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Does Fuel Hedging Add Value? Quantitative Analysis but Qualitative Conclusion in the Case of the US Airline Industry.

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Abstract

This empirical analysis uses daily data sets to study hedging activity of major US airlines during 1996-2005 to examine whether hedging is a value added activity as perceived by the investors. The US airline industry presents a good environment to measure the risk exposure due to changes in jet fuel prices. Fuel price risk is omnipresent across the industry. Given jet fuel price volatility, airlines have an incentive to find value in hedging future prices of jet fuel. The research does not find a reason that would contradict the economic fundamentals of hedging; airline stock returns are negatively related to percentage changes in jet fuel prices, on average. However, looking at daily returns of jet fuel and stock prices, we do not find a significant correlation that can be used to support the theorized sensitivity. This result is consistent with the assertion that the benefit of hedging is of a limited value to the investors who seek a combination of stocks that will reduce the overall risk exposure of the portfolio rather than the risk inherent in this or that individual firm.

Jet fuel prices have been substantially volatile throughout the last decade. Between the years 1996 and 2005, a barrel of crude oil was traded at a price range between $10.82 and $69.91. The fluctuation in crude oil prices certainly has an impact on airline industry operations as fuel costs on average represent 16.29% of total airline operating expenses (See Table One). A recent article in The Wall Street Journal lists the airline industry as the likely beneficiary of oil price decreases[1]. Because the airline industry's operations depend heavily on crude oil, major airlines' profits could climb when their own cost drops, as fuel prices fall. Furthermore, according to a study of trading patterns by Bianco Research LLC, the airline sector is most inversely correlated to oil prices[2]. Thus, the drop in commodity prices pushes investors to search airlines' stocks. To mitigate the risk of fuel exposure, some airlines have used derivatives to lock in the price. As such, this temporary protection will shield airlines from high energy costs, but also might keep them from enjoying lower costs when the crude price falls.

This paper investigates the fuel hedging behavior of major airlines in the US during the 1996-2005 period to examine whether such hedging has an effect on stock prices of these airlines. Since airline jet fuel prices are hedgeable, some investors might find value in an airline's attempt to hedge future prices of jet fuel. That will be the truth only if the use of a hedging strategy is positively correlated with a firm's value. As a result, the underlying price of the airline stock that has a hedging program in place would have higher intrinsic value, as its underinvestment cost is reduced. By the same token, the variability of the stock should be reduced as the price of jet fuel is fixed. Thus, the stock of airlines that engage in hedging is perceived as less risky. The research, contrary

[1] Wall Street Journal (2006)
[2] Wall Street Journal (2006)

to the notion of a positive relationship between hedging and value, shows that hedging is not valued by the investors as reflected in the price of a stock. While using derivatives to hedge jet fuel costs might increase firm value, it is of little importance for investors as their returns do not depend on whether the airline implements the hedging strategy. Individual shareholders are primarily concerned with the cumulative risk exposure of their portfolios rather than with individual stocks.

Literature Review

Recent literature has made progress in understanding why firms may hedge. Most of the research focuses on the notion that hedging increases firm value. Based on the results, one can divide the literature into three distinctive groups. The first group of researchers concludes that hedging results in higher firm value. The second group interprets the hedging as a non-value added activity, while the others argue that hedging creates value only under some circumstances. The three distinctive groups and their findings are described in the paragraphs that follow.

Smith and Stulz (1985) argue that firms can increase value by hedging. They found that by reducing the probability of bankruptcy, hedging can increase firm value. This effect is larger for firms with higher costs of financial distress. Further, Stulz (1996) classifies the failure to invest in valuable projects due to debt as financial distress costs. Froot, Scharfstein, and Stein (1993) build on the Smith and Stulz model, illustrating the value of hedging for firms facing financial constraints. In his research, he found that hedging is more valuable to firms as investment opportunities are inversely correlated with the risk factor's cash flow. In the other words, hedging reduces the need to access outside capital during the periods it is most expensive.

Carter, Rogers, and Simkins (2002, 2006) find that airline industry investment opportunities correlate positively with jet fuel costs, while higher fuel costs are consistent with lower cash flow. The results of their studies show that jet fuel hedging is positively related to airline firm value, as it comes from reduction of underinvestment costs. However, the model used by Carter, Rogers, and Simkins might not be applicable in the case of the airline industry and it can yield inaccurate results. The standardized monthly market model used in their studies has been applicable to currency and gold price exposure to risk. It has not yet been determined that this model can accurately predict the airline exposure to jet fuel price changes. Another potential problem in the Carter, Rogers, and Simkins studies can be found in the variables used in the model. The CRSP value-weighted market portfolio might be a poor estimate of the market return. Most of the investors base their financial decisions on more general indexes like the S&P 500[3]. In addition, using the change in jet fuel price might not adequately reflect the airline industry as jet fuel contracts do not exist in the United States[4]. In reality, futures on crude oil are used to hedge jet fuel purchases. This relatively small change in the variables might have an impact on the model. Also, the study done by Carter, Rogers, and Simkins does not address periods of low jet fuel prices. According to Energy Information Administration a gallon of jet fuel was traded at $0.62 on January 2, 1996, compared to $1.78 on December 30, 2005. It yet has to be determined that jet fuel hedging adds value when the jet fuel prices drop.

[3] Jin and Jorion (2004)
[4] Morell and Swan (2005)

Jin and Jorion (2004) found that, although hedging reduces the firm's stock price sensitivity to oil and gas prices, it does not affect the market value of the firm. Contrary to Carter, Rogers, and Simkins, they use the S&P 500 as the stock market index and the futures contract for oil in their model. Thus, the two factor model provides for a more realistic approach in measurement of the price exposure. However, Jin and Jorion exclude credit rating as one of the factors in their studies. Since hedging requires financial commitment, credit worthy firms are more likely to hedge. This can create some distortion in the results as indicated by Allayannis and Weston (2001) who find a positive relation between currency hedging and Tobin's Q. The difference between the studies can be attributed to the commodity risk exposure itself. Some investors might find it relatively easy and inexpensive to hedge their own risk. It yet has to be determined how investors perceive the jet fuel exposure risk.

Morrell and Swan (2005) find in their studies weak empirical justification behind hedging. According to the researchers, hedging on average smoothes or exacerbates airline profit cycles, but it depends on the time period used in the research. The only time it would create exceptional value is when an airline is on the verge of bankruptcy, a theory difficult to believe. Airlines close to bankruptcy simply are not creditworthy and cannot obtain funds for the margin requirement. In conclusion, Morrell and Swan state that hedging is a signal to investors that management is technically alert. Although it cannot be explained by a mathematical or economic model, it can be just the psychology of the market that pushes airline hedging. Thus, there is no clear link between jet fuel hedging and market value of the firm as there are too many simultaneously operating factors.

Industry

The US airline industry presents a good environment to measure the risk exposure due to changes in jet fuel prices. Fuel price risk is omnipresent across the industry. Because fuel prices are more volatile than other airline costs, hedging stabilizes overall costs and profitability. Also, it is not possible in the short run to pass the higher fuel prices on to passengers due to the highly competitive nature of the industry. The underlying implications are that hedging reduces risk exposure due to changes in jet fuel price and maximizes firm's value. Maximization results in higher stock prices, because investors perceive risk as a cost. To mitigate the risk and prevent swings in operating expenses and bottom-line profitability, airlines engage in hedging using various instruments[5].

The plain vanilla energy swap is an agreement whereby a floating price is fixed over a certain period of time. This transfer does not require the physical item and is not reported on the balance sheet. The contract is settled by transfer of cash, which is determined as the difference between fixed and floating prices. Similar to plain vanilla, a differential swap is based on the difference between a fixed differential for two different commodities and their actual differential over time. Thus, the airline can hedge by use of a commodity other than jet fuel price. Differential swaps eliminate the risk that jet fuel prices will increase more than the underlying commodity.

A call option is the right to buy the underlying asset at a predetermined price at a time up to the maturity date. Generally, over-the-counter options are settled in cash, while exchange-traded oil options on NYMEX are exercised into future contracts.

[5] Carter, Rogers, Simkins (2001)

Oftentimes, the settlement price is based on the average price for a period. Because call options are relatively expensive due to the volatility of energy commodities, many airlines use zero-cost collars instead.

A collar is a combination of a put option and a call option, where the put option is sold at the strike price below the current commodity price and the call option is purchased at a strike price above the current commodity price. The collar option provides protection from upward movement in the prices of the underlying commodity. The premium received from the sale of put option helps offset the cost of the call option. Also, the airline locks the price between the minimum and maximum over the period of time the options are outstanding. When the price received from the sale of a put option equals the price paid for call option a “zero cost collar” results. Using a zero-cost collar does not require upfront expense cost.

A futures contract is an agreement whereby a buyer and seller commit to buy or sell a specified quantity and quality of a commodity at specified price at the future date. The seller who takes a short position agrees to deliver the commodity. The buyer takes a long position and agrees to purchase the commodity. Forward contracts are similar to futures, but with exceptions that they are standardized and traded on organized exchanges. While futures might require daily payment of price adjustments, forwards are settled at the maturity date. Thus, futures and forwards can be used by the airlines as a tool that mitigates the risk exposure of jet fuel price changes[6].

Derivative Accounting

[6] Carter, Rogers, Simkins (2001)

To better understand how investors perceive hedging, it is necessary to discuss how derivatives are accounted for. The Financial Accounting Standard Board issued Statement 133 that requires the recording of changes in the derivative's fair value to be recorded in either the income statement when realized or as "other comprehensive" income. As a result, derivative instruments are presented at fair market value on the balance sheet, but any unrealized changes in net market value are not reported on the income statement. Also, hedging effectiveness takes into consideration historical performance of the airline and anticipated future performance. This helps to determine if the hedges are deemed to be effective. Although it is beyond the scope of this study to explain in depth all the accounting behind derivatives, it is important to know that any amount of jet fuel hedged that is not consumed by the airline in a given period will appear as a charge on the income statement. Thus, the airlines never hedge the entire 100% of their fuel needs[7].

Data

The analysis is performed on publicly held US major passenger airlines between the years 1996 and 2005. The 10-K filings of these firms provide the data regarding fuel hedging as a percentage of next year's fuel requirements, fuel as a percentage of operating expense, and total asset value. The daily spot price of jet fuel and crude oil was obtained from the Energy Information Administration, while the daily stock prices of airlines were downloaded from the Yahoo Finance Database. The following nine airlines are included in the study: American Airlines, Southwest Airlines, Delta Air Lines,

[7] Carter, Rogers, Simkins (2001)

Northwest Airlines, Continental Airlines, Alaska Air Group, US Airways Group, Airtran Holdings, and JetBlue. Seven airlines disclose adequate levels of data for the analysis, while US Airways Group's daily stock price was not accessible and JetBlue trading history does not go beyond year 2002.

The airlines' 10-K filings and management discussion of operations suggests that fuel price risk is of significant importance. For the full sample of firm observations, fuel costs averaged 16.29% of operating expenses between 1996-2005 (See Table One). The percentages range from 13.8% (Delta Air Lines) to 23.57% (Airtran Holdings). The sample's hedging as a percentage of next year's fuel requirement averaged 26.91% for the period 1996-2005 (See Table Two). The percentage ranges from 4% for Airtran Holdings to 60.80% for Southwest Airlines. While all airlines hedged during the entire study period, only American Airlines, Southwest Airlines, US Airways Group, and JetBlue always had hedges in place at the end of every year covered in the studies. The data also reveals wide variations in the amount of fuel hedged by each airline. Although, there has been movement among airlines to increase the maximum length of hedging horizons, the majority of them do not use derivatives with a maturity in excess of one year.

In addition to 10-K filings, the analysis takes into consideration any airline bankruptcy proceedings. Currently, airlines are allowed to file for Chapter 11 bankruptcy in order to restructure and reorganize, while being protected from the creditors. Additional competitive pressure is therefore experienced by the airlines that do not operate under Chapter 11. As one observer noted: "Chapter 11 allows airlines to go into file [sic] for bankruptcy, put its house in order, cut costs and therefore rival other airlines who in turn end up in bankruptcy because they had to cut costs in order to keep up with the competition."[8] As Barla and Koo (1999) find in their studies, bankrupt airlines are able to lower their operating costs and these cost reductions are partially translated into lower prices. Thus, price competition in the highly competitive airline industry contributed to the financial losses. Airlines might consciously elect not to hedge, as the future price increases in jet fuel might be offset by bankruptcy court-approved rejections of onerous or costly contracts. As a result, bankrupt airlines that restructured their labor and other contracts might have an advantage over the airline(s) that did not file for Chapter 11.

Analysis

So far, it can be noted that the airline industry appears to view volatile jet fuel prices as a source of risk exposure. Next the model that takes into consideration jet fuel return factor is developed. For each firm-year in the sample, the following time-series regression is estimated using daily data points:

$R_{et} = \alpha + \gamma R_{ejt} + \beta R_{emt} + \varepsilon_t$

where R_{et} is the total stock rate of return for firm in day t, R_{ejt} is the percentage change in US Gulf Coast Kerosene – Type Jet Fuel spot prices obtained from the Energy Information Administration, R_{emt} is the daily rate of change in the stock market index, represented here by the S&P 500 index, and ε_t is the idiosyncratic error term.

The regression analysis of American Airlines reveals the following results: $R_{et} = 0.00062 – 0.18R_{ejt} + 1.48R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). With an R-square of 19%, the model is limited in its ability to

[8] Wharton Business School

explain changes in the return of stock prices of American Airlines. This would seem reasonable, as American Airlines hedged its expected fuel requirements for all the years in the study period. Therefore, its stock price should be less responsive to changes in jet fuel prices. In addition, its consumption of fuel as percentage of operating expenses is below the average. The analysis uses the following assumption to measure fuel-efficiency. Airlines control their own expenses, but cannot control their revenues due to the highly competitive nature of the industry. Airlines engage in hedging to reduce fuel expenditures and increase fuel-efficiency as measured by the percentage of operating expenses. It should be stated this assumption does not consider whether the airlines use less fuel per dollar of revenue, or simply are less efficient in controlling other costs as compared to its competitors. Other variables used to measure fuel efficiency include gallons per passenger mile or expenditures per passenger mile. Since American Airlines is more fuel-efficient compared to the average airline as measured by the fuel expense as percentage of operating expense, it is rational that its stock price is not as vulnerable to jet fuel price changes. American Airlines never has filed for bankruptcy, thus it can be perceived by investors as a more stable firm. This might explain why the regression equation explains only 19% of the variation in the stock price, using the percentage changes in jet fuel and S&P 500 as the independent variables.

The regression analysis of Southwest Airlines shows the following results $R_{et} = 0.00052 - 0.04R_{ejt} + 0.98R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). While an R-square of 21% suggests this model is somewhat better than the American Airlines model, it is still limited in its ability to explain changes in the return of stock prices of Southwest Airlines. Similarly to American Airlines, Southwest Airlines hedged its expected fuel requirements throughout the study period. The airline had hedged significantly more than any other airline in the studies consulted. In addition, Southwest's consumption of fuel as percentage of operating expenses is below the average. Both of these factors have a direct effect on the vulnerability of the stock price to fuel cost swings. Southwest did not file for bankruptcy either and can be perceived by investors as the airline most capable of swallowing margin calls on fuel futures contracts. This might explain the 21% R-square, as other factors like a homogenous fleet can help keep the costs under control.

The Delta Air Lines analysis produced the following outcome: $R_{et} = 0.0011 - 0.11R_{ejt} + 1.26R_{emt} + \varepsilon_t$ (See Table Four). As before, the coefficients are significant at α=.10 (two tailed test). Delta's R-square of 16% is somewhat disappointing in its ability to explain the variations in the stock price returns of this airline. During the study period, Delta hedged its expected fuel requirements annually with the exception of one year. On average, the airline hedged significantly more of its fuel use than any other airline in the studies. Amazingly, Delta has hedged more than American and less than Southwest. Consistent with the theory that hedging has an impact on stock variability, Delta's jet fuel coefficient falls between that of American and Southwest. In addition, Delta Air Lines' consumption of fuel as percentage of operating expenses is the lowest in the sample. Both of these factors have direct effect on the vulnerability of its stock prices. Delta Air Lines did file for Chapter 11 bankruptcy protection in the fall of 2005 and can be perceived by investors as a less creditworthy firm. Thus, the airline might not face some increased stock variability due to the uncertainty of its future.

The regression analysis of Northwest Airlines reveals the equation $R_{et} = 0.0013 - 0.06R_{ejt} + 1.33R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). With an R- square of 14%, the model is significantly less useful to explain changes in the return of stock prices of Northwest Airlines. The small jet fuel coefficient seems unreasonable, as Northwest Airlines is a below-average hedger, compared to the other airlines. Nevertheless, its stock prices are less responsive due to changes in jet fuel prices. In addition, its consumption of fuel as a percentage of operating expenses is above the average. Since Northwest is less fuel-efficient compared to the average airline, one needs to seek some other explanation to determine the reason for the lower vulnerability in stock prices. Northwest, like Delta Air Lines, was during part of the study period in Chapter 11 bankruptcy proceedings. Thus, benefiting from the court protection, the airline could reorganize its debt structure. Also, as can be seen from the data, Northwest hedged during the years with low jet fuel prices, but did not hedge in the years where jet fuel prices were high. Thus, Northwest's successful hedging strategy allowed the airline to enjoy the low vulnerability of its stock prices.

Continental Airlines' regression equation is $R_{et} = 0.0004 - 0.10R_{ejt} + 0.99R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). The R-square of 10% is yet again disappointingly weak. This appears counterintuitive, as Continental Airlines did not hedge its expected fuel requirements for every one of the years in the study period. Therefore, we would expect its stock price to be more responsive due to changes in jet fuel prices. In addition, similar to Northwest, its consumption of fuel as a percentage of operating expenses is above the average. Since Continental Airlines is less fuel efficient compared to the average airline, it is strange that its stock prices are not as vulnerable to jet fuel changes. Continental Airlines twice filed for Chapter 11 bankruptcy protection prior to the study period. However, like Northwest Airlines, Continental did not hedge during the years when the jet fuel price was the highest. The successful hedging strategy might have contributed to the stabilization of its stock prices.

The regression analysis for Alaska Air Group shows that $R_{et} = 0.004 - 0.06R_{ejt} + 1.08R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). The R-square of 21% is somewhat more robust in explaining jet fuel returns changes compared to the case of other airlines. Although Alaska Air Group did not hedge between 1996 and 2000, it implemented a hedging program thereafter. Nevertheless, its average hedging as a percentage of next year's fuel requirements is below that of the study sample. It is difficult to explain why its jet fuel coefficient is so relatively small compared to other airlines. A simple explanation could be that Alaska Air Group implemented a program during the time when jet fuel prices increased from $86.50 to $171.58 in nearly twelve months. Alaska Air Group, like Northwest, has fuel as a percentage of operating expenses above the average. However, the airline has never pursued a Chapter 11 filing.

The regression analysis of US Airways is of limited benefit, since insufficient data points are available to perform the calculation for the entire study period. The limited results show that $R_{et} = 0.008 - 0.28R_{ejt} + 1.35R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). The R-square of 16% suggests that there are many other factors besides jet fuel and S&P 500 that might explain the fluctuation in the stock prices. Available data for US Airways shows that only 4% of its fuel requirements were hedged. In turn, that resulted in a significantly higher jet fuel correlation, in contrast with the other airlines. However, US Airways controlled its fuel costs more effectively than the average airline. Its fuel expenditure as a percentage of operating expenses was below the average for the study period. US Airways filed for bankruptcy once during the study period and disposed quickly of those aircraft in its fleet with the highest seat-mile costs.

The regression analysis of Airtran supplied this result: $R_{et} = 0.0006 - 0.04R_{ejt} + 0.61R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). The R-square of 2% is small to the point of meaninglessness. Worth noting is that Airtran hedged a percentage of its fuel requirements similar to that of American Airlines. Nevertheless, we encounter a model with no fit. Therefore, there must be some other explanation behind the fluctuations of stock prices of Airtran. During the study period, Airtran did not file for bankruptcy protection and its fuel expense as a percentage of operating expenses was the highest of all airlines in the studies, a testimony to its ability to control costs in other departments.

The regression analysis of JetBlue should be used with caution in comparison with the airline's peers, since it was not publicly traded prior to the year 2002. From the available data, the following result was obtained: $R_{et} = 0.0006 - 0.02R_{ejt} + 0.16R_{emt} + \varepsilon_t$ (See Table Four). The coefficients are significant at α=.10 (two tailed test). R square 0.4% does not explain the fluctuation in the price of JetBlue stock as the dependent variable is not explained by a model with an R-square of 0.4. We note that JetBlue Airlines never has filed for bankruptcy and has had a hedging program in place from the inception of the airline in 2003. Significant is that JetBlue uses the youngest air fleet of all majors. Still, its fuel use as percentage of operating expenses was much greater compared to other airlines during the most recent years recorded.

An Alternate Route

The research shows that, on average, airlines' stock prices are negatively correlated to changes in jet fuel prices. Therefore, the hypothesis of an inverse relationship between airline stock prices and the price of jet fuel finds statistical support. As has been demonstrated by the regression analysis**,** hedging apparently does not have an effect on the sensitivity of airline stock prices to fluctuations in jet fuel prices. However, we need to caution that this relationship rarely depends solely on the proportion of next year's fuel requirement hedged. Successful hedging involves correct estimation of future pricing (e.g. that the actual market price will be higher than the strike price on the day of delivery). The percentage proportion of fuel requirements hedged is not the only factor that may exert significant influence on the movement of an airline's common stock. Looking at daily returns of jet fuel and stock prices, we do not find a significant correlation that can be used to support the theorized sensitivity**.** The suggestion for further research is to focus on qualitative not quantitative research. Often, investors make their decisions in context of their portfolios, beyond simply a fixed body of data used by researchers to explain correlation between hedging and firm value.

Conclusion

The apparent logical explanation for these results is that investors seek to earn abnormal returns and beat the average return in the market. If no analyst can beat the passive strategy, investors will not spend their time and resources on the analysis. Instead, they will adopt less expensive passive strategies. The resulting opportunity will create a situation where investors can earn abnormal profits. The critical assumption is that investors make their own decision about how to manage their money. Thus, rational investors who want to beat the average return on the market will not choose to invest in the companies that spend their cash flow on hedging. Simply, hedging, like combinations of puts and calls, reduces the range of possible profits and returns for investors. Also, hedging strategy requires cash commitments that could be redistributed in dividends to the investors. Therefore, investors might be less concerned with the fluctuation of jet fuel prices, as they hold stock of airlines with no hedging strategy, anticipating earning abnormal returns.

Most airlines use hedges to some extent to limit their jet fuel risk exposure. Few cover more than one year's expected requirements and it is not possible to find an airline with more than 85% of future needs hedged. There is not a reason that would contradict the economic fundamentals of hedging; airline stock returns are negatively related to percentage changes in jet fuel prices, on average. Even a hedging strategy in place does not seem to have any significant effect on airline stock returns. This might be because the investors, when selecting their portfolio, seek a combination of stocks that will reduce the overall risk exposure of the portfolio rather than the risk inherent in this or that individual firm. Investors are in a better position to hedge any residual exposure independently. Also, the return on jet fuel prices might be a poor or inappropriate indicator. Since airlines use derivatives to hedge their risk exposure, the spot prices of these instruments would be more useful in the model. However, such prices are not presently available as hedging contracts are negotiated on a case-by-case basis. It has yet to be determined that hedging affects perceived firm value. If that were the case, all the airlines would hedge the maximum amount of future fuel requirements to maximize their value. As we have seen**,** the airline industry does not follow that practice. More importantly, airlines focus on successful hedging, the one that will keep their jet fuel cost under control during periods of commodity price turmoil and run-ups.

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Appendix A

TABLE I Fuel expense as % of operating expense

Date	American Airlines	Southwest Airlines	Delta Air Lines	Northwest Airlines	Continental Airlines	Alaska Air Group	US Airways Group	Airtran Holdings	JetBlue	Total Average
1996	13.50%	17.80%	13.00%	14.80%	13.30%	16.00%		21.71%		
1997	12.90%	15.00%	14.00%	14.30%	14.00%	14.50%		21.47%		
1998	10.70%	11.20%	12.00%	10.90%	10.20%	11.40%		16.70%		
1999	10.60%	12.50%	11.00%	11.60%	9.70%	13.30%		26.00%		
2000	14.10%	17.40%	13.00%	16.50%	15.20%	17.40%		25.90%	14.00%	
2001	13.90%	15.60%	12.00%	15.00%	13.50%	14.30%		22.90%	14.20%	
2002	12.50%	14.90%	11.00%	12.70%	12.10%	13.10%		22.00%	14.40%	
2003	14.00%	15.20%	13.00%	14.50%	14.50%	14.50%	11.00%	21.50%	17.80%	
2004	19.20%	16.70%	16.00%	18.70%	15.90%	20.00%	13.40%	24.60%	22.10%	
2005	24.20%	19.80%	23.00%	23.72%	26.70%	24.00%	20.00%	32.90%	29.50%	
Average	14.56%	15.61%	13.80%	15.27%	14.51%	15.85%	14.80%	23.57%	18.67%	16.29%

TABLE II Hedging as a % of next year's fuel requirement

Date	American Airlines	Southwest Airlines	Delta Air Lines	Northwest Airlines	Continental Airlines	Alaska Air Group	US Airways Group	Airtran Holdings	JetBlue	Total Average
1996	22.00%	30.00%	8.00%	0.00%	24.00%	0.00%		0.00%		
1997	28.00%	25.00%	17.00%	0.00%	24.00%	0.00%		0.00%		
1998	40.00%	30.00%	82.35%	28.00%	24.00%	0.00%		0.00%		
1999	48.00%	77.00%	80.00%	10.00%	25.00%	0.00%		66.60%		
2000	19.00%	56.00%	80.00%	24.00%	24.00%	0.00%		22.00%		
2001	40.00%	80.00%	51.00%	6.00%	23.00%	23.00%		40.00%		
2002	40.00%	60.00%	56.00%	2.00%	0.00%	24.00%		30.00%		
2003	32.00%	83.00%	65.00%	60.00%	23.00%	20.00%		41.00%	45.00%	
2004	15.00%	82.00%	8.00%	0.00%	0.00%	33.00%		29.00%	40.00%	
2005	5.00%	85.00%	0.00%	6.00%	0.00%	28.00%	4.00%	28.00%	20.00%	
Average	28.90%	60.80%	44.74%	13.60%	16.70%	12.80%	4.00%	25.66%	35.00%	26.91%

TABLE III Bankruptcy proceedings

Date	American Airlines	Southwest Airlines	Delta Air Lines	Northwest Airlines	Continental Airlines	Alaska Air Group	US Airways Group	Airtran Holdings	JetBlue
Before the study period	0	0	0	0	1	0	0	0	0
During the study period	0	0	1	1	0	0	1	0	0
Currently in the bankruptcy	0	0	1	1	0	0	0	0	0

Table IV Individual Statistics

American Airlines

	R Square	*F*	*Significance F*
	0.188648875	289.8262105	6.7425E-114

	Coefficients	*t Stat*	*P-value*
Intercept	0.000615632	0.824549677	0.409706184
Jet Fuel	-0.181776311	-6.754280666	1.78008E-11
S&P 500	1.47772549	22.93488702	8.8202E-106

Southwest

	R Square	*F*	*Significance F*
	0.208383928	328.1269486	3.151E-127

	Coefficients	*t Stat*	*P-value*
Intercept	0.000518731	1.163077025	0.244909567
Jet Fuel	-0.041558439	-2.585068909	0.009792258
S&P 500	0.978170367	25.41490107	6.6741E-127

Delta

	R Square	*F*	*Significance F*
	0.156186442	230.7220578	1.16483E-92

	Coefficients	*t Stat*	*P-value*
Intercept	-0.001157751	-1.649930824	0.09908306
Jet Fuel	-0.115638541	-4.571930206	5.06848E-06
S&P 500	1.263729064	20.86949705	2.82334E-89

Northwest

	R Square	*F*	*Significance F*
	0.138394952	200.2185432	2.29993E-81

	Coefficients	*t Stat*	*P-value*
Intercept	-0.001305938	-1.683736387	0.092357819
Jet Fuel	-0.061533276	-2.200939088	0.027831698
S&P 500	1.327213417	19.82895257	2.2652E-81

Continental

	R Square	*F*	*Significance F*
	0.102497617	142.3542513	2.87666E-59

	Coefficients	*t Stat*	*P-value*
Intercept	0.000446989	0.631168194	0.527988418
Jet Fuel	-0.104339374	-4.087357666	4.50113E-05
S&P 500	0.994002958	16.26458975	1.3044E-56

Alaska

	R Square	*F*	*Significance F*
	0.211254225	333.8571192	3.4043E-129
	Coefficients	*t Stat*	*P-value*
Intercept	0.000368678	0.753845519	0.451013179
Jet Fuel	-0.05579474	-3.16500598	0.001569499
S&P 500	1.078719622	25.55941335	3.5768E-128

US Airways

	R Square	*F*	*Significance F*
	0.16155612	5.780570064	0.005060809
	Coefficients	*t Stat*	*P-value*
Intercept	0.008297535	2.743348874	0.008007474
Jet Fuel	-0.27681979	-2.198109202	0.031810509
S&P 500	1.345778271	2.956769605	0.00444018

Airtran

	R Square	*F*	*Significance F*
	0.028551789	36.63582376	2.08256E-16
	Coefficients	*t Stat*	*P-value*
Intercept	0.000610366	0.730496593	0.465155336
Jet Fuel	-0.040920021	-1.35865791	0.174377931
S&P 500	0.606773929	8.41515668	6.51761E-17

JetBlue

	R Square	*F*	*Significance F*
	0.004133312	1.913365206	0.14816845
	Coefficients	*t Stat*	*P-value*
Intercept	0.00065754	0.706341633	0.480154157
Jet Fuel	-0.024121895	-0.6780922	0.497883373
S&P 500	-0.159144393	-1.868373725	0.062026949