

A study of the correlation between volatility and risk diversification control in options and futures markets

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Abstract. With the continuous development of financial derivatives, many enterprises increasingly prefer using financial derivatives such as options and futures when hedging their risks. However, in the process of using them, many enterprises do not use them as a tool for risk hedging but instead use them for hedging or even try to achieve short-term wealth appreciation through options and futures trading, which is contrary to the original intention of enterprises to use financial derivatives. At the same time, financial derivatives are affected by market volatility. Without professionals to carry out risk control, it will be a double-edged sword; using bad will become a sword to stab at the enterprise. This paper adopts the illustrative method and literature research method to analyse the impact of market volatility and the importance of risk control of options futures by taking the example of the German metal company trying to hedge through options futures in 1993, which ultimately caused the enterprise to fall into difficulties.

1 Introduction

Modern options and futures are indispensable financial derivatives used for risk control in today's financial market trading. In modern times, futures and options trading has been further developed and standardised to become important tools in the financial markets. The futures and options market provides producers, consumers, and investors with a platform for risk hedging, price discovery, and speculative trading. It plays an important role in the stability and development of the modern economy. Modern options futures trading began around the end of the 19th century and the beginning of the 20th century with several landmark events. The Chicago Board of Trade (CBOT), founded in 1848, was one of the world's first futures exchanges. Initially, the CBOT was primarily designed to provide trading in agricultural futures to help farmers and merchants hedge their exposure to price fluctuations. As industrialisation grew, so did the demand for industrial commodities and metals in the financial markets. In order to hedge against fluctuations in the prices of these commodities, futures exchanges began to offer more types of futures contracts, including metals and energy. Options trading is a relatively recent development but has a long history. In the early 1900s, options trading began to take off on exchanges such as the Chicago Derivatives Exchange (CME). Options contracts give investors the right to buy or sell the underlying asset at a specific price at a certain time. In 1973, the Chicago Board Options Exchange (CBOE) was established, which marked the formal formation of the options trading market. With the development of computer technology, the emergence of electronic trading

platforms has revolutionised futures and options trading, making it more efficient and convenient. Overall, the origins of modern futures and options markets can be traced back to the 19th and early 20th centuries in the U.S. Over time, these markets have continued to grow and become an integral part of the global financial market. Although risk is hedged due to options futures, many firms in the market still fail to hedge or control risk due to market uncertainty. Due to the uncertainty of the market, options and futures also have large market volatility, and many firms face great market uncertainty while using options and futures for risk hedging [1]. Therefore, studying market volatility and risk control of options and futures is important to enterprises and can help them create better risk control strategies for their conditions. It is of great business value for individual companies to avoid unnecessary costs and reduce risks.

The analysis by Frank Asche et al. concluded that market volatility is divided into implied volatility and actual volatility, the use of implied volatility to predict future changes in commodity prices, and the relationship between implied volatility and actual volatility. The research results show implied volatility can be used as an effective risk management tool to help traders better control the risk of futures and options trading [2]. Meanwhile, a dynamic hedging strategy based on stochastic volatility is proposed by Man-man Zhu et al. 2021, which can effectively reduce trading risk in futures and options trading. The research results show that the strategy can achieve good risk management effects under different market conditions [3]. This shows a strong correlation between market volatility and risk control management. Not only that, market volatility can also predict the risk faced by the enterprise and make a more

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reasonable response program. Lars Stentoft 2015, studied the impact of market volatility on futures and options trading and proposed a trading strategy based on implied volatility, which can help traders better respond to changes in market volatility and risk management [4]. Most scholars have only studied the arbitrage of option futures, and only a few have studied the correlation between market volatility of option futures and risk control management and the impact between the two.

This paper first takes the failure of futures trading of a German metal company in 1993 as a case to analyse the impact of market volatility on risk control, which shows that option futures hedging risk does not only look at the company itself but also needs to be analysed from the macro point of view of the market. The case is then used to illustrate the risks inherent in options and futures and the impact of market volatility on risk control, showing that risk control is not 100%. Finally, the theories provide insights and warnings to companies that need to control risk.

2 Case description

The case of Deutsche Metallbau is a story of failed risk management in financial derivatives trading. German Metals is a long-established industrial group dealing in metals, energy, and other products. Its U.S. subsidiary, MGRM, entered into several long-term supply contracts with a number of oil retailers in 1993, promising to supply petrol, heating oil, and jet fuel at fixed prices. These contracts also included an option that allowed the retailers to terminate the contracts and receive cash compensation if the market price was higher than the contracted price. In order to hedge against the risk of rising oil prices, MGRM employed a hedging strategy in the futures and storefront markets by buying large quantities of short-term oil futures contracts and swaps that it continually rolled over. In this manner, MGRM hoped to lock in future profits while taking advantage of the market's law of spot premiums to earn basis differentials. However, MGRM's hedging strategy encountered a series of problems that led to large losses. First, in late 1993, there was a sharp decline in oil prices, causing MGRM to incur large floating losses on its long futures contracts and swap agreements. Although future gains on the supply contracts could offset these losses, MGRM was required to make significant margin calls under the day-ahead settlement rules. Secondly, the spot premium pattern of the market has changed to a spot discount situation, where the spot price is lower than the futures price. This means that MGRM has to pay for closing losses when it rolls over and post in cash to cover the change in basis differentials. Again, because MGRM's futures position was too large, accounting for 20% of the total crude oil futures position on the New York Mercantile Exchange (NYMEX), the exchange decided to cancel MGRM's "hedging privilege" and double the margin. This put further pressure on MGRM. Finally, the Supervisory Board of Deutsche Metallbau, which did not understand MGRM's hedging strategy and regarded it as speculative, decided to close out MGRM's

futures position and cancel the supply contract. This decision occurred at the most undesirable time, causing MGRM to forgo future supply contract gains and pay liquidated damages. It is estimated that MGRM lost \$1.3 billion on the futures and swaps trades, more than half of Deutsche Metallbau's capital, and nearly caused the company to go bankrupt.

3 Analysis on the problems

3.1 The status of investments in futures trading

In addition to trading spot, futures, and options on commodity exchanges for its own industrial group, Deutsche Gesellschaft für Metallwirtschaft (DGM) also offers brokerage services to other businesses engaged in hedging, arbitrage, and speculative trading. It also trades in the over-the-counter market with counterparties acting as market makers. Oil commodities trading is the area of expertise for Deutsche Metals AG's U.S. subsidiary, MG REFINING AND MARKETING (henceforth referred to as "Deutsche Metals"). Deutsche Metals signed a deal to trade oil commodities with a client in the summer of 1993. "MG REFINING AND MARKETING signed a long-term supply agreement with its client in the summer of 1993.

This was unique because it combined a special supply contract with a financial derivative element. "Deutsche Metals committed to providing aviation fuel, heating oil, and automotive oil to oil retailers in the United States (henceforth referred to as "customers") at a fixed price for a period of ten years, with a portion of the supply to be delivered in regular quantities and a portion to be delivered at a time to be decided by the customer. The remaining portion of the supply will be delivered at the user's decision. Unlike typical long-term contracts that adjust for inflation, the contract ensures a fixed supply price for an extended period. Delivery time and quantity are uncertain. The financial derivative component gives the customer the right to choose whether to require Deutsche Metals to pay the difference between the spot price and contract price for the entire 10-year contract term. If the global oil spot price exceeds the contract price, the customer can choose whether to force Deutsche Metals to settle the contract by paying the difference in cash for the undelivered oil.

At the end of the contract, the contract was priced at \$3 to \$5 above the spot market price, which was attractive to the supply side. And crucially, German Metal Construction had to accept the terms of the contract. Subsequently, Deutsche Metallbau was confident in relying on its extensive trading experience in the global commodity markets and was even more assured of its technical capabilities in financial derivatives trading. As a result, German Metal Construction developed a hedging strategy in an attempt to hedge against the risk of changes in the price of oil by purchasing standardized futures contracts for oil on the New York Mercantile Exchange and swapping them on the over-the-counter market, thereby transferring the price risk arising from the contracts with its customers.

Although the firm's approach was theoretically and practically appropriate, the hedging strategy failed.

3.2 Reasons for analysis based on the characteristics of options futures trading

When the contract came up for renewal, Deutsche Metallurgical had to swallow the cost of closing the position and inject cash to bridge the widening spread between spot premiums and spot discounts. At this critical juncture, the New York Mercantile Exchange (NYMEX) proposed doubling initial margins for oil futures contracts, further compounding Deutsche Metallurgical's financial woes. With cash flow constraints and limited financial resources, the company struggled to meet the exorbitant margin requirements and the cost of rolling over contracts. Creditors and shareholders began to lose faith, reluctant to extend further loans or invest. This uncertainty led to major shareholders questioning the company's resilience in weathering the crisis. As a result, Deutsche Metallurgical—once a proud pillar of the German industrial landscape—teetered on the brink of bankruptcy, sending tremors throughout the industry.

3.3 Causes of the problem

Firstly, Deutsche Metallbau lacks a thorough understanding of the nature of futures trading. As a highly technical activity, financial derivatives trading involves various stages such as design, trading, clearing, and performance, which poses new management challenges for companies that produce and consume these contracts. It should be noted that financial derivatives trading has dual characteristics: it can be used for hedging to avoid risks, and at the same time, it can also be a tool for speculation by taking on high risks to pursue high returns. The dual nature makes it particularly difficult to accurately judge the nature and risks of a trade [5]. Many cases have shown that some people often trade speculatively in the name of hedging to gain personal benefits. Therefore, senior management must have sufficient professional knowledge or rely on the support of professional technical personnel to make independent and objective judgments on the nature of derivative transactions that could significantly impact the enterprise's overall risk [6].

However, Deutsche Metallbau demonstrates a clear speculative mentality in futures trading, completely ignoring market volatility. The company lacks sufficient technical support to hedge risks, and senior management handles futures trading too casually, ultimately leading to huge losses.

Using financial derivatives for hedging usually requires the help of complex mathematical models. The key is to accurately measure the correlation between the current price of goods and the price of derivative contracts selected. If the correlation measurement is inaccurate, the risk of hedging failure will increase. The G30 has conducted in-depth research on the technical level and issues of global financial derivatives trading

and recommends that rigorous testing must be carried out before practical applications of hedging design. In the case of Deutsche Metallbau, the hedging design models did not undergo rigorous testing, and there were significant problems with key technical parameters such as coverage, term matching, and risk prevention of basis swaps. In addition, potential liquidity risks and credit risks were not properly handled, which seriously affected the evaluation and implementation of the hedging strategy.

Finally, issues that arise in the later stages of futures management are partly attributed to the limitations of traditional accounting techniques. Traditional accounting techniques cannot timely reflect the profits and losses of trading positions.

It is important for businesses to understand how to manage the financing and profit/loss issues associated with hedging. Once the hedging position is established and the design is perfect, the loss on one side will always be balanced by the profit on the other side, regardless of market price changes. However, traditional financial accounting statements often fail to provide a clear and complete picture of the true profit, loss, and risk associated with derivative transactions. This, coupled with the fact that many managers, investors, and creditors may not have a comprehensive understanding of the concept of hedging, can lead to misinformation and only focusing on the loss side.

Therefore, it is essential for business stakeholders to gain a better understanding of hedging methods and their implications. In the case of Deutsche Metallbau, a lack of communication between management, shareholders, and other stakeholders about hedging long-term oil supply contracts led to management conflicts that ultimately had catastrophic consequences. To avoid such situations, businesses need to ensure that all relevant parties are well-informed and understand the purpose and risks associated with hedging strategies [7].

4 Suggestions

4.1 Establish a risk management system

The objective of risk management optimisation of the OTC commodity options business of the enterprise is to establish a comprehensive proactive and intelligent risk management system through the joint participation of the enterprise management and all employees, to ensure that the OTC commodity options business of the enterprise complies with the relevant laws and regulations, regulatory provisions, self-regulatory rules and requirements of the enterprise regulations, and to realise the maximisation of the value of the enterprise is to promote the enterprise on the premise that the overall risk is measurable, controllable and affordable, to Comprehensive implementation of development strategies and the achievement of business objectives, to promote the company to continuously strengthen the awareness of risk management, take the initiative to form a good risk management culture, to ensure that the regulatory requirements, the group's decision-making

and deployment and the company's business management objectives are effectively implemented [8].

It is necessary to objectively analyse the current situation of the enterprise's economic operation. On this basis, should be hired in options and futures trading and risk avoidance of relevant technical personnel, focusing on the relevant tail hedging strategy, not only by the senior management's own decision to make decisions that affect the operation of the entire enterprise [9]. At the same time, a large enterprise should retain its customers and have the right to know the company's decision-making, not to arbitrage for the company's senior management, which can only play a negative role in the life of a company.

4.2 Professional staff to carry out risk control and operations

Facing up to the nature of the use of options and futures in the enterprise, the use of options and futures needs to be related to professional staff to carry out risk control and a series of operations. Critical attitude to the relevant opinions of senior management, the board of directors of the enterprise should be independent of a new regulatory authority to manage it, and at the same time to give high authority to isolate it from the senior management, can not influence the impact of relevant decisions, so as to ensure the normal operation of the enterprise and the rights and interests of shareholders and customers. It is also important to utilise market volatility, supplemented by the appropriate use of relevant data tools, for risk control management [10].

4.3 Improvement of accounting standards and traditional accounting

First, the Activity-Based Costing (ABC) method was introduced: traditional accounting focuses only on direct and indirect costs, ignoring activity-based costs. Introducing the ABC method can allocate costs more accurately and help companies better understand the impact of different activities on costs, thus enabling more effective cost control and decision-making.

Second, introducing performance evaluation indicators: Traditional accounting mainly focuses on financial indicators and ignores the impact of non-financial indicators on business performance. The introduction of performance evaluation indicators can more comprehensively assess the performance of the enterprise, including customer satisfaction, employee satisfaction, product quality, and other non-financial indicators, to help enterprises more comprehensively understand their competitive advantages and disadvantages.

Third, introducing environmental accounting: Traditional accounting often ignores the impact of the enterprise on the environment and the impact of the environment on the enterprise. The introduction of environmental accounting can help enterprises understand their environmental costs and risks more

comprehensively to plan and manage the development of enterprises.

Fourth, introducing risk management accounting: Traditional accounting focuses only on historical data, ignoring future risks and uncertainties. Introducing risk management accounting can help companies better understand future risks and uncertainties and thus better plan and respond to future challenges.

5 Conclusion

This paper focuses on the collapse of the futures hedging strategy of Deutsche Metallbau in 1993 as an example to analyse the impact of market volatility and risk control of options futures on the whole strategy. Due to the limited technological development in those years, some of the tools for risk control were not yet intelligent; at the same time, the detailed nature of the traditional accounting techniques also contributed to the disaster, which led to the solution strategies proposed in this paper. Many techniques are now being realised, but the revelations are still significant for most who use option futures for risk hedging. These strategies can reduce, in most cases, the subjective and objective risks associated with implementing risk controls that companies can address. On this basis, they can also remind companies that when using options futures, they should be clear about the purpose of their use and follow the basic principle of maximising the company's interests rather than simply hedging for a small group of people. However, due to the diversity and uncertainty of the market, many factors are not considered in other conditions ideal to solve the existing problems.

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