The Application of Financial Derivatives in Corporate Investment Risk Management: A Case Study Analysis Based on Southwest Airlines and LTCM

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Abstract. In today's economic environment, some companies opt to use their surplus funds or operational profits for financial investments to generate additional income beyond their core activities, aiming for rapid growth in cash flow. While some organizations are aware of financial derivatives, fearing they might not only fail to produce profits but also jeopardize their operating income. So, does using financial derivatives help companies earn extra profits, or does it pose a risk to their operations? This paper aims to provide insights on whether companies should incorporate financial derivatives into their investment strategies, assisting them in making better decisions. It examines cases involving Southwest Airlines and LTCM, two companies that utilized financial derivatives. By analyzing risk exposure, speculative opportunities, investment strategies, and outcomes, this paper explores whether derivatives can support effective risk management or if they harm company growth. The case studies show that Southwest Airlines managed to maintain revenue during the 2008 fuel price spike through derivatives, whereas LTCM faced liquidation by the Federal Reserve and went bankrupt. Ultimately, it demonstrates that financial derivatives can help firms mitigate risks and generate additional profits, provided they select appropriate strategies, utilize sound financial models, and keep costs in check

1 Introduction

In modern society, most non-financial and even some financial enterprises choose to use financial derivatives. These derivatives serve as tools not only for hedging but also for speculation [1]. In 2004, the notional value of derivatives exceeded US$200 trillion in both formal and over-the-counter markets [2]. The use of financial derivatives has continued to grow over time. Hedging theory shows that, as a core component of non-financial enterprises' risk management strategy [3], financial derivatives can play an important role in hedging foreign exchange rates, interest rates, or commodity prices. Moreover, the risk of derivatives is relatively low, usually below the overall financial risk exposure, which also explains why enterprises are willing to admit in the questionnaire that they regularly hold derivatives

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positions [4]. Many companies have achieved success using financial derivatives, such as Enron. Although Enron eventually went bankrupt due to many unfavourable factors, its innovation in the field of financial derivatives has become a benchmark for the industry. Some companies abuse financial derivatives and rely on high leverage to grow their businesses, such as Evergrande, which was eventually close to bankruptcy. However, they still chose to use financial derivatives to grow their businesses because when faced with volatile foreign exchange rates and commodity prices, financial derivatives can help companies manage these risks. So, how do they avoid risks during actual operations?

1.1 Practical perspective

In practice, companies may consider the risk of large foreign exchange rate fluctuations when expanding internationally, because they are uncertain about how much profit they will earn after converting sales revenue into the local currency on a specific day in the future [5]. Therefore, most companies choose to sign forward foreign exchange contracts to lock in the exchange rate for future transactions, ensuring that the company's basic profits are protected and thus reducing foreign exchange exposure [6]; similarly, interest rate derivatives are also among the most widely used derivatives by non-financial companies [7]. In the face of uncertain interest rate fluctuations, companies can enter into interest rate swap contracts, exchanging a series of fixed interest rate payments for floating interest rate payments. This strategy helps reduce the risk associated with interest rate changes and may allow companies to earn profits through interest rate swaps. When dealing with commodity prices, some energy companies may opt for derivatives such as forwards and futures to lock in future prices or secure a fixed price for raw materials related to energy, thereby reducing income risks caused by price fluctuations in the energy market.

1.2 Risk management perspective

However, when companies assess the value that financial derivatives can provide, they also consider the risks involved. Only if the estimated benefits outweigh the potential risks will companies decide to use financial derivatives. Additionally, when using financial derivatives, enterprises may face basis risk, which occurs when the hedged items do not match the assets of the derivatives, potentially making the hedging less effective or even causing it to fail [8]; or when hedging, they fail to accurately estimate the hedging ratio that aligns with their corporate capital structure and blindly increase their leverage, risking excessive debt. When market conditions move in the opposite direction, the company's leverage ratio becomes too high, making it unable to repay its debts, which directly causes a decline in the company's credit rating [9]. In the future, a low credit rating will prevent the company from obtaining refinancing from banks or the market, which may lead to an inability to continue operations; when adjusting positions or facing excessive losses, they might not recover margin in time, resulting in forced liquidation, indicating the company's liquidity is insufficient [10]; when using financial mathematical models to analyze market conditions, they tend to ignore extremely low probability events, resulting in a hedging ratio that cannot entirely eliminate risks, and may even increase them. From a risk management perspective, companies should properly use financial derivatives, because many have avoided some risks caused by market fluctuations through derivatives, or start-ups have gained significant benefits by using financial derivatives. However, from the perspective of potential problems that could arise in actual operations, the decision of whether to use them and how to use them correctly remains to be discussed. The company's capital structure is fundamental, and factors such as whether they have stable cash flow, strong debt repayment ability, and high credit ratings that enable them to secure substantial refinancing are all considerations these companies should evaluate.

Therefore, whether enterprises need to use financial derivatives to hedge their risks in their business development and how to use them properly are central issues in this paper. The purpose of this study is to analyze the real role of financial derivatives in corporate risk management, including hedging effects, cost-benefit analysis, and potential risks, and to propose recommendations for optimizing corporate derivatives strategies to balance risk control and profitability.

2 Theoretical review

In the introduction, readers might find that many companies choose to use financial derivatives to hedge potential operational risks. Their decision to adopt financial derivatives is based on hedging theory. What is hedging theory? Its theoretical foundation comes from the price insurance hypothesis proposed by Keynes and Hicks. The hypothesis suggests that risk-averse individuals can transfer price risks through hedging tools, thereby locking in future uncertainties and reducing risks, which provides companies or investors with a more predictable income stream. Companies select hedging based on considerations such as risk management, income stability, and risk transfer. Hedging strategies include futures hedging, which uses futures contracts to protect against market price fluctuations; option hedging, which involves buying put options to guard against asset price declines and call options to lock in future purchase prices; and dynamic hedging, which involves adjusting hedging positions in real-time based on market changes to achieve more precise risk management. What factors influence the implementation of hedging? The first is basis risk—the uncertainty from the difference between spot prices and futures prices, which significantly affects hedging effectiveness. The presence of basis risk means that hedging cannot eliminate price risk, requiring companies to optimize management practices. The second factor is market liquidity; when market liquidity is limited, hedging operations can face higher transaction costs and impact costs [11]. With the principles of hedging theory, readers can better understand the two specific cases this article is about to examine.

3 Case analysis

3.1 Southwest Airlines case

Founded in 1971, Southwest Airlines is the second-largest airline in the United States. It is known for its low costs and is widely praised in the industry for its "low ticket price + high customer satisfaction" model. In the company's total operating costs, fuel costs account for 24% of its operating expenses, second only to labor costs, which is the company's second-largest expenditure. For airlines, fluctuations in the prices of bulk commodities such as fuel or commodity derivatives significantly impact overall operating expenses. Therefore, since 1994, Southwest Airlines has begun exploring fuel hedging to stabilize its fuel cost fluctuations. By 2000, a systematic strategy had gradually been developed, becoming a benchmark in the aviation industry. As mentioned earlier, the aviation industry is highly sensitive to fuel prices. In 2008, international crude oil prices surged to $147 per barrel, and after 2014, fuel prices rapidly declined to $30 per barrel or even lower (Retrieved from 2008 and 2014 International Crude Oil Price List). Facing these short-term increases and decreases, Southwest Airlines must balance cost control with financial stability amid volatile oil prices.

Now examining how Southwest Airlines employs financial derivatives to stabilize costs and mitigate risks amid significant fluctuations: Southwest Airlines first adopted a combination of "futures + options + swaps," including locking in the benchmark demand price for the next 3-5 years via NYMEX crude oil futures and signing futures contracts to secure the right to purchase crude oil at the agreed-upon price in the future, thereby hedging against fuel price fluctuations; regarding options, they buy call options and pay premiums to gain extra returns when oil prices rise, and sell put options to create zero-cost collar options—using premiums from selling put options to buy call options, reducing overall premium costs but accepting the obligation to purchase if oil prices drop below the lower bound (Air China and China Eastern Airlines adopted a "betting agreement" in 2008 by selling call options and buying put options. When oil prices plummeted, they faced large compensation costs for selling call options, making the speculative aspect far outweigh the hedging purpose) ; they also signed fixed-price swap agreements to hedge against extreme volatility risks, agreeing to pay fixed fuel costs in exchange for cash flows based on floating market prices. Additionally, they maintain a flexible, dynamic adjustment mechanism. In 2008, 70% of the fuel demand was locked in at \$51 per barrel, saving \$1.1 billion when oil prices peaked at \$140 that year (Retrieved from Southwest Airlines 2007 Annual Report, Fuel Risk Management Chapter). Simultaneously, the hedging ratio was adjusted flexibly according to market conditions. After oil prices fell in 2008, the company reduced its hedging position from 2009 to 2013. In 2023, the hedging ratios for fuel demand from 2024 to 2026 were 58.8%, 48%, and 16.64%, respectively (Retrieved from Southwest Airlines 2023 Annual Report, Fuel Derivatives Contract Details), clearly demonstrating its forward-looking market strategy. The third aspect is innovation in risk management. For the issue of insufficient liquidity in aviation fuel, Southwest Airlines chose to use futures contracts of substitutes like WTI crude oil and Brent crude oil to replace aviation fuel futures contracts. At the extension level, Southwest Airlines also has unique insights, splitting long-term hedging into rolling contracts to adjust positions every quarter based on market conditions, such as dividing five-year hedges into 20 quarterly contracts, and dynamically increasing or decreasing coverage according to oil price trends. It is precisely because of Southwest Airlines' exceptional financial derivatives strategy that, in 2008—a year when the U.S. aviation industry was at its lowest—Southwest Airlines' hedging income covered 98% of the additional costs, saving up to \$11 billion (Retrieved from Southwest Airlines 2008 Annual Report, Notes to the Income Statement), making it the only profitable airline in the world and continuing its 36-year streak of consistent profitability.

Why was Southwest Airlines able to hedge against the risk of fuel price fluctuations in 2008? From the entire case, it is clear that Southwest Airlines used a combination of multiple derivatives in their financial strategies and did not rely on a single derivative alone. The proportion of each was also consistent with the company's capital structure at the time, enabling them to hedge risks effectively with this mix. Additionally, their dynamic adjustment mechanism was highly responsive, allowing them to swiftly detect market fluctuations and promptly adjust their derivative investments. These two factors explain why they were the only ones to successfully hedge while their peers relied solely on financial derivatives strategies.

3.2 LTCM case

Long-Term Capital Management (LTCM) was founded in 1994 by Nobel Prize winners in economics, Merton and Scholes, along with many Wall Street trading elites. The company's assets under management peaked at \$4.8 billion in 1997. Its core strategy was "convergence trading", which utilizes mathematical models to identify and profit from price differences in the bond market, achieving an average annual return of 40% from 1994 to 1997. However, in 1998, Russia's debt default triggered a chain reaction, ultimately leading to LTCM's loss of more than \$4.6 billion in one month and its forced liquidation by the Federal Reserve.

In terms of specific operations, LTCM initially attempted to short German government bond futures and long Italian government bond futures, betting on the convergence of interest rate spreads after the euro's launch and locking in spreads through swaps. At the same time, it held a position in the spread between US 30-year government bonds and mortgage bonds, and sold S&P 500 volatility options when the market volatility was predicted to be 19% according to the model. However, the company did not account for political risks. The Russian debt default in 1998 first led to a spread in risk aversion, causing the interest rate spread between Germany and Italy to widen; interest rate swap losses accounted for 35% (Retrieved from Federal Reserve Crisis Assessment Report, Loss Attribution Analysis). Secondly, the Russian debt default caused the volatility to soar to 27%, and it directly lost $1.3 billion in options. The second is choosing repurchase financing to increase leverage. LTCM used repurchase agreements to finance at zero discounts and used $2.8 billion in principle to control a $1.25 trillion position (Retrieved from 1998 Federal Reserve Liquidation Report, Notes to LTCM Balance Sheet), resulting in a leverage ratio of 453 times. Although high leverage can magnify returns from a speculative perspective, losses of only 5% would trigger a margin call. In 1998, the company lost $4.6 billion in a single month, its liquidity was exhausted, and it became impossible to cover its positions. The third issue is flaws in risk control. Although the Var model assumes the market follows a normal distribution, it does not consider the "fat tail effect", and the actual loss far exceeds the prediction of the 99% confidence interval; its risk stress test model also fails to account for sudden increases in asset correlation, leading to the diversification of the portfolio. Financial derivatives cannot effectively hedge risks.

So why did LTCM not successfully hedge its position using financial derivatives? First, readers must acknowledge that its use of derivatives was appropriate, but it failed to consider the possibility of low-probability events like political developments during the specific implementation process. Over-betting on a particular asset led to significant losses. Second, it relied too heavily on historical data when applying financial models for analysis, making it impossible to assess current risks accurately and ultimately resulting in a failed hedge.

3.3 Comparison

Comparing these two cases to observe the difference in the risk control levels they use in financial derivatives. In terms of leverage, Southwest Airlines has almost no leverage and only needs to pay premiums, without worrying about the possibility of liquidation under high leverage, while LTCM's leverage ratio averages 30 times, reaching up to 453 times at its peak, which easily triggers a crisis. Regarding liquidity management, Southwest Airlines uses liquidity extension and alternative hedging methods. Not only can it adjust position sizes in a timely manner, but it can also address issues like insufficient aviation fuel futures contracts. Meanwhile, 98% of LTCM's positions are over-the-counter derivatives, which cannot be closed and carry unlimited risks. For stress testing, Southwest Airlines employs a simulation with a 30% fluctuation. When oil prices fluctuate more than 30%, it urgently implements hedging measures. Although LTCM uses models to predict risks, they do not account for low-probability events like sovereign defaults. This ultimately led to the company's downfall. Clearly, for Southwest Airlines, utilizing financial derivatives helped them maintain stable revenue amid fluctuating oil prices in 2008, and they avoided a collapse. For LTCM, the use of financial derivatives was not the reason they faced Federal Reserve supervision and bankruptcy. Essentially, financial derivatives remain a type of financial instrument. Under reasonable conditions of use, they cannot determine whether a mature company will go bankrupt. Of course, this doesn’t mean every company must use financial derivatives, but it shows that financial derivatives can indeed provide additional funds to companies when used properly.

4 Conclusion

The key factors for the successful fuel hedging of Southwest Airlines are, first, the company's long-term strategic thinking and ability to adapt dynamically; second, the combination of tools and risk management. It chose to use collar options instead of complex derivatives. This "minimalist" strategy avoided the uncontrollable risks associated with complex products; third, it strictly focused on hedging and eliminating speculation. The key factors behind LTCM's failure are, first, its over-reliance on mathematical models and historical data without considering extremely low-probability events; second, its use of high leverage, which increased its risks; and third, its liquidity risk. LTCM held many assets with poor liquidity, making it difficult to sell quickly to close positions during the crisis. At the same time, margin requirements increased sharply, while collateral values declined, creating a vicious cycle. From this, readers can see that in the actual operation of the enterprise, the reasonable and correct use of financial derivatives tools helps the enterprise hedge risks and gain additional benefits; in terms of speculation, it is important to choose the right position and leverage ratio. Under the condition of controllable costs, financial derivatives can also become part of the enterprise's funding sources; then, during the actual operation, companies must closely monitor the market situation and adjust the position ratio in time to prevent the risk of liquidation; when using data analysis models, be careful not to rely solely on historical data, but instead combine the current situation and apply the model to generate accurate data that reflects the current economic environment. Given the face of the calculated data, companies should also consider the possible impact of extremely low probability events and adjust the model in time. Hoping this article provides a direction and idea for whether enterprises choose to use financial derivatives, and offers some avoidance methods or possible solutions to some problems they may encounter. In conclusion, financial derivatives are just a special kind of financial instrument, and enterprises should not view them as the main focus of future business operations or the primary source of profits. Instead, they should be seen as an additional value, providing benefits beyond the basic business value to the enterprise, and the cost should be kept within a reasonable and controllable range. Finally, this paper does not cover all financial derivatives cases, so there may be limited arguments. For companies, whether or not to use financial derivatives still depends on their individual circumstances and should be based on an analysis of their specific economic situation.

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