Competition from Incumbent Firms During Mergers:

Estimating the Effect of Low-Cost Carriers on Post-Merger Prices

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Abstract

In an evaluation of a merger, the type of existing competitors in the market should play a role in constraining market power following the merger. In the airline industry, heterogeneity between low-cost carriers (LCCs) and legacy carriers suggest that the types of airline competitors could affect the price effects of a merger. This paper investigates the pro-competitive effects that existing, non-merging airline carriers have on prices when an airline merger occurs. Using data in the years around the 2008 merger between Delta and Northwest Airlines, the results show that average price levels of Delta and Northwest dropped after the merger, with larger price decreases on routes with LCC competitors. There is evidence that incumbent LCC competitors have a larger influence than legacy competitors in restricting post-merger prices and market power, confirming that the type of competitors matters in assessing the level of competition in a market. This paper also shows that much of the cost efficiencies from the merger were concentrated on routes with a hub of Delta or Northwest.

Keywords: Airline Merger, Airline Competition, Market Structure

I. Introduction

Since the Airline Deregulation Act of 1978, mergers have been a trademark of the airline industry. Over 40 airline mergers have been approved and completed since 1978, dramatically consolidating the market power of carriers (Kwoka 2010). This shift towards an airline market characterized by less competition and higher prices has threatened the interest of consumers. Consequently, the Department of Justice (DoJ), who is responsible for approving all mergers, has been more vigilant about the state of the airline industry. Policy debates about these approvals have intensified amidst the recent 2008 Delta-Northwest and 2010 United-Continental mergers, which had record-setting transactions of 3.1 billion and 3.2 billion dollars respectively. In late 2013, the proposed merger between American Airlines and US Airways cleared the final legal hurdles in the approval process, another step closer towards the formation of the world's largest airline (usatoday.com). With the increasingly massive monetary and infrastructural size of airline mergers, the consequences of the DoJ's merger approval decisions to consumers and the industry alike have only magnified. Research about the effects on post-merger price levels has never been as instrumental.

When reviewing an airline merger application, the DoJ might be led to approve if bankruptcy of one of the merging companies is imminent, in an attempt to avert the waste of capital and assets. Also, the DoJ might actually believe that the merged firm with an expanded network of routes might lower costs or provide higher-quality service to consumers, such as fewer cancellations and delays. While the first two categories of arguments in support of an airline merger highlight the possible benefits, the potential entry defense attempts to argue that the threat of potential entrants will significantly diminish the ability of merging firms to increase prices. The role that potential entrants have in limiting the market power of merging firms has been frequently studied in the past few decades and played an influential role in the approval of mergers such as TWA's acquisition of Ozark in 1986 (Nannes 2000). However, equally important in evaluating the increased market power of merging firms is the type of incumbent firms, specifically whether they are a legacy or a low-cost carrier (LCC).

Throughout the same time that the airline industry was experiencing increased merger activity, a new type of airline called low-cost carriers (LCCs) has rapidly emerged, especially in the 1990s. LCCs are able offer lower prices through a different business model characterized by

point-to-point routes rather than a traditional hub-and-spoke network, as well as fewer amenities. The entry of LCCs in the market has stiffened competition and caused traditional legacy carriers, such as Delta or Northwest, to lower prices accordingly (Dresner 1999). Now that LCCs are widespread across domestic routes, it is fruitful to study not only the competitive effects that LCCs have when entering a market, but also their influence as an incumbent competitor on price changes following a merger. Furthermore, since LCCs often only serve a smaller, secondary airport in metropolitan areas with several airports (ex. Chicago's O'Hare and Midway airports), competitor effects across neighboring airports will be included in the analysis as well. Since many merger analysis papers don't contrast the role of LCCs and legacy carriers in limiting the anti-competitive effects of the merger, this is a research gap that the paper intends to fill.

This paper will focus on whether the types of incumbent carriers (LCC vs. legacy) in a market has a significant effect on post-merger prices of merging firms like Delta-Northwest and overall prices among all carriers, within and across neighboring airports. If this paper does show that facing competition from LCCs rather than legacy carriers significantly limits the ability of merging firms to increase prices, then the degree of overlap between routes served by LCCs and routes served by merging firms should be weighted more heavily in the DoJ's approval decision of potential mergers.

II. Literature Review

There is abundant research about the expansion of LCCs in the 1990s and 2000s and how their entry significantly increased competition on newly served routes. In fact, Dresner (1999) provides evidence that the entry of the LCC ValuJet into routes originally dominated by Delta significantly lowered Delta's prices, leading to the recommendation that governments should promote entry by LCCs to increase consumer welfare. Research done by Pels (2009) expands upon this by looking into whether LCCs that serve the smaller, secondary airports in the London metropolitan area have a competitive effect on legacy carriers operating on the larger Heathrow and Gatwick airports. Though Pels does find statistically significant cross-price elasticties between the different airports, the conclusions are narrower in scope because only flights that arrive or depart from the London metropolitan area were used in the analysis.

Airline models that account for competition among neighboring routes and span a wide range of metropolitan areas are more realistic in its assumptions and widen the scope of the conclusions. For example, Dresner (1996) includes competitive effects between all domestic airports that are within 50 miles apart in the analysis of Southwest's entry. The conclusions drawn were that entry by a LCC on a nearby route had a weaker effect on prices of incumbent legacy carriers than entry on the same route, though the effects were still significant and large in magnitude. Morrison (2001) also considers the competitive effects of Southwest's entry into the same or nearby routes to those operated by legacy carriers, estimating that consumer savings due to competition by Southwest totaled $12.9 billion, where $9.5 billion comes from the lower legacy fares induced by Southwest's competition within and across neighboring routes. In total, both Dresner (1996) and Morrison (2001) argued that the gain in consumer welfare due to Southwest's entry is rather large, especially when the definition of competition is no longer restricted to just the same route.

The articles discussed above are studied under the context of LCCs entering a market. However, as the subject of study shifts from airline entries to airline mergers, the role of LCC competitors in influencing post-merger prices of legacy carriers is often overshadowed. For example, Kwoka (2010) analyzes the price effects of Piedmont Air's 1989 merger with US Airways, focusing on routes where the merging carriers directly competed or one dominated. While the Herfindahl-Hersch Index (HHI) is included to control for the level of competition, the model lacks distinction between legacy and LCC competitors as well as interacting effects between the existing level of competition and the merger on price levels. Luo (2014) analyzes the same 2008 Delta-Northwest merger that will be studied here, finding small increases in prices of less than 5%. Though there are controls for the entry of LCC and legacy competitors, there are no interacting effects between the merger and non-merging competitors. There is a need for research integrating the detailed analyses of LCCs frequently found in articles about airline entry, with research about airline mergers.

III. Data

The dataset used for the estimation of the model described later is the Department of Transportation's Airline Origin and Destination Survey (DB1B), a 10% sample of all domestic airline tickets collected on a quarterly basis and made accessible online. For every passenger in the sample, there is information about the price paid, the operating carrier, origin and destination of the flight, and the location of connecting stops, if any exist. However, the data lacks information about which flight each ticket was booked for as well as when the flight took place within the quarterly sample. For instance, a direct flight on Delta Airlines from Dulles Airport to LaGuardia departing on April 10th would be indistinguishable from another direct flight with the same carrier, itinerary, and price departing on May 10th, since both would be aggregated into the 2nd quarterly sample of that year. Furthermore, all demographic information about the individuals is absent from the data, taking away the ability to identify whether each ticket was purchased by a business or leisure traveler. Although the DB1B data has disadvantages compared to data from travel agencies that may provide flight and individual-level data, the DB1B's representative sample of all carriers and domestic routes allows for more powerful conclusions about a merger's effect on the airline industry to be drawn.

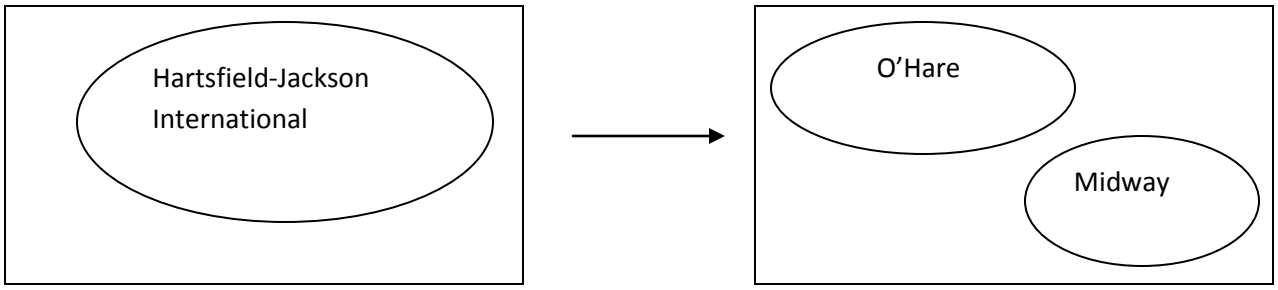
The data used will span quarter 1 of 2006 to quarter 1 of 2010, allowing for an adequate number of data points preceding and following the Delta-Northwest merger that occurred on quarter 2 of 2008. Yet the time frame of 2006-2010 Q1 is short enough to avoid overlap with other major airline mergers. The preceding merger was between US Airways and American West in 2005, while the succeeding merger was between United and Continental in May of 2010. Thus, any merger effects captured by the specification will only reflect the Delta-Northwest merger.

The remaining modifications to the data are related to the type of tickets. Only round-trip, direct flights are kept before defining the regressors and estimating the specification. Also, routes where neither Delta nor Northwest flown passengers are excluded in order to allow the competition variables to better capture the merger effects.

IV. Theoretical Framework and Empirical Model

In many airline articles, a market is defined to be all flights with a specific origin and destination airport, also referred to as a route or directional airport pair. However, analyzing the research question of this paper will require a market definition that allows competition not only among carriers on the same route, but also on neighboring routes that share the same origin and destination metropolitan areas. To illustrate this broadened definition of a market, referred to as directional city pairs, figure 1 categorizes routes into their respective markets.

Market A: Flights from Atlanta (1 Airport) to Chicago (2 Airports)



Market B: Flights from Chicago to Atlanta

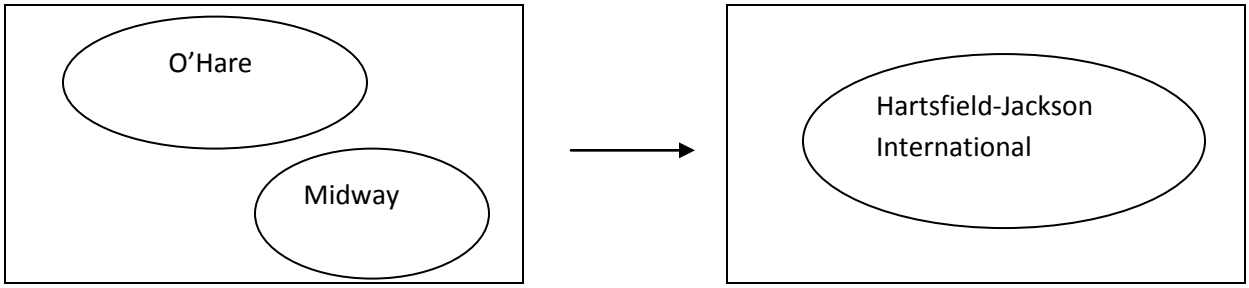


Figure 1

Concretely, neighboring routes are considered to be linking the same metropolitan areas if both the first route's origin and destination airports are within a certain specified distance of the second route's origin and destination airports, respectively. Dresner (1996) used a radius of 50 miles, while Morrison (2001) found that a radius of 75 miles provided the best fit for regressions. The importance of considering neighboring routes is demonstrated in figure 2, which depicts the share of passengers among different carriers in the market Chicago-Atlanta. The data, which is described above, is from quarter 1 of 2008.

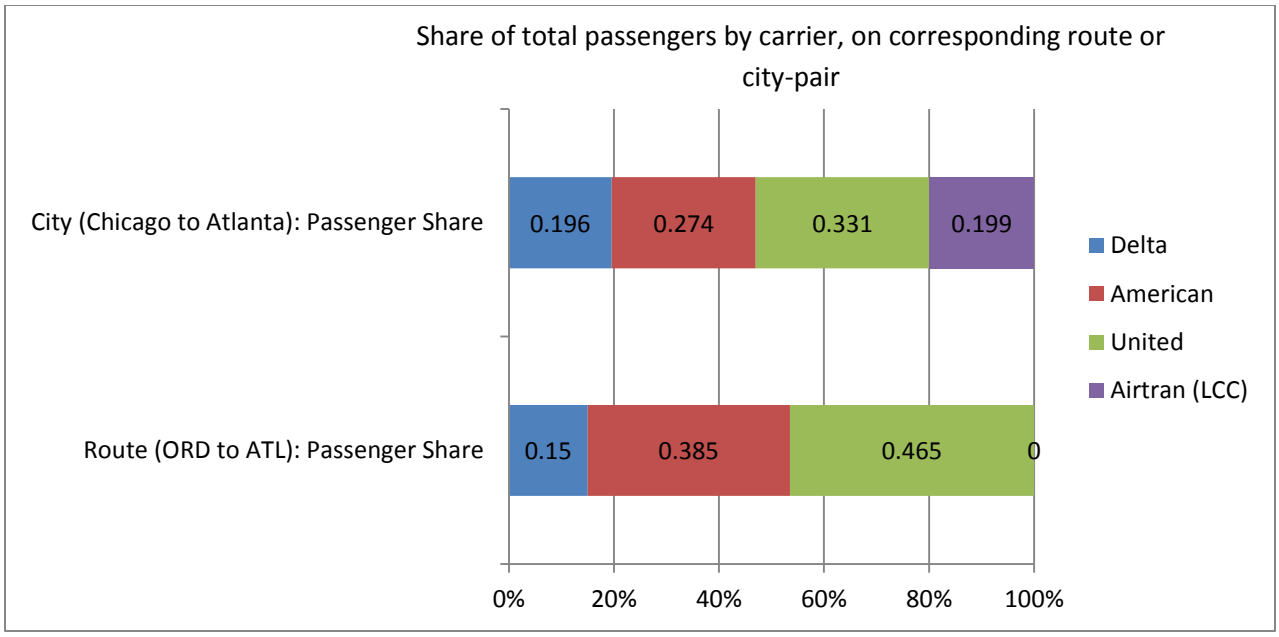


Figure 2

Within Chicago, the LCC AirTran only operates from Midway (MDW) airport but not the primary O'Hare (ORD) airport. When considering levels of competition faced by carriers on the route ORD to ATL, the competitive effects exerted by AirTran would be completely ignored if one does not account for competitors on the neighboring route MDW to ATL. Thus, the merger analysis represented by the model should account for both incumbent competitors on the same route as well as neighboring routes.

Although the definition of a market presented above is a directional city pair, the merger effects among different routes (directional airport pairs) within a market (directional city pairs) are a main focus of this paper. Therefore, the empirical analysis will involve prices and variables of individual routes across time. A fixed-effects regression will be run with route *i*, carrier *j*, and quarter *t*, where quarter 1 of year 2007 is different from quarter 1 of year 2008. The standard error term in regression analysis is given by $\varepsilon_{i,j,t}$.

$$log(p_{i,j,t}) = \lambda_{i,j} + \delta_t + \sum_k (\beta^k x^k_{i,j,t}) + \sum_k (\beta^k x^k{}_{i,j,t} * nonDLNW_i) + \epsilon_{i,j,t} \quad (1)$$

Dependent Variables ($\log(p_{i,j,t})$)

To test the effects of the Delta-Northwest merger on prices of both merging and non-merging carriers, all independent variables will be interacted with *nonDLNW*, a dummy for being a non-merging carrier. Delta and Northwest's tickets will be pooled in computing their combined mean price variable, while tickets from all other carriers are used separately to compute prices. So for every route-quarter combination in the data, there may be multiple observations each corresponding to a different carrier. The interaction variable allows the price effects of the merger to differ between merging and non-merging carriers.

Fixed Effects

For every route *i* and carrier *j*, longitudinal data for each quarter *t* allows a fixed-effects regression to be run with the route-carrier combinations as the entities. Route-specific characteristics that are roughly time-invariant such as the destination's appeal to tourists, distance between the airports, and distance to nearest airport are captured by the route-carrier fixed effects ($\lambda_{i,j}$). Carrier-specific characteristics such as pricing strategies inherent to LCCs or legacies are also captured by the route-carrier fixed effects ($\lambda_{i,j}$). Finally, these route-carrier fixed effects will also capture characteristics related to each carrier's hub routes, such as benefitting from lower costs when flying between main hubs. Quarter dummies will be included in the regression to capture time fixed-effects (δ_t), such as seasonal variations in demand or the great recession's impact on consumer spending.

Explanatory Variables ($x_{i,j,t}$)

Much care needs to be taken when selecting the explanatory variables, because using regressors such as competitors' prices and quantities will likely lead to endogeneity issues. The prices and quantities of all firms in a particular market are simultaneously determined, causing biased estimates if Delta and Northwest's prices are regressed on the prices of competing carriers.

Past articles including Dresner (1996) and Morrison (2001) have instead used explanatory variables such as the presence of a competitor or the Herfindahl Index, a measure of the level of competition in a market. The decisions of a competitor to enter or exit a market may be more weakly endogenous because such decisions are more long-term, compared to the three months for each time period *t* in the empirical specification. The explanatory variables used here will follow similar lines:

- *NumLCC*: the number of LCC competitors operating on the same route. A carrier must have at least 5% share of all passengers in that particular route and quarter to be considered a competitor.

- *NumLegacies:* the number of legacy competitors, operating on the same route. Since Delta and Northwest are both legacy carriers, the merger will lower the value of this variable by one on routes where Delta and Northwest were directly competing. Holding all else equal, this represents the merger's effect on prices through lowering competition and concentrating the market. The synergistic effects of the merger are captured below by *Postmerger*. Competitors must also exceed the 5% threshold of passenger share to be counted.

- *NumLCC_neighboring*: the number of LCC competitors operating on any neighboring route where both the origin and destination airports are within 75 miles from the main route's origin and destination airports, respectively. If there are two or more neighboring routes, a carrier will not be counted twice as a competitor. For example, if Southwest just begins offering flights in the same quarter on RDU-JFK, RDU-Newark, and RDU-LaGuardia (routes within the Raleigh-New York market), then *NumLCC_neighboring*

will only increase by one for routes in this market. Competitors from a neighboring route must have a passenger share of at least 5% on that neighboring route.

- *NumLegacies_neighboring*: the number of legacy competitors, operating on any neighboring route. Like *NumLegacies*, this variable will capture the merger's effect on prices through lowering competition. Similar rules regarding double-counting and passenger share are applied.

- *Postmerger:* A dummy variable that equals one if the quarter is after 2008 Q2, when the merger occurred. Synergistic effects on price should be captured here, such as the fact that the merged firm can better utilize aircraft fleet and gates previously held independently by Delta and Northwest. The merger's effects on prices through concentrating the market are not captured by *Postmerger*, but by *NumLegacies and NumLegacies_neighboring*.

- *Postmerger*NumLCC* an interaction variable that measures how the merger's effects on prices vary depending on the number of incumbent LCC competitors on the same route.

- *Postmerger*NumLegacies*: an interaction variable that measures how the merger's effects on prices vary depending on the number of incumbent Legacy competitors.

- *Postmerger*NumLCC_neighboring*: an interaction variable similarly defined and interpreted.

- *Postmerger*NumLegacies_neighboring*: an interaction variable similarly defined and interpreted.

- *nonDLNW*: a dummy variable that equals one if the observation and prices are that of a non-merging carrier. All regressors described above are interacted with *nonDLNW*.

Table 1 below summarizes the competitor counts and average prices, for the routes that will be used in the regression throughout the 2006-2008 Q1 time frame described above. Since the analysis includes only routes where at least one of the merging carriers operates, the number of legacy carriers is at least 1. The feature that the mean number of LCC or legacy competitors is so low can be explained by the fact that most routes are between small airports that have a lower volume of traffic.

VARIABLES	(1) N (Route-Qtr-Carriers)	(2) mean	(3) sd	(4) min	(5) max
Mean Ticket Price ($)	31,314	368.3	132.0	80.77	1,225
numlcc_same	31,314	0.578	0.627	0	3
numlegacy_same	31,314	1.582	0.705	1	4
numlcc_neighboring	31,314	0.367	0.665	0	4
numlegacy_neighboring	31,314	0.418	0.745	0	4
Postmerger	31,314	0.489	0.500	0	1
Postm*numlcc_same	31,314	0.279	0.518	0	3
Postm*numlegacy_same	31,314	0.762	0.920	0	4
Postm*numlcc_neighboring	31,314	0.165	0.470	0	3
Postm*numlegacy_neighboring	31,314	0.202	0.563	0	4

Table 1. Summary statistics for main variables. Quarterly data for each carrier on every route generates a total of 31,314 observations.

V. Results

VARIABLES	(1) log(mean price)
numlcc_same	-0.159***
	(0.00598)
numlegacy_same	-0.0304***
	(0.00665)
numlcc_neighb	-0.0463***
	(0.00641)
numlegacy_neighb	-0.0143**
	(0.00610)
Postmerger	-0.106***
	(0.00771)
Postm*numlcc_same	0.0122***
	(0.00436)
Postm*numlegacy_same	0.0301***
	(0.00454)
Postm*numlcc_neighb	0.00831*
	(0.00497)
Postm*numlegacy_neighb	0.0335***
	(0.00382)
numlcc_same*nonDLNW	0.0531***
	(0.00771)
numlegacy_same*nonDLNW	0.0313***
	(0.00851)
numlcc_neighb*nonDLNW	0.00539
	(0.00768)
numlegacy_neighb*nonDLNW	0.0138*
	(0.00793)
Postmerger*nonDLNW	0.114***
	(0.0108)
Postm*numlcc_same*nonDLNW	-0.0291***
	(0.00599)
Postm*numlegacy_same*nonDLNW	-0.0427***
	(0.00584)
Postm*numlcc_neighb*nonDLNW	-0.00211
	(0.00616)
Postm*numlegacy_neighb*nonDLNW	-0.0228***
	(0.00486)
Observations	31,314
R-squared	0.211

Table 2. Quarter and Carrier-Route Fixed Effects Included.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The results of the main specification are shown in table 2. Table 3 shows the same regression coefficients but divides them into two groups: the non-interacted variables describing price effects on Delta-Northwest's tickets and the interacted variables describing effects on non-merging carriers. In the first column of Table 3, the baseline coefficients describing effects on Delta and Northwest's prices are shown, while interaction terms in column 2 show how these effects differ for a non-merging carrier. Column 3 sums up the coefficients in the first 2 columns, yielding the effect for non-merging carriers.

VARIABLES	Effect on DL/NW	Interaction with Non-Merging Carrier (nonDLNW)	Sum Effect on Non-Merging Carriers
numlcc_same	-0.159***	0.0531***	-0.1059***
	(0.00598)	(0.00771)	(0.00976)
numlegacy_same	-0.0304***	0.0313***	0.0009
	(0.00665)	(0.00851)	(0.0108)
numlcc_neighbor	-0.0463***	0.00539	-0.04091***
	(0.00641)	(0.00768)	(0.01)
numlegacy_neighbor	-0.0143**	0.0138*	-0.0005
	(0.00610)	(0.00793)	(0.01)
Postmerger	-0.106***	0.114***	0.008
	(0.00771)	(0.0108)	(0.0133)
postm*numlcc_same	0.0122***	-0.0291***	-0.0169**
	(0.00436)	(0.00599)	(0.00741)
postm*numlegacy_same	0.0301***	-0.0427***	-0.0126*
	(0.00454)	(0.00584)	(0.00740)
postm*numlcc_neighbor	0.00831*	-0.00211	0.0062
	(0.00497)	(0.00616)	(0.00791)
postm*numlegacy_neighbor	0.0335***	-0.0228***	0.0107*
	(0.00382)	(0.00486)	(0.00618)

Table 3. First two columns show the same coefficients as in table 2. Column 3 shows the sum effect on prices of non-merging carriers.

Coefficient estimates from the first column of table 3 indicate that a low-cost competitor on the same route has a 15.9% negative effect on average prices of Delta and Northwest, while a legacy competitor on the same route has only a 3.04% negative effect on prices. A positive 3.04% is also the rise in prices experienced by the merging carriers on routes where both Delta and Northwest competed, since the merger decreases the legacy carrier count by 1. On neighboring routes, low-cost competitors also have a larger effect on prices than legacy competitors, although

the magnitudes are lower than those on the same route. These results are consistent with the literature reviewed in that low-cost carriers have a larger effect on prices than legacy competitors. Since the *postmerger* variable includes the synergistic effects of the merger, the results indicate that cost reductions and better utilization of Delta and Northwest's combined capital were responsible for part of the 10.6% decrease in their own prices. The *postmerger* interaction variables are all positive, suggesting that the merger caused a smaller price drop in a crowded market, but caused a larger price drop in a market with fewer competitors. These interaction effects on the same route are similar to effects on neighboring routes. The key conclusion is that estimates for every low-cost competitor variable are more negative than the corresponding legacy competitor variable (e.g. *postm*numlcc_same* vs. *postm*numlegacy_same*). For the interaction variables, this means that Delta-Northwest cut their post-merger prices more when facing LCC competitors, rather than an incumbent legacy competitor.

Looking at column 2, the interaction variables with being a non-merging carrier all counteract the effect from column 1. The first four interaction variables are positive, reducing or even washing out the baseline coefficients from column 1. On a route where the Delta-Northwest merger decreased the number of legacy competitors by 1, the merging carriers would benefit from a 3% increase in prices while non-merging carriers would have an insignificant change from less competition. The un-interacted variable *postmerger* is negative for Delta-Northwest but insignificant for non-merging carriers. Since the efficiency gains from the merger are captured in *postmerger*, a non-merging carrier's price drops should be smaller or insignificant from zero in this case. Column 3 shows the sum effects, calculated by adding estimates from column 1 with 2, when studying the effects on prices of non-merging carriers. Like column 1, every low-cost competitor variable estimate is more negative than the corresponding legacy competitor variable (e.g. *postm*numlcc_same* vs. *postm*numlegacy_same*). Non-merging carriers' prices are minimally affected by the merger, and may decrease slightly more when facing LCC competitors.

To summarize, the main findings from the results are that:

- On average across all routes, Delta and Northwest show a significant drop in prices from the merger, whereas non-merging carriers have an insignificant change in prices.
- When Delta-Northwest face LCC competitors on their own routes, Delta-Northwest's ticket prices drop by a larger amount than with legacy competitors on the route

VI. Welfare Calculations: Consumer Benefits from Having LCC competitors

Consumers benefit from the lower post-merger prices due to LCC competitors, which can be calculated by summing up the model's predicted effect on individual routes. On every route where a LCC competitor was present as the merger occurred, the model predicts that post-merger prices on the route would have been higher if the LCC competitor was replaced by another legacy competitor. The amount that prices are higher by is determined by the regression estimates in Table 2. An example calculation of consumer savings from only Delta's ticket prices on the O'Hare-Atlanta (ORD-ATL) route is shown below in Table 4. The first half shows the calculation of the difference in Delta's 2009 prices on O'Hare-Atlanta, with and without LCC competitors on the same route. Since there are no LCCs on the route ORD-ATL, this effect under this exercise is nonexistent. The second half shows the same calculation of Delta's 2009 prices on ORD-ATL, with and without LCC competitors on the neighboring route of Midway-Atlanta (MDW-ATL). The presence of the LCC AirTran Airways on MDW-ATL resulted in an estimated reduction of $6.6 in Delta's average prices on ORD-ATL, and total savings of about $163,635 throughout 2009.

Price Effect from LCC Competitors at ORD-ATL (Same Route)		Price Effect from LCC Competitors at MDW-ATL (neighboring route)	
Mean 2009 price of Delta on ORD-ATL	262	Mean 2009 price of Delta on ORD-ATL	262
# of Total LCC Competitors on ORD-ATL	0	# of Total LCC Competitors on MDW-ATL	1
$\beta_{postm*numlcc\_same}$	0.0122	$\beta_{postm*numlcc\_neighbor}$	0.00831
$\beta_{postm*numlegacy\_same}$	0.0301	$\beta_{postm*numlcc\_neighbor}$	0.0335
$\Delta\beta$	0.0179	$\Delta\beta$	0.02519
Savings Per Delta Ticket = $\Delta\beta$*(Average Delta Price)*(# of LCCs)	0	**Savings Per Delta Ticket =** $\Delta\beta$*(Average Delta Price)*(# of LCCs)	6.6
Total Savings on Delta = (Savings Per Delta Ticket)*(# of Delta Passengers)	0	**Total Savings on Delta =** (Savings Per Delta Ticket)*(# of Delta Passengers)	163,635

Table 4. Effect on prices at ORD-ATL

Similar calculations of consumer savings can be replicated for all carriers across all routes. To visualize the amount of consumer savings due to lower post-merger prices, figure 3 plots average prices in 2007 across all routes, and the predicted change in prices caused by the merger. In addition, the predicted change in prices is calculated in a counterfactual world where

all LCCs are replaced by legacy carriers. The difference between the two points in 2009 is calculated similarly to the "Savings Per Delta Ticket" in Table 3, but averaged across all routes instead of just ORD-ATL. This is done by substituting a legacy carrier for each LCC in all markets from the data, while keeping the total number of competitors in each market the same. The merger was responsible for roughly a $15 drop in the merging carriers' average tickets, but only about $9 if the merging carriers had faced only legacy competitors rather than LCCs. For the non-merging carriers, the merger was responsible for less than a $2 drop in average prices, but a very small change if LCCs were replaced by legacy competitors.

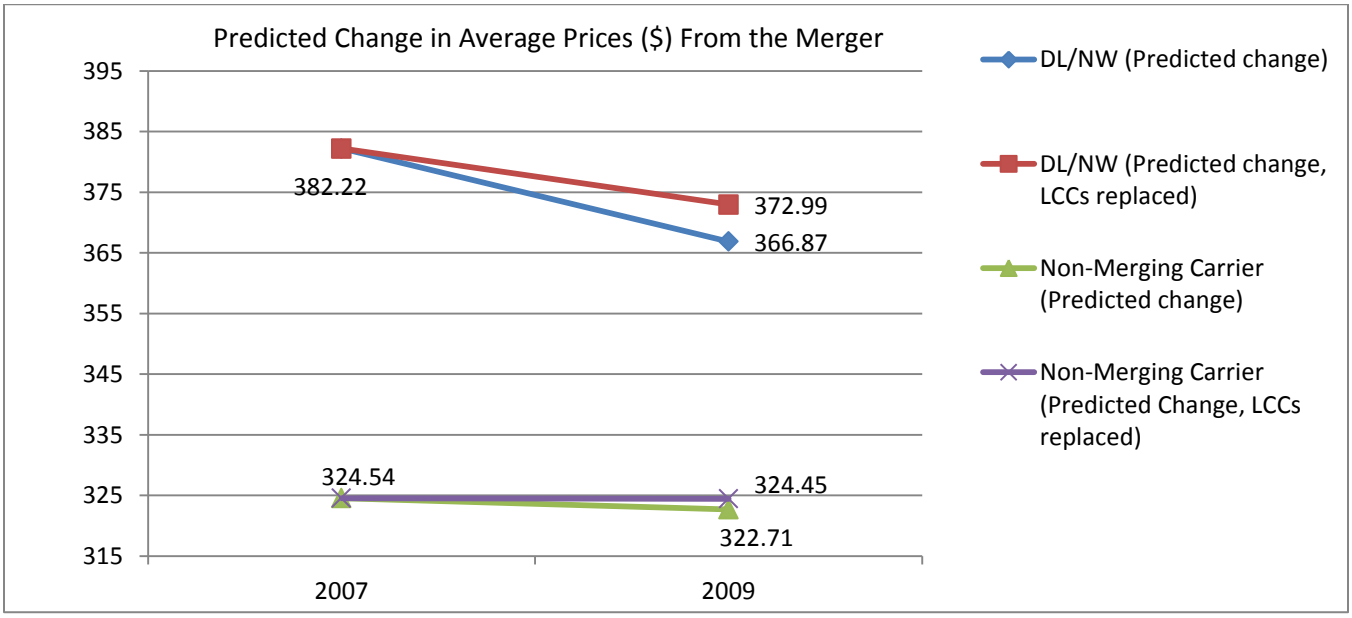


Figure 3

At the aggregate level, consumers saved $84.0 million on Delta's tickets and $209.8 million on other carriers' tickets in 2009 due to having LCCs instead of only legacy competitors, for a total of $293.8 million. Although the savings per ticket is lower for non-merging carriers (less than $2) compared to Delta-Northwest ($6), aggregate savings is higher for non-merging carriers because they have higher overall quantities across the routes analyzed. In reference to previous literature about LCC entry in the 1990's, the aggregate savings of $293.8 million per year found here is small compared to the $9.50 billion calculated by Morrison (2001), who studies initial entry of LCCs in the 1990s. However, the savings of $293.8 million in this paper refers to just the Delta-Northwest merger, which is only one of many airline mergers in recent decades. Studies of other mergers could also yield large welfare benefits from LCC incumbents.

VII. Alternate Specifications: Hub Effects

Airlines often have designated airports, commonly called hubs, which serve as a transfer point for many of their passengers. Since the traffic of each airline tends to be concentrated at their own hubs, the merger could have a different price effect on flights into or out of a hub. The same price effects of the Delta-Northwest merger can be compared between routes that include at least one of the merging carrier's hubs, and routes where the origin and destination airport are not Delta-Northwest's hubs. Examples of each type are shown in table 5.

	Hubs	Ex: Hub Route	Ex: Non-Hub Route
Delta	ATL (Atlanta) CVG (Cincinnati)	ATL-CVG CVG-ORD (O'Hare)	DEN-RDU
Northwest	MSP (Minneapolis-St. Paul) DTW (Detroit)	MSP-RDU DTW-RDU	MDW-RDU

Table 5.

Shown in table 6, the same specification is estimated for the subsample of routes that involve at least one hub of Delta or Northwest and another subsample of routes where neither airport is a hub of Delta or Northwest. The most notable difference between the two subsamples is that Delta and Northwest's post-merger price drops mainly occur on their hub routes. Delta and Northwest's prices decrease by about 17.9% on average in their hub routes, but have insignificant changes on any non-hub routes. Since cost efficiencies are a large factor that drives the *postmerger* variable, the benefits from combining capital should come from the hubs where the fleet of aircraft and gates were already centralized. The combined airline can better optimize scheduling of flights by utilizing all four hubs, which were owned separately before the merger. On the flip side, routes that don't include any hubs of Delta or Northwest should see reduced effects of synergies. Since the dataset used in the analysis includes only direct tickets, the addition of available hubs as transfer points would have a minimal effect on direct flights between non-hub airports.

VARIABLES	(1) log(mean price) Routes with DL/NW Hubs	(2) log(mean price) Routes w/o DL/NW Hubs
numlcc_same	-0.200***	-0.126***
	(0.00904)	(0.00785)
numlegacy_same	-0.0417***	-0.0171*
	(0.00892)	(0.01000)
numlcc_neighb	-0.0827***	-0.0247***
	(0.0117)	(0.00756)
numlegacy_neighb	0.00259	-0.0102
	(0.0103)	(0.00783)
Postmerger	-0.179***	0.00416
	(0.0105)	(0.0114)
Postm*numlcc_same	0.0228***	0.00190
	(0.00597)	(0.00641)
Postm*numlegacy_same	0.0394***	0.0145**
	(0.00666)	(0.00612)
Postm*numlcc_neighb	0.0323***	-0.00501
	(0.00992)	(0.00581)
Postm*numlegacy_neighb	0.0202***	0.0288***
	(0.00708)	(0.00455)
numlcc_same*nonDLNW	0.0813***	0.0248**
	(0.0120)	(0.00992)
numlegacy_same*nonDLNW	0.0372***	0.0172
	(0.0119)	(0.0124)
numlcc_neighb*nonDLNW	-0.00866	-0.00294
	(0.0158)	(0.00882)
numlegacy_neighb*nonDLNW	0.0142	0.00467
	(0.0139)	(0.01000)
Postmerger*nonDLNW	0.0751***	0.114***
	(0.0161)	(0.0151)
Postm*numlcc_same*nonDLNW	-0.0287***	-0.0218**
	(0.00846)	(0.00850)
Postm*numlegacy_same*nonDLNW	-0.0206**	-0.0466***
	(0.00904)	(0.00763)
Postm*numlcc_neighb*nonDLNW	-0.0333**	0.00866
	(0.0134)	(0.00710)
Postm*numlegacy_neighb*nonDLNW	-0.0137	-0.0239***
	(0.00929)	(0.00574)
Observations	16,280	15,034
R-squared	0.295	0.154

Table 6. Column 1 only uses routes where the airport-pair includes at least one hub of DL or NW.

Like the first specification that pools hub routes and non-hub routes together, the interaction variables in table 7 for non-merging carriers generally counteract the coefficients describing Delta and Northwest's prices. Non-merging carriers drop prices by 10.4% on average across hub routes, compared to a 17.9% drop in Delta and Northwest prices. On non-hub routes, non-merging carriers' prices increase by roughly 11.8% even though Delta and Northwest's price change very little. The pricing decisions of non-merging carriers seem to adjust depending on the amount of cost efficiencies of Delta-Northwest, which is very large on hub routes but minimal on non-hub routes.

Also consistent with the main specification that pools hub and non-hub routes, route-level prices are lower with LCC rather than legacy competitors. On hub routes, price drops due to the merger are larger when Delta and Northwest face LCC competitors rather than legacy competitors. In almost all cases, incumbent LCC competitors help to maintain low prices following a merger for the benefit of consumers. The rare exception occurs for non-merging carriers' prices on non-hub routes, shown in column 3 of table 8. Their price increases are larger with LCC competitors compared to having legacy competitors.

VARIABLES	Effect on DL/NW	Interaction with Non-Merging Carrier (nonDLNW)	Sum Effect on Non-Merging Carriers
numlcc_same	-0.200***	0.0813***	-0.1187***
	0.00904	0.012	0.015
numlegacy_same	-0.0417***	0.0372***	-0.0045
	0.00892	0.0119	0.0149
numlcc_neighb	-0.0827***	-0.00866	-0.09136***
	0.0117	0.0158	0.0197
numlegacy_neighb	0.00259	0.0142	0.01679
	0.0103	0.0139	0.0173
Postmerger	-0.179***	0.0751***	-0.1039***
	0.0105	0.0161	0.0192
Postm*numlcc_same	0.0228***	-0.0287***	-0.0059
	0.00597	0.00846	0.0104
Postm*numlegacy_same	0.0394***	-0.0206**	0.0188*
	0.00666	0.00904	0.0112
Postm*numlcc_neighb	0.0323***	-0.0333**	-0.001
	0.00992	0.0134	0.0167
Postm*numlegacy_neighb	0.0202***	-0.0137	0.0065
	0.00708	0.00929	0.0117

Table 7. Hub Routes Only. First two columns show the same coefficients as the first specification in table 6. Third column shows sum-effect on non-merging carriers.

VARIABLES	Effect on DL/NW	Interaction with Non-Merging Carrier (nonDLNW)	Sum Effect on Non-Merging Carriers
numlcc_same	-0.126***	0.0248**	-0.101***
	(0.00785)	(0.00992)	(0.0127)
numlegacy_same	-0.0171*	0.0172	0.0001
	(0.01000)	(0.0124)	(0.0159)
numlcc_neighb	-0.0247***	-0.00294	-0.0276**
	(0.00756)	(0.00882)	(0.0116)
numlegacy_neighb	-0.0102	0.00467	-0.00553
	(0.00783)	(0.01000)	(0.0127)
Postmerger	0.00416	0.114***	0.118***
	(0.0114)	(0.0151)	(0.0189)
Postm*numlcc_same	0.00190	-0.0218**	-0.0199*
	(0.00641)	(0.00850)	(0.0106)
Postm*numlegacy_same	0.0145**	-0.0466***	-0.0321***
	(0.00612)	(0.00763)	(0.00978)
Postm*numlcc_neighb	-0.00501	0.00866	0.00365
	(0.00581)	(0.00710)	(0.00917)
Postm*numlegacy_neighb	0.0288***	-0.0239***	0.0049
	(0.00455)	(0.00574)	(0.00732)

Table 8. Non-Hub Routes Only. First two columns show the same coefficients as the second specification in table 6. Third column shows sum-effect on non-merging carriers.

Limitations

The conclusions drawn so far have several limitations that should be mentioned. First, the analysis is unable to measure exactly how much of the price decreases following the merger was attributed to cost reductions. The overall price decrease of 10.6% in Delta and Northwest's prices may be driven by a different pricing strategy adopted by the newly merged firm, or lower demand for Delta's flights. The results from the hub versus non-hub routes provide evidence that cost efficiencies exist and are significant, since the source of price cuts are largely from routes with a Delta or Northwest hub. However, other factors may work in conjunction with cost efficiencies to lower overall prices. For future research, a more descriptive model that specifies demand and supply could better distinguish and quantify the different factors that help lower prices.

The focus on direct flights done here also limits the scope of the study. Connecting flights are alternative products that affect the demand of direct flights on the same route. Thus, accounting for connecting flights offered by competitors could yield different conclusions about price effects following the merger. Incorporating the effect of connecting flights could also alter the comparison between LCC and legacy competitors. Legacy carriers rely more on the hub-and-spoke model of transportation than LCCs, so connecting flights may have different effects on route-level competition depending on the type of carrier. A study that includes both direct and connecting flights would need to further categorize connecting flights based on the number of stops and the location of stops. The substitutability of a connecting flight versus a direct flight would depend heavily upon the total travel time required.

Finally, the calculation of aggregate consumer savings from having LCCs throughout the Delta-Northwest merger relies upon simplifying assumptions. Replacing LCC carriers to calculate changes in price levels on every route holds several factors constant, such as the number of firms in the market. If LCCs had not initially entered the markets studied here, then the equilibrium number of firms in the various markets could be different. Based on the literature reviewed showing that LCC entry in the 1990's reduced revenues of legacy carriers, this equilibrium number of firms may have been higher in routes if LCCs had not entered. For future research, estimating a structural model would yield more accurate and reliable counterfactual calculations.

VIII. Conclusion

When two airlines conduct a merger, the type of competitors they face does impact the price changes associated with the merger, on top of any cost efficiencies. Using domestic airline pricing data from 2006-2010, the estimated model allows different effects on ticket prices from legacy versus LCC competitors, as well as competitors on neighboring routes versus the same route. The findings are that the merger lowered prices by about 10% for Delta and Northwest, but had minimal effects for non-merging carriers on average across all routes. The same analysis was also carried out separately on routes where at least one of the airports is a Delta or Northwest hub, and routes where neither airport is a hub of the merging carriers. Since Delta and Northwest's price cuts came predominately from routes that involved at least one of their hubs, there is strong evidence that the cost efficiencies due to the merger came from sharing aircraft and other infrastructure that are centralized at the hubs.

The overall price decreases found here seem to stand in contrast to previous studies on the Delta-Northwest merger such as Luo (2014), who finds moderate price increases of up to 5%. A main difference is that Luo focuses on routes where the merger lowered the number of competitors, specifically routes where Delta and Northwest both competed prior to the merger. In contrast, this paper also includes routes where either Delta or Northwest was present but not both, instead of looking at the very small minority of routes (less than 1%) with both carriers. Cost efficiencies would seem to dominate if the number of competitors is not affected by the merger in the vast majority of routes.

Another noteworthy result of this paper is that LCC competitors had a non-negligible effect in lowering post-merger prices, especially those of Delta and Northwest. Route-level prices drop by a larger amount when the competitors are LCCs rather than legacies. Using estimated coefficients from the first specification that pools hub and non-hub routes, calculations show that consumers saved an average of $6 on Delta and Northwest's tickets and $2 on tickets from other carriers. The findings that LCCs help maintain market competition and low prices throughout a merger corroborates previous literature about the pro-competitive effects of when LCCs entered many routes in the 1990's, such as ValuJet (Dresner 1999) and Southwest (Morrison 2001).

These conclusions can have policy implications to the DoJ and other institutions that study merger cases. In addition to cost efficiencies, sources of competition that may restrict the abuse of market power after a merger are an important factor in considering the approval. When looking at existing competitors in the market, the types of incumbent competitors in addition to the total number of incumbent competitors are important to assessing their pro-competitive effects during a merger. The findings of this paper highlight that feature by distinguishing the effects of LCC and legacy competitors in airline mergers. Since price decreases following the Delta-Northwest merger are larger in routes with LCC competitors, the type of incumbent competitor on each route does matter when analyzing airline mergers. In future merger approval cases, the degree of overlap between routes served by LCC competitors and those of merging airlines should also be considered.

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