

**INVESTIGATING THE PRICING IMPACT OF THE
AMERICAN AIRLINES AND US AIRWAYS MERGER**

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Master of Science

by

Yunzhou Zhang

August , 2017

© 2017, Yunzhou Zhang

ABSTRACT

In 2013, American Airlines merged with US Airways creating the largest airline in the world. This thesis analyzes this merger's effect on domestic airline ticket pricing using the Department of Transportation's 10% ticket sample. This analysis focuses on the role of competition, and shows that the merged airline was able raise their fares. In addition, legacy carrier were able to rose the price when merged companies did not play a role (as either an incumbent or a potential entrant). In markets where the merged companies did play a role, fares for these legacy carriers still rose but by less than when these carriers were present. For low cost carriers in the equivalent situations, prices declined. In markets where the merged companies did play a role, for low cost carriers, prices declined and those declines were larger when merged companies were as incumbents than as potential competitor.

BIOGRAPHICAL SKETCH

Yunzhou Zhang was born and raised in Beijing, China. He is a M.S. candidate at Cornell University in Transportation System Engineering, with a minor in System Engineering. Before entering graduate school, he earned his Bachelor of Science Degree with cum laude in Civil Engineering at Technion – Israel Institute of Technology receiving University’s Scholarship. Yunzhou Zhang has a passion in design and actualizing, in Engineering, with a specific interest in mathematical modeling. During his stay at Cornell, he has focused on mathematical modeling in analyzing real-world’s questions. He had two internships during his study in Cornell, in modeling department of Beijing Transportation Research Center and in modeling department of Delaware Valley Regional Planning Commission. He is looking forward to become a research-oriented engineer in the field of Transportation Engineering.

Acknowledgements

I would like to express my deepest thankfulness to Professor Linda Nozick, who has guided me in research with her extraordinary expertise in the field and warm-heartedness. She provided useful help far more than I expected, and I could not finish this thesis without her help.

I would also like to thank Professor Ricardo Daziano, who provided assistance when I needed the most. I have gained a lot knowledge from Professor Daziano.

TABLE OF CONTENTS

Title Page	
Copyright Page	
Abstract	
Biographical Sketch	1
Acknowledgements	2
Table of Contents	3
List of Figures and Tables	4
Chapter 1 Introduction and Literatur Review	5
Chapter 2 Data, Variables Considered and Models	7
Chapter 3 Results.....	10
Chapter 4 Conclusions.....	14
Chapter 5 References.....	15

LIST OF TABLES

Table 1: Estimated Coefficients

Table 2: Change in Fares Relative to 2011

CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

The Airline Deregulation Act of 1978 largely removed US governmental controls over the Airline industry for fares and market entry. Since then, more than 50 mergers have taken place in the United States including several mega-mergers, like the merger between Delta with Northwest or United with Continental. These mergers have dramatically reshaped the airline industry. Out of 12 major airlines operating at the beginning of last decades, only 4 of them are still in operation. These 4 airlines surprisingly control about 70% of the domestic passenger commercial flight market share [1]. To preserve competition in the passenger airline market so as to protect consumers, the Department of Justice has the power to block mergers under antitrust regulation. A signal that these laws have been implemented effectively is that, on average, fares have declined by about half since the airline industry was deregulated [2].

The recent mega-merger between American Airlines and US Airways in 2013, created the largest airline company in the world, measured by revenue, fleet size, and passenger-kilometer-flown; therefore, understanding what changes in fares occurred post-merger and the factors that are particularly correlated with those changes is particularly important. This thesis gives an analysis of fare impacts using the 10% ticket survey on legacy and low-cost carriers stemming from the merger as well as investigates how those changes were influenced when the market is subject to slot constraints. We adopt the idea of potential competition as described in [3] and test whether the fare impacts they identified in the 1987 merger between US Airways and Piedmont are also evident in this recent merger.

There have been a number of studies that have investigated airfare impacts from a variety of causes. [4] uses data from 1983 and empirically investigates contestability in the airline industry and concludes that they are imperfectly contestable. They also show that both actual and potential competitors reduce fares. [5]-[8] all showed using different data over different time frames that when low cost carriers enter a route, prices fall. [9] showed that when a low cost carrier exited a market, prices rose. [10],[11] and [12] again showed that when a low cost carrier provides service on a route, prices fall on that route. They also showed

that prices decline on routes that have a low cost carrier providing service at either the origin or the destination of the route. [13] showed that prices fall when a new carrier is anticipated on a route and fall again if that entry materializes using fare prices over the evolution of Southwest Airlines. [14] examines the impact of low cost carriers on price and how those impacts are influenced by the magnitude of service they provide.

Our focus is an empirical analysis of the pricing impacts of the US Airways and American Airlines merger. Hence analyses in the literature that focus on quantifying the impact of mergers on fare price are particularly relevant. For example, [3] examine the impacts of the U.S. Airways and Piedmont merger in 1987. They find that the magnitude of fare increases was impacted by whether either or both carriers provided service on the route prior to the merger, and secondarily, if either or both provided service to either the origin or destination airports on the route. [4] focused on understanding the impact on fares of the Northwest and Delta Airlines merger. They concluded that if both carriers provided service on a route prior to the merger, the fare impacts were smaller.

The next section describes the data, variables and models used for this analysis. The third section describes the empirical results found. The final section gives conclusions and opportunities for future research.

CHAPTER 2:DATA, VARIABLES CONSIDERED AND MODELS

We make use of the Department of Transportation's Airline Origin and Destination Survey [1]. This survey is a 10% sample done on a quarterly basis of passenger tickets. We focus on tickets that meet the following four criteria. First, we only use tickets that were non-stop. There are important differences in service when

comparing non-stop to single and multi-stop routes which would have been important to address, had they been included. Second, we focus on tickets that cost more than \$10 and less than \$2000. These bounds are the same as used in [3]. Other authors have suggested other airfare bounds. For example, [4] used a lower bound of \$25 and no upper bound. Third, we only include fare records from four legacy carriers and seven low cost airlines. The four legacy carriers are US Airways, American Airlines, Delta and United. The seven low cost carriers considered are Jet Blue, Frontier, Southwest, Spirit, Allegiant, Sun Country and Virgin Atlantic Airlines. Finally, we only consider tickets for which the ticketing carrier and the operating carrier are the same.

We make use of ten fields in the DB1B database: market, year, quarter, ticketing carrier, origin airport, destination airport, passengers, market fare and market distance. With the date and the market information, we identify whether the origin or destination airports are slot constrained. We also compute the Herfindahl–Hirschman Index (HHI) for each market in the appropriate quarter. HHI is a widely accepted measurement of market concentration.

We also make use of six dummy variables to describe whether US Airways and/or American Airlines was providing service on that particular route at that time as well as whether one, the other or both were potential competitors. This yields the following six variables: two-zero, one-one, zero-two, one-zero, zero-one and zero-zero. For example, two-zero indicates that both American Airlines and US Airways were providing service on the route; hence neither was a potential competitor on that route (because they were both incumbents). In contrast zero-two indicates that neither were providing service on the route however, both were providing service on other routes that used either the origin and/or destination airports for the route. This is the same as described in [3].

The model, ignoring the concepts of incumbent and potential competition pre and post-merger, is given in Equation (1) below.

$$\ln(fare_{ijt}) = \beta_0 + \beta_1 \ln(Dist_{ij}) + \beta_2 \ln(HHI_{ijt}) + \beta_3 Slots_{ij} + \beta_4 Post + \beta_5 OLeg + \beta_6 LCC + \beta_7 Q_2 + \beta_8 Q_3 + \beta_9 Q_4 + \beta_{10} OLeg * Post + \beta_{11} LCC * Post \quad (1)$$

where $fare_{ijt}$ is the one-way fare from origin airport i to destination airport j in time period t , $Dist_{ij}$ is the distance between origin airport i and destination airport j , HHI_{ijt} is the Herfindahl–Hirschman Index in time period t on the direct route from airport i to airport j , $Slots_{ij}$ is a dummy variable that equals one if airport i or airport j or both are slot constrained (where JFK, Newark, LaGuardia and Reagan National are defined as slot constrained), $Post$ is a dummy variable that equals one if time period t is after the merger and is zero otherwise, and $OLEg$ is a dummy variable that equals one if the carrier is either United Airlines or Delta Airlines and is zero otherwise. LCC is a dummy variable that equals one if the carrier is one of the five low cost carriers and is zero otherwise. Q_2 , Q_3 , and Q_4 are dummy variables that indicate if the record is for quarters 2, 3 or 4, respectively.

The baseline model given in Equation (1) is extended to include the concept of potential competition as given in Equation (2) below.

$$\begin{aligned} \ln(fare_{ijt}) = & \beta_0 + \beta_1 \ln(Dist_{ij}) + \beta_2 \ln(HHI_{ijt}) + \beta_3 Slots_{ij} + \beta_4 Post + \beta_5 OLeg + \beta_6 LCC + \beta_7 Q_2 + \\ & \beta_8 Q_3 + \beta_9 Q_4 + \beta_{10} OLeg * Post + \beta_{11} LCC * Post + \beta_{12} Pot_{ijt} + \beta_{13} INC2POT0_{ijt} + \\ & \beta_{14} INC1POT1_{ijt} + \beta_{15} INC0POT2_{ijt} + \beta_{16} INC2POT0_{ijt} * POST * OLeg + \beta_{17} INC1POT1_{ijt} * \\ & POST * OLeg + \beta_{18} INC0POT2_{ijt} * POST * OLeg + \beta_{19} INC2POT0_{ijt} * POST * LCC + \\ & \beta_{20} INC1POT1_{ijt} * POST * LCC + \beta_{21} INC0POT2_{ijt} * POST * LCC \end{aligned} \quad (2)$$

where Pot_{ijt} is the number of carriers that provide service to airport i and or airport j in time period t but do not provide service from airport i to airport j and $INCmPOTn_{ijt}$ is a dummy variable that takes on a value of one if there are m incumbents and n potential entrants in the market from origin airport i to destination airport j in time period t and is zero otherwise. The full set of $INCmPOTn_{ijt}$ variables has six different categories [3], but we only use four of them in these models. There are effectively no markets that fit the description of $INC1POT0_{ijt}$ and $INC0POT1_{ijt}$, hence they are discarded.

Notice that in the extended model, we attempt to understand how the presence of US Airways and/or American affected prices post-merger when they were either an actual or a potential competitor prior to the merger; and how these impacts might have varied if the competing carrier was either a legacy carrier (United or Delta) or a low cost carrier.

CHAPTER 3: RESULTS

Both models were fit using 2011 and 2015 or 2011 and 2016 data to assess whether impacts are more persistent or transitive in nature. The coefficients for all four models are given in Table 1. It is useful to notice that many of the coefficients are very similar across both sets of models implying that the general trends of the impacts of the merger generally persisted over the two-year period.

Table 1: Estimated Coefficients

Variable	AY 11-15 Base Model (AY11-16 Base Model)	AY 11-15 Extended Model (AY11-16 Extended Model)
Intercept	2.24*** (2.12***)	1.81*** (1.7***)
$\ln(Dist_{ij})$	0.446*** (0.468***)	0.472*** (0.488***)
$\ln(HHI_{ijt})$	0.436*** (0.537***)	0.39*** (0.505***)
$Slots_{ij}$	0.07*** (0.073**)	0.079*** (0.080***)
$Post$	0.096*** (0.02)	0.126*** (0.038**)
$OLeg$	-0.039** (-0.039 **)	-0.0444***(-0.042**)
LCC	-0.521*** (-0.533***)	-0.532*** (-0.542***)
$OLeg * Post$	-0.023 (0.050**)	0.662*** (0.669***)
$LCC * Post$	-0.289*** (-0.272***)	-0.5*** (-0.598***)
Q_2	-0.022**(-0.049***)	-0.020*(-0.046***)
Q_3	-0.072***(-0.063***)	-0.090***(-0.058***)
Q_4	-0.058***(-0.0263**)	-0.076***(-0.019*)
Pot_{ijt}		-0.0429***(-0.040***)
$INC2POT0_{ijt}$		0.565***(0.561***)
$INC1POT1_{ijt}$		0.596*** (0.595***)
$INC0POT2_{ijt}$		0.618*** (0.613***)
$INC2POT0_{ijt} * POST$		-0.694***(-0.649***)
$* OLeg$		
$INC1POT1_{ijt} * POST$		-0.668***(-0.649***)
$* OLeg$		
$INC0POT2_{ijt} * POST$		-0.652***(-0.635***)
$* OLeg$		
$INC2POT0_{ijt} * POST * LCC$		0.0339 (0.190***)
$INC1POT1_{ijt} * POST * LCC$		0.298***(0.422***)
$INC0POT2_{ijt} * POST * LCC$		0.321***(0.454***)
Adjusted R ²	0.279 (0.273)	0.31 (0.317)

(* ,** ,***significant at .01, .001 and .0001, respectively)

Consistent with other studies, we find that higher HHI, which implies higher industry concentration, is associated with higher fares. At a national scale and very approximately, the coefficient on HHI implies that there is approximately a 40-50% increase in fares when the number of carriers declines from five equal

size carriers to a single carrier. We also find, again similar to other studies that prices are generally about 7% higher at slot-constrained airports and that prices are generally higher for legacy carriers in contrast to low cost carriers.

It is useful to notice that the coefficient for the variable post is positive in all four models indicating that prices rose after the merger. In only one model the significance for that coefficient is 0.15. In contrast, in the other three models, the significance level is better than 0.001. In comparison with 2011, the merged carrier's fares were about 12% higher in 2015 but that difference was only about 4% in 2016 (in comparison to 2011). Not unexpectedly, based on the extended model, fares decrease with an increasing number of potential entrants (about 4% per additional potential entrant).

Table 2, using the extended model, gives the % change in fares (for 2015 and 2016 in comparison to 2011) for the merged carrier, the two legacy carriers and low cost carriers. For the other legacy carriers and the low cost carriers, the estimates are different based on the role American Airlines and US Airways played in the market prior to the merger.

Table 2: Change in Fares Relative to 2011

Carrier Group	2015	2016
Merged Carrier (AA)	13.43%	3.87%
United/Delta w/o AA/USAir in Mkt	119.90%	102.79%
United/Delta with (2,0)	9.86%	5.97%
United/Delta with (1,1)	12.75%	5.97%
United/Delta with (0,2)	14.57%	7.47%
LCC w/o AA/USAir	-31.20%	-42.88%
LCC with (2,0)	-28.83%	-30.93%
LCC with (1,1)	-7.32%	-12.89%
LCC with (0,2)	-5.16%	-10.06%

(incumbent, potential entrant)

On routes where US Airways and American Airlines were not an incumbent or a potential entrant Delta and United raised prices and low cost carriers reduced prices on average (about 120% and -30%, in 2015 in comparison to 2011, for example).

The increase in fares by United and Delta in these markets, on the surface, is quite interesting. About 1% of the markets fit into this category; that is where United and/or Delta operated but neither American or US Airways was an incumbent or potential entrant. In 2011, the average airline fares in these markets was about 65% higher in comparison to all markets. In 2015, it was about 125% higher and in 2016, they were 138% higher. Overwhelmingly these markets connect two small airports. Further, in more than 90% of these markets there is only one carrier.

In markets where American Airlines and/or US Airways were an incumbent or a potential entrant, low cost carriers reduced prices post-merger and those reductions were highest where both American Airlines and US Airways were incumbents and least when they were both potential entrants. More specifically, when both were incumbents, prices fell by about 29% in 2015 (in comparison to 2011) and the comparison between 2016 prices and 2011 was essentially the same. When both American and US Airways were potential entrants, the decline in 2015 (in comparison to 2011) was only about 5%. This decline did continue, however, into 2016 with a total average decline of about 10% from 2011 to 2016.

In contrast, for other legacy carriers (Delta and United), on routes where US and/or American played a role pre-merger, prices rose in 2015 but those increases did not fully persist into 2016, with the increases from 2011 to 2016 being about half of those estimated from 2011 to 2015. For example, when both US Airways and American were incumbents, fares of the other legacy carriers rose by about 10% in 2015 (in comparison to 2011). When both carriers were potential entrants, fares rose by about 15% (in comparison to 2011). These same increases were about 6% and 7.5% in 2016 in comparison to 2011. It is useful to notice that the

presence of US Airways and American as incumbents was more effective at suppressing price increases by these legacy carriers than when they were both potential entrants.

As an example of the dichotomy between legacy and low cost carriers price setting behavior, in 2011 the average (one-way) fares from Albuquerque, NM (ABQ) to San Francisco, CA (SFO) was \$159 on Southwest and it declined to \$154 in 2015. For that same market, the average fare rose on United from \$170 in 2011 to \$199 in 2015. As another example, in 2011 the fare from Nantucket, MA (ACK) to Washington, DC, (DCA) on US Airways was \$198 and it jumped to \$243 in 2015. In contrast, on Jet Blue, the fare declined from \$233 in 2011 to \$104 in 2015.

CHAPTER 4: CONCLUSIONS

This thesis describes an analysis that makes use of the 10% ticket sample to gain insight into the impact of the mega merger of US Airways and American Airlines on ticket prices. This analysis confirmed insights that have been gained in prior analysis including where there is heightened competition, prices are lower. It also demonstrates again that mergers can cause prices to rise. What is perhaps novel is that while legacy carriers generally increased prices post-merger, low cost carriers did not appear to have that same freedom. Rather, they lowered prices and those fare reductions were largest in markets for which American Airlines and US Airways played a larger role pre-merger.

It is useful to extend this research in several different directions. First, these models ignored the role that hubs and focus cities play in airline networks. There is extensive empirical evidence to suggest that hubs do affect fare prices hence integrating this into the statistical models is very useful. Second, these models focused on direct service only. Extending the models to include one-hop and multi-hop tickets is very important. Third, there is some evidence that when competing carriers provide service at nearby airports that also suppresses prices [15]. Our focus for potential competition is on carriers that service one or both airports in a market but that do not serve the market itself. Extending that definition to include nearby airports is likely to be valuable.

CHAPTER 5: REFERENCES

1. U.S. Department of Transportation, BTS accessed electronically on June 28, 2017 at <https://www.transtats.bts.gov/>
2. D. Thompson, How Airline Ticket Prices Fell by 50% in 30 years (and Why Nobody Noticed), *The Atlantic*, Feb. 28, 2013.
3. Kwoka, J., and Shumilkina, E. (2010). The price effect of eliminating potential competition: evidence from an airline merger, *The Journal of Industrial Economics*, 58(4), 767-792.
4. D. Luo, (2014). The price effects of the Delta/Northwest Airline merger, *Review of Industrial Organization*, 44(1), 27-48.
5. Strassmann, D.L., (1990). Potential competition in the deregulated airlines. *The Review of Economics and Statistics* 72, 696-702.
6. Whinston, M.D., and Collins, S.C., (1992). Entry and competitive structure in deregulated airline markets: an event study analysis of People Express. *RAND Journal of Economics* 23(4), 445±462.
7. Bennett, R.D., and Craun, J.M., (1993). *The airline deregulation evolution continues: the southwest effect*. US Department of Transportation, Washington, DC.
8. Windle, R.J., and Dresner, M.E., (1995). The short and long run effects of entry on US domestic air routes. *Transportation Journal* 35(2), 14-25.
9. Morrison, and S., Winston, C., (1995). *The Evolution of the Airline Industry*, The Brookings Institution, Washington, DC.
10. Dresner, M., Lin, J.-S.C., and Windle, R., (1996). The impact of low-cost carriers on airport and route competition. *Journal of Transport Economics and Policy* 30(3), 309-328.
11. K. Richards, (1996). The effect of Southwest Airlines on U.S. airline markets. *Research in Transportation Economics* 4, 33-47.
12. S.A. Morrison, (2001). Actual and adjacent and potential competition: estimating the full effect of Southwest Airlines, *Journal of Transport Economics and Policy*, 35, 240-255.
13. Goolsbee, A., and Syverson, C., (2008). How do incumbents respond to the threat of entry? Evidence from the major airlines, *The Quarterly Journal of Economics*, 123 (4), 1611-1633.
14. Kwoka, J, Hearle, K., and Alepin, P., (2016). From the fringe to the forefront: Low cost carriers and airline price determination, *Review of Industrial Organization*, 48, 247-268.
15. I Daraban (2007), *Low Cost Carrier Entry, Incumbent Responses and Spatial Competition in the U.S. Airline Industry*, PhD dissertation, Florida State University.