

Research on Airline Fuel Hedging Strategies-Case Analysis and Strategy Design

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Abstract. The paper examines the impact of soaring international oil prices since 2000, especially on the airline industry, which is highly sensitive to fuel costs due to its significant share in operational expenses. The volatility in fuel prices, driven by various factors including geopolitics and market demand, has compelled airlines to adopt risk management strategies, such as financial hedging and technological innovations, to safeguard against unpredictable price swings and secure their profitability. A notable instance highlighted is the 2008 oil price crash, which resulted in a drastic reduction in fuel expenses, benefiting airlines, although those with hedging positions faced losses. Contrastingly, Southwest Airlines demonstrated financial resilience through effective hedging, which is the focus of this paper. The study delves into Southwest Airlines' strategic use of hedging mechanisms, like call options and collar structures, attributing its low-cost strategy success to these practices. Furthermore, it contrasts Southwest's hedging techniques with Delta Air Lines', providing insights for a customized hedging approach for Delta. Utilizing simulation analysis on historical oil prices and airline operational data, the research emphasizes the importance of aligning hedging strategies with market conditions and forecasts, aiming to offer guidance for airlines on proficient jet fuel hedging.

Keywords: Fuel; hedging; strategy design

1. Introduction

Amidst fast-paced global integration, the aviation sector is facing the challenges of unpredictable economic fluctuations and geopolitical changes. The stability of operations in this industry heavily relies on the cost of aviation fuel. This paper examines the intricacies of aviation fuel hedging, which is a financial strategy used by airlines to protect themselves from the unpredictable changes in oil prices that have a significant impact on their financial performance. The study focuses on the strategy adopted by pioneers such as Southwest Airlines during the instability caused by the 2008 financial crisis, with the goal of clarifying the function of financial derivatives in the airline industry.

The research extensively explores the successes and difficulties of airline hedging strategies in the face of market speculation and regulatory influences, aiming to establish a comprehensive comprehension of hedging as a tool that can offer protection while also carrying risks. The paper presents a sophisticated hedging strategy for Delta Air Lines, focusing on the sharp decline in oil prices during the COVID-19 pandemic and the sudden increases caused by geopolitical tensions. The results suggest that Southwest Airlines' approach to hedging jet fuel is more stable than Delta's, showing the ability to withstand the unpredictable changes in oil prices and the overall economic conditions. The proposed strategy seeks to navigate the volatility of fuel prices while solidifying a competitive advantage through shrewd financial planning and risk reduction. This academic study aims to bring a new viewpoint to the discussion on managing fuel costs. It provides real-world data and strategic plans that have the potential to change the financial outlook for airlines operating in an uncertain global market. The goal is to enhance the discussion by providing practical information that could impact the decision-making and financial management of current and future participants in the aviation industry.

2. Literature Review

Extensive studies on optimal hedging ratios, term selection, and strategy efficacy are compiled in Futures Hedging Research. Notably, Lin R et al. utilized regression analysis to demonstrate the positive impact of hedging on airline investment value and profitability using fuel hedging data from 1994 to 2003 for domestic airlines in the United States [1]. Based on their analysis of daily trading data for heating oil, Peter et al. determined the minimum variance hedging ratio and recommended three-month heating oil futures as the most effective risk management instrument against fuel price fluctuations [2]. In their study, Ghorbel et al. distinguished the efficacy of contemporary portfolio strategies in fuel hedging from that of conventional approaches [3]. In a similar vein, Hassan et al. Emphasized the superior efficiency of hedging with Brent crude oil futures, highlighting the advantages for airlines' financial performance of cross-hedging with crude and Brent oil futures [4]. In contrast to futures hedging, Option Hedging Research compares and contrasts the fuel hedging practices of Delta Air Lines and Southwest Airlines in terms of their distinct outcomes. The nuanced risk and reward profiles of options, which include European and American varieties, and the approach of integrating multiple options for portfolio management highlight the adaptability of options in contrast to futures hedging. Carter reflected on the successful jet fuel option hedging of domestic airlines in the United States from 1992 to 2003, emphasizing the role of hedging in enhancing corporate value [5]. Additional research conducted by Bajo et al. and Capinski et al. examined the effects of production and basis risk, as well as the similarity of hedging effects between dynamic weighting strategies and options, respectively [6]. Yin and Han demonstrated an empirical framework that enhances the utility of investors by combining hedging with foreign exchange derivatives and stocks, thereby highlighting the strategic adaptability of options [7]. The focus of hedging and corporate governance research is on the corporate behavior and strategic foundations of hedging activities. A correlation was identified by Ugur Lel between strong corporate governance and a preference for utilizing derivatives to hedge currency risk [8]. Rekik Lilia et al. and Lim and Hong underscored the operational cost advantages that well-governed companies can attain by employing strategic fuel hedging and utilizing derivatives for hedging purposes, respectively, as opposed to engaging in speculation [9-10]. The meta-analysis conducted by Markus et al. highlighted the mutually beneficial association between proactive risk management and improved debt capabilities, which ultimately contributes to industrial value [11]. Hege et al. reached the conclusion that derivatives hedging activities are strengthened by corporate governance reforms, thereby reducing exposure to foreign exchange risk [12].

3. Southwest Airline

3.1. Company Profile

This case study explores how Southwest Airlines navigated the 2008 financial crisis with a sophisticated fuel hedging strategy, contributing to its sustained profitability amidst industry turmoil. Since its establishment in 1967, southwest, a leader in the low-cost carrier model, focused on expanding domestic short-haul routes and achieved notable financial success, even during challenging times such as post-9/11 and the 2005 fuel price hikes. The airline's fuel hedging journey can be categorized into three phases: initial, growth, and maturity. Beginning in the early '90s, Southwest's minimal hedging during the Gulf War laid the groundwork for a comprehensive risk management strategy. By 2000-2008, the airline had increased its hedging coverage to 90%, showing flexibility and foresight by extending hedging durations. This strategy proved crucial during the 2008 crisis. Post-crisis, Southwest further embraced fuel hedging, utilizing over 70 financial derivatives to protect against fuel price volatility, which significantly stabilized and enhanced operational profits. Financial analysis from 2002 to 2008 highlights the critical role of hedging in maintaining Southwest's financial health, demonstrating that without it, the airline could have faced significant challenges (See Table 1).

Table 1. U.S. Southwest Airlines Hedging Ratio 2004-2007.

Year	Plan Hedging Year	Planned hedging ratio	Actual hedging ratio	Year	Plan Hedging Year	Planned hedging ratio	Actual hedging ratio
2004	2005	85%	80%	2006	2007	90%	70%
	2006	65%			2008	65%	
	2007	45%			2009	50%	
	2008	30%			2010	25%	
	2009	25%			2011	15%	
	2006	70%			2012	15%	
2005	2007	65%	85%	2007	2008	70%	90%
	2008	35%			2009	55%	
	2009	30%			2010	30%	
					2011	15%	
					2012	15%	

3.2. Fuel Hedging Instruments

Southwest Airlines has utilized a diverse array of financial instruments to hedge against the fluctuating cost of jet fuel, notably including:

1. Swap Agreements: These contracts have allowed southwest to exchange a variable fuel price for a fixed one over a set period, without the physical exchange of fuel. Specifically, the airline engaged in both plain vanilla swaps for straightforward fixed to float price agreements and differential swaps to manage the price differential between jet fuel and other commodities like heating oil.

2. Options Contracts: The airline has strategically purchased call options, providing the right but not the obligation to buy jet fuel at a predetermined price before a specified date. This method was particularly advantageous in protecting against price surges.

3. Collars: Southwest has employed both zero-cost and premium collar strategies. These involve buying a call option to cap the maximum fuel price while selling a put option to set a floor price, effectively bracketing the price of fuel within a predefined range.

4. Futures and Forwards: The airline has also ventured into futures contracts for a standardized agreement to buy fuel at a predetermined price at a future date, and forward contracts for more customizable terms, although not traded on an exchange.

These hedging strategies have historically shielded Southwest Airlines from the brunt of fuel price volatility, contributing to its reputation for financial savvy in the airline industry. The use of swaps and options, in particular, has allowed the airline to maintain operational costs more predictably, translating into competitive pricing strategies and consistent profitability.

However, the airline's reliance on these financial instruments has not been without its challenges, particularly during unprecedented events such as the COVID-19 pandemic. The dramatic decrease in air travel demand led to an "over-hedged" position, prompting the cancellation of some contracts and resulting in financial losses. Despite these setbacks, the strategic use of hedging has overall provided a financial cushion against fluctuating fuel costs.

Comparison with Other Airlines' Hedging Practices, The fuel hedging strategies of Southwest Airlines stand in contrast to those of other carriers, many of which have employed less aggressive or diverse hedging portfolios. The varying outcomes across the industry highlight the significance of strategic risk management in navigating the inherent uncertainties of the aviation fuel market. While some airlines have benefited from similar strategies during periods of high fuel prices, others have faced challenges due to less protective hedging positions or the absence of hedging strategies altogether.

4. Proposed Strategy for Delta Airlines

4.1. Company Profile

Delta Air Lines is an Atlanta-based airline in the United States. It was founded in 1928 and owns the largest hub, Hartsfield-Jackson Airport in Atlanta. Currently, it is the second-largest airline globally in terms of total domestic passenger miles traveled and the size of its passenger fleet. Delta Air Lines is one of the original members of the SkyTeam alliance and serves over 325 destinations across 52 countries on all six continents. The airline has a workforce of 800,000 employees and a fleet of over 800 aircraft. It operates more than 5,400 flights every day and transports 180 million passengers each year.

4.2. Analysis of Delta's Hedging Programme Needs

This comparative analysis underscores the importance of a nuanced approach to fuel cost management, where the selection of hedging instruments must align with broader financial goals and market forecasts. Southwest's experience, despite its challenges, exemplifies the potential benefits of a well-orchestrated hedging strategy in sustaining airline profitability amidst market volatilities. The global outbreak of COVID-19 and its repercussions on the economic landscape have starkly influenced commodity markets, including aviation kerosene. Between 2005 and 2024, the trading prices of aviation kerosene experienced significant volatility. A notable peak in November 2012 saw aviation fuel prices reaching 0.9091\$/liter, followed by a sharp decline to 0.291\$/liter within four years—a 67.99% decrease. The pandemic's onset in 2020 pushed aviation fuel prices to historic lows, with May figures showing a price of just 0.1863\$/liter. This reduction in fuel prices partly mitigated the financial strain caused by decreased travel demand. However, the respite was short-lived as the conflict between Russia and Ukraine in early 2022 led to a resurgence in WTI crude oil prices, crossing \$120 per barrel for the first time since 2014. From 0.2363\$/liter in June 2020 to 1.086\$/liter in July 2022, aviation kerosene prices soared by 359% (See Fig. 1).

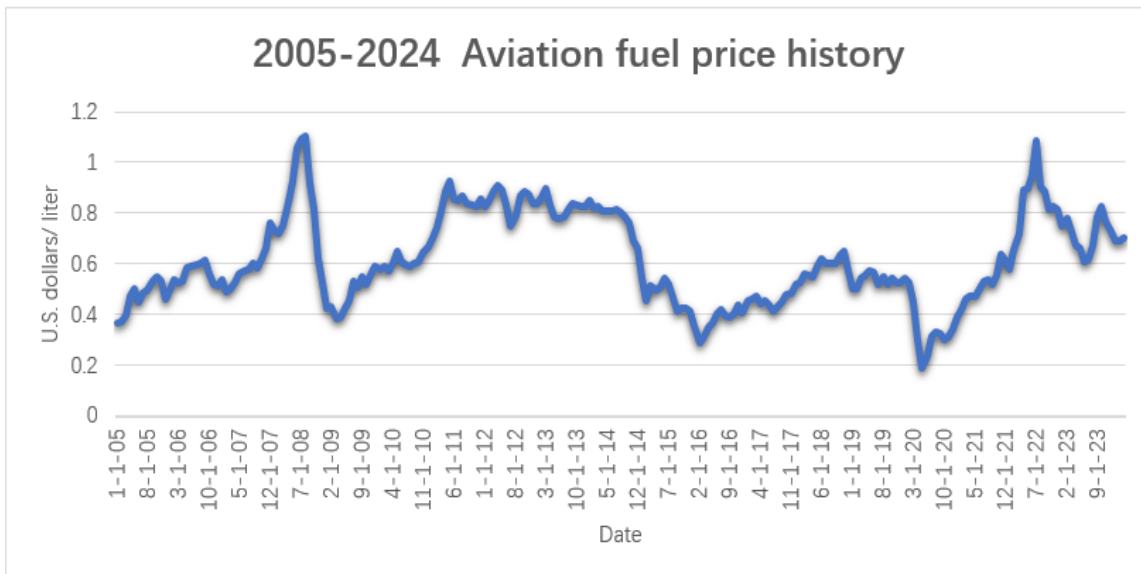


Fig 1. 2005-2024 Aviation fuel price history.

The fluctuating cost of aviation kerosene poses a significant challenge to airline operations, necessitating effective cost management strategies to hedge against fuel price volatility. Historical practices in the aviation industry demonstrate the efficacy of derivative hedging transactions in managing fuel costs. For instance, Delta Airlines could enhance its operational stability by employing sophisticated derivative hedging strategies alongside its existing cost control measures. During the COVID-19 pandemic, the plummet in air travel demand led Southwest Airlines to revise its fuel purchase and consumption forecasts significantly downwards for 2020 and 2021. The airline found

itself "over-hedged" due to its forward-looking fuel demand hedging in the subsequent years. This situation prompted the cancellation of certain fuel hedging contracts related to this period, resulting in financial losses. The uncertain nature of events like a resurgence of COVID-19 makes it challenging to accurately predict future fuel needs and the appropriate quantity of derivatives to purchase. Despite the unfavourable hedging outcomes in 2020, where the cost of hedged fuel and oil expenses exceeded those without hedging, the strategy was instrumental in reducing the company's risk exposure.

The company faced extraordinary challenges in 2020, with a sharp drop in overall operating revenue to \$17,095 million and a significant net loss of \$12,385 million. The harsh effects of travel restrictions and a notable decline in passenger demand were the main contributors to these unfavorable results. The debt-to-asset ratio peaked during the crisis at 97.91%, a sign of higher levels of financial leverage. Delta's third-quarter financial report for 2023 paints a different picture. While the company's total liabilities, at \$65,397 million, are still substantial, its total assets have increased to \$73,497 million. Nonetheless, the business has been able to successfully lower its debt-to-asset ratio to 88.98%, which suggests a stronger financial position. With a remarkable comeback, the total operating revenue now stands at \$28,337 million. This sum not only exceeds the \$17,095 million that was produced in 2020, but it also represents a significant rise over the numbers that were documented in 2022. The airline has recovered from the negative effects of the pandemic, as evidenced by the complete turnaround in net income, which reached \$1,464 million. The strong \$8,100 million in shareholder equity and the 18.07% return on equity suggest a good level of profitability. This stands in sharp contrast to the 2020 observation of -807.37%. In conclusion, the comparison demonstrates Delta Air Lines' resilience to the epidemic and its ability to overcome its obstacles, paving the way for a phase of operational stability and financial recovery (See Table 2).

Table 2. Analysis of Delta Air Lines' Corporate Operations.

Year		2023	2022		2021		2020		2019		2018	
		10-Q	10-Q	10-K	10-Q	10-K	10-Q	10-K	10-Q	10-K	10-Q	10-K
Balance sheet	Total assets	73,497	74,805	72,288	75,309	72,459	72,261	71,966	62,518	64,532	55,796	60,266
	Total liabilities	65,397	70,994	65,706	74,028	68,572	63,571	70,462	48,560	49,174	42,940	46,579
	Debt-to-asset ratio	88.98%	94.91%	90.89%	98.30%	94.64%	87.97%	97.91%	77.67%	76.20%	76.96%	77.29%
Income statement	Total operating revenue	28,337	23,173	50,582	11,276	29,899	10,060	17,095	23,008	47,007	21,743	44,438
	Total operating expense	2,215	735	46,921	11,858	28,013	15,285	29,564	19,860	40,389	19,223	39,174
	Operating Profit	2,215	735	3,661	-582	1,886	-	-	3,148	6,618	2,520	5,264
	Net income	1,464	-205	1,318	-525	280	-	-	2,173	4,767	1,572	3,935
	Shareholder's equity	8,100	3,811	6,582	1,281	3,887	8,690	1,534	13,958	15,358	12,856	13,687
	Return on equity	18.07%	-5.38%	20.02%	-40.98%	7.20%	-	-	15.57%	31.04%	12.23%	28.75%
	Total Profit	1,556	-83	2,467	-369	2,188	-	-	2,304	4,603	1,609	3,837
	EBIT	1,812	-167	1,914	-739	398	-	-	2,853	6,198	2,090	5,151

From Eyden Samunderu's research, this paper can analyze the statistical effects of oil price fluctuations on the industry and the corresponding hedging strategies adopted by airlines to determine the extent to which airlines will engage in kerosene hedging in the future and the potential impact of such hedging on their corporate value and performance [13]. This paper can also learn how the two airlines are affected by changes in global economic trends and oil prices. Regression analysis was used in the study, which covered a sample of airlines between 2008 and 2017. To calculate the effect of yearly fluctuations in oil prices (WTI), multiple regression analyses were performed on two airlines. Delta Air Lines is severely impacted negatively by changes in oil prices. The price of oil's stock declines as prices rise. The performance of Southwest Airlines' stock and fluctuations in oil prices do not significantly correlate. Moreover, there has been little correlation between his stock performance and the expansion of the world economy. Changes in oil prices and the growth of the world economy have less of an effect on the stock prices of these airlines than they do on Delta Air Lines.

4.3. Design of the Company's Hedging Plan

Option hedging operations are intrinsically uncomplicated as option contracts enable buyers to engage in multi-directional operations, enabling them to speculate on both declining and increasing prices. Investors have the option to mitigate their risk by buying option contracts that have opposite directions but equal amounts. When the market price increases, the investor who owns the call option will gain an advantage. Conversely, if the market price decreases, the investor who owns the put option will generate a profit. While there is a financial expense involved in buying option contracts, which can impact overall profits, this approach effectively mitigates the risk encountered by the investor. Options serve as a hedging tool that effectively reduces risk for airlines while also maintaining the potential for future earnings growth for investors, within a defined maximum loss range. When an airline buys an option, the option premium it pays represents the highest potential loss it could experience in a single option strategy. However, if the price of the underlying asset exceeds the strike price, the airline can benefit from all the gains. Nevertheless, when compared to futures, options are a more intricate financial instrument, requiring the consideration of additional factors and variables when developing a hedging strategy.

1. **Crude Oil Futures Strategy:** This strategy is specifically tailored for aviation companies concerned about the potential increase in fuel costs. The company can secure the price of fuel for the upcoming year by initiating long futures contracts at the start of each year and renewing them before they expire. Modifications to the hedging ratio are determined according to predictions of fuel prices and consumption.

2. A call option strategy entails purchasing call options at the prevailing market price, with a strike price that matches the current market price, and refraining from exercising them until they reach their expiration date. This strategy effectively fixes the expense of fuel when prices exceed the predetermined threshold, while also restricting potential losses to the amount paid for the options if prices drop below the threshold.

3. The Bull Spread Option Strategy involves simultaneously holding a call option with a lower strike price and selling a call option with a higher strike price. This strategy presents the opportunity for profit if the price of the underlying asset falls within the range of the two strike prices. It also restricts potential losses to the total cost of the options.

4. The Butterfly Spread Option Strategy involves the combination of three options, either calls or puts that have varying strike prices. The maximum potential loss is restricted to the net cost of the options, while there exists a profit opportunity within a defined range of price fluctuations in the underlying asset.

5. The Straddle Option Strategy involves simultaneously holding a call option and a put option. It gains from substantial price fluctuations in either direction, and the maximum potential loss is restricted to the premiums paid for both options.

Hedging duration selection should consider multiple factors, such as market conditions, company operations, and derivative pricing. The optimal duration should be neither excessively long nor

excessively short. Long-duration options typically have a greater time value, resulting in higher costs. Moreover, extended time periods amplify the challenge of forecasting fluctuations in prices, consequently heightening uncertainty. Margin trading carries the potential risk of requiring additional margin deposits if prices drop below the maintenance margin thresholds, which can impact cash flow and accounting statements. Although short-term trading is prevalent in futures markets, where traders aim to make small profits from rapid trades, it is less feasible in options markets due to factors such as reduced liquidity, a large number of contracts, increased trading expenses, and the possibility of market volatility risks.

Hedging Proportion: The determination of the most effective hedging ratio is a primary area of study and encompasses techniques such as least squares, minimum variance, and error correction models. The information presented in this text is derived from the practical knowledge of Southwest Airlines. The airline company made modifications to its hedging ratios as per the prevailing economic circumstances, predictions of fuel demand, and fuel prices. Southwest Airlines mitigated 63%, 57%, and 15% of its projected fuel consumption for 2017, 2018, and 2019 respectively through hedging. Nevertheless, in 2018 and 2019, the hedged proportions experienced a notable increase, reaching 79% and 77% respectively. Therefore, when determining the amount of fuel to hedge, it is crucial to be acutely aware of changes in fuel prices, take into account the most effective hedging ratios, and be adaptable in adjusting the current hedging ratios based on economic and political circumstances as well as company operational data. Additionally, it is imperative to take into account the expenses associated with hedging and guarantee that the overall losses incurred from the entire position remain within the company's predetermined maximum acceptable loss threshold. The main idea conveyed is that companies, such as Delta Airlines, should embrace a strategic and adaptable approach to hedging, enabling them to make necessary adjustments in response to evolving circumstances. Southwest Airlines is renowned for its effective fuel hedging practices, which serve as a standard for comparison. Instead of restricting itself to a single hedging duration, the company takes a long-term perspective and adapts its approach based on its overall strategic objectives. Likewise, the proportions of hedging are constantly modified to accurately represent the evolving economic environment and the requirements of the company. The crucial aspect is to proficiently handle risks without experiencing unacceptable losses or impeding liquidity as a result of margin calls.

5. Conclusion

The study delves into airline fuel hedging strategies, focusing on Southwest Airlines and Delta Air Lines, to understand how airlines manage the risk of fluctuating oil prices, which significantly impacts their financial planning. It highlights Southwest Airlines' successful use of various hedging techniques, such as call options, collars, and spreads, to maintain its low-cost operational model. This approach has allowed southwest to stabilize operating costs and mitigate the financial risks of fuel price volatility. Conversely, Delta Air Lines' experiences reflect the diversity of hedging practices within the industry and the need for strategies tailored to an airline's specific financial and operational context, especially highlighted during the challenges posed by the COVID-19 pandemic. The research advocates for a strategic, flexible hedging approach aligned with market conditions and long-term forecasts. It posits that the cases of Southwest and Delta offer critical insights for other airlines, emphasizing the integration of hedging strategies into a broader financial risk management framework. The study suggests future exploration in airline fuel hedging should focus on new financial instruments, the persistent volatility of oil markets, and lessons from these case studies to enhance financial stability through strategic hedging.

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