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What are the Effects of Mergers in the U.S. Airline Industry? An Econometric Analysis on Delta-Northwest Merger

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Abstract: *The Delta-Northwest Merger in 2008 has significantly reshaped the airline market structure and raised public concerns regarding market dominance. In this study, I will employ OLS techniques to examine the effects of merger on airfares, using more than 1,000 observations from 2008 and 2009 airline markets. Results show the belief that unbalanced market share will lead to heightened airfares misleading and unreliable. There is no significant evidence suggesting positive or negative correlations between airport dominance and airfares.*

I.   Introduction

The U.S. airline industry has undergone radical changes in the last decade: all five legacy carriers in U.S. have declared bankruptcy since 2000.[1] After exiting bankruptcy, each of these airlines successfully merged with another airline, with exception of American Airlines, which just declared bankruptcy recently.[2] As a result, the three largest legacy airlines make up 47.3% of the U.S. domestic airline market.[3] Perhaps more importantly, these three airlines are affiliated to global airline alliances that together make up 77.1% of the global market.[4]. This wave of mergers has drawn sharp criticisms from the public and leads to fierce debate among economists, because people worry that mergers among major airlines will reduce the intensity of competition and drive up airfares.[5] Offsetting these effects may include improvements in efficiency that might benefit consumers by lowering unit costs at the same time. Despite the fact that domestic competition has been sharply reduced by the mergers among legacy carriers, one may contend that the rapid expansion of low-cost carriers (LCC) has compensated, at least in part, for the reductions in competition. Southwest Airlines, for example, has 14.7% of the domestic market share and takes the second spot among all carriers that operate in the United States.

This paper examines the effects of mergers in the U.S. airline industry focusing on the effects of Delta-Northwest Merger that took place in 2008[6]. In general, the most recent merger wave is very different from the first wave following deregulation in the early 1980s[7] in that the early wave was not related to financial distress.[8] Conversely, all of the mergers among the legacy carriers after 2005 were subsequent to the filings of bankruptcies.

In this paper, I found mergers are possibly associated with higher airfares, and airlines involved in mergers tend to charge even more on long trips (over 500 miles) than those who are not involved. However, these findings are not statistically convincing. They are also subject to biases due to the dataset I used.

This paper is divided into six sections. The next section provides a synopsis of the economic theory and empirical research in the field of airline mergers. Section 3 develops the conceptual model and discusses the ideal measurement of concepts. Section 4 describes the actual data sources and their limitations. Section 5 shows the empirical results along with interpretations. The last section concludes the paper with summary of the findings and ideas for future research.

II.   Literature Review

i.   Theoretical Background

The idea of merger in the airline industry is not new. According to Scherer and Ross (1990), there are three motives for merger: the monopoly motive, speculative motive, and normal business motive. In my view, most mergers between major airlines involve all the three motives. Despite all the good intentions of mergers, the authors found that "the picture that emerges is a pessimistic one: widespread failure, considerable mediocrity, and occasional successes"[9] by examining nearly 6000 mergers made between 1960 and 1976 that linked to 4409 reporting lines of businesses. Therefore, they conclude from their analysis that the hypothesis that profitability and efficiency increase due to mergers is at best weak.

However, their general findings might not apply to the airline industry, especially to the mergers between major airlines after deregulation. If we look at the history of airline mergers, we can see that post-deregulation mergers differ significantly from pre-deregulation mergers in the way they are assessed by authorities.

Before 1978 when the Airline Deregulation Act was officially signed into law, Civil Aeronautics Board (CAB) approved airline mergers primarily to rescue airlines that were facing severe financial distress or were in danger of bankruptcy. Consequently, CAB disapproved many mergers that could have achieved potential efficiency gains

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in order to prevent airlines from creating monopolies that would reduce competition in a market and harm other airlines. Under deregulation, however, authorities[10] no longer consider the profitability of other airlines and make their decisions by assessing the potential competition, instead of the actual competition, in the markets involved. In other words, the authorities will not disapprove a merger even if it reduces the number of competitors in a market, as long as the merger does not create barriers to entry and new competitors are free to enter this market (Morrison and Winston, 1989).

However, the discretions based on contestability theory are far from perfect, according to some previous research. For example, by using 363 markets of various sizes in 1984, Baker and Pratt (1989) found that airline markets exhibit imperfect contestability, which Morrison and Winston (1986) used to describe markets with some entry barriers where fares are viewed as cost plus a markup. Furthermore, Borenstein (1992) contended that potential competition does not equal to actual competition in the airline industry. According to the contestability theory, prices should not be affected by the number of actual competitors in the market. Unfortunately, much literature (Morrison and Winston, 1987; Borenstein, 1989) found evidence that the price level on a route is significantly influenced by the number of actual competitors in that market. Yet, as Butler and Huston (1989) had argued, "the concept of a perfectly contestable market is a theoretical one"[11], I decide not to worry about contestability issues in this paper by adopting a more conventional way of studying the economic effects of mergers.

Almost all economists agree that mergers in airline industry have twofold effects that will influence airfares in opposite directions. As a result, the joint effect of a merger cannot be determined without ambiguity *a priori* (Lichtenberg and Kim, 1989, Kim and Singal, 1993). Therefore, in order to understand what the potential effects of a merger are, one has to decompose the two opposing effects. On the one hand, mergers drive up airfares because reduced competition, especially at hub airports where concentration is high and barriers of entry are possible to exist, will increase the market power of the dominant airline and thus raise the price-cost margin. On the other hand, mergers might reduce the airfares by attaining efficiency gains and lowering unit costs due to economies of scale and improved productivity. On an overall level, however, there is no agreement among economists what the joint effect of mergers on airfares is. Morrison and Winston (1989), and Kim and Signal

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(1993) found that mergers were associated with higher airfares. On the other hand, Lichtenberg and Kim (1989), Brueckner *et al* (1992), contended that airfares were lowered (or at least, not increasing as fast as the market average) because of mergers. Some other studies could not reach a compelling conclusion with certainty. For example, Borenstein (1990) found a significant increase in airfares associated with Northwest-Republic merger in 1986, but no evident proof that airfares had changed significantly on routes affected by TWA-Ozark merger that happened in the same year. Butler and Huston (1989) showed that the effects of mergers were smaller and more subtle than one might imagine from public debates by analyzing 363 city-pairs in 1984.

Some literature also endeavors to discuss the effects of airline mergers on consumer welfare, despite the fact that consumer welfare is a qualitative concept and thus more difficult to measure than airfares. Morrison and Winston (1989), for instance, used frequent flyer mileage as their proxy for non-price traveler's welfare. Using a random sample of 115 routes, they showed that if frequent flyer mileage was taken into consideration, the aggregate effect of the six mergers that took place between 1986 and 1987[12] was a $79 million (1988 dollars) increase in traveler's welfare. However, if the benefits from frequent flyer programs were eliminated from the analysis, the welfare would be lowered by approximately $395 million per annum. Borenstein (1992) disagreed with these findings by contending that Morrison and Winston (1989) over-estimated the value of frequent flyer mileage. Based on the same data set, he argued that if frequent flyer miles were valued at 0.8 cents (in 1988 dollars) per mile, instead of 2.7 cents per mile as suggested by Morrison and Winston, then the consumer welfare would be lowered by over $200 million. Today, frequent flyer miles are valued at less than 1 cent (2008 dollars) per mile in many airlines' financial statements. It should be noted that even if the estimate of the value of frequent flyer program by Morrison and Winston were accurate, it would be imprudent, even invalid to apply this estimate to measure consumer welfare today for at least two reasons. Firstly, frequent flyer mileage was first introduced in early 1980s and was far from being as extensively used as today. Secondly, whether or not it is appropriate to use frequent flyer miles as the only proxy for traveler's welfare can be called into question. Therefore, for the reasons listed above, I opt not to analyze the welfare improvements based on frequent flyer program in my own research.

  ii.   **Previous Empirical Research**

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As there were almost no mergers in the airline industry before mid 1980s, the literature on the effects of airline mergers dates from the late 1980s. Following unprecedented wave of mergers that took place between 1985 and 1988, considerable attention was drawn to the subject of airline mergers. Using data on Ozark-TWA merger, Butler and Huston (1989) found that mergers that result in major carrier hub airports are likely to benefit time-sensitive but price-insensitive business travelers because more flights will be offered, but harm price-sensitive but time-insensitive tourists at the same time because higher concentration is usually associated with higher airfares. Morrison and Winston (1989) also recognized the non-price benefits of mergers using data on 115 routes that were affected by six mergers during 1986 and 1987. In other words, travelers will benefit from a larger network such as more cities, fewer connections and easier transfers. Although some of the benefits were offset by higher airfares due to reduced competition, on an overall level, consumer welfare was improved by mergers. Lichtenberg and Kim (1989) also found that in aggregate, airlines involved in mergers did not increase prices as much as airlines that were not involved by OLS regression using data on five mergers that took place between 1972 and 1981[13]. They found that the joint effect was a small increase in price-cost margin and a substantial decrease in unit costs that could be attributed to declines in input prices and improvements in productivity.

Unfortunately, later studies were not as positive concerning the effects of airline mergers. Brueckner, Dyer and Spiller (1992) analyzed 6054 observations on Ozark-TWA and Northwest-Republic mergers and found the joint outcome of reduced competition and improved efficiency to be dependent on the number of actual competitors on the routes where the merging companies operated. Had there been no other post-merger competitors on a route affected by the merger, the price would increase significantly. If there were still one or two competitors after the merger, the network and competition effects were likely to cancel out and left the joint effect ambiguous. If there were even more than two post-merger competitors on that route, the effects of expansion in network size would tend to outweigh those of reduction in competition and thus lower the airfares. Borenstein

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(1992) had a similar opinion. Although he acknowledged that passengers benefited from a larger number of cities served and more connections possible without changing airlines, he argued that mergers would cause prices to rise much faster than nationwide average at hubs where the merging airlines share. Kim and Singal (1993) also found that during the 1985-1988 sample periods, mergers[14] were associated with higher fares and lower consumer welfare. They also argued that the mergers of financially troubled airlines were different in nature from mergers of normal airlines. More specifically, airlines that face financial distress cut prices during the announcement period and will dramatically increase fares to about industry level as soon as the merging process is completed. In contrast, normal airlines will substantially raise airfares during the announcement period until they attain efficiency gains when the merger is completed. However, the decrease in airfares due to efficiency gains will not fully offset the increase during the announcement period, thus making consumers worse off in this case.

More recent studies suggest the necessity of considering more implicit factors in order to fully understand the effects of mergers among airlines. Kim and Singal (1993) and Singal (1996) argued that most of previous studies overlooked the potential effect of multimarket contacts and might be inappropriate and misleading. Kim and Singal (1993) also contended that although the increase in market power due to higher concentration can be offset by efficiency gains, market power derived from multimarket contacts could not be moderated. Singal (1996) further showed that multimarket contacts influence airfares even more than market concentration on long-distance routes using data on the same 14 mergers. However, he could not find any evidence suggesting correlation between multimarket contacts and airfares on short-distance routes, possibly because other means of transport provide adequate competitions that compensate the reduction in competition from other airlines.

Later literature examined the airline industry in more detail by differentiating air services between full service airlines (FSA) and low cost carriers (LCC) that was typically viewed as homogenous by earlier studies. For example, Morrison (2000) analyzed the effects of southwest airlines on market fares using quarterly data from 1000 most heavily travelled routes in 1998. He concluded that the total savings due to competition from Southwest Airlines was approximately $12.9 billion. Moreover, Morrison and Winston (2004) used a simultaneous equations model (3SLS model) to analyze airline demand, supply, and frequency on the 1000 most

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heavily travelled non-directional domestic routes as of 2000. They also concluded that Southwest benefits the travelers most, valued at about $20 billion by 2000, and that low-cost carriers has become the "primary source of reduced fares for domestic travelers"[15]. In my own analysis, however, I do not differentiate between FSA and LCC since Southwest is the only LCC included in my dataset.

III.   Conceptual Model and Ideal Measurement

i.   The Dependent Variable

In my hypothetical model, the dependent variable is the average market fare for each airline that serves in this market. Here, markets are defined quite narrowly compared to some of the literature I discussed above. The restrictions I imposed on the markets will be discussed in more details in Section 5. Following the conventional practice (Lichtenberg and Kim, 1989; Kim and Singal, 1993; Singal 1996; Morrison, 2000), I used natural logarithm of airfares in my model.

ii.   The Merger Variable

I used a dummy variable to capture the merger effect in my model. Ideally, the dummy is set to 1 if the route is affected by Delta-Northwest Merger, and 0 otherwise. However, there is no commonly accepted norm in determining whether a route is affected by merger or not. Some papers (Butler and Huston, 1989; Kim and Singal, 1993; Singal, 1996) view any routes on which either of the merging airlines operated as affected by the merger. Nevertheless, a market should not be affected by the merger unless either of the merging carriers has a considerable market share on the route. Therefore, in addition to the conventional way of characterizing a market, I included one additional method of deciding whether it is affected by the merger or not. Under this method, the dummy is set to 1 only when either of the merging airline owns more than 30% of the market share in either the origin airport or destination airport. I will refer to these two methods as method 1 and method 2 in the rest of this paper.

iii.   The Control Variables

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Although I am primarily interested in studying the effects of fare changes due to Delta-Northwest Merger, it is important to include other variables that might potentially influence airfares.

Distance:

Fares are expected to be higher for longer trips for cost reasons. I used the natural logarithm of market distance (including ground transport) for distance variable.

Frequency:

Frequency of traffic on the supply side implies economies of scale. Thus, more supply of air services tends to reduce airfares. The frequency of traffic is conventionally measured by the number of flights on a route. Morrison, Winston and Maheshri (2004), however, argued that frequent flights of small aircrafts do not necessarily suggest dense traffic. To account for differences in aircraft types, they used the number of available seats instead. I tried to use both variables (natural logarithm) in my analysis to measure frequency, but since the number of available seats is highly correlated with the number of flights and number of passengers, I encountered severe multicollinearity problem. Thus, I decide to adopt the conventional way of measuring frequency by only using the number of flights.

Passengers:

On the one hand, more passengers tend to drive up airfares because the demand is larger. On the other hand, however, more passengers make economies of scales possible (Winston 1998), which tend to lower the fares. Therefore, the effect of more passengers cannot be determined with certainty. In my model, I simply used the aggregate number of passengers (natural logarithm) on a particular route. However, according to many previous studies (Butler and Huston , 1989; Brueckner, Dyer, and Spiller, 1992; Morrison, 2000; Meyer and Menzies, 2000), airlines use various ways to differentiate business travelers from pleasure travelers in order to charge business travelers higher fares. Trip purpose is usually captured by using the temperature differences in January between the origin city and the destination city.

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Efficiency:

I used load factor as the proxy for efficiency in my analysis. Load factor equals the ratio of passenger miles to available seat miles. Since in most cases, passenger miles is the product of the number of passengers and market distance (in miles) while available seat miles is the product of the number of available seats and market distance (in miles), load factor is equal to the enplanement rate and measures the efficiency of the airline. According to the findings by Lichtenberg and Kim (1989) and Baker and Pratt (1989), load factor should have a negative sign, suggesting more efficient operation reduces airfares.

Airport Concentration:

Airport concentration is a measure of airport dominance. Numerous previous research (for example, Kim and Singal, 1993; Singal, 1996; Morrison, 2000) have shown a positive correlation between airport concentration and airfares. Brueckner, Dyer, and Spiller (1992) suggested, however, that high airport concentration has two opposite effects on the overall market airfares. On the one hand, the high fares charged by dominant airline would allow its competitors to charge almost as high fares. On the other hand, competitors tend to charge lower fares to attract more passengers. Thus, although dominant airlines almost always charge high fares, the overall market fare might be lowered if other competitors reduce their fares enough to compensate the high fares charged by the dominant airlines.

Year:

My dataset consists of 10% of tickets in the second quarter (Q2) of year 2008 and 2009. Therefore, this dummy variable is set to 1 if the observation is in year 2009 and 0 otherwise. It captures the market wide changes from 2008 to 2009.

Long:

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According to *Singal*, fares on long-distance routes are qualitatively different from those on short-distance routes. I used a dummy variable *long* to accommodate this unobservable difference. *Long* is equal to 1 if the distance is greater than 500 miles.

Therefore, my conceptual model can be written as:

$$ln(Airfare) = f\{Dummy(Merger), ln(Distance), ln(Departures), \ln(Passengers), Efficieycy,$$

$$Origin\ Airport\ Concentration, Destination\ AIrport\ Concentration, Dummy(Year), Dummy(Long)\}$$

Ideal Data

My ideal data would look quite similar to the actual data with only a few exceptions. Firstly, as said earlier, there is no easy way of measuring to what extent a market is affected by the merger. Secondly, the variables *frequency* and *passengers* would ideally capture the supply and demand in a certain market. However, estimating supply and demand is much more complicated and requires higher level techniques (see Morrison, Winston and Maheshri, 2004, or Peters, 2006). To simplify my model, I used number of flights (or number of available seats) as the proxy of supply and number of passengers as the proxy of demand. Thirdly, *efficiency* should ideally be a true measure of the efficiency or productivity in a market. Some papers used other measures of efficiency (for example, average stage length in Lichtenberg and Kim, 1989, or capacity in Borenstein, 1990) in addition to load factor, but none of them could fully capture the efficiency in the airline market. Since load factor is the most widely-accepted and widely-used measure of efficiency, I adopt load factor as the proxy for efficiency. Lastly, most literature measured market concentration by Herfindahl–Hirschman Index (HHI, $\sum_{i=1}^{N} s_i^2$), but I used the four firm concentration ration(CR4, the total market share of the four largest airlines on a route), mainly because of data availability.

IV. Actual Data

I was able to get almost all my data from Research and Innovative Technology Administration, Bureau of Transportation Statistics (RITA BTS) website, which is affiliated to Department of Transportation (DOT).

Unfortunately, previous papers used quite different types of datasets. Research focusing on single mergers is divided into two groups in terms of time window. Some (Butler and Huston, 1989; Kim and Singal, 1993; Singal, 1993) used consecutive quarterly data from one quarter before the merger to one quarter after the merger. Others used the same quarter of consecutive years (Borenstein (1990) used the third quarter while Meyer and Menzies (2000) used the second quarter). I adopted the second method, using the second quarter of 2008 and 2009 to "avoid summer peaks and winter troughs, as well as major holiday travel periods"[16] as Meyer and Menzies (2000) did.

The data for origin and destination airports, market ID, operating carrier, and market distance are downloadable from Origin and Destination Survey, DB1B Market. The data for airfares, number of flights, available seats, and passengers are downloaded from T-100 Domestic Segment (U.S. Carriers). As said earlier, I included only one-way nonstop domestic coach tickets (excluding Hawaii and Alaska, as well as all off-shore U.S. territories, such as Puerto Rico) that are operated by major airlines[17]. Any tickets whose price is less than $50 or greater than $1000 are excluded because they are likely to be recording error. Further, to be included in my dataset, the origin and destination airport has to be listed as middle or large hub airport according to Federal Aviation Administration (FAA). Then I calculated average fares by grouping tickets with the same market ID together. As for airport concentration CR4, it is also available on the same website, under airport section. [18] Then I chose a random sample of 550 markets for each year and dropped 36 observations because of missing data or directional redundancy (for example, if both JFK-LAX and LAX-JFK are drawn, one of them is dropped). The final dataset consists of 1064 observations in total. Although all the data in my dataset (average of airfares, total passengers, etc.) were based on an original dataset that consists of multimillion observations, my own dataset became biased after I imposed all the market restrictions stated above. Therefore, conclusions drawn from this analysis might not apply to the entire airline industry because I did not take connecting flights, first or business class, regional airlines, small or non-hub airports, and directional effects into consideration.

V.   Results

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I ran four regressions in total. The first two regressions analyze the markets that are affected by the Delta-Northwest merger using only observations after the merger. These two regressions are almost identical in nature, except that they use the two different methods mentioned in Section 3 to assess whether a certain market is affected by the merger or not. (Method 1 counts any routes on which either of the two involved airlines had operated both before and after the merger. Method 2 only counts routes on which the market share of either of the two airlines (or combined) is greater than 30% at either endpoint airport.) The last two regressions are the most encompassing and use all the observations in 2008 and 2009. They examine how airfares changed from the second quarter of 2008 (2 quarters before the merger[19]) to the second quarter of 2009 (2 quarters after the merger). Note that the dummy for merger is set to 0 for every observation in 2008, regardless of whether the route is operated by Delta/Northwest or other airlines, since the merger was yet to happen at that time. All the results are presented in the table below.

From the table, we can see that almost every regression gives the same signs for each variable, with the only exception of *Origin Concentration*. Furthermore, it should be noted that the coefficients in Regression 1 and 2; Regression 3 and 4 resemble each other, and the overall fit are quite similar as well. Now, I would like to discuss the coefficients of each variable in more details.

Departure has the expected negative sign, meaning airfares decrease as the number of flights increase on a particular route. Since I used double log for departure, the coefficient should be interpreted as elasticity (same for *Passengers*, and *Distance*). The coefficients range from -0.123 to -0.241 among the four regressions, meaning with 1% increase in the number of flights on a route, the airfares will drop by 0.123% to 0.241%. The results are insignificant using only 2009 data but significant at 5% level using aggregate dataset.

Passengers shows that the number of passengers on a route seems to be negatively correlated with airfares. On average, the elasticity for the number of passengers is -2.189. This elasticity implies that airfares go down by 2.189% on average with 1% increase in the number of passengers on a particular route. This result suggests the

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reduction of fares due to economies of scale tend to dominate over the increase in fares because of higher demand. However, none of the coefficients from the eight regressions is significant at 5% confidence level.

Load Factor is positive in all regressions estimated above, and two of them are significant at a 5% level. On average, the elasticity in load factor is 2.98. This result suggests that higher load factor, which can also be interpreted as the rate of enplanement in the case of passenger planes, is associated with higher fares. This result goes against the findings by Lichtenberg and Kim (1989) and Baker and Pratt (1989).

Distance has the expected positive sign and is significant at 1% confidence level in all four regressions. On average, the elasticity for distance is 0.298. This seems to be a sensible estimate of the effect of distance on airfares.

The regressions differ quite considerably in estimating the sign of *Origin Concentration*. Two regressions suggest a positive sign while the rest suggest a negative sign. However, none of the estimates is significant even at 10% level. Similarly, none of the regressions provides statistically reliable estimate on the sign of *Destination Concentration* although they all agree on a negative sign. As a result, the signs of airport concentration are ambiguous and I cannot conclude how airport concentration influences airfares with certainty.

All the regressions unanimously give a positive sign to the dummy variable *Long*, suggesting long trips (over 500 miles) qualitatively cost more than short trips. On average, the coefficient is 0.08. Since airfare is estimated under natural logarithm, the average coefficient suggests that airfares are $1.08 (exponential of 0.08 with base of *e*) higher for long trips. Again, the estimates on *Long* are not quite reliable.

The estimates of dummy *Year* are dropped in the first two regressions due to multicollinearity, because I separated data between 2008 and 2009 in some regressions. Looking at the coefficients that are not dropped, however, we can see the coefficients are negative but quite close to zero, suggesting airfares in 2009 are about $1 ($e^0$) higher than in 2008.

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Several regressions dropped dummy *Merger* because I studied markets affected by merger and those not affected separately. Also, only markets in 2009 that are affected by 2009 are set to 1. However, using the estimates that are not dropped, we can see the merger increased airfares by about $1.1 if we count all markets where either of the merging airlines had operated as "affected markets", and about $1.12 if we only count markets where either of the two airlines had at least 30% market share at either endpoint. Unfortunately, these findings are not statistically significant at 5% level.

None of the coefficients from the four regressions looks significantly different from the other ones. Thus, changing the way of defining how "a route is affected by the merger" does not change the results qualitatively.

It should also be noted that none of these regressions has a very good overall fit if we look at the Adjusted R^2 value, despite their high F-values. Serious multicollinearity problems might account for the poor fits. As we can see the average VIF values in the table, none of them is smaller than 5, which is the threshold for multicollinearity. Despite the existence of multicollinearity, I decide not to do anything to correct for it for two reasons. First, all the variables I used are in accordance with previous studies and are thus theoretically justifiable. Second, the variables are evaluated under log-log form, so I can do very little to improve them by transforming into other forms.

Lastly, I want to talk briefly about the residuals. All the residual plots are shown in the appendix. As can be seen from the residual plots, none of the residual plots seems to need any corrections. Since my regressions are evaluated using log-log functions, there is no heteroskedasticity in my residuals.

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The Dependent Variable is ln(Airfares) in all regressions				
	2009, Method 1	2009, Method 2	Aggregate, Method 1	Aggregate, Method 2
ln(Departure)	-0.123	-0.123	-0.241**	-0.241**
	(-0.84)	(-0.84)	(-2.35)	(-2.36)
ln(Passengers)	-1.816	-2.155	-2.343*	-2.443*
	(-0.79)	(-0.94)	(-1.77)	(-1.84)
Load Factor	2.190	2.613	3.489**	3.616**
	(0.73)	(0.88)	(1.97)	(2.04)
ln(Distance)	0.311***	0.319***	0.281***	0.284***
	(5.83)	(5.93)	(7.65)	(7.71)
Origin Concentration	0.130	0.023	-0.167	-0.215
	(0.46)	(0.08)	(-0.80)	(-1.05)
Destination Concentration	-0.344	-0.309	-0.025	-0.005
	(-1.09)	(-0.97)	(-0.11)	(-0.02)
dummy Long	0.063	0.051	0.107*	0.101
	(0.83)	(0.68)	(1.68)	(1.59)
dummy Year	(omitted)	(omitted)	-0.072	-0.025
			(-1.31)	(-0.64)
dummy Merger (all)	0.104*		0.094	
	(1.83)		(1.62)	
dummy Merger (30%)		0.118*		0.115
		(1.69)		(1.61)
constant	0.236	-0.151	-1.118	-1.253
	(0.08)	(-0.05)	(-0.64)	(-0.71)
Sum Square Residuals	173.500	173.500	409.622	409.622
F-Statistic	6.66	6.56	14.11	14.07
Adjusted R^2	0.0831	0.0823	0.1023	0.1022
Sample Size	497	497	1064	1064
Average VIF	5.94	5.93	5.76	5.50
t-value is in the parenthesis below each coefficient				
* Significant at 10% level				
** Significant at 5% level				
*** Significant at 1% level				

VI.   Conclusion

In this paper, I examined the economic effects of Delta-Northwest Merger that took place in 2008. Using 1064

observations from the second quarter of 2008 and 2009, I found that routes that are affected by this merger tend to

be more expensive than those not affected. Moreover, although long trips are qualitatively more expensive than

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short trips, long trips that are operated by merging airlines are even more expensive than those that not operated by merging airlines. However, these findings have some potential deficiencies for at least two reasons and thus should be used with caution when generalizing the effects of mergers on to the entire airline industry. The first deficiency is that the statistical results are weak, and that my regressions are not immune from multicollinearity problems. The second concern is that the dataset I used is a biased one due to the restrictions I imposed on the market and ticket data. In the future, techniques that are more sophisticated could be employed and more complete dataset could be used to improve this study.

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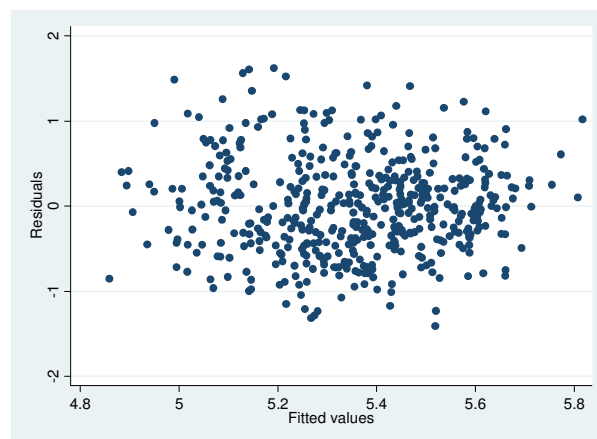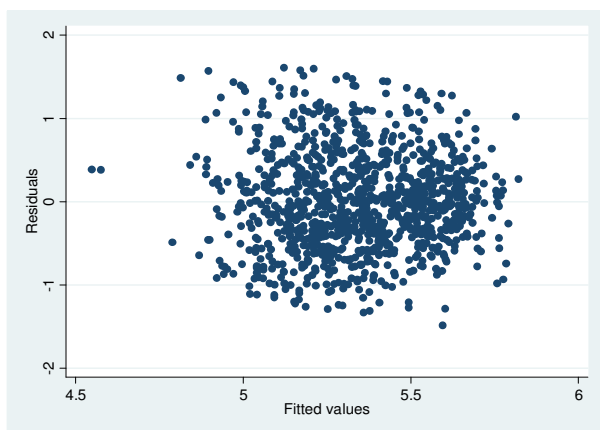
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Appendix

Residual Plots

Regression 1: 2009, all routes on which either of the merging airlines had operated (Method 1)
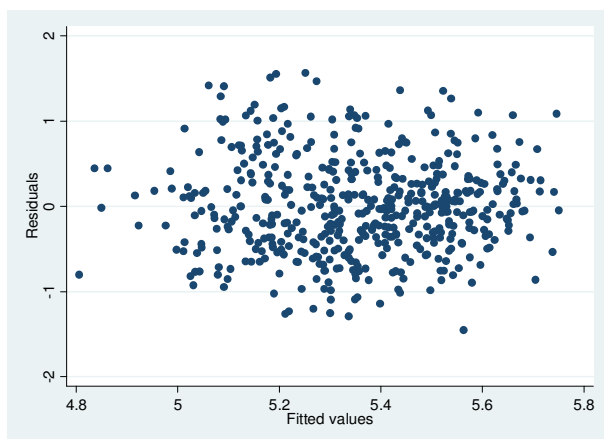
Regression 2: 2009, only routes on which either of the merging airlines had at least 30% market share at either endpoint airports (Method 2)

Regression 3: Aggregate data (2008+2009), all routes on which either of the merging airlines had operated (Method 1)

Regression 4: Aggregate data (2008+2009), only routes on which either of the merging airlines had at least 30% market share at either endpoint airports (Method 4)

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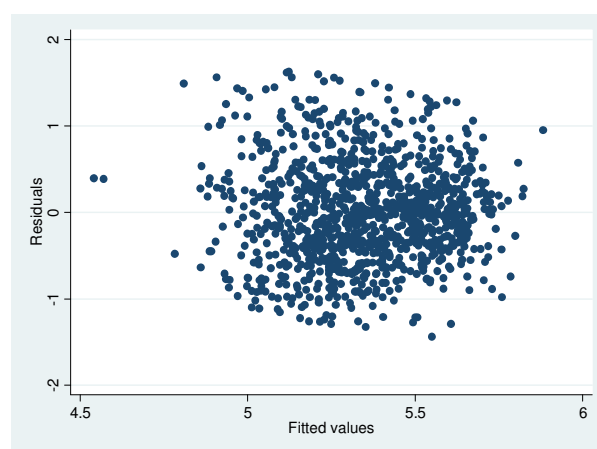
Endnotes

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[1] United Airlines filed bankruptcy in December 2002, US Airways in September 2004, Delta and Northwest in September 2005, and American Airlines in November 2011.

[2] US Airway was bought by America West in September 2005, keeping its US Airway brand. Delta and Northwest merged in October 2008 and became the world's largest airline until it was overtaken in October 2010 when United Airlines merged with Continental.

[3] Delta makes up16.4%, American 13.3%, United 9.7%, US Airways 7.9% based on Revenue Passenger Miles August 2010 - July 2011, according to Bureau of Transportation Statistics.

[4] Star Alliance, which includes Continental, United and US Airways, has 27 members in the world and makes up 29.3%. SkyTeam has Delta and 14 other members globally and owns 24.6% of the market. Oneworld has American and 11 other members and makes up 23.2%.

[5] The debates on the benefits and costs of mergers are recorded in more details in Section 2, Literature Review.

[6] On April 14, 2008, Delta and Northwest Airlines announced that they would merge to create the world's largest airline at that time under the Delta name. Later, on September 26, it was announced that both Delta and Northwest's shareholders had approved the merger. On October 29, 2008, the United States Department of Justice approved this merger plan. Northwest continued to operate as a wholly owned subsidiary of Delta until December 31, 2009.

[7] The first wave of mergers include: Muse Air-Southwest (April, 1984), Empire-Piedmont (March, 1985), Frontier-People (March, 1985), Republic-Northwest (April, 1985), Eastern-Texas Air (April, 1985), Ozark-TWA (April, 1985), People-Texas Air (February, 1986), Jet America-Alaska (February, 1986), Western-Delta (February, 1986), Air Cal-American (March, 1986), Horizon-Alaska Air (March, 1986), Pacific Southwest-US Air (March, 1986), Piedmont-US Air (April, 1986), Florida Exp-Braniff (March, 1987).

[8] In fact, there were no bankruptcies declared at all during the period 1982-1989.

[9] Scherer, Frederic M., and Ross, David, *Industrial Market Structure and Economic Performance*, Third Edition (1990), Houghton Mifflin Company, pp. 174

[10] The Department of Transportation (DOT) took over after the elimination of Civil Aeronautics Board (CAB) in 1984.

[11] Butler, Richard V., and Huston, John H., Merger Mania and Airline Fares, *Eastern Economic Journal*, Vol. 15, No. 1, January, 1989, pp. 8

[12] United-Pan American, Northwest-Republic, Trans World Airlines-Ozark, Texas Air-Eastern, Texas Air-People Express, Delta-Western.

[13] Northeast-Delta, North Central-Southern, National-Pan American, Air West-Republic, Texas International-Continental

[14] They analyzed 14 mergers, as listed here: Muse Air-Southwest, Empire-Piedmont, Frontier-People, Republic-Northwest, Eastern-Texas, Ozark-TWA, People-Texas, Jet America-Alaska, Western-Delta, Air Cal-American, Horizon-Alaska Air, Pacific SW-US Air, Piedmont-US Air, Florida Ex-Braniff.

[15]Morrison, Steven A., Winston, Clifford, and Maheshri, Vikram, Competition and Welfare in the U.S. Airline Industry, October, 2004, pp. 29

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[16] Meyer, John R., and Menzies, Thomas R., Maintaining Competition in Deregulated Airline Markets, *Journal of Trnsport Economics and Policy*, Vol. 34, No. 1, January, 2000, pp. 6

[17] AirTran Airways, American Airlines, Alaska Airlines, Continental Airlines, Delta Airlines, Frontier Airlines, JetBlue Airlines, Northwest Airlines, Southwest Airlines, United Airlines, US Airways.

[18] However, there is no nice downloadable table for CR4. I therefore went through all the airports that are included in my dataset one by one to get the concentration rate.

[19] The reference time is October 29, 2008, when the United States Department of Justice approved this merger plan.

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