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THE PRICING BEHAVIOR OF DOMESTIC AIRLINES IN THE GREAT RECESSION

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ABSTRACT

The goal of this paper is to analyze the relationship between an airlines market share on a route and its pricing decisions on that route under recessionary economic conditions. The airline industry has a unique structure. Each route an airline chooses to fly is itself a market in which it is competing against other airlines. In different markets, the same airline may be a different type of competitor. By looking at data from the Department of Transportation's Domestic Airline Consumer Airfare Report, I examine changes in airline pricing by type of airfare as well as by market share. I use a number of tools to examine the impact of market share on pricing during the recession as well as the impact on market share itself during the recession. Together, these allow me to form a more complete analysis of the behavior of airlines during recessionary periods. My results show that airlines aggressively cut fares during the recession, while market shares remained stable throughout.

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1. Introduction

When the financial crisis struck in late 2007, the United States was propelled into one of its worst economic periods since the Great Depression of 1929. Businesses of all sizes and across all industries faced conditions they had never seen before and were not built to withstand. One of the biggest obstacles that businesses were forced to overcome was the sudden drop in demand. Consumers were facing the same economic hardships as businesses. Many individuals had their wages cut. Those who were deemed expendable lost their jobs and unemployment spiked. Consumers were forced to cut their expenditures as much as possible as many were facing severe financial difficulties. According to the Bureau of Labor Statistics Consumer Expenditure Survey, annual consumer expenditures increased 1.7 percent in 2008 and decreased 2.8 percent in 2009. Over the same period, expenditures on transportation decreased 4.6 percent and 6.6 percent respectively (BLS, 2010). Even with total consumer spending rising slightly at the beginning of the recession, transportation spending was already declining sharply. When forced to make spending cuts, consumers essentially chose between wants and needs. Things that were necessary were budgeted for and things that were not were pushed aside until the recession would pass.

One of the industries that saw the demand for its goods decrease sharply was the airline industry. In January of 2010, the International Transport Association (IATA) reported that in

2009, North American carriers experienced a 5.6 percent decrease in passenger demand. The global decline in airline passenger demand of 3.5 percent was the largest recorded post-WWII decline. The CEO of the IATA said, "In terms of demand, 2009 goes into the history books as the worst year the industry has ever seen. We have permanently lost 2.5 years of growth in passenger markets" (IATA, 2010). Combining this with the IATA estimate of $11 billion in global losses for the airline industry exemplifies the hardship faced by the airline industry during the recession.

From this information, two questions naturally arise about the industry. One, how did the airlines price their goods during this period? The second, did some airlines behave differently than others? These questions are important to explore because they give insight into how airlines react to demand shocks. The lack of understanding of how much the recession impacted the lives of Americans and affected different types of businesses is concerning as we look towards recessions that may occur in the future It's important to understand how a firm will behave under different sets of conditions. This will allow a better prediction of what will happen in the future if similar conditions ever arise. It also helps to uncover what the airline finds most valuable. Just like with consumers, when faced with uncertain economic conditions, a company should presumably choose to prioritize what it deems necessary.

In this paper, I will analyze the change in different types of domestic airline fares and domestic airline market shares during the Great Recession. This analysis will give me insight into how different types of airlines behave and provide the framework to help predict future behavior.

2. Literature Review

When looking at the current literature on this subject, it is evident that there is a gap to be filled. There exists a lot of literature that covers the macroeconomic impacts of the recession as well as literature that focuses more on general pricing behavior of airlines. However, there has been little work done that specifically views pricing behavior during recessions. This gap is where my research will be focused. By exploring this relationship, and developing a framework that can apply to more areas than just the airline industry, it will be easier to both understand and prepare for what will happen in future recessions.

Looking at the existing relevant literature, I have focused on two particular topics. The first is those papers discussing behavior of firms throughout the business cycle, specifically during recessions. The second is those papers discussing the behavior of airlines.

In the first category, I would like to focus on two papers in particular. Both have important insights into how the behavior of firms changes during recessions. The first paper is by J. Robert Branston, Keith G. Cowling, and Phillip R. Tomlimson (2014). It focuses on the change in the degree of monopoly in the most recent recession (2007-2011 period). The authors of this paper use evidence from the United States and United Kingdom manufacturing sectors, as well as the United Kingdom retail sector, to present evidence of increased collusion during recessions due to excess capacity. They tell a story of falling demand due to the recession

leading to excess inventory. In response to this excess inventory firms cut prices. Their main statement is that this is strictly temporary and leads to the realization that price-cutting is mutually destructive. This, according to the authors, leads to a greater degree of collusion amongst the competing firms (Branston et al, 2014). The authors used profit margin as a way to estimate the degree of monopoly for a company with the following equation with sales turnover defined as revenue generated from operations:

$$\mu = \frac{sales\ turnover - material\ costs}{sales\ turnover}$$

They determined that over the course of the recession, 18 of the 25 largest manufacturing industries experienced increases in the degree of monopoly, with the same number experiencing a decrease during the recovery (Branston et al, 2014). This study is important to consider because it provides an example of the impact of recessions on firm behavior that will give me a case to which I will compare my results from the airline industry.

Similarly to the Branston paper, Cowling (1983) discusses the viability of oligopoly collusion during a recession. He notes a symbiotic relationship between the rivalrous nature of oligopoly firms and their collusion. The rivalry, according to Cowling, is what strengthens the belief of firms that retribution for breaking from the collusive group will be swift and severe. He, like Branston, also cites excess capacity as an important factor. The excess capacity resulting from a decrease in demand is what allows rival firms to be able to react accordingly to any breach of collusion. Cowling notes that, "a leftward shift in the demand curve can be countered by a bigger mark-up in marginal cost…Thus, the degree of monopoly can rise in times of depression" (Cowling, 1983).

The second category, the behavior of airlines, has 5 papers I would like to discuss. The first of these papers is by Borenstein and Rose (1994). This paper seeks to discover patterns of airline price dispersion and the factors that determine that dispersion. This paper is particularly relevant because the authors make an effort to include discussions of airline market shares when looking at price dispersion. The authors find that two passengers on the same route chosen at random, experience an expected price difference of 36 percent of the mean route fare (Borenstein and Rose, 1994). The authors also make a concerted effort to explore the relationship between price discrimination and the observed dispersion. They suggest that price dispersion will increase with concentration if monopoly-type price discrimination is used, but will decrease with concentration if competitive-type price discrimination is used. Using their empirical model, the authors find that competitive-type price discrimination as well as cost variations are the major factors of price dispersion implying that as markets become more competitive, there is greater price dispersion.

Cornia, Gerardi, and Shapirio (2012) also examine price dispersion in the airline industry in their paper. However, they look at dispersion over the course of the business cycle while controlling for the factors observed by Borenstein and Rose, i.e. market structure and cost variations. Observing price dispersion over two complete business cycles, these authors show that price dispersion is pro-cyclical. Their data show a rise in price dispersion during the boom of the late 1990s, followed by a fall during the recession of the early 2000s. Price dispersion is flat throughout the mid-2000s before falling again during the Great Recession. They also take into account the differences between legacy and low-cost carriers, showing that price dispersion

among the legacy carriers is more pro-cyclical than that of the low cost carriers. Similarly to

Borenstein and Rose, these authors also observe a positive relationship between price dispersion

and competition (Cornia et al, 2012).

In another of his papers, Borenstein (1989) explains the positive correlation between

route concentration and fare price by examining market power. Specifically, he examines the

ability of airlines that dominate traffic at particular airports (hubs) to charge higher prices on

routes that include that particular airport. This dominance is maintained through loyalty

programs like frequent flier programs or travel agent bonuses. It is also maintained through

increased ability to prevent other airlines from gaining a foothold in these airports. By

developing what is essentially monopoly power in their hub airport, airlines are able to increase

prices of their flights arriving at or departing from those airports (Borenstein, 1989).

In their paper, Hofer, Dresner, and Windle (2005) discuss the impact of an airlines'

financial situation on its' pricing behavior. They focus, specifically, on three rationales that

might cause an airline to charge lower fares: supply-side, demand-side, and strategic. Under the

first rationale, which is mostly irrelevant to the area I will be focusing on, a bankrupt airline has

its costs reduced and therefore can charge lower prices. Under the second rationale, consumers

will demand lower prices due to their awareness of the financial distress of the airline. Under the

third rationale, an airline will price below its profit maximizing value in order to ensure their

seats are sold thus gaining cash to increase probability of long term survival. When running the

data through their model, the authors found support for the supply and demand side rationales,

but little support for the strategic rationale (Hofer et al, 2005). This will be an important subject

to look at, because it provides insight into the pricing behavior of firms under conditions that may be similar to what they experience during recessions.

The last paper I want to discuss is by Goodman (2008). This paper discusses some of the impacts of the most recent recession on airlines costs as that may affect their pricing behavior. The focus is the relationship between increased oil prices and employment. The author notes that in the years after the September 11th terrorist attacks in New York and preceding the most recent recession, the price of oil drastically increased. As air travel was just beginning to recover following 9/11, airlines were unable to raise prices to offset rising fuel costs for fear of doing greater damage to demand for air travel. Airlines turned to cost cutting measures to offset the increase due to oil prices. One of the primary methods of cost cutting airlines employed was reducing employment. Airlines began handing over many responsibilities to computer systems that were previously managed by people as well as outsourcing jobs like maintenance. After a brief respite from falling employment in 2006, the collapse of the economy in late 2007 and rising oil prices led to another decline going into 2008 (Goodman, 2008). This paper is important to understand when looking at pricing behavior as it provides insight into some of the effects airlines are unable to offset through pricing.

The current literature has explored many different facets of airline pricing behavior. The gap that I am hoping to fill in this literature is at the intersection of the literature on oligopolies during economic recessions and the literature on airline pricing behavior. There is very clear research that has been done on consumer behavior during recessions across different industries, but I believe it is equally important to understand how firms behave across different industries

during recessions. I want to develop an understanding of how both legacy and low cost/regional

airlines alter their behavior during recessions. Given the large role of the travel industry in the

modern economy, being able to understand the behavior of these firms would give us the ability

to better predict future scenarios that may come to pass.

3. Data

I use data from the Domestic Airline Consumer Airfare Report. This data is compiled quarterly by the United States Department of Transportation. I use, specifically, the data from the first quarter of 2006 through the second quarter of 2010. The Consumer Airfare Report is part of a larger Department of Transportation report, the monthly Air Travel Consumer Report, and was created in response to consumer inquiries specifically regarding airfares. In this report, a fare is the ticket price that a passenger pays for a flight, and market share is defined as the percentage of passengers flown by the carrier.

This report provides information on the 1,000 largest city-pair markets within the contiguous United States. These markets include approximately 70 percent of all domestic passengers. These routes are directionless, meaning the data for flights going both ways on the route are combined together. I use two specific subsets of this data. The first subset provides the average fare in the market for the city-pair, as well as the number of passengers per day that travel the route and the distance between the two cities. The report also identifies the carriers with the highest market share and lowest average fare, and details the average fare for the carrier with the largest market share as well as the market share for the carrier with the lowest average fare. In this dataset, only those airlines with market shares over 10 percent were included unless there was only one airline with an over 10 percent market share. I only used airlines with

observations in all periods. For example, the city-pair of Boston and Charlotte in the first quarter of 2008 would be presented as follows:

Table 1: Example of First Data Set

Period	City 1	City 2	Mkt Fare	Highest M.S. Carr.	M.S. of High M.S. Carr.	Avg. Fare	Lowest Fare Carr.	M.S. of Lowest Fare Carr.	Avg. Fare
9	Boston, MA	Charlotte, NC	$219.28	US	0.667906	$249.79	B6	0.141502	$137.23

The second subset of the data provides information on high-fare, short-haul routes. These routes are directionless, meaning the data for flights going both ways on the route are combined together. High-fare is, in this case, defined as any route having an average fare of over $200. Short-haul, in this case, is defined as any route having stage length of less than 750 miles. The report also includes short-haul routes with average fares below $100 for comparison, though I did not use this data in any of my work. For each city-pair, the report lists those carriers with at least a 10% passenger share. As with the previous set, I only included carriers with observations in each quarter. For each carrier, the report provides the number of passengers carried, the market share of the carrier, and the carrier's average fare. In addition, the report provides information on the maximum and minimum $25 fare interval that contains at least 5% of passengers, as well as the percentage of passengers who pay at least three times the minimum $25 fare interval. For example, the city-pair of Denver, CO and Tulsa, OK in the third quarter of 2008 is presented as follows:

Table 2: Example of Second Data Set

Period	Mkt Fare	City 1	City 2	Carr.	M.S.	Avg. Fare	Min Fare	Min Fare %	Max Fare	Max Fare %	3x Min. Fare %
11	$254.54	Denver, CO	Tulsa, OK	UA	0.6292	$282.20	$200	7.77%	$350	24.83%	2.04%
11	$254.54	Denver, CO	Tulsa, OK	AA	0.1201	$205.07	$150	6.32%	$275	8.70%	1.98%
11	$254.54	Denver, CO	Tulsa, OK	WN	0.2227	$200.53	$175	20.26%	$275	7.46%	0.00%

I also used economic data from the Federal Reserve Bank of St. Louis. This data was used as a measure the economic conditions of the U.S. to provide a backdrop with which to compare the data on fares. Specifically, I used quarterly data on the United States GDP from the same period used in the first two data sets.

Lastly, I used the Department of Transportation's Air Carrier Statistics Database. This database contains data reported by air carriers on the T-100 form. Specifically, I used the T-100 Domestic Segment data. From this data set, I used data on the number of passenger travelling on domestic airlines and the number of available seat-miles (a measurement of capacity).

4. Methodology

For this study, my goal was to determine how different types of airfares changed over the business cycle. I accomplished this by looking, specifically, at the Great Recession experienced by the United States between 2008 and 2009. I began by creating an index of airline fares. I used the quarterly data beginning in the first quarter of 2006 and going through the fourth quarter of 2010. I selected this range because it included the period leading up to the economic collapse as well as the period in which the recovery began. This gave me two different periods with which to compare the period of recession.

4.1. Fares

I developed different measures of airline fares based off of the two data sets I previously described. The first data set provided information on the carriers with the largest market share between each city-pair and the carriers with the lowest fares between each city-pair.

I looked first at the carriers with the largest market share on each city pair. I found the average fare for each carrier across all city-pairs in which it held the largest market share, and, using the first quarter of 2006 as a base year, created an index plotting the change in this average fare over the 20 periods (Figure 1). I included in this index city-pairs in which the carrier with the lowest fare and the carrier with the highest market share were the same as my goal with this

subset was to focus on market share. Of the 19 carriers that were the highest market shares on at

least 1 city-pair, 14 had observations in all quarters and were therefore included.

**Figure 1: Average Fares of Carriers with the Largest Market Share**
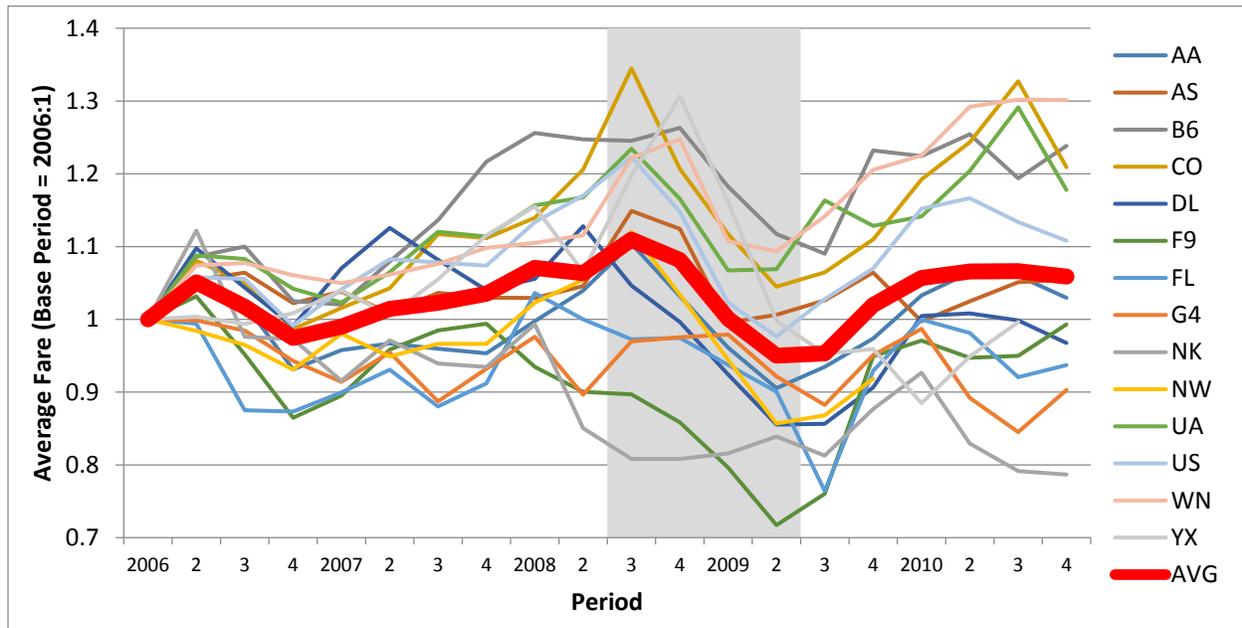
Next, I looked at the carriers with the lowest fare in each city-pair market. In the same

way as with the high market share carriers, I developed an index that showed the change in the

average fare for the carriers with the lowest fares in each city-pair market (Figure 2). In this

index, however, I did not use city-pairs in which the carrier with the lowest fare was the same as

the carrier with the highest market share as my goal here was to look at how these carriers

changed their fares when they were not dominant in the market. For the same reason, I included

only "low-fare" carriers and regional carriers in this index. Of the 16 "low-fare" and regional

carriers included in the report, 8 had observations in all quarters, and were therefore included.

**Figure 2: Average Fares of Carriers with the Lowest Fare**
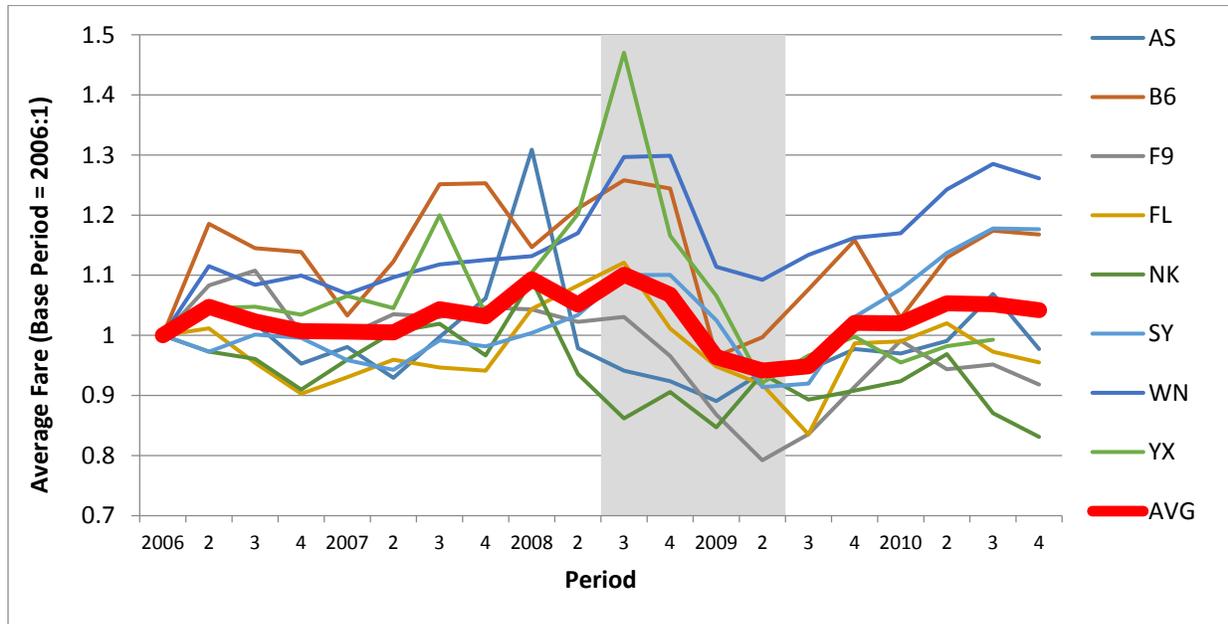
I used the second subset of the Department of Transportation data next. This data

provided information for all carriers with over a 10 percent passenger share on routes no longer

than 750 miles and with average fares no less than $200. For routes with no carriers with at least

a 10% market share, the carrier with the next highest market share is included. Similarly to the

method described above, I plotted average fares over time. Using the first quarter of 2006 as the

base, I calculated the average fare for each carrier across all city-pairs to create an index of fares

(Figure 3). Of the 18 carriers that appeared in the report, 5 had observations in all quarters which

allowed me to include them.

**Figure 3: Average Fares of Carriers on Short Haul High-Fare Routes**
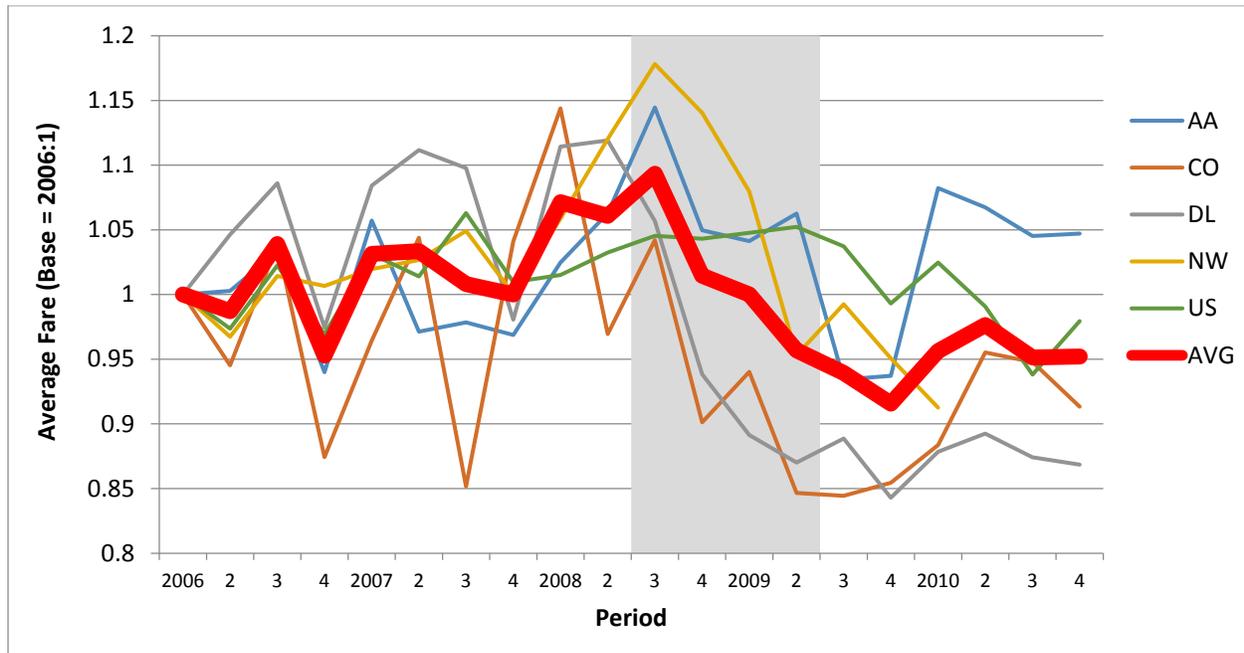
After constructing these indices on the carrier level, I then took the average across all

carriers. I plotted these averages together to compare them. As I wanted to focus on the

relationship between fares and the business cycle, I also included the United States GDP as a

measure of the economy along with the aggregate average fare data (Figure 4). I used the

Economic Research Department of the Federal Reserve Bank of St. Louis to gather data on the

United States Gross Domestic Product. Using the first quarter of 2006 as the base period, I used

quarterly GDP data to establish the structure of the business cycle.

Figure 4: Aggregated Average Fares vs. U.S. GDP
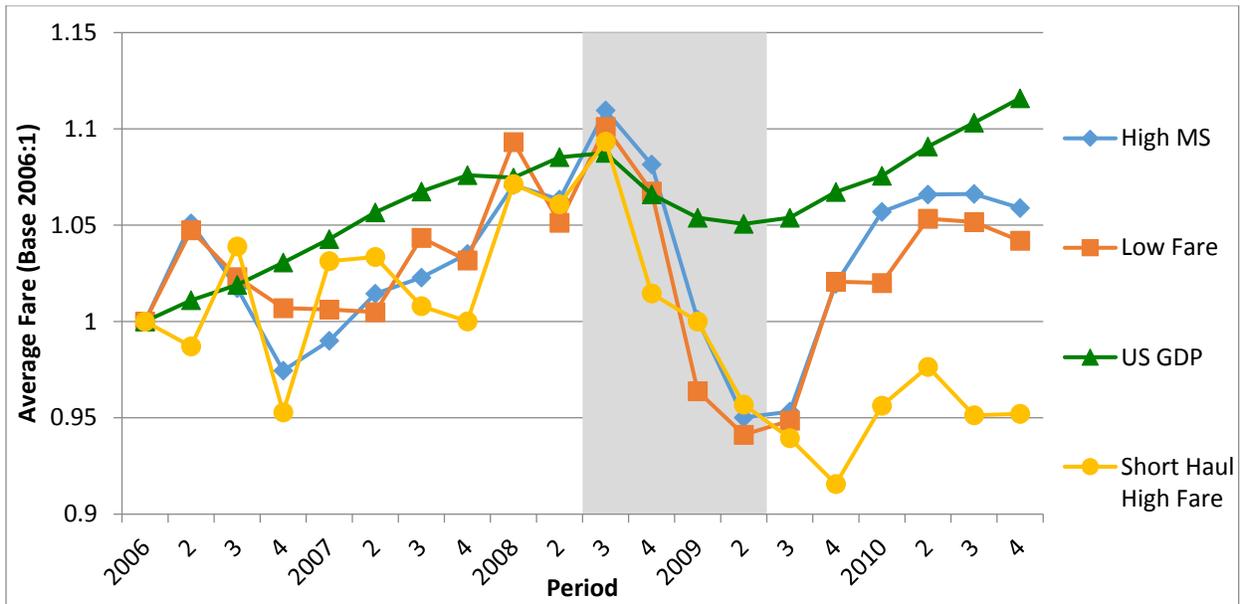
Going forward, my focus was on the aggregate fare data. Using the index I developed, I calculated the quarterly change in fares as well as in GDP (Figure 5).

Figure 5: Changes in Aggregated Average Fares vs. U.S. GDP
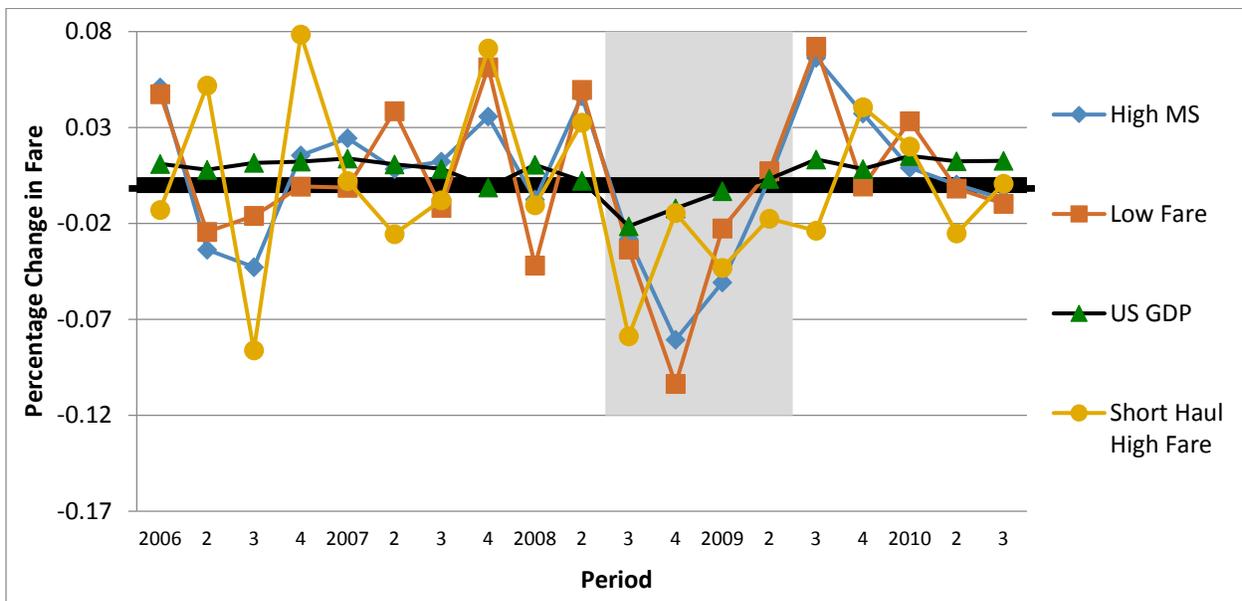
This allowed me to run a regression to determine the impact on recessionary conditions in the economy on these different measures of airline fares. I created a dummy variable to establish the periods in which the economy was in recession. Using the United States GDP data, I defined the recessionary period as a sequence of quarters experiencing GDP contraction. In the range I selected, the period that qualified was from the third quarter of 2008 through the second quarter of 2009. I used the T-100 Domestic Segment data to add two additional variables to my regression (Equation 1). I included the percent change in total domestic passengers as well as the percent change in total available domestic seat-miles. Both of these things could potentially influence the pricing of airline tickets, so excluding them could result in some omitted variable bias.

Equation 1:

$$\%\Delta Fare = \alpha_0 + \beta_1 Recession + \beta_2\%\Delta Passengers + \beta_3\%\Delta SeatMiles + \varepsilon$$

Table 3: Regression Results

Regression on High Market Share Type			
Variable	Coefficient	P-Value	R Squared
Recession	-0.0566922	0.009	0.3754
Passengers	0.1593881	0.488	
Seat-Miles	-0.3272778	0.453	
Regression on Low Fare Type			
Variable	Coefficient	P-Value	R Squared
Recession	-0.0522853	0.035	0.2703
Passengers	0.1072397	0.695	
Seat-Miles	-0.1524074	0.768	
Regression on Short Haul High Fare Type			
Variable	Coefficient	P-Value	R Squared
Recession	-0.0376826	0.13	0.2924
Passengers	-0.3852125	0.188	
Seat-Miles	0.7906641	0.155	

4.2. Market Share

After establishing the behavior of fares over the course of the recession, I did the same for market shares. For this part of the analysis, I only used the first data set. As I did with the fares, I began the analysis of market shares with the part of the data regarding the carriers with the highest market share on each city-pair. I took the average of each carrier's market share across all city pairs over time. Then I calculated the change in market shares over each period (Figure 6).

Figure 6: Change in Avg. Mkt. Share for Carriers with the Largest Mkt. Share
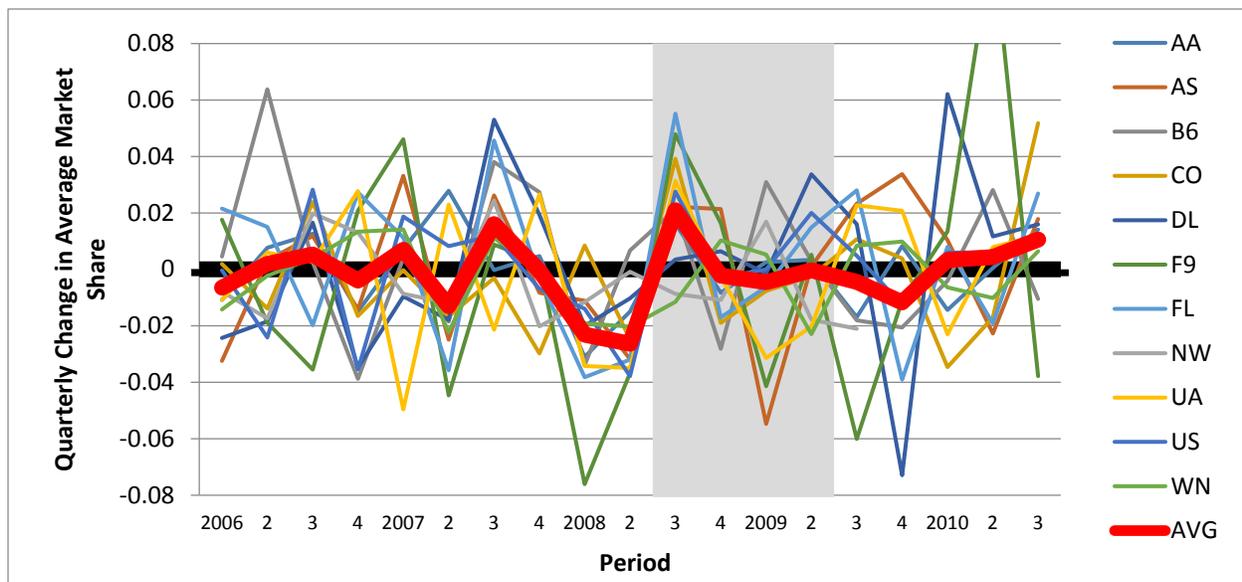
Next, I followed a similar process with those carriers with the lowest fare on each city pair. I calculated the average market share across all city pairs and then plotted the change in the

average market share over each period. As with the fare analysis, for this group I only included

"low fare" and regional airlines (Figure 7).

Figure 7: Change in Avg. Mkt. Share for Carriers with the Lowest Fare
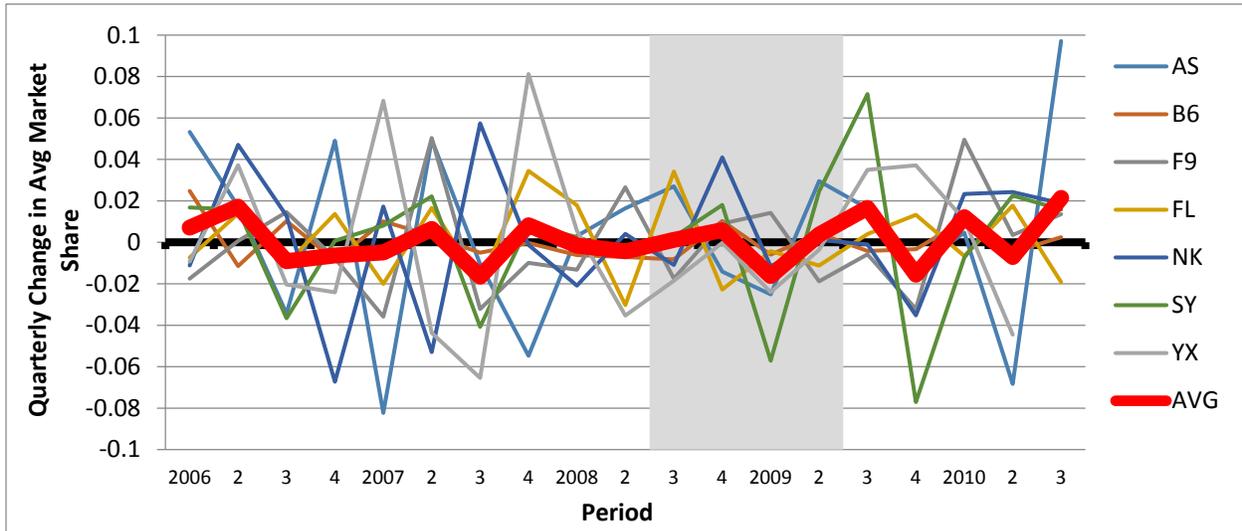
After compiling the changes in market share across carriers, I switched focus to the

aggregate so that I could compare the changes in market share of the high market share carriers

and low fare carriers to each other as well as to the corresponding aggregate changes in fares that

I compiled above (Figure 8).

Figure 8: Change in Avg. Fare vs. Change in Avg. Mkt. Share
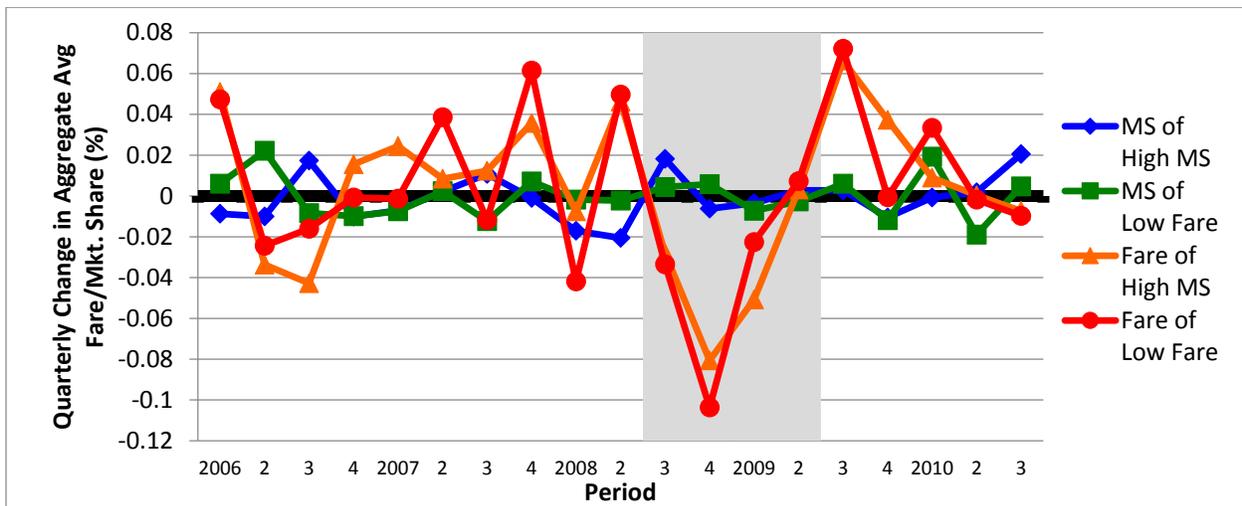
5. Results

5.1. Fares

When looking at three different types of fares shown in Figure 4, there is a clear drop in each of the quarters that make up the recessionary period. The high market share and low fare types move in lockstep throughout the entire range. The short haul high fare type, while following the same general path, is much more volatile in the period leading up to the recession. All three follow the same general path leading up to the recession with a dip at the end of 2006 followed by a steady rise until the third quarter of 2008. Going into the recession, all three types experience a steep decrease in fares. Coming out the recession, however, the "short haul high fare" type remains depressed for an additional three quarters before recovering.

The results are reinforced by three regressions introduced earlier (Table 3). The results show that the recession has a statistically significant impact on the high market share and low fare types (Table 3). For the high market share type, the coefficient on the recession variable is -.0567 with a P-value of .009. This shows that for each period of recession, the average fare for the high market share type decreased by an average of 5.67 percent. For the low fare type, the coefficient on the recession variable is -.0522 with a P-value of .035. This shows that the average fare for the low fare type is reduced 5.22 percent on average for each period of recession. The result for the short haul high fare type is not statistically significant, as its p-value

is greater than .05, but the coefficient on the recession variable is -.0377 showing that the average decrease in average fare during any period of recession is 3.77 percent.

5.2. Market Share

Overall, there was much less volatility on average than I expected with the market shares of the two types I tested. The high market share carriers (Figure 6) generally moved together throughout the range. There was a noticeable two percent spike in the first quarter of the recession, which followed the percent drop in the period preceding. Other than that, however, the average quarterly change oscillated between -0.5 percent and +-.5 percent throughout the recession. The low fare carriers, on the other hand, had no real consistency across carriers at any point during the range I observed. In one quarter, a few of the low fare carriers would see growth of market share while the others would see a loss, and in the next the reverse would play out. From the outset, it made sense to me that, during the recession, low fare and regional carriers would gain market share as consumers flocked to lower fares. However, as relative prices did not change significantly, these carriers did not gain any market share.

6. Discussion

The primary goal of my research was to determine the pricing behavior of airlines during the Great Recession. My hope was that by understanding this behavior, I could then begin to paint a picture of what drives that behavior. My initial hypothesis was that during the recession there would be a drop in prices due in part to the fall in demand, as called for by the traditional supply-demand relationship, but also beyond that due to a desire to maintain market share. My reasoning was that if the airlines expected demand to eventually pick back up, sacrificing short-term profits in order to sure a stable market share when demand picked back up would be the smart decision. In a down market, it is logical that consumers would substitute away from the major carriers to the low fare carriers operating on the same routes. By ensuring relative pricing stayed the same

The data shows that the airlines did lower prices during the recession and that that price drop was more severe than any price change in the two years before or one year after the recession. For the high market share types, the largest decrease was 10 percent while the largest decrease for both low fare types and short haul high fare types was 8 percent. The data also shows that, during the recession, market share for both the high market share types and the low fare types remained, on average, very stable, while the high market share types even experienced a 2 percent increase on average during the first quarter of the recession. Now this certainly does not mean that the behavior of the market share is a direct result of the pricing decisions, but it does make an important connection between the two.

Pricing of plane tickets, while important, is just one decision that airlines have to make. When trying to determine what airlines view as the best path through a recession, it is equally important to look at the other decisions they are making. One of the most important variables is capacity. I included the average seat-miles (total seats available multiplied by miles flown) in my regression as a way to capture this, but it was by no means exhaustive. Changing capacity is a means for the airlines to control the cost side of their profit function just as changing price is a means to control the revenue side. The data I used does show significant decreases in seat-miles during the recession, with 2015 being the first year to return to pre-recession peaks. Another cost variable to look at would be fuel costs. During the recession, jet fuel prices plummeted, which may have allowed airlines to drop prices more than they otherwise could have. Looking at the historical relationship between fares and jet fuel prices could give insight into what would happen to fares during a recession in which jet fuel prices did not drop so severely.

By combining the conclusions of this paper with these other potential avenues of research, a framework will develop that will allow for prediction of behavior under similar conditions. In this paper, I have established that market share stability is the most likely outcome under these conditions. There is evidence that shows airlines accomplished this through price cutting, but there are surely other variables that airlines control simultaneously, which work in concert to achieve the end goal.

Appendix

Table 4: List of Airlines by IATA Code

IATA Code	Carrier
AA	American Airlines
AS	Alaska Airlines
B6	JetBlue Airways
CO	Continental Airlines
DL	Delta Air Lines
F9	Frontier Airlines
FL	AirTran Airways
G4	Allegiant Air
NK	Spirit Airlines
NW	Northwest Airlines
SY	Sun Country Airlines
U5	USA3000 Airline
UA	United Airlines
US	US Airways
WN	Southwest Airlines
YX	Republic Airline

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