{t-1}] = 0$ follows from the theoretical restriction that $\beta_i = [Cov(R_{it},R_{mt})/Var(R_{mt})]$.

[53]See Malatesta and Thompson [1985] for a related derivation.

where $E[\tilde{\epsilon}_{it} | I_{t-1}, \delta_t, Z_t] = 0$ and where, assuming independence of $(R_{mt}-R_{ft})$ and (δ_t, Z_t) conditional on I_{t-1}, $E[(R_{mt}-R_{ft}) \tilde{\epsilon}_{it} | I_{t-1}] = 0$. Next, note that we can replace $E[\tilde{d}_{it} | I_{t-1}, \delta_t, Z_t]$ in (C.4) by,

$$E[\tilde{d}_{it} | I_{t-1}, \delta_t = 0] + \delta_t \{E[\tilde{d}_{it} | I_{t-1}, \delta_t = 1, Z_t] - E[\tilde{d}_{it} | I_{t-1}, \delta_t = 0]\},$$

or, letting $\Delta_i(Z_t)$ be the expected change in firm i's discounted profits conditional on events with characteristics Z_t occurring on day t, by:

$$E[\tilde{d}_{it} | I_{t-1}, \delta_t = 0] + \delta_t \Delta_i(Z_t). \qquad \text{(C.5)}$$

Also, since $E[\tilde{d}_{it} | I_{t-1}] = 0$, it must be that,

$$\begin{aligned} E[\tilde{d}_{it} | I_{t-1}, \delta_t = 0] &= -q\, E[\Delta_i(Z_t) | I_{t-1}, \delta_t = 1] \\ &= -q\, E[\Delta_i(Z_t) | \delta_t = 1] \qquad \text{(C.6)} \end{aligned}$$

where the latter equality follows from the i.i.d. assumption. Substituting (C.5) and (C.6) into (C.4) we have:

$$(R_{it}-R_{ft}) = -\left[\frac{q\ E[\Delta_i(Z_t) | \delta_t=1]}{V^i_{t-1}}\right] + \beta_i(R_{mt}-R_{ft}) + \delta_t\left[\frac{\Delta_i(Z_t)}{V^i_{t-1}}\right] + \tilde{\epsilon}_{it} \qquad \text{(C.7)}$$

Finally, noting that $q\ E[\Delta_i(Z_t) | \delta_t=1]$ is a constant, we get equation (1) in the text, which then leads to our estimating equation (4).

Note that estimation of equation (4) under the above assumptions leads to consistent estimates of the event effects despite the presence of some "anticipation" of these events (in the sense that $q > 0$). Nevertheless, as elsewhere in the event study literature, it is worth noting two possible sources of inconsistency that can arise if the stochastic process of events is other than that assumed above.

First, information about the likelihood of an event happening on day t and its characteristics may arrive prior to day t, even though the processes for any two days t' and t" may still be independent. In this case, q and $E[\Delta_i(Z_t) | \delta_t=1]$ in equation (C.7) should be functions of I_{t-1}, $q(I_{t-1})$ and $E[\Delta_i(Z_t) | \delta_t=1, I_{t-1}]$, so that estimating (4) leads in general to inconsistent estimates.[54]

We can, however, identify two situations of interest in which more can be said about this bias. First consider the case where the event characteristics consist of a single variable, such as SM_{it} in Section 5.1. While it is difficult to say anything about the bias in equation (4), it is possible to show that if we replace (α_i/V_{it-1}) by the constant α_i, then the estimate of the event variable is necessarily biased toward zero.[55] In fact, estimates using this form produce estimates nearly identical to those reported in the text.

The other case arises when there is a fixed effect included in f(· ·) in addition to one or more other variables. In this case, we can think of the event characteristics in equation (4) as terms of the form,

$$\gamma_0\left[\frac{N_t}{V_{i\,t-1}}\right] + \sum_{j=1}^{J} \gamma_j\left[\frac{N_t}{V_{i\,t-1}}\right] z^j_{it}$$

where N_t is the number of entry events on day t and z^j_{it} is the average of characteristic j for carrier i on day t. It can be shown that as long as $E\left[\left(\frac{N_t}{V_{i\,t-1}}\right)z^j_{it}\right] = E\left(\frac{N_t}{V_{i\,t-1}}\right)E(z^j_{it})$,

[54]This is the sense in which "anticipation" matters for obtaining consistency; it is learning that a particular day is unusually likely (or unlikely) to have an event that creates problems.

[55]The argument for a single equation case is simple; for our SUR system with a constrained parameter the argument makes use of the positive definiteness of Λ^{-1}, the inverse of the covariance matrix of the errors.

then γ_j is estimated consistently in equation (4). For example, even if information becomes known about the likelihood of an event occurring and about the likely number of events, as long as each carrier has a fixed likelihood of being an incumbent (as measured by, say, seatmiles) conditional on an event occurring, then the incumbency effect (e.g., effect per seatmile) will be consistently estimated.

A second source of inconsistency arises when the events themselves are not independent so that the occurrence of an event on day t has not only a direct impact but also reveals information about the likelihood of an event on some day $\hat{t} > t$. This problem, which is always a concern in event studies, could lead to either over or underestimates of the economic effect of an event[56].

[56]For example, the simplest case to think about is where the number of entry events in the sample period provides information about the number of events that will occur in some later period. In a Bayesian learning model where information is revealed about People Express' "propensity to enter", for example, we would get over–estimates. If the total number of events is known a priori and events today merely substitute for those tomorrow, we get under–estimates. Note, though, that if events have no economic effect, then no bias is introduced.

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