Financial Distress and the Effect of Chapter 11 Bankruptcy in the US Airline Industry

By

Catherine Renee Craig

Advisor: Dr. Christian Hofer

An Honors Thesis in partial fulfillment of the requirements for the degree Bachelor of Science in Business Administration in Transportation and Logistics.

Sam M. Walton College of Business
University of Arkansas
Fayetteville, Arkansas

May 14, 2011

Abstract

      This paper seeks to understand how financial distress in the US airline industry affects air fares. Prior research indicates that financial distress lowers fares, however, this study hypothesizes that the effect of distress on fares is greater for air carriers that are both financially distressed and operating under Chapter 11 bankruptcy. Empirical analysis is conducted using data from the US domestic airline industry. Results from the analysis indicate that when financial distress and Chapter 11 bankruptcy interact, there is a negative effect on air fares. Implications of how this affects policy makers and managers within the industry are addressed.

Table of Contents

1. Introduction

In recent years, the airline industry has been at the forefront of media coverage surrounding the recession in the United States economy. In 2008, American Airlines was estimated at losing $3.3 million a day (Gimbel, 2008). The other major airlines are in the same boat, turning to Chapter 11 bankruptcy or mergers as ways out from under financial distress (Gimbel, 2008). The distress of US air carriers has manifested itself in various ways. Its effects have been studied in terms of service levels (Borenstein and Rose, 2003), route market entry decisions (Liu, 2009), and safety procedures (Noronha and Singhal, 2004). The most widely studied effect of financial distress in the airline industry, however, has been on prices (Barla and Koo, 1999; Borenstein and Rose, 1995; Busse, 2002; Chevalier and Sharfstein, 1996; Hendel, 1996; Hofer et al., 2005; Hofer et al., 2009; Kennedy, 2000; Phillips, 1995). It is the impact on United States airlines' pricing behavior that piques interest in this study.

Because four of the six major airlines in the US airline industry filed for bankruptcy protection in the first decade of the 21st century, and because the industry as a whole has experienced financial trouble, it is pertinent to understand how airlines behave under such conditions. What is most pertinent to the consumer, of course, is how these conditions will affect ticket prices. For this reason, this study examines the impact of financial distress, which is the point in time when a firm's liquid assets are unable to cover its debts. This study will also examine the impact of filing for Chapter 11 bankruptcy protection, which is when a firm's business is reorganized (Payne and Hogg, 1994) and its creditors are forced to stop collecting on the firm's debts and accruing interest on those debts (Wong, 2003). How does each of these elements affect air fares? While Chapter 11 bankruptcy incurs significant costs to the firm (Bris, Welch, and Zhu, 2006), it also offers many benefits to firms that are under duress, by restructuring their debts and allowing the businesses to continue operations (Payne and Hogg, 1994). Research has found that the more financially distressed a firm is, the more likely the firm is to file for Chapter 11 bankruptcy (Chatterjee et al., 1996). This study takes a step further to examine the interaction between financial distress and filing for Chapter 11, asking the questions how do these two elements interact with each other and what affect does that interaction have on air fares? While extant literature covers the effects of financial distress on prices and the effects of Chapter 11 bankruptcy on prices, there is a gap in the literature that would explain the impact on prices when a carrier is not only financially distressed, but bankrupt as well.

These questions are answered through performing empirical analysis on data pulled from the US airline industry from 2003 to 2006. A regression model was built to determine the relationship that variables such as a carrier's operating expense, occupancy rates, and market share have with price, as well as to determine the significance of those variables.

The structure of this paper is as follows: a brief overview of the literature landscape concerning financial distress in the US airline industry in Section 2, which is used as the backdrop for developing the hypotheses tested in this study, an explanation of the data used and the variables studied in Section 3; a presentation of the empirical results is in Section 4; finally, conclusions and implications from the results of the research are set forth in Section 5.

2. Literature Review and Development of Hypotheses

The literature surrounding financial distress indicates that distress can affect an industry or individual corporation in a variety of ways. Hotchkiss et al. (2008) define financial distress as the point in time when a firm's liquid assets are insufficient to cover the requirements of its debt contracts. In the airline industry, distress can affect service levels offered by individual airlines (Borenstein and Rose, 2003; Liu, 2009), for instance, in terms of new route market entry decisions (Liu, 2009). Distressed firms generally act more conservatively and, because of their low liquidity, are unlikely or unable to enter a new market (Liu, 2009). Borenstein and Rose (2003) found that when a carrier goes bankrupt, mid-size airports often see a sizeable reduction in the amount of available flights. The financial stability of an airline also serves as an indicator for the airline's emphasis on safety, as examined by Noronha and Singhal (2004) who found that the higher an airline's bond rating, the less likely it was to experience a safety mishap. Financial distress is also the cause of price wars, according to Busse (2002). Airlines that are having trouble meeting financial obligations will cut prices to increase demand, which will then start a price war with the distressed carrier's competitors (Busse, 2002). The most widely studied affect of financial distress on the airline industry appears to be the effect on prices (Barla and Koo, 1999; Borenstein and Rose, 1995; Busse, 2002; Chevalier and Sharfstein, 1996; Hendel, 1996; Hofer et al., 2005; Hofer et al., 2009; Kennedy, 2000; Phillips, 1995). These studies note that, in general, airlines in financial distress will decrease their air fares.

Extant literature offers several different views of the reasoning behind the price-cutting that airlines engage in to pull themselves out of financial distress. One of the most notable views established are that airlines reduce air fares due to a decrease in demand (Borenstein and Rose, 1995; Busse, 2002; Hofer et al., 2005). Some researchers suggest that customers who are aware of the financial condition of particular airlines generally do not want to fly with an airline that is financially distressed (Hofer et al., 2005). In efforts to increase demand for passenger seats, carriers will decrease their prices below those of their competitors (Borenstein and Rose, 1995; Busse, 2002; Hofer et al., 2005). This study seeks to determine the nature of this relationship between distress and prices, and, because airlines have been found to decrease their prices below those of their competitors (Borenstein and Rose, 1995; Busse, 2002; Hofer et al., 2005) and because this type of behavior creates price wars (Busse, 2002), this study hypothesizes

H1: The distressed firm's air fares have an inverse relationship with the degree of financial distress.
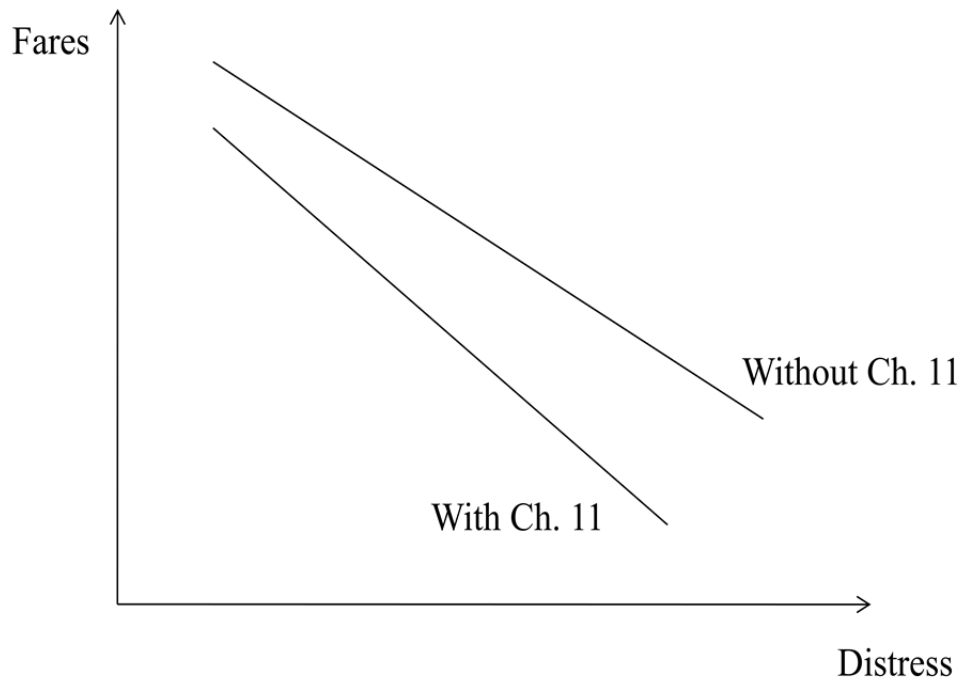
Filing for Chapter 11 bankruptcy is an option for firms who find themselves in extreme financial trouble and, through reorganization of their businesses, might be able to recover (Payne and Hogg, 1994). Chapter 11 allows the firm to continue operations, but it stops its creditors from collecting on all pre-filing debts and stops accrual of interest on those debts (Wong, 2003). Some studies suggest that bankrupt carriers experience a loss in consumer demand (Borenstein and Rose, 1995; Hofer et al., 2005). In these studies, prices seemed to fall as an airline's financial condition declined and then fell further once the airline filed for Chapter 11 bankruptcy (Borenstein and Rose, 1995; Hofer et al., 2005). It is possible that the airlines lowered their prices to counteract the loss of passenger demand for seats (Hofer et al., 2005). Competitors decreased their prices in response to the fare reductions of financially distressed airlines, which indicates that there is a fight for consumer demand in the airline industry (Borenstein and Rose,

1995; Busse, 2002; Hofer et al., 2005). From a supply perspective, bankrupt carriers could reduce their prices in response to a decrease in their operating costs as a result of filing for Chapter 11 bankruptcy (Barla and Koo, 1999; Hendel, 1996; Hofer et al., 2005; Kennedy, 2000). Researchers who have studied the phenomenon from this perspective found that ticket prices of financially distressed airlines did not fall in the quarters preceding bankruptcy, but decreased after Chapter 11 filings, indicating that it was the restructuring of their organization and reduction of operating expenses that allowed them to cut their prices (Barla and Koo, 1999; Kennedy, 2000). For this reason, in addition to examining the effect of financial distress on air fares, this study will examine the effect filing for Chapter 11 bankruptcy has on a carrier's air fares. It will test the hypothesis

> **H2**: Filing for Ch. 11 bankruptcy has a direct relationship with airlines decreasing air fares.

The measures taken by a company that files for Chapter 11 fall into the category of an operating strategy for the purpose of turning the company around (Hofer, 1980). Operating strategies focus on short-term revenue generating changes, such as price cutting, and operational restructuring like cost and asset reduction as the key to coming out from under distress (Hofer, 1980; Robbins and Pearce, 1992; Sudarsanam and Lai, 2001). This strategy seems to be taken on by firms that are financially distressed (Barla and Koo, 1999; Chatterjee, et al., 1996; Hendel, 1996; Hofer et al., 2005; Kennedy, 2000), but more so by firms that are financially distressed to the point of filing for Chapter 11 bankruptcy (Chatterjee, et al., 1996). Chatterjee, et al. (1996) found that firms who have defaulted on a large proportion of their public debt are more likely to file for Chapter 11 rather than firms who have defaulted on a lower proportion of their public debt. Therefore one can assert that carriers who file for Chapter 11 bankruptcy have experienced greater financial distress than those that have not. The interaction between financial distress and Chapter 11 bankruptcy could possibly lower fares to a greater extent for financially distressed and bankrupt firms than for those that are financially distressed only. This interaction is illustrated in Figure 1.

Figure 1: The effect of financial distress on air fares

For this reason, this study hypothesizes that
H3: The effect of financial distress on air fares is greater for carriers operating under Chapter 11 bankruptcy protection than for those carriers who are not.

3. Data and Variables

Data

Data from the United States airline industry are used to test the hypotheses set forth in this study. Airlines are required to report information regarding their finances and operations, which includes their balance sheet, income statement, statement of cash flow, and aircraft inventory. Airlines are also required to report information on every tenth domestic ticket sold. This information includes origin and destination as well as other information regarding the itinerary of the passenger. All of this data is publicly available and was purchased from Database Products, Inc., which screens all data for accuracy and customizes data sets. Data was selected from the time period from 2003 to 2006. Data was not included from years prior to 2003 because of the effect the September 11, 2001 terrorist attacks had on the United States airline industry, and it was not included after 2006 because data was not yet available at the time the data was collected. Data was collected for each quarter during this 2003 to 2006 time frame for the top

2,000 United States domestic airport-to-airport route markets in terms of passenger volume. Because of the great extent of the sample selection, analysis will consider both major and smaller route markets. The data set analyzed includes 218,169 complete observations, in which each observation is tied to a specific carrier in a specific origin and destination route market in a specific quarter. Of these observations, 153,867 observations were identified as distressed carriers and are used in this study to test the hypotheses. These carriers were identified as distressed through assessing current and past performance as well as the relative liquidity and debt of a firm and determining a z score for each observation. Those with positive z scores were identified as distressed.

Variables

In this study, the dependent variable of primary interest is average ticket price (*Price*). Prior research indicates that air fares are affected by various characteristics pertaining to the carrier and the route (Hofer et al., 2009).

Carrier-specific characteristics that are examined to determine the impact on *Price* include the number of stopovers a passenger will make per one-way trip (*Stopovers*), the number of passengers (*Passengers*), and the carriers' occupancy (*Occupancy*) of the flights, as calculated as the ratio of passenger-miles to available seat-miles. Operating expenses of a carrier per seat-mile (*OperatingExpense*) are examined for the purpose of determining the differences between a carrier's cost structure and its strategy, for instance, if the carrier is a low cost carrier. Route-specific characteristics consist of the number of miles between the airports of origin and destination (*Distance*), whether or not the route market is defined as a tourist market (*TouristMarket*), a carrier's share in a route market (*RouteMarket*), and the amount of concentration in a particular route market (*RouteConcentration*). *RouteConcentration* will be calculated using the Herfindahl-Hirschman Index, which is a commonly used tool to measure the degree of market concentration by summing the squares of market share of each firm competing in a particular market (United States Department of Justice, 2011). Degree of airport market concentration (*AirConcentration*) is also measured using the HHI. In addition, airport market share is measured (*AirMarket*).

The variable used to measure financial distress (*FinDistress*) in this study divides the airlines in the sample into two groups: distressed firms and non-distressed firms. A binary variable (*FinDistressDummy*) will be used to identify which carriers in which quarters are distressed by identifying them with the value of 1 if the carrier *Distress* score is positive and the value of 0 if the carrier's *Distress* score is negative. Observations of carriers that are distressed are the ones that will be included in further analysis. Observations including carriers that have filed for Chapter 11 bankruptcy are identified with the value of 1 for the *Chapter11* variable, and it is for those observations that the variable *FinDistress*Chapter11* is measured. *FinDistress*Chapter11* is measured to determine if firms that have filed for Chapter 11 bankruptcy decrease their ticket prices to a greater degree than firms under financial duress that have not filed.

This study contends that all of the variables henceforth presented collectively affect airline fares. This is represented by the following model:

$$\ln(Price) = \beta_0 + \beta_1\ln(Passengers) + \beta_2\ln(Distance) + \beta_3(\ln Distance)^2 + \beta_4 Stopovers +$$
$$\beta_5 TouristMarket + \beta_6 Distress + \beta_7 Occupancy + \beta_8 OperatingExpense +$$
$$\beta_9\ln(RouteConcentration) + \beta_{10}\ln(AirConcentration) + \beta_{11}RouteMarket + \beta_{12}AirMarket +$$
$$\beta_{13}Chapter11 + \beta_{14}Distress*Chapter11 + \Sigma\beta_i Carrier_i + \Sigma\beta_t Time_t + \varepsilon$$

The mean and standard deviation for the variables examined in this study are presented in Table 1. The observations included in these descriptive statistics are a subsample of distressed carriers. Table 2 presents the correlations of most of the variables. Most of the correlations are found to be statistically significant at the 5% level. There are some variables that have correlations greater than 0.5, however, one would expect these variables to be highly correlated. For example, airport market share and route market share are highly correlated.

Table 1: Descriptive Statistics

Descriptive Statistics (n = 153,867)

Variable	Mean	Standard Deviation
Distance	1171.89	652.90
FinDistress	2.06	6.77
Distress^2	50.08	529.04
Chapter11	0.33	0.47
FinDistress*Ch11	1.39	6.83
TouristMarket	0.27	0.44
Occupancy	77.05	6.23
OperatingExpense	0.13	0.02
Passengers	503.52	1401.62
Price	155.27	75.27
Stopovers	1.87	0.42
RouteMarket	12.89	20.94
RouteConcentration	4673.69	2125.30
AirportShare	13.94	15.57
AirportConcentration	2983.77	1319.55

Table 2: Pairwise Correlation

Pairwise Correlation (n = 153,867)

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Distance	1.000												
2	FinDistress	0.028	1.000											
3	FinDistress^2	0.030	0.962	1.000										
4	TouristMarket	0.059	0.001	-0.004	1.000									
5	Occupancy	0.087	-0.168	-0.158	0.035	1.000								
6	OperatingExpense	-0.061	-0.051	-0.065	-0.003	0.127	1.000							
7	Passengers	-0.019	-0.012	-0.015	0.028	-0.031	-0.043	1.000						
8	Price	0.169	-0.017	-0.006	-0.135	0.043	0.021	-0.037	1.000					
9	Stopovers	0.262	0.029	0.033	0.035	0.124	0.001	-0.513	0.169	1.000				
10	RouteMarket	-0.046	-0.037	-0.035	-0.023	-0.134	-0.016	0.578	-0.001	-0.594	1.000			
11	RouteConcentration	-0.500	-0.011	-0.012	-0.060	-0.036	0.036	0.020	-0.026	-0.134	0.045	1.000		
12	AirportMarket	-0.090	-0.058	-0.052	-0.010	-0.128	-0.011	0.509	0.026	-0.525	0.757	0.082	1.000	
13	AirportConcentration	-0.134	0.004	0.008	-0.163	-0.059	-0.046	0.026	0.043	-0.061	0.034	0.427	0.128	1.000

4. Results

Regression modeling was used to examine all variables included in this study. A regression model was run for each hypothesis: the first included all independent variables and the *FinDistress* variable; the second added the *Chapter11* variable; the third, the *FinDistress*Chapter11* variable. In Table 3, the output for all three regressions is presented, with the coefficients for each variable listed and the standard error listed below that. The number of stars to the side of the coefficients indicates the significance of that variable. Three stars represents the highest level of significance, where the significance level is at 99%, and two stars represents a significance level of 95%. The F-statistics of all three outputs indicate that the models as a whole are statistically significant. The R-squared value indicates that 23% of the variability in this data set is accounted for by the models, which is adequate for this study.

From this output, one can see how each of the independent variables affects *Price* and the nature of that relationship. The variable *Passengers* is negatively related to *Price*, meaning that the more passengers that are on a flight, the lower the air fares. *Distance* also acts in the same way toward *Price*. *Distance^2*, however, acts differently because it is a non-linear relationship. As distance increases, in this case, fares increase as well at an increasing rate. *Stopovers* is positively related to *Price*, meaning that the more stopovers on a given flight the higher the price of the ticket. *TouristMarket* and *Occupancy* are both negatively related to *Price*. That the particular route of a flight is considered a tourist route or that occupancy of a particular flight is high indicate that the fares would be lower. *OperatingExpense* is positively related to *Price*, meaning that the higher the operating expense of an air carrier the higher its ticket prices will be. *RouteMarket*, *RouteConcentration*, *AirportMarket*, and *AirportConcentration* are also all positively related to *Price*. All of the variables tested are also highly significant, with p-values less than 0.01 or at the 99% significance interval. The first regression was run to test H1, specifically to determine the effect of financial distress on air fares. In the table one can see that *FinDistress* is negatively related to *Price*, meaning that as financial distress increases, air fares decrease. This variable is also highly significant, meaning that H1 is supported.

The second column in Table 3 displays the output for the regression model to test H2. The *Chapter11* variable is found to be negatively related to air fares and is highly significant. This means that the negative effect of financial distress on a carrier's prices increases when a carrier is bankrupt, which supports H2. The regression model used to test H3 is presented in the third column. The *FinDistress*Chapter11* variable is also found to be negatively related to *Price* and is highly significant in the 95% significance interval. This means that while financial distress and Chapter 11 bankruptcy both result in lower fares, the combination of both variables reduces fares even further. Therefore, H3 is supported, meaning that when a carrier is under both financial distress and Chapter 11 bankruptcy protection air fares decrease.

Table 3: Empirical Results of Regression Analyses

Price	Regression 1 Coefficient		Regression 2 Coefficient		Regression 3 Coefficient	
Intercept	5.094		5.138		5.138	
	(1020.697)		(1019.411)		(1019.362)	
Passengers	-0.062	***	-0.063	***	-0.063	***
	(0.001)		(0.001)		(0.001)	
Distance	-0.307	***	-0.304	***	-0.304	***
	(0.027)		(0.027)		(0.027)	
Distance^2	0.038	***	0.037	***	0.037	***
	(0.002)		(0.002)		(0.002)	
Stopovers	0.107	***	0.106	***	0.106	***
	(0.003)		(0.003)		(0.003)	
TouristMarket	-0.146	***	-0.146	***	-0.146	***
	(0.002)		(0.002)		(0.002)	
Occupancy	-0.001	***	-0.002		-0.002	***
	(0.000)		(0.000)		(0.000)	
OperatingExpense	0.360	***	0.003	***	0.006	
	(0.103)		(0.104)		(0.104)	
RouteConcentration	0.013	***	0.013	***	0.013	***
	(0.002)		(0.002)		(0.002)	
AirportConcentration	0.012	***	0.011	***	0.011	***
	(0.002)		(0.002)		(0.002)	
RouteShare	0.004	***	0.004	***	0.004	***
	(0.000)		(0.000)		(0.000)	
AirportShare	0.005	***	0.005	***	0.005	***
	(0.000)		(0.000)		(0.000)	
FinDistress	-0.002	***	-0.001	***	0.002	
	(0.000)		(0.000)		(0.001)	
Chapter11			-0.051	***	-0.048	***
			(0.003)		(0.003)	
FinDistress*Chapter11					-0.003	**
					(0.001)	
F-Statistic	908.22		900.10		883.22	
R^2	0.2334		0.2352		0.2352	

5. Conclusion

This study examined pricing behavior in the United States domestic airline industry under financial distress and Chapter 11 bankruptcy protection. It also looked at the interaction between distress and Chapter 11 bankruptcy protection and how the interaction between those two variables affects air fares. By empirical analysis and regression modeling, each variable included in this study was found to be significant, meaning that they do, in fact, impact air fares. The number of passengers for a given flight route, the distance between origin and destination, and whether or not a route market is defined as a tourist market are all negatively related to ticket prices. Conversely, the number of stopovers a passenger will make for a one-way flight, route market share, route market concentration, airport market share, airport market concentration, operating expense, and the degree of occupancy of each flight are all positively related to ticket prices.

The variables of consequence in this study—financial distress, whether or not a firm is operating under Chapter 11 bankruptcy protection, and the interaction of distress and bankruptcy protection on the firm—are all found to be significant as well. They are also all negatively related to ticket prices. Put plainly, as financial distress on a carrier increases, it will decrease its prices. As a carrier files for Chapter 11 bankruptcy, it will decrease its prices. Finally, financial distress and Chapter 11 bankruptcy protection interact together, decreasing a carrier's prices. The results of this study's analysis support all three hypotheses set forth: financial distress, Chapter 11 bankruptcy protection, and the interaction between the two all decrease prices. In particular, the effect of financial distress on air fares is greater for carriers operating under Chapter 11 bankruptcy protection than for those carriers that are not. This contributes to the literature landscape in that, previously, the literature spoke clearly as to how financial distress alone affects air fares and how filing for Chapter 11 bankruptcy affects fares. These findings fill the gap in research concerning the effect of the interaction of financial distress with filing for Chapter 11 bankruptcy.

In addition to adding to the literature landscape examining distress and pricing strategies under distress in the US airline industry, the findings of this research will benefit greatly managers of financially distressed firms as well as managers of competing firms. Competitors will be able to use this information to better anticipate competitive actions taken by their financially distressed counterparts, thus giving them competitive advantage. Policy-makers will also find this information useful in reviewing and possibly revising bankruptcy law in the future and how bankruptcy affects the free market.

This study was not without its limitations. For instance, the time period from which data was collected—all financial quarters from 2003 to 2006—was constrained by the September 11, 2001 terrorist attacks that very negatively affected air travel in the United States, the effects of which cannot be measured.

6. References

Barla, P., Koo, B. 1999. Bankruptcy protection and pricing strategies in the US airline industry. Transportation Research. Part E, Logistics & Transportation Review, 35, 101-120.

Borenstein, S., Rose, N. 1995. Bankruptcy and pricing behavior in us airline markets. The American Economic Review, 85(2), 397-402.

Borenstein, S., Rose, N. 2003. The impact of bankruptcy on airline service levels. The American Economic Review, 93(2), 415-419.

Bris, A., Welch, I., Zhu, N. 2006. The costs of bankruptcy: Chapter 7 liquidation versus Chapter 11 reorganization. The Journal of Finance, 61(3), 1253-1303.

Busse, M. 2002. Firm financial condition and airline price wars. The Rand Journal of Economics, 33(2), 298-319.

Chatterjee, S., Dhillon, U.S., Ramirez, G.G. 1996. Resolution of financial distress: Debt restructurings via chapter 11, prepackaged bankruptcies, and workouts. Financial Management, 25(1), 5-18.

Chevalier, J., Scharfstein, D. 1996. Capital-market imperfections and counter-cyclical markups: Theory and evidence. The American Economic Review, 86(4), 703-726.

Gimbel, B. 2008. American Airlines loses $3.3 million a day. Fortune Magazine. http://money.cnn.com/2008/04/28/magazines/fortune/gimbel_american.fortune/

Hendel, I. 1996. Competition under financial distress. Journal of Industrial Economics, 44(3), 309-324.

Hofer, C., Dresner, M., Windle, R. 2005. Financial distress and US air fares. Journal of Transport Economics and Policy, 39(3), 323-340.

Hofer, C., Dresner, M., Windle, R. 2009. The impact of airline financial distress on US air fares: A contingency approach. Transportation Research Part E, 45, 238-249.

Hotchkiss, E., John, K., Mooradian, R., Thorburn, K. 2008. Handbook of Empirical Corporate Finance. Elsevier B.V. p. 2-53.

Kennedy, R. 2000. The effect of bankruptcy filings on rivals' operating performance: Evidence from 51 large bankruptcies. International Journal of the Economics of Business, 7(1), 5-25.

Liu, C. 2009. Entry behavior and financial distress: An empirical analysis of the US domestic airline industry. Journal of Transport Economics and Policy, 43(2), 237-340.

Noronha, G., Singhal, V. 2004. Financial health and airline safety. Managerial and Decision Economics, 25(1), 1-16.

Payne, D., Hogg, M. 1994. Three perspectives of chapter 11 bankruptcy: Legal, managerial, and moral. Journal of Business Ethics, 13(1), 21-30.

Sudarsanam, S., Lai, J. 2001. Corporate financial distress and turnaround strategies: An empirical analysis. British Journal of Management, 12(3), 183-199.

United States Department of Justice. 2011. The Herfindahl-Hirschman Index. http://www.justice.gov/atr/public/testimony/hhi.htm