AN ABSTRACT OF THE THESIS OF

Najmus Sakib bin Salam for the degree of Master of Science in Applied Economics presented on May 22, 2012

Title: Is There Still A Southwest Effect?

Abstract approved:

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The US airline industry is going through a period of consolidation through mergers between leading airlines. A number of recent mergers have been approved by the Antitrust Division of the Department of Justice (DOJ) based on the presence of Southwest Airlines in merger-affected markets. In doing so, the DOJ makes a key assumption that Southwest is unresponsive to the reduced competition when its competitors merge. We find that Southwest raised fares more in markets where Delta/Northwest and US/America-West used to operate jointly between 2005-2010. However, Southwest's fares either decreased or rose by less if facing direct or adjacent competition from a low-cost carrier (LCC). Furthermore, Southwest is now merging with AirTran Airways, its biggest LCC competitor. This implies that the DOJ should not rely on Southwest Airlines as a post-merger deterrent to fare increases.

Is There Still A Southwest Effect?

by

Najmus Sakib bin Salam

A THESIS

submitted to

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in partial fulfillment of

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APPROVED:

Major Professor, representing Applied Economics

Director of the Applied Economics Graduate Program

Dean of the Graduate School

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

Najmus Sakib bin Salam, Author

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TABLE OF CONTENTS

LIST OF TABLES

IS THERE STILL A SOUTHWEST EFFECT?

Introduction

In 2010 the US Department of Justice (DOJ) approved the proposed merger between United and Continental Airlines after the carriers agreed to transfer Continental's take-off and landing slots and other facilities at Newark Liberty Airport to Southwest Airlines.[1] Prior to merging, United and Continental competed against each other for nonstop service in several routes involving Newark. The slot transfer requirement was a response to antitrust concerns by introducing Southwest Airlines in those markets to maintain competition. The DOJ also approved two earlier airline mergers between US Airways (US) and America West (HP) in 2005 and Delta (DL) and Northwest Airlines (NW) in 2008 based on the presence of Southwest and other low cost carriers (LCCs) in the airline markets affected by the mergers[2].

The impact of Southwest's entry on reducing incumbent airlines' prices has spurred considerable academic interest and has been well-documented in the literature. Boguslaski et al (2004), Dresner et al (1996), and Richards (1996) analyze that Southwest's competitive presence is associated with lower market fares. Morrison (2001) finds that this so-called "Southwest Effect" is not confined to direct entry by Southwest, but occurs through adjacent and potential competition as well[3]. Goolsbee & Syverson (2008) focus on Southwest's

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[1] http://www.justice.gov/atr/public/press_releases/2010/262002.htm
"United airlines and Continental airlines transfer assets to Southwest airlines in response to department of justice's antitrust concerns", US Department of Justice Press release, August 27, 2010.

[2] Another reason for approving the US Airways and America West case merger was the small number of overlapping routes where both carriers competed for service prior to merging.

[3] Southwest has historically avoided large hub airports and instead flown through adjacent airports (for example, Midway (MDW) instead of O'Hare (ORD) in Chicago. Morrison finds that Southwest's service to a destination from an adjacent airport (say MDW and PDX)

potential competition and find that incumbent airlines reduce their fares in anticipation of Southwest's entry. Brueckner et al (2010) show that Southwest's presence has a stronger effect on reducing fares than competition from legacy carriers[4]. It is thus not surprising that the DOJ frequently cites Southwest as the deterrent to any possible post-merger market power.

In doing so however, the DOJ makes a critical assumption that Southwest Airlines is unresponsive in its pricing to any reduction in competition that it faces from other carriers. For example, if a market is served by Continental, United, and Southwest Airlines, then after merger it is expected that Southwest fares would remain low despite facing reduced competition. Whether this assumption is valid or not requires analyzing Southwest's post-entry pricing strategies, particularly in response to the earlier US/HP and DL/NW mergers for which post-merger data are available.

In a preliminary analysis, we examined 56 of Southwest's airport-pair markets that are affected by the US/HP and DL/NW mergers and calculated the percentage change in Southwest's own passenger-weighted real average fares in each market between 2005-2010[5]. Table 1 shows the results for the top ten markets in which SW showed the largest percent increase in fares and also the top ten markets in which SW had the largest decrease (or

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appeared to reduce fares between the same destination and other airports in the same originating city (ORD and PDX). The "Southwest Effect" through potential competition occurs when Southwest operates on both end-points of a market (say PDX-other destinations and SEA-other destinations) but not between the given end-points (PDX-SEA). In such a case, incumbent airlines anticipate Southwest's possible entry and respond by lowering their fares.

[4] Legacy carriers are American, United, Delta, Continental, Alaska, and US Airways, named so because of their enduring presence in the industry from before deregulation in 1978.

[5] Real fares were calculated using the Consumer Price Index (CPI) with 1995 as the base year. Data was used from the US Bureau of Economic Analysis.

smallest increase) in fares during this period. Column 3 shows the premerger market shares of the merging airlines[6] (for example, the first row indicates NW and DL had a combined market share of 9.3%, while the second row indicates NW had a 48.1% market share, while HP had a 20% market share)[7]. Column 6 shows the change in the Herfindahl Hirschman Index (HHI)[8], which is a measure of competition where a positive change implies decrease in competition and vice versa. The last column indicates presence of other LCCs in these markets along with the market share.

We find that Southwest fares increased significantly in merger-affected markets in the absence of other LCCs[9]. On the contrary, presence of other LCCs appears to change Southwest's strategy to keep fares low following a merger between rival carriers. For example, in the LAS-PHL market where HP and US had a combined premerger market share of 57.6%, Southwest's fares went up by 51.5%. In the DTW-LAS market where NW had a pre-merger share of 56.2% and HP had a market share of 18.2%, Southwest fares actually decreased by 1.6%, which is possibly attributable to presence of Spirit Airlines, another LCC, with 17% market share in the latter market.

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[6] Market share is defined in terms of share of total passengers carried in a given market.

[7] These merger definitions follow Morrison (1996). A merger-affected market can have both or only one of the merging airlines.

[8] The HHI is calculated by adding the square of the market shares in terms of passengers of all competing airlines in a market. The HHI is restricted between 0 and 1, where 0 implies perfect competition and 1 implies monopoly.

[9] Southwest's competiting LCCs are Jetblue, Airtran, Frontier, Spirit, and Virgin America.

Origin	Destination	Premerger Shares	2005 HHI	2010 HHI	HHI Change	%WN Fare Change	LCC Presence
LAX	PHL	NW/DL (9.3%)	0.25	0.30	0.04	66.4%	
DTW	PHX	NW (48.1%), HP (20%)	0.34	0.33	-0.01	53.5%	
LAS	PHL	HP/US (57.6%)	0.23	0.35	0.12	51.5%	
RNO	TPA	HP/US (29.7%)	0.18	0.33	0.15	45.9%	
LAX	PHX	HP (24.5%)	0.59	0.55	-0.04	40.2%	
BWI	SLC	NW/DL (42.7%)	0.32	0.48	0.16	38.6%	
LAS	SNA	HP 55%	0.49	0.95	0.47	36.4%	
BWI	PHX	HP (28.6%)	0.47	0.37	-0.10	35.0%	
BUR	PHX	HP (21.1%)	0.66	0.75	0.08	35.0%	
LAS	PHX	HP (19.5%)	0.68	0.66	-0.02	34.8%	
LAS	PDX	HP (18.2%)	0.37	0.44	0.07	4.0%	
MSP	TPA	NW (66.6%)	0.46	0.49	0.03	-0.5%	FL (14%)
DTW	LAS	NW (56.2%), HP (18.2%)	0.38	0.44	0.07	-1.6%	NK (17%)
DTW	TPA	NW (46.4%)	0.41	0.45	0.04	-2.2%	B6 (24%)
LIT	TPA	NW/DL (52.6%)	0.22	0.32	0.10	-7.0%	
MDW	GEG	NW (17.7%)	0.37	0.52	0.16	-8.7%	F9 (37%)
MSP	PIT	NW (65.9%)	0.45	0.49	0.04	-10.5%	FL (10%)
DTW	FLL	NW (46.4%)	0.50	0.43	-0.07	-11.2%	NK (48%)
DTW	MCO	NW (56.7%)	0.46	0.41	-0.04	-13.5%	NK (36%)
MCO	MSP	NW/DL (61.1%)	0.38	0.31	-0.07	-21.5%	FL (15%)

Table 1: Changes in Southwest Airlines' fares in merger-affected airport-pair markets between 2005-2010

*For space reasons only 10 markets each with the highest fare increases and decreases are shown.
*** WN = Southwest Airlines*
FL = Airtran Airways
NK = Spirit Airlines
B6 = Jetblue Airlines
F9 = Frontier Airlines

In overlapping merger markets where both merging airlines operated prior to merger, there is an increase in the HHI that implies a reduction in competition (for example, LAX-PHL, LAS-PHL, RNO-TPA, BWI-SLC, DTW-LAS, LIT-TPA, and MCP-MSP). Theory suggests a negative correlation between fares and competition, which suggests that Southwest fares may go up if it faces lower competition. However, in this case the presence of other

LCCs appears to keep Southwest fares low even when there is a reduction in competition after a merger between two legacy carriers.

Regardless of the "Southwest Effect" upon entry, if post-entry Southwest fares rise in merger-affected markets, then the "Southwest effect" might not deter post-merger market power unless a second LCC is present. However, in 2011 the DOJ approved the proposed merger between Southwest and Airtran Airways, one of Southwest's biggest low-cost competitors. In its merger evaluation, the DOJ claimed that improved network connections and service to customers arising from this merger exceeded the cost of the potential reduction in competition due to some overlapping routes between Southwest and Airtran[10]. This merger potentially eliminates one of Southwest's own deterrents to raising fares when it faces lower competition arising from mergers between rival legacy carriers.

One hypothesis behind Southwest's post-entry response to reduced competition is that Southwest is evolving from its traditional low-cost structure to a quasi-network airline and possibly starting to mimic its legacy counterparts in fare determination. Southwest has expanded rapidly to a much wider network, from 4.47% market share in 2000 to 14.9% overall market share in 2010 in the entire domestic airline industry[11], second to only Delta Airlines with 16.3%. In more recent years Southwest has begun to enter larger hub airports

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[10] http://www.justice.gov/atr/public/press_releases/2011/270293.htm
Statement of the Department of Justice Antitrust Division on it Decision to Close its Investigation of Southwest's Acquisition of Airtran., April 26, 2011.

[11] Airline domestic market shares measured by industry-wide share of revenue passenger miles December 2010- November 2011, Bureau of Transportation Statistics (BTS), Research & Innovative Technology Administration (RITA).

such as Washington Dulles International Airport (IAD) in 2006[12], which is an aberration from its traditional adjacent airport strategy. In some of the airports it operates in, Southwest's share of total passenger enplanements resembles that of legacy carriers at large hub airports. In airports such as Baltimore (BWI) and Houston Hobby (HOU), Southwest's share of total enplaned passengers is about 50% and 84.5% respectively[13]. Such airport dominance and a much wider network arising from rapid expansion gives Southwest's current network system certain hub-and-spoke-like characteristics, which is a deviation from its traditional point-to-point network system. This may have implications for Southwest's operating costs and thus pricing decisions. However, testing this hypothesis is beyond the scope of this paper and is left for future research. Our goal is to present evidence of Southwest's post-entry pricing strategy that undermines the DOJ's evaluation of airline mergers where Southwest is frequently used as one of the reasons to ensure post-mergers fares reflect a competitive environment.

Literature Review

Deregulation of the airline industry in 1978 was followed by a wave of mergers and acquisitions, which led to a number of studies in the 1990's testing for post-merger market power versus efficiency gains, if any. A majority of these studies found evidence of market power and higher post-merger fares, which certainly adds credibility to antitrust concerns.

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[12] http://southwest.investorroom.com/index.php?s=43&item=1152
"Southwest Airlines Does Dulles! Airline Announces Fares and Flights for Newest Destination", Southwest Airlines News Release, July 13, 2006.

[13] Source: Origin & Destination Database 1B 2010Q3.

Kim and Singal (1993) examine the impact of airline mergers on airfares and consumer welfare through increased efficiency and/or greater market control. They hypothesize that mergers could generate efficiency gains and thus lower marginal costs for the merging firms through economies of scope, improved production techniques, combination of complementary resources, redeployment of assets to more profitable uses, and more efficient management. In fact, this efficiency gains argument is frequently used by airlines proposing to merge. In the absence of market power, this has the potential to lower airfares in the affected routes. On the other hand, mergers could also lead to greater market power and higher airfares. The overall impact on airfares depends on the efficiency effect compared to the market power effect. Kim and Singal also analyze the impact of mergers on the fares offered by rival firms operating in the same routes. Lower rival firm fares provide evidence for the efficiency effect while the opposite implies some degree of collusion amongst the airlines. Their results favor the increased market power hypothesis over the efficiency effect, implying that relaxation of anti-trust policy for airline mergers after deregulation did permit greater exercise of market power, which dominated any efficiency gains.

In another study, Singal (1996) hints at higher airfares in merged routes through “multi-market contact”, a situation where airlines that compete in multiple routes become interdependent and compete less vigorously. As a result, if mergers lead to higher airfares, rival airlines respond by raising their fares as well. Singal also finds that increases in fare instigated by multi-market contact arise only in long-

distance routes, whereas short-haul markets are less affected due to multi-modal competition.

Various other studies find similar effects of mergers on airfares. Using quarterly cross-sectional data, Morrison (1996) analyses the impact of four airline mergers in the mid-eighties on route concentration and airfares in those markets. He finds that mergers are associated with higher concentration and greater market control and increased airfares in the routes served by the merging airlines. Werden et al (1991) compare relative fares for all carriers during the year before a merger with fares in the year after the merger. They find that fares increase by 5.2% on routes less than 1000 miles and 7.5% on routes on more than 1000 miles. Using data four quarters before and after the merger for the merged carriers only, Borenstein(1990) finds that relative fares go up for the merged airlines.

Contrary to the notion that mergers lead to greater market share and higher fares across routes served by the merging airlines, Breuckner et al (1992) propose that mergers could lead to lower fares if efficiency gains and cost-reductions overshadow any effect of reduced competition. They argue that merger-induced increases in traffic volume on the spokes of a network lead to lower fares in the markets it serves because of economies of density. Higher traffic density allows airlines to use larger and more efficient planes and to operate them at higher load factors, which reduces per passenger cost.

Studies on the "Southwest Effect" and low-cost competition are also plentiful in the literature. Morrison (2001) finds that competitors respond to direct, adjacent and potential competition from Southwest Airlines by lowering their fares. Du et al (2010) find that the Southwest effect is not only confined to actual competition from Southwest, but can occur through codeshare agreements as well. Goolsbee & Syverson (2008) find that with the heightened likelihood of Southwest's entry in those markets where Southwest does not serve between the end-points but operates out of the end-points of the market to other airports, incumbent airlines respond by lowering their own fares in anticipation of Southwest's potential entry. Brueckner, Lee, and Singer (2010) find that competition from low cost carriers, Southwest Airlines in particular, has a stronger effect on lowering fares than competition from legacy carriers. This implies that any resulting loss of competition due to the merger between United (UA) and Continental Airlines (CO) should not have any significant impact on fares, particularly if other LCCs are present in UA-CO overlapping markets.

The "Southwest effect" and the impact of Southwest's entry have been well-documented in the literature. Our paper contributes to the literature by shedding some light on Southwest's post-entry pricing strategies using an applied framework.

Data

In this study we use the US Department of Transportation's Origin & Destination (O&D) passenger survey dataset DB1B, which is a 10% quarterly sample

of all airline tickets, from which we examine data from the third quarters of 2005 and 2010. We select these two years for the following reasons. First, we seek a sample of markets where Southwest operated in both of the time periods. The latest available data during our study was from 2010, which also represents a period when the airline industry reported positive operating profits for the first time since 2007[14], indicating some recovery from the effects of the 2008 recession. By 2005, Southwest had entered several new routes for which we have data in 2010, yielding a five year window for Southwest's post-entry prices. Prior to 2005 would lead to dropping some of the 2010 routes (for example, all routes involving Denver), while selecting years between 2006-2009 was deemed problematic due to the economic recession. Second, the 2005-2010 period covers operational completion of the HP/US and NW/DL mergers[15,16]. Third, we focus on data from only one quarter of each year to eliminate quarterly effects from our regression analysis, which allows us to focus solely on the issue at hand. We choose the third quarter, which represents the peak air travel season for which the data are rich in both business and leisure travel (Whelan 2005).

Each observation from the O&D data includes the origin and destination of travel and connecting airports, the total number of passengers traveling in the

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[14] http://www.bts.gov/press_releases/2010/bts044_10/html/bts044_10.html

[15] http://news.delta.com/index.php?s=43&item=430
Delta Airlines News Release: Delta-Northwest Merger Becomes Visible to Customers with Introduction of Combined Domestic Products, March 30, 2009.
http://www.usairways.com/en-US/aboutus/pressroom/history/chronology.html
US Airways Chronology

[16] The US/HP was reported to have been completed in the fourth quarter of 2005, while the DL/NW in Jan 2010.

itinerary, the fare paid per passenger, non-stop distance as well as the actual distance flown, and the carrier operating each segment of the itinerary. The number of coupons in each observation indicates the number of segments in travel. We drop itineraries with more than 3 coupons in each direction for one-way trips and more than 6 coupons for round trips, as well as open-jaw and interline travel itineraries[17]. We retain both one-way and round-trip itineraries[18], as well as connecting and direct flights, although we do not distinguish between them in our study. We also exclude observations where the one-way fare is below $25 or greater than $1000, which could be the result of data entry errors, different fare classes, or frequent flyer deals. Our sample excludes markets where Southwest is not present.

We define a Southwest market by non-directional airport-pairs[19]. This entails aggregating the O&D data to the airport-pair market level. We first calculate Southwest's passenger-weighted average fare in a market, which is given by $\sum(P_i*\$_i)/\sum P_i$, i=1 to n, where P_i is the total Southwest passengers in itinerary i, $\$_i$ is the per passenger fare reported in that itinerary, and $\sum P_i$ represents the total passengers carried by Southwest in the market which is found by adding all of Southwest's passengers in the individual itineraries in the market. The passenger-weighted average

[17] Open-jaw itineraries are where the passenger does not return to the origin. For example, PDX-DEN-BWI, and then BWI-MDW. Interline agreement itineraries are ones where there are multiple ticketing carriers. For example, an itinerary may have the first segment ticketed by airline A, but the return flight ticketed by airline B.

[18] For round trip itineraries the fare is divided by two to yield the one-way fare.

[19] SEA-PDX is considered the same as PDX-SEA, for example.

fare is then adjusted for inflation by using the Consumer Price Index (CPI) from the US Bureau of Economic Analysis, with 1995 as the base year[20].

This market-definition is in contrast to the city-pair market definition, where all airports within a city are considered to be a single airport[21]. Generally airline market-definitions are driven by the purpose of the research[22]. In our case however, we choose airport-pairs based on data issues. The airport-pair definition leaves us with 148 Southwest markets chosen from the US DOT's top 1,000 O&D airport-pairs in 2010[23]. A city-pair market definition would lead to loss of degrees of freedom in our regression analysis. For example, SJC-SEA and OAK-SEA, two markets from the San Francisco Bay area to Seattle, would be reduced to a single San Francisco-Seattle market under a city-pair definition.

The variables of interest are constructed as follows. *LCC* is a dummy variable that indicates presence of another LCC in a given Southwest market. *LCC10*, *LCC15*, and *LCC20* are variants of the *LCC* dummy where the ending number represents the minimum market share of the competing LCCs. *LCC_adj* is a dummy variable that captures adjacent competition from other LCCs. For example, *LCC_adj* is equal to

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[20] The Bureau of Transportation Statistics reports inflation-adjusted airfares in this manner.

[21] For example, no distinction is made between Midway (MDW) and O'Hare (ORD) airports in Chicago in the city-pair approach. In the airport-pair approach however, markets involving different airports in the same city are considered to be different. For example, ORD-PDX is a different market from MDW-PDX, but a city-pair approach removed the distinction and considers the Chicago-Portland market by pooling all the data together.

[22] For a discussion of market definitions, see Brueckner et al (2010).

[23] We also exclude some markets with fewer than 100 O&D passengers in the sample.

one and zero otherwise if in a Southwest airport-pair market A-B, LCC X is present in B-C, where C is an adjacent airport in the same city as A. Given Southwest's fare patterns in table 1, we expect the presence of other LCCs to keep Southwest fares low.

Merger is a dummy variable indicating whether a merger took place in a given market. Following the work of Morrison (1996), this dummy equals one if the following conditions satisfy:

Merger = 1 in a given Southwest airport-pair market if:

a) Northwest and Delta have a combined market share of at least 10% in 2005[24]
b) US and America West have a combined market share of at least 10% in 2005
c) Northwest has a market share of at least 10% in 2005
d) America West has a market share of at least 10% in 2005

HHI is the market level Herfindahl Hirschman Index, which is typically used as the proxy for competition in similar studies. The HHI is the sum of the squares of individual markets shares of all competing airlines in a given market, where shares are calculated by the share of total passengers carried in a market. By design, the HHI is restricted to values between 0 and 1, where 0 indicates perfect competition and 1 indicates monopoly. We expect Southwest fares to vary inversely with competition.

[24] It is common in airline competition studies to use 10% market share as the minimum for competitive presence (Brueckner et al 2010).

We aim to control for demand side factors by using the *inc*, *pop*, and *tempdiff* variables. *Inc* and *pop* are the geometric means of the income and population between the end-points of a market respectively. The income and population data come from the US Census Bureau's Metropolitan Statistical Area (MSA) income and population datasets. We expect fares to be a positive function of income and population. *Tempdiff* is the absolute difference in the January temperatures between the market endpoints. A higher value indicates vacation travel to warmer climates. Since leisure travelers tend to be more price-sensitive, we expect *tempdiff* to be negatively related to Southwest fares.

Dist is the non-stop distance between the market endpoints, and is commonly used as a cross-sectional proxy for airline costs. Operating costs rise non-linearly with distance due to the diminishing marginal cost of an additional mile of flight. We capture this non-linearity by using the natural log of distance. Finally, *Roundtrip* indicates the percentage of Southwest's round-trip itineraries in a given market. By considering this variable, we control for and test whether Southwest's round-trip fares are cheaper than one-way fares.

Table 2 shows summary statistics for the 2005 and 2010 subsamples. Comparing the two subsamples, we see that Southwest's average real fares are higher in 2010 ($124 compared to $106 in 2005). An interesting observation is that the range of prices appears to be higher in the 2010 sample compared to the 2005 sample. In 2005, Southwest's average prices range from 44.2- 172.4 = 128.2, while in 2010 the

range is 206 - 61.06 = 144.94. Furthermore, the standard deviation of prices is also higher in the latter sample: 33.7 compared to 30.6 in 2005. A higher dispersion in prices in the airline industry is indicative of greater price discrimination, which is typical among legacy carriers (Levine 2002). This apparent change in Southwest's price range and dispersion could indicate that Southwest's pricing strategies have changed in the given time period and are more similar to legacy pricing strategies.

HHI is also higher in 2010 (.57 compared to .52 in 2005), implying lower competition in Southwest's markets. The 2010 average of each of the LCC dummies is higher than in 2005: for example in 2005 Southwest faced LCC competition (with at least rival LCC 10% market share) in about 21% of it's markets, while in 2010 it faced the same level of LCC competition in 26% of its markets. Southwest also appears to face lower adjacent competition from LCC rivals in 2010 than in 2005. The 2010 sample has a slightly greater number of round-trip itineraries than in 2005. Finally, both income and population levels are higher in 2010, which is expected.

Table 2: Summary Statistics for 2005 subsample

		Mean		SD		Min-Max	
Variable	Obs	(2005)	(2010)	(2005)	(2010)	(2005)	(2010)
Dist	148	1107.6	1107.6	683	683	197-2534	197-2534
Merger	148	.38	.38	.49	.49	0-1	0-1
Rwnfare	148	106	124.3	30.6	33.7	44.2-172.4	61.06-206
HHI	148	.52	.57	.25	.26	.12-1	.13-1
LCC5	148	.28	.36	.45	.48	0-1	0-1
LCC10	148	.21	.26	.41	.44	0-1	0-1
LCC15	148	.18	.19	.39	.39	0-1	0-1
LCC20	148	.15	.18	.36	.38	0-1	0-1
Tempdiff	148	18.5	18.5	11.8	11.8	.7-45.3	.70-45.3
Roundtrip	148	.68	.65	.09	.07	.25-.8	.41-.76
N_Adj_Lcc	148	.24	.38	.44	.65	0-2	0-3

Pop	148	3.8	4	2	2	.75-11.1	.75-11.02
Inc	148	35.6	40.8	9.44	9.9	12.8-76.9	14.84-81.63

Methodology

We proceed by estimating a reduced form log-log fare equation using Southwest's real average fare *P* on route *x* at time *t* as the dependent variable and a vector of independent variables that include dummy variables to identify the US/HP and DL/NW mergers and other variables that proxy for demand, cost, and competitive conditions that might affect fares as suggested by previous airline studies. Our base model is specified as follows:

$$\boldsymbol{LnP}_{,t,x} = \beta_0 + \beta_1 \boldsymbol{lnDistance}_{t,x} + \beta_2 \boldsymbol{lnHHI}_{t,x} + \beta_3 \boldsymbol{Roundtrip}_{t,x} + \beta_4 \boldsymbol{Tempdiff}_{t,x} + \beta_5 \boldsymbol{LCC}_{t,x} + \beta_6 \boldsymbol{LnIncome}_{t,x} + \beta_7 \boldsymbol{LnPop}_{t,x} + \beta_8 \boldsymbol{Adj\_LCC}_{t,x} + \beta_9 \boldsymbol{Merger}_x + \beta_{10} \boldsymbol{Merger}_x \boldsymbol{*LCC}_{t,x} + \delta_1 \boldsymbol{Airline}_i + \delta_2 \boldsymbol{Year}_t + \acute{\varepsilon}_{x,t}$$

The Merger dummy captures whether Southwest fares are higher in merger affected markets. Based on Southwest's post-entry fare patterns in table 1, we notice that Southwest fares do not rise in all merger affected markets- Southwest's pricing strategy in such markets appear to vary depending on the presence of other LCCs. This disciplining effect of LCC presence on Southwest's prices in merger affected markets is captured by the interaction term between the merger and LCC dummy variables. Merger*LCC is equal to 1 if a market is affected by a merger, and Southwest faces competition from an LCC. We expect the estimated coefficient β_9 to be positive if Southwest's fares are significantly higher in merger affected markets, while β_{10} should be negative to reflect the competitive impact of other LCCs on Southwest's ability to

raise fares when faced with mergers from rival legacy carriers. The impact of mergers on Southwest's fares is $\beta_9 + \beta_{10}$***LCC***, given by differentiating the above equation with respect to ***Merger***.

Results

Table 3: Regression Results

ln P	**(Pooled)**	**(2005)**	**(2010)**
ln Distance	.399*** (25.07)	.412*** (15.71)	.390*** (21.78)
ln HHI	.108*** (4.87)	.116*** (3.27)	.097*** (3.73)
Roundtrip	-.869*** (-8.23)	-.891*** (-5.96)	-.758*** (-5.07)
Tempdiff	-.005*** (-5.92)	-.006*** (-4.39)	-.004*** (-4.06)
Lcc15	-.054** (-2.34)	.015 (.40)	-.116*** (-4.53)
Ln Pop	-.009 (-.6)	-.014 (-0.55)	.005 (.27)
Ln Inc	.078* (2.27)	.117* (2.12)	.040 (1.02)
N_adj_lcc	-.038*** (-2.53)	-.054* (-1.68)	-.039** (-2.72)
Y2010	.131*** (7.65)		
Intercept	2.43*** (12.95)	2.23*** (7.62)	2.65*** (11.42)
R^2	.804	.752	.853
Adj R^2	.798	.738	.845
N	296	148	148

****p<.01, **p<.05, *p<.1*
T-Statistics in Parenthesis

Columns 2 and 3 in table 3 are the regression results from the base model using data from the third quarters of 2005 and 2010 respectively, but excluding the merger dummies. The first striking difference is the coefficient of the LCC dummy variable. In 2005, presence of other LCCs appears to have had no significant impact on Southwest's fares, although the impact of adjacent LCC competition is slightly significant at the 10% level. In contrast, direct LCC competition has a strong negative impact on Southwest's fares in 2010, while the impact of adjacent LCC competition is much more significant. Southwest's fare are about 12% lower when facing direct in-market LCC competition, while adjacent LCC competition accounts for about 4% lower fares by Southwest. In both time periods, Southwest fares increase by about .4% for every 1% increase in market distance. Round-trip fares are cheaper, as are fares in leisure markets as indicated by the negative tempdiff coefficient. Column 1 shows the pooled results with a time dummy for 2010, which likely captures the impact of higher operating costs such as fuel and other difference between the two years, such as the merger between DL/NW, US/HP and/or Southwest's pricing strategy.

The results from table 3 suggest that LCC competition, both direct as well as adjacent, has a significant impact on keeping Southwest's fares low in 2010, while presenting no such evidence in the 2005 sample. A conventional Chow test for differences in the estimated slopes reveals a structural break between 2005 and 2010[25].

[25] We obtain a F statistic of 3.99 with an associated P-value of 0.00, which leads to rejection of the null hypothesis that the estimated slopes are the same across both time periods.

Next we test whether HP/US and NW/DL mergers may have played a role in Southwest's pricing between 2005-2010. Our hypothesis is that Southwest's fares rose in merger affected markets, but didn't increase significantly or even decreased if faced with other LCC competition. This role played by other LCC competition on Southwest's fare strategy could explain why the LCC competition variables are significant in 2010 but not in 2005 in the results above.

Table 4: Regression Results With Merger Dummies

ln P	**(Pooled)**	**(2005)**	**(2010)**
ln Distance	.400*** (25.27)	.412*** (15.53)	.391*** (23.15)
ln HHI	.116*** (5.05)	.117*** (3.06)	.118*** (4.66)
Roundtrip	-.866*** (-8.10)	-.899*** (-5.84)	-.771*** (-5.21)
Tempdiff	-.005*** (-5.63)	-.006*** (-4.26)	-.004*** (-3.91)
Lcc15	-.015 (.591)	.023 (.49)	-.043 (-1.47)
Ln Pop	-.012 (-.79)	-.014 (-.55)	-.004 (-.22)
Ln Inc	.075* (2.20)	.117* (2.11)	.029 (.77)
N_adj_lcc	-.037*** (-2.47)	-.054* (-1.67)	-.037*** (-2.65)
Merger	.020 (.99)	.004 (.1)	.040** (1.88)
*Merger*Lcc15*	-.111*** (-2.59)	-.022 (-.31)	-.202*** (-4.38)
Y2010	.13*** (7.66)		
Intercept	2.43***	2.23***	2.69***

	(12.9)	(7.49)	(11.93)
R^2	.809	.753	.872
Adj R^2	.802	.735	.862
N	296	148	148

****p<.01, **p<.05, *p<.1*
T-Statistics in Parenthesis

The results in column 1 of table 4 show the base pooled model, including the merger variables and the 2010 year dummy variable, which is a proxy for increased operating costs due to factors such as higher fuel prices. The purpose of including the year dummy here is to analyze whether Southwest's fares in merger markets are higher after controlling for increases in costs since 2005. The merger interaction coefficient is negative and strongly significant. The *merger* coefficient is insignificant in this specification. However, this may mean that Southwest's fares in the specified merger markets were not significantly higher in 2005 prior to the merger, but increased after the mergers were complete. Another Chow test verifies that there are significant slope differences between 2005 and 2010 when analyzing the impact of mergers and LCC presence on Southwest fares[26]. This leads us to analyze the specification in column 1, but using data on individual years. The results are shown in the second and third columns in table 4. The results using the 2005 sample shows that both merger coefficients are statistically insignificant. Repeating the same specification but using 2010 data, changes the results altogether: ceteris paribus, Southwest's fares in the merger affected markets are statistically significantly higher

[26] The Chow F statistic is 2.72 with a p value of 0.0013.

in 2010, but lower if another LCC is present. Next we quantify the impact of mergers and LCCs on Southwest's prices in the 2010 sample.

The impact of mergers on Southwest's prices P, $\delta LnP/\delta Merger$, can be quantified as:

$$\delta LnP/\delta Merger = .04 - .202 LCC15$$

If a LCC is not present in a merger affected market, then *LCC15* equals zero and $\delta LnP/\delta Merger$ is .04. The impact of a merger absent another LCC can then be interpreted by using $100(e.^{04}-1) = 4.08$, since the dependent variable is in logarithmic form and the independent variable is binary: Southwest fares are about 4% higher. If a LCC is present in such a market, then LCC equals one and $\delta LnP/\delta Merger$ is -.162: direct LCC competition is associated with $100(e.^{-.162}-1)$ or about 15% lower Southwest prices in merger affected markets. Using the .19 sample mean of LCC15 in 2010, the average $\delta InP/\delta Merger$ equals .00162. This implies that on average, Southwest fares are about $100(e^{.00162}-1) = .162\%$ higher in merger affected markets. Using the average real Southwest fare in the 2010 sample, Southwest's fares in merger affected markets were about .00162(124.3) = 20 cents higher. Even though Southwest's fares are on average statistically higher in merger affected markets, in economic terms this 20-cent merger-premium is not alarmingly high.

The impact of LCC competition on Southwest's prices is given by:

$$\delta LnP/\delta LCC15 = \beta_5 + \beta_{10} Merger = -.043 - .202 Merger$$

This is interpreted as:

$$100(e^{(\beta 5 + \beta 10 Merger)}-1) = 100(e^{(-.043-.202Merger)}-1)$$

The coefficient on *LCC15*, β_5 = -.043, is of the expected sign but not statistically different from zero using a 95% confidence interval. In merger affected markets, *Merger* equals one, and $\delta LnP/\delta LCC15$ equals -.245 with a standard deviation of .04, given by $\{Var(\beta_5) + Var(\beta_{10}) - 2CoVar(\beta_5,\beta_{10})\}^{.5}$. Thus, Southwest prices in merger affected markets are $100(e^{-.245} – 1)$ = 21.73% lower if facing LCC competition. Using the standard deviation, this figure varies between $100(e^{-.205} – 1)$ to $100(e^{-.285} – 1)$, or 18.54%-24.8% lower. In markets unaffected by mergers, the impact of an LCC on price is only $100(e^{-.043} – 1)$ = 4.21% lower.

Combining the above analysis reveals how Southwest's pricing strategies are affected by competition from other LCCs and the reduced competition from the HP/US and DL/NW mergers in its own markets. First we find that the impact of LCC competition on Southwest's fares is insignificant in 2005. On the other hand, both adjacent and actual LCC competition appears to have a strong impact on Southwest's fares in 2010. Next we test whether the legacy mergers explain the difference in LCC competition's impact on Southwest's fares by including merger dummies in our model. We find that fares in the merger affected markets in 2005 were not significantly higher before the mergers took place, but in 2010 fares in the same merger markets are higher in the absence of LCC competition, but lower if Southwest faced competition from other LCCs. The result that Southwest's prices are more

responsive to LCC presence in the more recent year, combined with its increased range of distribution and price dispersion, indicates that the Southwest pricing strategy is evolving more akin to legacy pricing.

Robustness of Results

In this section we analyze whether the preceding results are robust to certain variable definitions and model assumptions. First we address the issue of defining the dependent variable, and then possible endogeneity issues with the HHI.

The pervasive presence of price discrimination in the airline industry implies that using average fares can be misleading (Levine 2002). Legacy carriers typically match LCC price levels with capacity or purchase restrictions for the majority of its tickets in a market while selling other tickets at higher prices to customers with corporate contracts or large frequent flyer accounts. This can lead to different fare profiles for airlines competing with apparently small differences in average fares.

We address this issue by using the 25th, 50th, and 75th percentiles of Southwest's fares in a given market as the dependent variable and re-estimating the models in table 4. The goal here is to analyze whether any particular fare profile, low or high, affected the estimates using average fares as the dependent variable. The results using the 2010 sample are shown in table 6. Column four includes the earlier results from using average fares as the dependent variable for comparison. We see that regardless of which percentile fares are used as the dependent variable, the coefficients

of interest still bear the same statistical significance and signs. Since the model is setup as a log-log function, the coefficients can be interpret as partial elasticities and are summarized in table 6. We notice that the partial elasticities appear to vary depending on the distribution of the fare.

Table 5: Regression Results Using Different Percentile Fares as Dependent Variable

ln P	**(25th Pctile)**	**(Median)**	**(75th Pctile)**	**(Average Fare)**
ln Distance	.409*** (24.40)	.373*** (21.82)	.361*** (17.73)	.391*** (23.15)
ln HHI	.066** (2.64)	.088*** (3.46)	.106*** (3.47)	.118*** (4.66)
Roundtrip	-.265* (-1.80)	-.450*** (-3)	-.610*** (-3.42)	-.771*** (-5.21)
Tempdiff	-.003*** (-3.44)	-.003*** (-3.78)	-.002** (-2.24)	-.004*** (-3.91)
Lcc15	-.034 (-1.16)	-.019 (-.64)	-.009 (.26)	-.043 (-.1.47)
Ln Pop	-.010 (-.58)	-.009 (-.53)	-.017 (-.83)	-.004 (-.22)
Ln Inc	.011 (.30)	.041 (1.09)	.026 (.58)	.029*** (.77)
N_adj_lcc	-.030** (-2.17)	-.020 (-1.42)	-.032** (-1.93)	-.037*** (-2.65)
Merger	.054** (.2.54)	.062*** (2.85)	.045* (1.75)	.040* (1.88)
*Merger*Lcc15*	-.152*** (-3.34)	-.202*** (-4.33)	-.241*** (-4.35)	-.202*** (-4.38)
Intercept	1.99*** (8.87)	2.47*** (10.88)	2.98*** (10.96)	2.69*** (11.93)
R^2	.883	.857	.8009	.871
Adj R^2	.8748	.847	.786	.862
N	148	148	148	148

****p<.01, **p<.05, *p<.1*
T-Statistics in Parenthesis

Table 6: Partial Price Elasticities of Explanatory Variables

	25th Pct Fare	Median Fare	75th Pct Fare
Distance	0.36%	0.37%	0.36%
HHI	0.07%	0.09%	0.11%
Roundtrip	-27%	-45%	-61%
Tempdiff	-0.3%	-0.3%	-0.2%
Adj_LCC	-3.0%	-2.0%	-3.2%
Merger	5.4%	6.2%	4.5%
Merger*LCC	-15.0%	-20.0%	-24.1%

The elasticities are almost identical in the case of distance and tempdiff. However, for every 10% increase in the HHI that implies decrease in competition, the 25th percentile fare goes up by .7%, the median fare increases by .9%, and the 75th percentile fare rises by 1.1%. Recalling that higher fares in the fare distribution in the same market typically correspond to business class or price-insensitive travel, it is not surprising that the impact of reduced competition can be more easily passed on to less price-sensitive travelers. Also interesting are the varying effects of the merger variables on different quartiles of Southwest's fares. While the 25th, 50th, and 75th percentile fares in merger affected markets rise by between 4.5-6.2%, the disciplining effect of the presence of LCCs in those markets appears to increase significantly for higher-end fares: 15% decrease for the 25th, 20% for the median, and 24.1% for the 75th percentile fare. LCCs with point-to-point networks typically have lower variance in their fare distribution than full-service network carriers. Such LCCs limit their high-end fares to attract customers from rival network (or quasi-network) airlines to their less attractive product (Levine 2002). The increasing price disciplining effect might be a strategy to avoid losing passengers to LCC rivals.

Several airline studies in the past have noted potential endogeneity of airline market entry decisions which could cause the HHI variable to be endogenous. Breuckner et al (2010) acknowledges this endogeneity and as an alternative uses an airline count variable approach instead of using the HHI as a proxy for competition. Borenstein (1989) argues that HHI could be a function of the market fare, the dependent variable, and proceeds with an instrument variable approach. If HHI is a function of prices, then ***lnHHI*** in our specification could be correlated with the error term $\acute{\varepsilon}_{x,t}$. The intuition is that if, for example, an airline charges a higher fare, it might encourage entry by a new airline, which could result in a lower HHI. Conversely, a lower fare could force rivals to exit and lead to a higher HHI. This assumes no collusive pricing behavior among rivals and low barriers to entry/exit in the airline industry.

A possible remedy to this potential endogeneity issue is to estimate the model using two-stage least squares (2SLS) and a suitable instrument variable that is correlated with the endogenous variable but uncorrelated with the error term in the original specification. We attempt to use a one year lagged value of the HHI as an instrument, denoted ***lnHHI09*** in the model. For example, the 2010 quarter 3 HHI is instrumented by the 2009 quarter 3 HHI and all the other exogenous variables from the original specification. The first criterion for the instrument is met, yielding a high correlation coefficient of .96 between HHI in 2009 and 2010. Next we test for endogeneity by first regressing the natural log of HHI on its instrument and other

exogeneous variables from the original specification using the 2010 sample, as follows:

$$\boldsymbol{lnHHI}_{t,x} = \beta_0 + \beta_1\boldsymbol{lnDistance}_{t,x} + \beta_2\boldsymbol{Roundtrip}_{t,x} + \beta_3\boldsymbol{lnHHI09}_{t,x} + \beta_4\boldsymbol{LCC}_{t,x} + \beta_5\boldsymbol{Adj\_LCC}_{t,x} + \beta_6\boldsymbol{Tempdiff}_{t,x} + \beta_7\boldsymbol{InIncome}_{t,x} + \beta_8\boldsymbol{InPop}_{t,x} + \beta_9\boldsymbol{Merger}_x + \beta_{10}\boldsymbol{Merger}_x\boldsymbol{*LCC}_{t,x} + \delta_1\boldsymbol{Airline}_i + \delta_2\boldsymbol{Year}_t + \boldsymbol{U}_{x,t}$$

The residuals from this model are then included in the original specification:

$$\boldsymbol{LnP}_{,t,x} = \beta_0 + \beta_1\boldsymbol{lnDistance}_{t,x} + \beta_2\boldsymbol{Roundtrip}_{t,x} + \beta_3\boldsymbol{lnHHI}_{t,x} + \beta_4\boldsymbol{LCC}_{t,x} + \beta_5\boldsymbol{Adj\_LCC}_{t,x} + \beta_6\boldsymbol{Tempdiff}_{t,x} + \beta_7\boldsymbol{InIncome}_{t,x} + \beta_8\boldsymbol{InPop}_{t,x} + \beta_9\boldsymbol{Merger}_x + \beta_{10}\boldsymbol{Merger}_x\boldsymbol{*LCC}_{t,x} + \delta_1\boldsymbol{Airline}_i + \delta_2\boldsymbol{Year}_t + \delta_3\boldsymbol{U}_x + \boldsymbol{\acute{\varepsilon}`}_{\mathbf{x,t}}$$

The intuition here is that since each of the exogenous variables are uncorrelated with $\boldsymbol{\acute{\varepsilon}}_{\mathbf{x}}$, then ***lnHHI*** is uncorrelated with $\boldsymbol{\acute{\varepsilon}}_{\mathbf{x,t}}$ iff $\boldsymbol{U}_x$ is uncorrelated with $\boldsymbol{\acute{\varepsilon}}_{\mathbf{x,t}}$, which occurs if $\delta_3 = 0$. If δ_3, the coefficient of $\boldsymbol{U}_{x,t}$, is significantly different from zero, that would confirm endogeneity issues. However, a simple t-test yields a p-value of .43, implying that δ_3 is not statistically different from zero and HHI is not endogenous. Regardless, we proceed with 2SLS to check for robustness of our results. As table 6 shows, the results are very similar, which means that our estimates are robust to relaxing the exogeneity assumption.

Table 7: Comparison of OLS and 2SLS Results

ln P	**(OLS)**	**(2SLS)**
ln Distance	.39*** (23.15)	.39*** (22.31)
ln HHI	.12*** (4.66)	.11*** (3.93)
Roundtrip	-.77*** (-5.21)	-.76*** (-5.1)

Tempdiff	-.0035***	-.0034***
	(-3.91)	(.00089)
Lcc15	-.043	-.045
	(-1.47)	(-1.53)
Ln Pop	-.0037	-.00013
	(-.22)	(-.03)
Ln Inc	.029	(.00061)
	(.77)	(.68)
N_adj_lcc	-.037***	-.038***
	(-2.65)	(-2.77)
Merger	.04**	.039**
	(1.88)	(1.81)
*Merger*Lcc15*	-.20***	-.20***
	(-4.38)	(-4.29)
Intercept	2.70***	2.79***
	(11.93)	(16.92)
R^2	.872	.87
Adj R^2	.862	.86
N	148	148

****p<.01, **p<.05, *p<.1*
T-Statistics in Parenthesis

The Southwest-AirTran Merger

In 2011 the DOJ approved the proposed merger between Southwest Airlines and AirTran Airways, which is arguably Southwest's biggest LCC competitor. In the preceding analysis we found that Southwest's fares in the more recent time period depends on the presence of other LCCs in its markets. In this section we attempt to find how individual LCC competitors affect Southwest's pricing strategy. We achieve this by simply replacing the LCC dummy in our base model with individual dummy

variables for each major LCC competitor using the 2010 sample[27]. These major LCC competitors include Airtran (FL), JetBlue (B6), Frontier (F9), Spirit (NK), and Virgin America (VX). Table 7 shows the estimated coefficients.

Table 8: Regression Results Using Individual LCC Dummies

ln P	**(1)**
ln Distance	.389***
	(21.04)
ln HHI	.097***
	(3.62)
Roundtrip	-.841***
	(-5.25)
Tempdiff	-.004***
	(-3.91)
Ln Pop	.003
	(.58)
Ln Inc	.001
	(.76)
N_adj_lcc	-.046***
	(-3.16)
FL	-.066**
	(-2.36)
NK	-.160***
	(-3.18)
B6	-.044
	(-.54)
F9	-.075
	(-1.46)
VX	-.128
	(-1.51)
Intercept	2.83
	(15.87)
R^2	.855

[27] We leave other less-prominent LCCs as the base case. As before, competitive presence is defined by having at least 10% market share.

Adj R^2	.842
N	148

****p<.01, **p<.05, *p<.1*
T-Statistics in Parenthesis

The results show that after including the necessary controls, Airtran and Spirit appear to have the strongest impact on Southwest's own fares, which are on average 6.57% lower if facing competition from Airtran and about 16% lower if Spirit Airlines is present. AirTran is present in 21 out of Southwest's 148 airport-pair markets in the 2010 sample. The Southwest-AirTran merger eliminates one of the competitive barriers to raising Southwest's own fares when facing reduced competition from other carriers.

Policy Implications for the US Department of Justice

Several airlines in the US airline industry have reacted to a turbulent past decade in terms of low demand following the 9/11 terrorist attacks and the 2008 recession, soaring fuel prices, and emergence and expansion of low cost carriers, through mergers and acquisition. The airlines claimed the possibility of significant post-merger efficiency gains and cost reductions. The US department of Justice approved these mergers based on its evaluation that the presence of LCCs in the merger-affected markets can prevent any post-merger anticompetitive backlash. The DOJ's evaluation at the time facing the Delta-Northwest and US-America West mergers was understandable given a series of studies in the literature that show that LCC presence is responsible for lowering fares in the industry, particularly the "Southwest Effect".

In its more recent United-Continental merger evaluation, the DOJ specifically called for Southwest's presence as a deterrent to possible post-merger market power. However, to continue to cite Southwest as one of the many reasons to approve a merger involving two of the biggest airlines in the industry is to make a strong assumption about Southwest's continued ability or intent to keep both pre and post-entry fares low.

In this study, we find that Southwest fares have changed in recent years by varying amounts. Southwest fares went up in markets involved in the HP/US or DL/NW mergers, but competitive presence of LCCs appear to restrict Southwest's fares. The results suggest that Southwest fares are susceptible to increases if its legacy competitors merge together unless it faces competition from other LCCs. One LCC in particular, AirTran Airways, is a strong deterrent to raising Southwest's fares. However, now that the DOJ has approved the Southwest-AirTran merger, that deterrent is on the verge of being eliminated. This puts into question validity of Southwest's purported deterrence to post-merger market power.

It is not clear whether further consolidation is imminent in the airline industry. American Airlines recently filed Chapter 11 bankruptcy after several years of operating losses and financial trouble. Although no official merger proposal has been made, it is possible that the DOJ may have another major merger evaluation in its hands in the coming years. Based on our findings, we recommend additional caution in citing Southwest Airlines as the reason behind approving any potential merger.

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