How Do Incumbents Respond to the Threat of Entry? Evidence from the Major Airlines*

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Abstract

This paper examines how incumbents respond to the *threat* of entry by competitors (as distinct from how they respond to the *actual* entry of competitors). We look, specifically, at the passenger airline industry and use the evolution of Southwest Airlines' route network to identify particular routes where the probability of future entry rises abruptly. When Southwest begins operating in airports on both sides of a route but not the route itself, this dramatically raises the chance they will start flying that route in the near future. We examine the pricing of the incumbents on threatened routes in the period surrounding such events. We find that incumbents cut fares significantly when threatened by Southwest's entry but only on the threatened route itself, not on routes out of non-Southwest competing airports (e.g., Chicago Midway routes but not Chicago O'Hare routes). About half of the total impact of Southwest on incumbents' fares occurs before they start flying. The fare cuts are restricted to routes that were concentrated before the entry threat. The results do not support most theories of entry deterrence as the driving explanation, however, in that the price cuts are just as large on routes where Southwest has pre-committed to enter and deterrence is moot. Similarly, there is little evidence of strategic investment in excess capacity on the routes. The results are more consistent with incumbent accommodation and an effort to weaken Southwest's strength upon entry by generating loyalty among higher-end business customers. The fare cuts are particularly large on business routes compared to leisure routes.

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I. Introduction

In this paper we examine how incumbents respond to the threat of entry by a competitor. Though this topic has been the object of considerable theoretical and policy debate, it has received little empirical attention, mainly due to the problems of identifying the *threat* of entry (as opposed to actual entry).

We will examine this issue in the passenger airline industry. In this circumstance, we are able to identify discrete shifts in the threat of entry. We do this by using the expansion patterns of the most famous potential competitor—Southwest Airlines—to identify situations where the threat entry rises significantly.[1] In particular, we look at situations where Southwest begins operating in the second endpoint airport of a route (having already been operating out of the first endpoint), but before it starts flying the route itself and then investigate how incumbents' prices respond to such threats.

As an illustrative example, consider the entry of Southwest airlines into the Philadelphia airport. On May 9, 2004, Southwest began operations in the Philadelphia airport (PHL) with nonstop flights to six other cities in its network, and one-stop service to several others. One route Southwest did *not* offer service to immediately upon entering the Philadelphia market was Philadelphia-Jacksonville, Florida (JAX). Jacksonville is a Southwest airport. Southwest does fly between JAX and other airports, just not the PHL-JAX route. But once Southwest began operating out of both end points on the route—JAX and PHL—the probability that they would soon start flying the route between those two airports rose dramatically (and, indeed, they did soon enter the route). We will document that operating in both end points raises the probability of entering the route by nearly a factor of 70. With that increase in probability, we can then look

[1] Southwest's network has been expanding rapidly for some time and the impact of their actual entry on prices in a market is well documented (see, for example, Morrison, 2001).

at, say, US Airways' and United Airlines' (the incumbents) fares on the JAX-PHL route once Southwest threatens entry but has yet to actually start flying.[2]

The paper builds on the extensive literature on airline competition, especially the work relating to airport presence and the sources of airline market power. Most of these papers have not looked at pre-emptive actions or the threat of entry but rather at the impact of observed market behaviors after they occur.[3] Our empirical strategy is perhaps closest to Whinston and Collins' (1992) study of the impact on incumbents of announcements of People Express's impending (actual) entry into particular routes (with a particular focus on incumbents' stock prices).

The paper provides an empirical setting for testing the considerable body of theoretical work on strategic entry deterrence and accommodation, particularly those models that offer rationale for preemptive action. These include, for example, Dixit's (1979) capacity commitment motivation, the strategic learning-by-doing of Spence (1981), cost-signaling as in Milgrom and Roberts (1982), the long-term contracting environment of Aghion and Bolton (1987), and switching costs as in Klemperer (1987) and Farrell and Klemperer (2004). These rationale were put forward as alternatives to the traditional argument that preemptive action is irrational, either because it is not subgame perfect (in the spirit of Selten's (1978) chain-store paradox), or because costly competitive actions should be delayed until entry actually occurs.

Our results suggest that incumbents in the airline industry do respond to the threat of entry. Incumbents drop average fares substantially when Southwest threatens a route (before

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[2] We use the example of PHL for illustration purposes. It occurred too recently to be included in our actual sample of threatened routes.

[3] Examples include Reiss and Spiller (1989), Hurdle et al. (1989), Borenstein (1989, 1991, 1992), Berry (1990, 1992), Brueckner et al. (1992), Evans and Kessides (1993), Whinston and Collins (1992), Borenstein and Rose (1994), Peteraf and Reed (1994), Hendricks et al. (1997), and the more recent work of Bamberger, Carlton, and Neumann (2001) or Mayer and Sinai (2004).

Southwest actually starts flying the route). This is true even when we compare the fare changes on threatened routes to those on incumbents' other routes out of the same airports, indicating that shifts in airport-specific operating cost are not creating spurious results. The lower prices, in turn, increase the number of passengers flying the incumbents prior to entry. We also find, interestingly, that while incumbents cut fares on the directly threatened route, they do not cut prices on routes to nearby airports in the same market (e.g., Chicago-O'Hare when Southwest threatens a Chicago-Midway route).

When we examine the evidence on the reasons for the pre-emptive fare cuts, we see that they are restricted to routes that were concentrated before Southwest's threat. On routes that were not concentrated (thus may have already been competitive) there is no evidence of pre-emptive price cutting.

We also find no support for strategic investment/excess capacity theories of pre-emptive action: there is little evidence that airlines add capacity in response to the threat of entry, and their load factors increase. Nor does the evidence support incumbents trying to use the pre-emptive price cuts as a way of deterring entry. On routes where Southwest's entry is guaranteed, the incumbents still cut prices pre-emptively.

The results are consistent with an accommodation story whereby the incumbent cuts prices in order to weaken the position of Southwest once it enters. This could take many forms, but the results provide some suggestion of a particular concern for loyal business customers in that the price drops are concentrated on business routes compared to leisure routes.

II. Data

Because we are primarily concerned with fares, we will use the U.S. Department of

Transportation's DB1A files from the first quarter of 1993 through the final quarter of 2004 to build the core of our sample. These data provide a 10% sample of all domestic tickets in each quarter, which we use to compute the average logged ticket prices within each route-carrier-quarter combination (unfortunately the data do not report any specific travel dates within the quarter).[4] We define a route by its two endpoint airports and we look at so-called "direct flights" (predominantly nonstop flights but technically including itineraries where the passenger stops but does not change planes). We restrict our sample to routes between airports that Southwest ever flies any flights to in our sample. This includes routes between 59 different airports.

The threatened entry events we study are identified from the observed expansion patterns of Southwest Airlines. Southwest grew tremendously throughout our sample period. Its revenue and passenger volumes almost tripled from \$2.3 billion to \$6.5 billion, and from 18.8 passengers to 53.4 billion passengers. It also added service to 22 new airports between the end of 1993 and the end of 2004.[5]

Every time Southwest begins service in a new airport, it raises the threat that Southwest will enter routes connecting that airport with other airports in its network. We illustrate this in Figure 1. Southwest enters Philadelphia and begins flights from there to Tampa in the second quarter of 2004. Southwest is already flying out of Jacksonville (and has been since 1997) to cities in its network other than Philadelphia. Now, though, the entry into Philadelphia makes Southwest highly likely to start flying Philadelphia-Jacksonville in the near future (and they did enter in the fourth quarter of 2004). For every entry of Southwest into a new airport found in the DB1A, we checked the local business press and press releases (using Lexis-Nexis) to confirm

[4] We use Severin Borenstein's cleaned files, which are aggregated up to the route-carrier-quarter level, since this is the level of our analysis rather than the ticket.

[5] Southwest exited one airport, San Francisco International (SFO), in 2001. It had operated there since before 1993.

that Southwest did, in fact, start service in that airport at the time indicated. That search caused us to drop what we believe to be an important airport error in the DB1A source data.[6]

Airport presence is a well known predictor of future route entry.[7] In Table 1 we present a simple probit regression of whether Southwest starts flying a route in a given quarter to verify in our own sample the impact of having presence in both route endpoints on the threat of entry. We present this only for descriptive purposes, not as an explicit model of entry. It does not include extensive controls, just the number of endpoints at which Southwest is already operating at the beginning of the quarter and time dummies for every quarter in the sample. The results show that having a presence in one airport significantly raises the unconditional probability of entry (the baseline probability is close to zero) to a small positive number. Having a presence in both airports, though, raises it by a factor of over 70—to 18.5 percent per quarter.

At any given point in time, we take that existing network as given and look at incumbents' fares on a route once it becomes clear that Southwest is looming as a competitor. To determine these price responses, we capture threatened entry effects using dummies in the quarters surrounding Southwest's establishment of operations in both endpoint airports (but without flying the route) and control for actual entry effects with dummies in quarters during and after the quarter Southwest starts flying the route. We restrict our attention to the behavior of the major carriers: American, Continental, Delta, Northwest, TWA, United, and US Airways.

[6] The flaw is that in several quarters, the DB1A source data (and, thus, the Borenstein summary files based on that data) indicates that Southwest airlines operated flights out of DFW airport in the late 1990s (particularly in the third and fourth quarters of 1998) for a few quarters and then exited. While the data show them flying from DFW to many different airports, the airline code for DFW must be mistaken. There is no record of Southwest operating these numerous flights out of DFW in the local business press at the time or in other department of transportation data such as the T100 (see the capacity section below) and the on-time performance data. We therefore do not count these observations as Southwest entering and do not consider DFW as being threatened with entry.

[7] See Bailey (1981) for a narrative of a particular episode where this idea was applied in antitrust policy toward the industry. Empirical work that has used endpoint airport presence as a potential predictor of entry (albeit in the cross section rather than within particular markets over time) includes Berry (1992) and Peteraf and Reed (1994).

We observe hundreds of routes threatened with entry over the period. In most of these cases, Southwest eventually starts flying the route at a later date in our sample; in others, Southwest establishes a presence in both airports but had not yet begun flying the route by the end of our observation period (up to three years after). We exclude any route from our sample where either Southwest never establishes an airport presence in both airports or where Southwest establishes the presence simultaneously with actually flying the route. In those latter cases we do not have so clear a period with which to identify the heightened threat of entry separately from actual entry, although we will look at those routes below when discussing the issue of entry deterrence.

For each route in our sample, we look at the 24 quarter/six year window surrounding the quarter in which Southwest establishes a presence in both endpoints—the three years before and the three years after and define Southwest's actual entry as occurring when it establishes direct service—i.e., flights without a change of plane—between the two airports. This follows the findings from U.S. antitrust authorities that non-stop service and connecting service be considered separate markets or at least to be substantially differentiated products. Our results are not sensitive to this definition, however. We repeated our regressions but defining entry as being *any* Southwest service (i.e., including change of plane flights) on the route and got similar coefficients that were not significantly different.

In all, we observe Southwest threatening entry into 654 routes over the sample period, 374 of which Southwest had actually entered with direct flights by the final quarter of 2004, the end of our observation period.[8] This yields almost 18,000 route-carrier-quarter observations of average logged fares and passenger counts for major airlines' direct flights on threatened routes.

[8] These numbers are somewhat smaller than those in earlier versions of this paper, as we lost a portion of our sample due to the dropping of the erroneous DFW observations discussed in section II above.

Summary statistics for these variables are shown in Table 2.

III. Hypotheses and Empirical Specifications

Our baseline model measures the impact of Southwest establishing a presence in both endpoints of a route by looking at the periods before, during, and after this event, while controlling for other influences. The basic specification, with some slight abuse of summation notation as explained below, is as follows:

$$y_{ri,t} = \gamma_{ri} + \mu_t + \sum_{\tau=-8}^{3+} \beta_\tau (SW\_in\_both\_airports)_{r,t_0+\tau} + \sum_{\tau=0}^{3+} \delta_\tau (SW\_flying\_route)_{r,t_e+\tau} + X_{ri,t}\alpha + \varepsilon_{ri,t}, \qquad (1)$$

where $y_{ri,t}$ is the outcome of interest (e.g., mean logged fares or logged total passengers) for incumbent carrier *i* flying route *r* in quarter *t*. $SW\_in\_both\_airports_{r,t_0+\tau}$ are time dummies surrounding the period when Southwest establishes a presence in both endpoints of a route but without flying the route. $SW\_flying\_route_{r,t_e+\tau}$ are then the time dummies which commence with the period Southwest actually starts flying on the route. Each dummy is mutually exclusive of the others so the implied effects on the dependent variable given by their coefficients are not additive. The γ_{ri} and μ_t are fixed effects for carrier-route and time. Some specifications will also include a set of controls $X_{ri,t}$.

In all regressions, we weight observations by the number of passengers flying the route-carrier in the quarter so larger incumbent routes have a greater impact on the measured average response than do smaller routes. We also cluster the standard errors at the route-quarter level.

The covariates of interest for determining the impact of threatened entry on incumbents' prices are the $SW\_in\_both\_airports_{r,t_0+\tau}$ coefficients. There are dummies for different periods around the quarter Southwest establishes dual endpoint presence on the threatened route (a time period we denote t_0). We include dummies for the periods seven or eight quarters before t_0, five or six quarters before, three or four, and one or two quarters prior. We include a separate dummy for t_0 itself. We also include dummies for one or two quarters after t_0 and for three or more quarters after. These post-t_0 dummies only take a value of one if Southwest has not yet entered the route. Essentially, because we include route-carrier fixed effects in the regressions, reported coefficients show the relative sizes of the dependent variable in the dummy period relative to its value in the period between two and three years (that is, the 9th through 12th quarters) prior to t_0.

Since Southwest typically announces service to a new airport several months in advance (in order to begin advertising, selling tickets and so on), we expect prices to start falling sometime before Southwest starts operating in both the endpoint airports.[9] What matters to the incumbents is not the precise moment Southwest actually begins operating in the second airport, but when the incumbents realize that Southwest is more likely to enter a route in the future. An announcement that Southwest will enter a second endpoint can serve the same purpose. If true, the price due to the threat of entry should occur 2 to 4 quarters before t_0.

As discussed above, the conventional, static-model view of threatened entry is that incumbents should not respond until they actually face competition. This notion, in the spirit of the classic Chicago-school critiques of limit pricing, is based on the seemingly simple proposition that incumbents should not cut prices before they have to. To do so entails losing profits in the short-run and has no impact on profits in the future. This view implies that the coefficients on the threat of entry should be zero.

[9] We examined the business press prior to several of the most recent episodes of Southwest starting operations in a new airport and found that Southwest typically announced its intentions four to six months ahead of commencing operations. The true date that industry insiders find out the information may be even earlier, since Southwest would begin discussions with municipal airport authorities regarding gate leases and such (and the fact that these negotiations are taking place could well be observed by incumbents) prior to any public announcement.

Explaining pre-emptive behavior requires a way for actions taken before Southwest enters to affect the market in later periods. The typical arguments made in the theoretical literature are that incumbents may want to engage in pre-entry strategic behavior either to deter entry, or to accommodate entry but soften competition with the new entrant once in the market.

There are several specific mechanisms/conditions that have been outlined in the literature that would support pre-emptive action. Strategic learning by doing (as in Spence, 1981), incumbent signaling of either low cost or commitment to a particular route in the spirit of Milgrom and Roberts (1982), strategic capacity expansion along the lines of Dixit (1977) or dynamic demand/customer lock-in such as the long-term contracting model of Aghion and Bolton (1987) or the switching cost model of Klemperer (1987) could all, potentially, provide an explanation.[10]

While the difficulties of testing between various theories of strategic behavior are well known, in the context of airlines, we will be able to reject several leading theories—namely, strategic investment in excess capacity and any form of strategic entry deterrence—by examining the details of how incumbents' pre-emptive behavior varies across routes.

IV. Results: Documenting Pre-Emptive Action

Column 1 of table 3 presents the results from estimating specification (1) using the average logged fares on incumbent carriers' routes faced with the threat of entry by Southwest. Fares drop significantly when incumbents learn of an increase in the probability of future Southwest entry. In the period well before the threat, prices show no significant trend. The coefficients on the periods 5 to 6 quarters before and 7 to 8 quarters before Southwest establishes

[10] Discussions of the role of consumer loyalty and lock-in for the airline industry can be found in work such as Cairns and Galbraith (1990), Borenstein (1996), and Lederman (2004).

a presence in both airports show no significant difference from the baseline period preceding them (recall that the coefficients show the value of average logged fares relative to the excluded period, i.e., the 9th through 12th quarters before Southwest establishes a presence in both endpoint airports). Then, the incumbent fares start to fall. Three to four quarters before Southwest starts operations, the incumbents' fares have fallen about 7 percent and by 1 to 2 quarters prior, they have fallen 10 percent. By the time Southwest actually starts operating on both sides of the route, prices are almost 12 percent lower. As time passes without Southwest entering, prices fall further.[11] As discussed above, the fact that prices begin to fall before t_0 is not surprising given the fact that Southwest announces airport operations and starts selling tickets months before airport entry and the industry insiders are likely to find out the news some time before that.[12]

Once Southwest actually enters the route at time t_e (designated in the table as the *Southwest flying route* coefficients), prices fall to 19 percent below the baseline and then continue falling to around 26 percent by the end of the period. The coefficients are not additive so the actual price drop at entry is the difference between the pre-emptive 12+ percent price drop and the ultimate 26 percent price drop.[13] Notice, too, that while all of these post-entry coefficients come after the price drops reflected in the threat of entry, the time difference between t_0 and t_e varies across routes: Southwest actually enters some threatened routes one

[11] This continued decline is not the subject of our analysis because it may reflect selection issues rather than strategic behavior. If Southwest waits longer to enter routes where incumbents cut fares the most, this could skew the coefficients negative and provide a natural alternative explanation to the view that the longer Southwest waits, the more likely it is to enter the route in the next period and thus the bigger the price cut by the incumbents.

[12] Our results here exclude the routes that Southwest enters immediately since it is not clear how to interpret the results in those cases. We will look at the immediate entry routes below when trying to examine why the incumbents are engaging in pre-emptive actions.

[13] The t_e results reflect a convex combination of threatened and actual entry responses, since entry does not generally occur on the first day of the quarter. Therefore some of the underlying microdata for the quarter reflect patterns prior to actual entry. The estimated impact of Southwest entry seen here is a bit smaller than that estimated in some previous work such as Morrison (2001). In that case, though, he estimates fare impacts using fare variation across routes rather than within a route across time as we do here. Our sample is also a selected one, since we are restricting things to the potential entry sample.

quarter after t_0, others several quarters after, and still others it does not enter at all (at least by the end of our three year window).

The pre-emptive price cuts are quite important. Something close to half the total price effect that Southwest Airlines has on incumbents' prices takes place before Southwest ever actually starts flying the route.

The first check on the plausibility of the results is that we look at the number of passengers flying with the incumbents on these routes during this period of pre-emptive price cutting. The results in column 1 suggest that incumbents' prices fall 12 percent or more before Southwest even starts flying on the threatened routes. If the price drop is real, the number of passengers flying on the incumbent carriers should rise. Column 2 presents results where the log number of passengers is the dependent variable. Although some of the estimates are noisy, they do show that at exactly the moment that prices fall, (that is, three to four quarters before Southwest starts operating in the two airports), the number of passengers rises. Using the fare and quantity changes from this period implies a demand elasticity between -0.64 and -1.12. We cannot rule out a somewhat broader range given the standard errors but such magnitudes are certainly consistent with the 21 different studies of the price elasticity for air travel surveyed in Gillen et al. (2003) whose median price elasticity was -1.1 and whose 25th to 75th percentile ranged from -0.64 to -1.4. We will also see in a later section that an independent data source on passenger volumes also documents this same increase in quantity during the relevant time frame.

Our second check of plausibility considers the potential role of cost shocks as an alternative explanation. For example, if Southwest chooses to enter airports where operating costs are falling, this will lead to a spurious correlation between our measure of Southwest's threat of entry and the decline in incumbents' fares. To control for such cost shocks we first, in columns 3 and 4, compare the fares on a threatened route to a control group of the carrier's fares on other routes involving the same airports on one end but non-Southwest airports on the other.

We illustrate the principle behind the routes in the control groups in Figure 2. In the Philadelphia-Jacksonville example, the dependent variable in column 3 is the average logged fare on (say) US Airways' PHL-JAX route minus the average logged fares on US Airways' routes between PHL and airports to which Southwest doesn't fly (we restrict alternative airports to those in the top 100 to be comparable). We do the same in column 4, but now for routes like those between JAX and non-Southwest airports. The regressions show what happens to incumbents' prices on a threatened route relative to their prices on their other routes out of the same airports. Any airport-specific operating cost shocks should be removed from this relative fare difference. The coefficients in both cases are not significantly different from those in the baseline specification (they tend to imply a slightly larger price response in column 3 and a slightly smaller response in column 4).

In column 5, we then go a step further and include those alternative-route prices directly in the regression as explanatory variables. (The average fares on the control routes are referred to as the "operating cost controls" in the table.) These controls have significant and positive coefficients, as one would expect. When US Airways' fares rise on non-threatened routes from an airport, US Airways' fares also rise on the threatened route out of that city. The estimated impact of Southwest's threat, however, is virtually unchanged with the addition of these cost controls. The pre-emptive price cuts by the incumbents do not seem to reflect fare declines in all routes out of the endpoint airports. They are restricted exclusively to the threatened routes.

As a third test, we check that our results are not somehow being driven by our choice of a three year event window or by the choice of the baseline comparison period. In Table 4 we estimate a specification that expands the event window out to four years before t_0 and breaks the timing dummies out quarter-by-quarter (the excluded period is therefore the 15th and 16th quarters before t_0). The results confirm the baseline findings. From 16 quarters before t_0 until 4 quarters before, there is little pattern in prices and no significant deviations from the baseline period. However, during the period where incumbents are most likely to learn that Southwest is going to establish a presence on both sides of a route, prices begin to fall significantly.

Finally, we examine the passenger traffic when Southwest threatens entry to a metropolitan area's secondary airport which does happen in some of the largest markets. In such cases, the incumbents' price cuts at the directly threatened (i.e., secondary) airport ought to draw passengers away from the main airport.

To examine this, we look specifically at routes flying out of LaGuardia, JFK, and Newark airports (when Southwest threatens entry into routes from Islip, Long Island), Miami (Southwest: Ft. Lauderdale), Reagan-National and Washington-Dulles (Southwest: BWI), Boston (Southwest: Providence and Manchester) and Chicago O'Hare (Southwest: Midway). We must exclude the Los Angeles, San Francisco, Houston and Dallas markets from this regression because, during our sample period, Southwest operates in virtually all the airports in these metro areas or else regulation prevents competition.[14]

We date the entry threat from Southwest's actions in the other airport. So, for example, when Southwest starts operations in Orlando in 1994, they were operating on both endpoints of the Orlando-Chicago Midway route without flying the route itself. Our previous results

[14] Southwest operates in the four largest Los Angeles airports: Burbank, Orange County, Ontario, and LAX. Long Beach was the only neighboring airport it did not fly into and has only a tiny amount of incumbent major airline traffic in our sample. In the San Francisco Bay area, Southwest operated in the Oakland, San Jose and San Francisco airports for most of our sample (until finally exiting from SFO in 2001). Southwest operates in both Houston Hobby and Houston Intercontinental. In Dallas, flights from Love field to anywhere but Alabama, Arkansas, Kansas, Louisiana, Mississippi, New Mexico, Oklahoma, and Texas are prohibited by law, so competition with DFW is quite limited.

examined incumbent responses on the Orlando-Midway route; here we look at Orlando-O'Hare, even though Southwest does not fly to O'Hare.

Column 1 of Table 5 confirms incumbents' passenger volumes in nearby but not directly threatened airports drop significantly. While the estimates are not precise, it appears that the decline then becomes even larger when Southwest actually starts operating flights on the competing route.[15]

Column 2 looks at the prices of incumbents on these nearby but not threatened routes. There is no evidence that prices fall when Southwest threatens entry into a nearby competing route and, if anything, the point estimates suggest fares *rise*. This result seems surprising but likely reflects a significantly changing customer base on the route. We saw above that incumbent prices fall substantially in the airport where Southwest operates (the 'other' airport) and passenger traffic increases. At least some of the added passengers are likely to have come from the nearby airports that we look at here. The switchers are likely to be the more price sensitive customers so the remaining customers at the nearby airport have relatively less elastic demands, which raises the average fare on the route. This is a standard finding from the impact of the actual entry of low-cost airlines on nearby routes, and the results in columns 1 and 2 confirm here that when once Southwest actually starts flying on the routes to the competing airport, incumbent quantities drop further and the prices rise more.

Taken together, the results strongly suggest that incumbents do engage in pre-emptive price cutting when they find out Southwest is likely to enter a route in the near future. In the next section we examine the evidence regarding what they are trying to accomplish by doing so.

[15] It is worth noting that in most cases the major incumbents at the Southwest airport and at the nearby airport are not the same. In Chicago, for example, Continental and Northwest are incumbents with substantial operations at Midway while United flies exclusively out of O'Hare. So the results do not necessarily imply that the same carrier is diverting passengers from its flights at one airport to its flights at another.

V. Testing Theories of Pre-Emptive Action: Strategic Investment, Entry Deterrence, Accommodation, and Lock-In

Having documented the pre-emptive price cutting on the part of incumbents, in this section we test theories of *why* the firms would want to engage in pre-emptive action—whether it is strategic, whether it is intended to deter entry or to accommodate entry, and so on.

A. Strategic Behavior and Route Concentration

At the most basic level, all theories of pre-emptive strategic behavior begin with incumbent market power. Pre-emptive strategic motives are hard to believe on routes that are already competitive. Previous work on the airline industry has suggested that the airline concentration on a route is an indicator of market power, so we compare the pre-emptive response by incumbents on more concentrated routes to those with many competitors.

To get at this issue, we split our sample by the HHI of carriers on that particular route over the four quarters prior to Southwest's entry threat. Column 3 of Table 5 shows the estimates from our baseline price regression obtained using routes whose HHI is at the median or below. Column 4 shows results from routes above the median. The results indicate that the pre-emptive price declines are concentrated almost entirely on the more concentrated routes. There is no significant pre-emptive price cutting in low-concentration routes in the run up to Southwest starting operations on both sides of the route.

B. A Direct Test of Strategic Investment in Excess Capacity

Our next result specifically tests for strategic investment in excess capacity in the spirit of

Dixit (1979) and others. Unfortunately, the DB1A files used to construct our core sample are a sample of tickets, not flights, so they cannot speak to capacity issues like the seat or flight capacity number of seats or flights on a route. We can get this type of information, however, from the T-100 data of the U.S. Department of Transportation. These data, rather than being a ticket-based sample, contain aggregate information at the segment-carrier-month level which we aggregate up to the route-carrier-quarter level to match our DB1A-based data. The data include the total number of passengers, the number of flights, and the total available seats on each segment. This data source also provides an independent check on the passenger number results obtained above using the DB1A data.

There are two problems with using the T-100 for our purposes. The first and more minor is that the T-100 data is based on segments rather than flights as in the DB1A. The T-100 counts one-stop flights without plane changes as two separate segments, where the DB1A would consider such a passenger trip a single, direct flight.[16] Second, and more importantly, the T-100 has serious coverage problems when the number of passengers on a segment is small. When we compare the T-100 to our sample of 17,923 direct flight route-carrier-quarters in the DB1A, there are only 2,875 matches in the T-100. The main source of the problem is that whereas the DB1A has each route in the sample for an average of 18 quarters, the T-100 has roughly half that. In the T-100, flights appear to start, stop, and start again. Correspondingly, the match quality is much worse for the very small segments. This matching problem is clearly concentrated in the smaller routes. The T-100 accounts for less than 20 percent of the route-carrier-quarters in the DB1A sample, but covers over 90 percent of the total passengers in the DB1A. Since we our weighting each route in our regressions by the number of passengers, we are less concerned

[16] A flight from Chicago O'Hare (ORD) to Washington Dulles (IAD), for example, that stops but does not involve a change of plane would show up as a direct flight in the DB1A but not as an ORD-IAD segment in the T-100.

about the missing routes.

To see this in the case of passenger loads, in column 1 of Table 6 we restrict the larger DB1A sample to only those route-carrier-quarters that are also in the T-100. The results for passengers are similar to the full-sample DB1A results. Next, in column 2, we report the corresponding estimates using the T-100's independent measure of total passengers flown by the incumbents. Both data sets indicate increases in the number of passengers surrounding the threat of Southwest entry, consistent with the price declines.

We look at two measures of incumbent capacity on threatened routes in columns 3 and 4. Column 3 shows results for the logged number of seats available and column 4 for the logged number of flights. While we cannot rule out a rise in capacity, the evidence for it is weak. Seats and flights offered increase markedly starting three to four quarters before Southwest establishes a dual presence in the route, but then do not rise to new levels that are statistically greater than the baseline period. More relevantly, in column 5, we look at the log of the load factor (the share of available seats on the flights that had passengers in them) and here, we find statistically significant evidence that, regardless of whether the number of flights grows, significantly more people are flying *per plane*. This is not an outcome that would be expected if incumbents were strategically investing in excess capacity.

C. Entry Deterrence or Accommodation?

Our next test of incumbent motivation tries to distinguish whether the incumbents using pre-emptive price cutting are trying to deter entry or instead are trying to soften competition once entry occurs—i.e., whether they are engaging in deterrence or accommodation.

To test this, we compare pre-emptive behavior on the routes in our sample (where

Southwest's future entry behavior is unknown and, in principle, could be deterred) to the pricing behavior of incumbents on a sample of routes where Southwest's future entry is guaranteed. In the spirit of Ellison and Ellison (2000) and Dafny (2005), if entry deterrence is the motivation, we should not see price cutting where deterrence is impossible.

Deterrence seems at the very least, extremely unlikely on routes in which Southwest pre-announces they will enter simultaneous with their start of operations in the airport. These are the routes where Southwest begins direct service between the two endpoint airports in the same quarter it starts operating in the second endpoint airport. In principle, Southwest might still be deterred from entering these routes even though they are pre-announced. In practice, however, our investigations of launch dates did not find a single case where Southwest claimed they would enter a route but then did not follow through.

The results from this non-deterable sample are shown in column 2 of Table 7. With only one exception (the dummy for the period one to two quarters before Southwest enters the routes' second endpoint airport), the coefficients imply pricing behavior that is quite similar to that seen in our benchmark specification (these are shown in column 1 for comparison purposes; note that because entry is immediate in the column 2 sample, t_0 and t_e are synonymous, and the threatened entry dummies for periods after t_0 do not exist). In other words, even on routes where deterrence is impossible, the incumbents engage in the same pre-emptive price cutting behavior. Thus the behavior cannot be motivated as seeking to deter entry. We conclude the firms are instead accommodating entry.[17]

[17] Of course, accommodative action does not imply that the incumbent is better off for the potential entrant having entered. If it were less costly, incumbent airlines surely would prefer to keep Southwest from entering their routes. Accommodation simply implies that, given the cost structures existing in the industry, incumbents find it cheaper to take actions to improve their future prospects given that entry occurs.

D. Lock-In, Loyalty, and Business Customers

Given that the evidence shows the incumbents must be using the pre-emptive price cutting to soften competition rather than deter entry, we also explore some suggestive evidence about the manner in which they do so. The most commonly postulated mechanisms through which pre-emptive behavior would operate involve either signaling (the incumbent seeks to signal to the potential entrant an unobservable element of its profit function) or dynamic demand (customer loyalty or other similar mechanisms imply that demand today is not just a function of today's prices, but previous prices as well). Distinguishing between these two is notoriously difficult, but we do note that it is less plausible to think incumbents are signaling their low costs to Southwest when they cut prices, because most costs are publicly observed in this industry and because Southwest has entered many markets against the same competitors before. Further, most signaling models are models of entry deterrence, a motive which is not supported by the earlier results.

We believe the most plausible explanation for the pre-emptive price cutting is an effort on the incumbents' part to generate loyalty or lock-in among its existing valuable customers that make them less likely to use Southwest upon entry. This could take many forms, of course. It might be that it is costly for customers to search for low fares (Southwest's fares, for example, can only be found on its own webpage, not on the big online travel sites like Expedia), and the incumbents might cut prices before Southwest enters so that customers will not tempted to start going to Southwest's site once they actually enter. It might be that by cutting prices and getting customers to fly more, the increased frequent flyer miles make them less likely to switch carriers in the future. Or the growth of loyalty might be something altogether more informal; all that is required is that it can be built through price cuts. Regardless of the mechanism, we can get an idea about whether loyalty is important by looking at how pre-emptive behavior varies across routes with different levels of more loyal/valuable customers. A broad class of such customers are business travelers; they are the biggest users of loyalty programs and the customers most sought after by incumbents with those programs.[18]

While the DB1A data do not allow us to observe who is and is not a business traveler, we do know that the share of business travelers (relative to leisure travelers) is higher on certain routes than others. We therefore test, in two ways, whether incumbents pre-entry fare drops are larger on those routes that likely have higher relative concentrations of business travelers.

In the first test, we classify routes by leisure status similarly to Borenstein (1989): for each endpoint airport's corresponding state, we compute the fraction of 1998 gross state product accounted for by the hotel industry. If this fraction is above one percent for either endpoint of a route, we classify it a leisure-intensive route.[19] The others routes we consider business-intensive. Columns 1 and 2 of Table 8 present the fare change estimates for routes that are leisure- and business-intensive, respectively. As can be seen, pre-emptive fare cuts are significantly larger on business routes than they are on leisure routes.

The second test is in the spirit of Brueckner, Dyer, and Spiller (1992). We use weather differences across a route's endpoints to discern between leisure- and business-intensive routes. For each route, we took the difference in weather scores for the two locations as measured by the *Places Rated Almanac* (2005) and divide the sample by how different the climates are (big differences in climate score are more likely to be leisure travel routes). The results from this

[18] See, for example, Alden (2004)

[19] Those states which meet this criterion and to which Southwest offers service are (in descending order of their fraction of GSP from hotels) Nevada, Florida, Mississippi, Arizona, Maryland, and Tennessee.

sample split are shown in columns 3 and 4 of Table 8. Again, as expected, fare drops are smaller on the leisure routes than on the business routes.

While data limitations prevent these tests from being clearly conclusive—it would obviously be preferable to know business/leisure status of individual passengers—they are consistent with the notion that incumbents aim their pre-emptive fare cuts at consumers in whom they would most like to build loyalty to the incumbent. This suggests that airlines faced with the threat of entry by Southwest, and perhaps realizing their inability to deter it, take efforts to reduce the probability that they lose business-travel customers once Southwest does enter.

VIII. Discussion and Conclusion

This paper has looked at the response of incumbent major airlines to the threat of entry by examining how the incumbents respond when Southwest starts operating in the airports on both ends of a route but before it actually starts flying that route. The nature of Southwest's network means that the likelihood of their entering such a route rises dramatically when Southwest starts operating in the second endpoint airport, thus generating a discrete change in incumbents' expectations about the likelihood of new competition through entry.

The results indicate that incumbents do indeed react pre-emptively to the threat of Southwest's entry. Incumbents drop fares significantly in anticipation of entry. This is not simply due to airport-specific cost shocks because fares drop on threatened routes relative to incumbents' fares on other routes from the same airports. The fare declines are accompanied by an increase in the number of passengers flying the incumbents' threatened routes and do not extend to routes into neighboring airports in the same MSA (i.e., where Southwest is not directly threatening entry).

The fare decreases are largest for routes that are concentrated beforehand, but there is little evidence to support strategic investment in excess capacity since the numbers of flights and seats do not expand significantly, and load factors rise significantly. Nor do the results support incumbents using pre-emptive price cutting as a way to deter entry. The price cutting is just as large on routes where deterrence is not possible.

The most likely reason why early actions are effective is that demand in the industry is inherently dynamic: loyalty mechanisms, both formal and informal, create consumer switching costs, and these switching costs can make it desirable for threatened incumbents to cut fares in order to build loyalty on the part of their customers before those customers have a new carrier to choose from. Consistent with the story, we find that routes that expectedly have larger fractions of business travelers (the customers who are most likely to be enrolled in frequent flyer programs and are subject to other mechanisms that create switching costs) see deeper fare cuts in response to Southwest's threatened entry.

The findings of this paper suggest that Southwest Airlines has a powerful competitive effect in the U.S. passenger airline industry, and that this effect does not operate solely through Southwest's head-to-head competition with major carriers. Substantial fare reductions from major carriers are induced merely by the *threat* of competing with Southwest. We have focused on the U.S. passenger airline industry in particular because it offers a good setting to empirically identify the causes and effects of interest, and to therefore add to the still sparse empirical literature on the threat of entry. If the response of incumbents here is anything like the responses in other industries, the study of preemption and customer loyalty may be fruitful avenues for future empirical research.

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Figure 1. Identifying a Threatened Incumbent Route

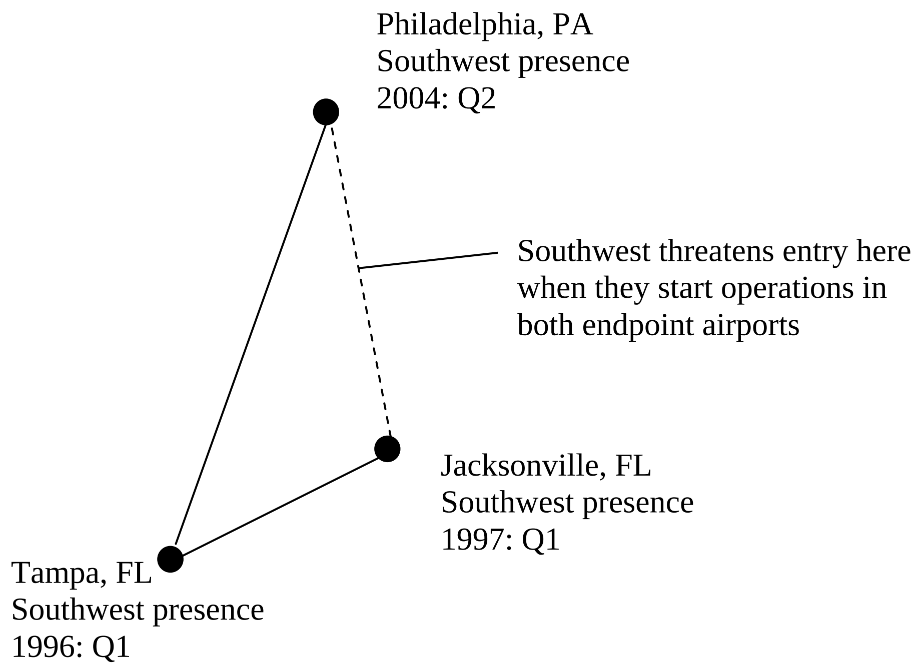

Figure 2. Comparison Routes for PHL-JAX

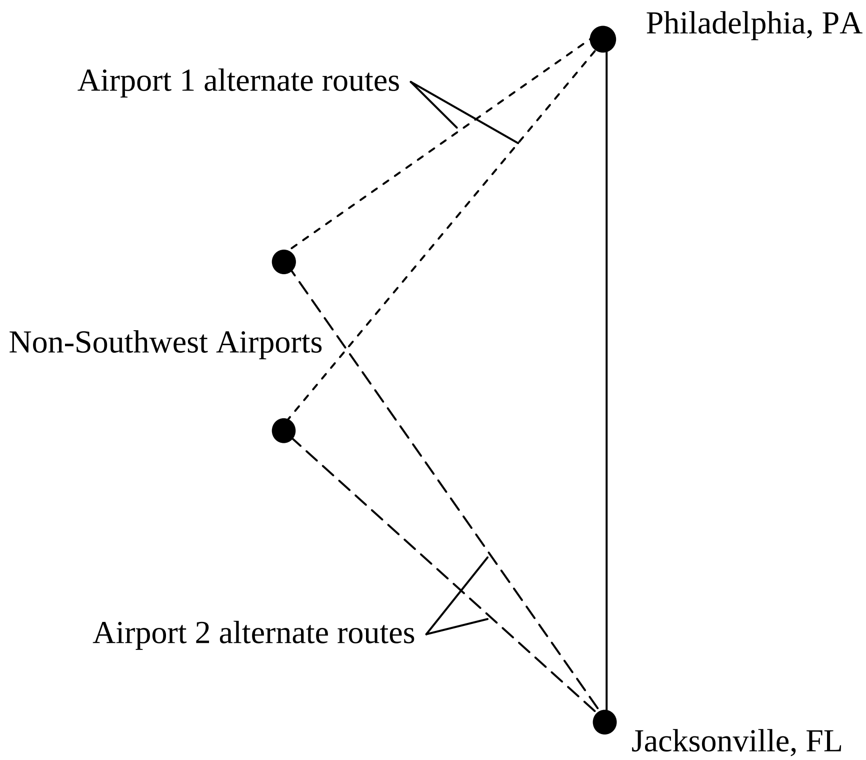

Table 1. Probability of Southwest's Entry into a Route

Southwest operates in one endpoint airport in the previous quarter (single presence)	0.0025 (0.0002)
Southwest operates in both endpoint airports in the previous quarter (dual presence)	0.1851 (0.0203)
N	163,952

Notes: The table shows estimates from a probit estimation for Southwest's entry into a route in a particular quarter, conditional on the number of the route's endpoint airports served by Southwest in the previous quarter. The excluded category includes observations where Southwest does not serve either endpoint airport in the previous quarter. Quarter fixed effects are included. Standard errors are in parentheses.

Table 2. Descriptive Statistics, Fare and Passenger Summaries

	Mean (std deviation)
Direct Flights to Threatened Airport	
Avg. ln(fare)	5.20 (0.45)
ln(passengers)	2.41 (2.01)
Number of Threatened Routes	678
Route-Carrier-Quarters in sample	17,923
Direct Flights to Neighboring Airport	
Avg. ln(fare)	5.16 (0.48)
ln(passengers)	3.81 (2.69)
Number of Threatened Routes	169
Route-Carrier-Quarters in sample	7,296

Notes: Authors' calculations using the DB1A database from the U.S. Department of Transportation.

Table 3. Incumbent Responses to the Threat of Entry

	(1)	(2) ln(Q)	(3) Altern. 1	(4) Altern. 2	(5) Cost Controls
Southwest in both airports (no flights)	-.033	-.027	-.030	-.006	-.017
t_0-8 to t_0-7	(.022)	(.049)	(.040)	(.029)	(.020)
Southwest in both airports (no flights)	-.012	-.055	-.025	.023	.003
t_0-6 to t_0-5	(.031)	(.044)	(.052)	(.035)	(.027)
Southwest in both airports (no flights)	-.067	.077	-.089	-.028	-.045
t_0-4 to t_0-3	(.031)	(.050)	(.053)	(.037)	(.028)
Southwest in both airports (no flights)	-.097	.062	-.110	-.081	-.085
t_0-2 to t_0-1	(.038)	(.058)	(.065)	(.042)	(.034)
Southwest in both airports (no flights)	-.118	.020	-.169	-.098	-.112
t_0	(.047)	(.073)	(.074)	(.051)	(.043)
Southwest in both airports (no flights)	-.133	-.006	-.152	-.137	-.107
t_0+1 to t_0+2	(.042)	(.068)	(.079)	(.046)	(.037)
Southwest in both airports (no flights)	-.209	.027	-.142	-.192	-.171
t_0+3 to t_0+12	(.054)	(.076)	(.089)	(.058)	(.048)
Southwest flying route	-.196	-.007	-.228	-.165	-.168
t_e	(.056)	(.084)	(.095)	(.061)	(.055)
Southwest flying route	-.213	-.016	-.221	-.204	-.187
t_e+1 to t_e+2	(.052)	(.085)	(.090)	(.058)	(.046)
Southwest flying route	-.261	-.003	-.303	-.248	-.231
t_e+3 to t_e+12	(.061)	(.094)	(.105)	(.068)	(.054)
Operating cost control,					.403
endpoint airport 1					(.031)
Operating cost control,					.268
endpoint airport 2					(.036)
N	17,923	17,923	16,288	17,430	17,198
R^2	.86	.94	.82	.87	.89

Notes: The dependent variable in columns 1 and 5 is the passenger-weighted average logged fares. In column 2 it is logged total passengers. In columns 3 and 4 it is average logged fares on the route minus the average log fares on comparable routes out of the same airports as described in the text. Standard errors are in parentheses and are clustered by route-quarter. The sample includes all routes where Southwest threatens entry as defined in the text. The "Southwest in both airports" dummies denote Southwest having flights involving airports on both ends of a route previous to actually flying the route. The "Southwest flying route" dummies denote Southwest actually operating flights on the route.

Table 4: Baseline Estimates with a Longer Event Window and a Finer Time Gradation

	Dependent Variable:	ln(p)
	Entry defined by:	direct-flight
	Southwest in both airports (no flights)	
	t_0-14	-.008 (.039)
	t_0-13	-.031 (.038)
	t_0-12	-.049 (.034)
	t_0-11	-.003 (.034)
	t_0-10	.025 (.037)
	t_0-9	.030 (.037)
	t_0-8	-.015 (.036)
	t_0-7	-.038 (.037)
	t_0-6	-.032 (.040)
	t_0-5	-.018 (.052)
Period incumbent learns of increase in Pr(SW Entry)	**t_0-4**	**-.046 (.047)**
	t_0-3	**-.079 (.048)**
	t_0-2	**-.106 (.051)**
	t_0-1	-.070 (.055)
	t_0	-.112 (.056)
	t_0+1	-.115 (.057)
	t_0+2	-.131 (.069)
	t_0+3 to t_0+12	-.197 (.069)
	Southwest flying route	
	t_e	-.187 (.069)
	t_e+1 to t_e+2	-.203 (.066)
	t_e+3 to t_e+12	-.247 (.076)
	N	19,489
	R^2	.86

Notes: This table shows estimates from passenger-weighted average logged fares for our baseline sample, but with an expanded event window (see text for details). All regressions include route-carrier and quarter fixed effects. Standard errors are in parentheses and are clustered by route to account for correlation across time and across carriers on the same route. See also Table 3 notes for variable definitions.

Table 5. Results by Route Type

	(1) ln(q) nearby airport	(2) ln(p) nearby airport	(3) ln(p) low HHI routes	(4) ln(p) high HHI routes
SW in both airports (no flights)	-.006	.017	-.017	-.04
t_0-8 to t_0-7	(.053)	(.038)	(.035)	(.025)
SW in both airports (no flights)	-.164	.123	.043	-.024
t_0-6 to t_0-5	(.062)	(.035)	(.047)	(.034)
SW in both airports (no flights)	-.086	.101	.006	-.080
t_0-4 to t_0-3	(.062)	(.036)	(.053)	(.035)
SW in both airports (no flights)	-.200	.132	-.013	-.109
t_0-2 to t_0-1	(.058)	(.039)	(.051)	(.042)
SW in both airports (no flights)	-.186	.076	-.055	-.126
t_0	(.068)	(.038)	(.067)	(.052)
SW in both airports (no flights)	-.225	.132	-.068	-.136
t_0+1 to t_0+2	(.072)	(.040)	(.072)	(.046)
SW in both airports (no flights)	-.322	.170	-.145	-.217
t_0+3 to t_0+12	(.096)	(.054)	(.078)	(.060)
SW flying route	-.340	.176	-.118	-.208
t_e	(.102)	(.055)	(.079)	(.065)
SW flying route	-.302	.159	-.162	-.221
t_e+1 to t_e+2	(.102)	(.058)	(.079)	(.060)
SW flying route	-.342	.170	-.220	-.266
t_e+3 to t_e+12	(.104)	(.058)	(.091)	(.068)
N	7296	7296	9540	8104
R^2	.89	.88	.86	.86

Notes: All regressions are weighted by passengers and include route-carrier and quarter fixed effects. Standard errors are in parentheses and are clustered by route to account for correlation across time and across carriers on the same route. The dependent variable in columns (1), (2) and (3) is the average log of fares for the route-carrier. The dependent variable in (4) is the log number of passengers. Columns (1) and (2) divide the sample between routes that have HHI concentrations at or below the median in the sample and routes with HHI concentrations above the median. Columns (3) and (4) look at the price and quantity responses on routes to neighboring airports that Southwest does not fly to but are in the same market as an airport where Southwest does operate. See also Table 3 notes for variable definitions.

Table 6. Incumbent Responses in Capacity: Passengers versus Seats, Flights, and Load Factors

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	ln(q)	ln(q)	ln(seats)	ln(flights)	ln(load factor)
Data Source:	DB1A	T100	T100	T100	T100
SW in both airports (no flights)	-.035	-.045	-.027	-.033	-.016
t_0-8 to t_0-7	(.058)	(.068)	(.055)	(.053)	(.027)
SW in both airports (no flights)	-.017	-.078	-.061	-.068	-.016
t_0-6 to t_0-5	(.048)	(.074)	(.062)	(.060)	(.029)
SW in both airports (no flights)	.135	.098	.038	.030	.058
t_0-4 to t_0-3	(.053)	(.057)	(.051)	(.048)	(.024)
SW in both airports (no flights)	.120	.118	.051	.034	.063
t_0-2 to t_0-1	(.063)	(.073)	(.063)	(.062)	(.028)
SW in both airports (no flights)	.074	.195	.078	.064	.119
t_0	(.080)	(.086)	(.077)	(.074)	(.031)
SW in both airports (no flights)	.057	.151	.038	.021	.112
t_0+1 to t_0+2	(.074)	(.088)	(.074)	(.071)	(.034)
SW in both airports (no flights)	.094	.198	.059	.040	.138
t_0+3 to t_0+12	(.082)	(.091)	(.080)	(.077)	(.038)
SW flying route	.065	.186	.053	.017	.134
t_e	(.091)	(.101)	(.086)	(.083)	(.048)
SW flying route	.055	.147	.041	.003	.106
t_e+1 to t_e+2	(.091)	(.105)	(.094)	(.088)	(.039)
SW flying route	.073	.157	.019	-.019	.137
t_e+3 to t_e+12	(.102)	(.110)	(.096)	(.090)	(.044)
N	2875	2875	2905	2905	2875
R^2	.94	.91	.91	.91	.72

Notes: All regressions are weighted by passengers and include route-carrier and quarter fixed effects. Standard errors are in parentheses and are clustered by route to account for correlation across time and across carriers on the same route. The dependent variable in columns (1) and (2) is the log number of passengers. The dependent variable in (3) is the log of the total number of seats available on the route. In (4) it is the log number of flights actually flown. In (5) it is the share of the seats flown that are filled with passengers. The data set for column (1) is the DB1A whereas the data set fo r columns (2)-(5) is the T-100 as explained in the text. The sample in (1) is restricted to the same routes as in the T-100. See also Table 3 notes for variable definitions.

Table 7. Deterrence versus Accomodation:
Price Response on Routes Where Southwest's Entry Date is Pre-Announced

	(1) Not Certain	(2) Pre-Announced
Dependent Variable:	ln(p)	ln(p)
Southwest in both airports (no flights)	-.033	-.033
t_0-8 to t_0-7	(.022)	(.034)
Southwest in both airports (no flights)	-.012	-.025
t_0-6 to t_0-5	(.031)	(.030)
Southwest in both airports (no flights)	-.067	-.072
t_0-4 to t_0-3	(.031)	(.034)
Southwest in both airports (no flights)	-.097	-.038
t_0-2 to t_0-1	(.038)	(.037)
Southwest in both airports (no flights)	-.118	-.121
t_0	(.047)	(.040)
Southwest in both airports (no flights)	-.133	
t_0+1 to t_0+2	(.042)	
Southwest in both airports (no flights)	-.209	
t_0+3 to t_0+12	(.054)	
Southwest flying route	-.196	
t_e	(.056)	
Southwest flying route	-.213	-.223
t_e+1 to t_e+2	(.052)	(.043)
Southwest flying route	-.261	-.263
t_e+3 to t_e+12	(.061)	(.050)
N	17,923	6054
R^2	.86	.84

Notes: The dependent variable in each column is the passenger-weighted average logged fares. Standard errors are in parentheses and are clustered by route-quarter. The sample in column (1) is the same as the baseline sample from table 3. The sample in column 2 includes all routes where Southwest begins flying the route simultaneously with entering the second airport. In such circumstances, of course, t_0 and t_e are the same and there are no periods after t_0 where Southwest is not yet flying the route so those coefficients are left out of the specification.

Table 8. Price Responses for Leisure Versus Business Routes

Definition Based On:	(1) LEISURE *State Hotel Revenue High*	(2) BUSINESS *State Hotel Revenue Low*	(3) LEISURE *Big Climate Differential*	(4) BUSINESS *Small Climate Differential*
SW in both airports (no flights)	-.020	-.113	-.039	-.053
t_0-8 to t_0-7	(.024)	(.046)	(.024)	(.034)
SW in both airports (no flights)	-.022	-.081	-.036	-.054
t_0-6 to t_0-5	(.026)	(.055)	(.027)	(.046)
SW in both airports (no flights)	-.030	-.212	-.094	-.135
t_0-4 to t_0-3	(.031)	(.058)	(.033)	(.045)
SW in both airports (no flights)	-.051	-.269	-.083	-.193
t_0-2 to t_0-1	(.038)	(.065)	(.036)	(.055)
SW in both airports (no flights)	-.114	-.312	-.106	-.254
t_0	(.048)	(.077)	(.049)	(.064)
SW in both airports (no flights)	-.145	-.357	-.091	-.310
t_0+1 to t_0+2	(.041)	(.079)	(.039)	(.061)
SW in both airports (no flights)	-.234	-.467	-.174	-.417
t_0+3 to t_0+12	(.051)	(.096)	(.050)	(.074)
SW flying route	-.185	-.451	-.127	-.430
t_e	(.060)	(.092)	(.061)	(.078)
SW flying route	-.163	-.524	-.123	-.490
t_e+1 to t_e+2	(.054)	(.093)	(.053)	(.076)
SW flying route	-.179	-.604	-.137	-.580
t_e+3 to t_e+12	(.060)	(.109)	(.058)	(.094)
N	8498	9425	8829	9094
R^2	.84	.88	.85	.88

Notes: All regressions are weighted by passengers and include route-carrier and quarter fixed effects. Standard errors are in parentheses and are clustered by route-quarter to account for correlation across time and across carriers on the same route. Columns (1) and (2) divide the sample into routes that have at least one endpoint in a leisure destination and routes that do not as measured by the amount of hotel revenue to Gross State Product in the location. Columns (3) and (4) divide the sample into leisure and non-leisure routes based on the climate differential between the two endpoints.