

Research on the Role of Risk Hedging and Arbitrage Strategies in Financial Derivatives Investment

Mengtong Tian^{1,a,*}

*¹School of Economics, The University of Edinburgh, Edinburgh, EH89YL, United Kingdom
a. tmt20030522@sina.com*

**corresponding author*

Abstract: In financial derivatives investment, risk hedging and arbitrage strategies play a key role. Risk hedging aims to reduce the uncertainty caused by asset price fluctuations and provide investors with stable returns through derivatives such as futures, options, and credit default swaps (CDS). This strategy is widely used by enterprises and financial institutions to manage commodity prices, exchange rates, and credit risks. Arbitrage strategies use market price differences, especially pricing differences in different markets or at various time points, to seek risk-free or low-risk returns. This paper reviews existing literature on financial derivatives, sorting out the role of risk hedging in financial derivatives investment. It summarizes the basic principles, application cases, advantages, and limitations of risk hedging. Additionally, the research delves into the role of arbitrage strategies in financial derivatives investment, covering its basic principles, types, application cases, advantages, and limitations. This research finds that hedging strategies, through instruments such as futures, options, and credit default swaps, provide effective risk management by stabilizing returns and reducing the impact of market volatility. Arbitrage strategies, on the other hand, exploit market inefficiencies to generate low-risk or risk-free profits, thereby enhancing market efficiency and liquidity. Despite these advantages, this paper also highlights certain limitations, such as the complexity and cost of hedging instruments, and the diminishing arbitrage opportunities as markets become more efficient.

Keywords: Risk hedging, arbitrage strategy, financial derivatives, investment.

1. Introduction

Financial derivatives are financial instruments whose value does not come directly from the underlying assets, but is based on the fluctuations of variables such as the prices, interest rates, exchange rates or indices of these assets. The development of such instruments allows investors to more accurately manage and operate the risks and returns of the underlying assets, thereby achieving specific investment or risk management goals [1]. Financial derivatives can be divided into many types according to different classification standards. According to the different underlying assets, financial derivatives can be divided into five categories: commodities, currencies, interest rates, equity and credit. If the product form is used as the basis for classification, these derivatives can be divided into different forms, such as futures, options, swaps, and forward contracts [2]. Financial derivatives are widely used in risk hedging, speculative trading and arbitrage strategies. Although they have no intrinsic value, their flexibility and leverage effect

provide investors with a variety of financial operation methods. However, most of the previous literature has conducted theoretical research from a single perspective, lacking an overall overview of the application of financial derivatives. This paper will integrate previous studies and systematically introduce and evaluate the application of risk hedging and arbitrage strategies in financial derivatives from the perspectives of the role of risk hedging in financial derivatives investment, including the basic principles, application cases, advantages and limitations of risk hedging, and the role of arbitrage strategies in financial derivatives investment, including its basic principles, types, application cases, advantages and limitations, so that later scholars can have a more comprehensive understanding. By understanding the effectiveness and potential risks of these strategies, scholars can optimize existing strategies, and identify and respond to risk points in complex markets. This analysis not only promotes the development of new strategies, but also provides a new perspective on market stability and efficiency, and provides a valuable reference for policymakers.

2. The role of risk hedging in financial derivatives investment

The basic principle of risk hedging is to establish a hedge position in the financial market that is opposite to the original position to reduce or offset potential losses caused by risk factors such as price fluctuations, interest rate changes, exchange rate fluctuations, etc. By using derivatives such as futures, options, swaps and forward contracts, investors or companies can lock in costs or benefits, transfer risks, and ensure that specific financial goals are achieved in market fluctuations.

2.1. Application Cases of Risk Hedging Strategies

2.1.1. How do companies use the futures market to hedge commodity price risks

Futures are standardized financial contracts where both parties agree to buy or sell a certain amount of assets at a predetermined price on a specific date in the future. These assets can be commodities (such as oil, gold, wheat, etc.) or financial instruments (such as stock indices, foreign exchange, interest rates, etc.). For production and operation companies, they can use futures hedging methods to ensure the stability of raw material prices, or use hedging methods to prevent their product prices from being affected by external factors. Futures contracts can lock in the price of future commodities or assets, so they are very effective tools for hedging commodity prices, foreign exchange risks or interest rate risks. Stulz believes that the main goal of corporate risk management is to maximize shareholder wealth by minimizing risks that may reduce the value of the company [3]. Not all risks need to be hedged. Companies should focus on hedging risks that may lead to financial difficulties, reduce investment capabilities, or increase financing costs. Stulz's point of view emphasizes that the key to companies using tools such as futures is that they can help companies deal with risks that cannot be diversified in other ways [3]. Generally speaking, commodity producers will sign purchase contracts with buyers and stipulate the quantity, quality and time of the assets to be bought and sold, but the transaction price is not fixed; that is, a floating price mechanism is adopted which poses a huge risk to producers. If commodity prices fall during trading, producers will suffer losses. To avoid this floating price risk, producers sell a futures contract that matches the spot quantity, and then buy an offsetting futures contract before the contract expires to close the position, thereby converting the floating price into a fixed price.

2.1.2. How do financial institutions use credit default swaps to hedge credit risk

Credit Default Swaps (CDS) are financial derivatives that allow institutions to hedge credit risks associated with bonds, loans, or other credit instruments. By purchasing a CDS, a financial

institution can transfer the risk of default from a credit asset to the CDS seller, who agrees to compensate the buyer in case of a credit event, such as a default or restructuring [4]. Financial institutions use credit default swaps (CDS) to hedge credit risk mainly in the following ways. First, through CDS, financial institutions can diversify the credit risk in their investment portfolios and adjust their risk exposure according to their risk tolerance. In addition, the use of CDS can also help institutions reduce the required capital, optimize capital allocation, and improve capital utilization efficiency. For example, after banks hedge bonds with higher default risks by purchasing CDS, they can reduce their capital adequacy requirements and thus improve capital utilization efficiency. Financial institutions may also use price differences in the CDS market to arbitrage and profit from it while hedging related risks. Finally, CDS is also used to hedge counterparty risks in derivative transactions and other credit agreements, ensuring that institutions can still receive compensation even if the counterparty defaults.

2.2. Advantages and limitations of risk hedging

2.2.1. Advantages

The benefits of risk hedging are mainly reflected in the following aspects. First, hedging can reduce the volatility of cash flow, thereby reducing the probability of entering financial distress. Secondly, hedging can enhance financial flexibility, allowing enterprises to maintain more stable cash flow and financial conditions when the market changes, so that capital expenditures and investment decisions can be made more flexibly. In addition, hedging can also reduce agency problems and information asymmetry because corporate management has a deeper understanding of the risks faced by the company. Through hedging, enterprises can reduce the uncertainty of external investors, thereby reducing capital costs and agency costs. Finally, financing advantages are also an important benefit of hedging strategies. By reducing financing risks, hedging strategies can reduce financing costs and enable enterprises to obtain capital on more favorable terms [5].

2.2.2. Limitations

Stulz [3] pointed out that excessive hedging may cause companies to miss out on potential profit opportunities, and hedging tools themselves may bring additional costs and complexity. Hedging strategies usually involve transaction fees and fees for hedging contracts, and these costs may affect the overall financial performance of the company. In addition, different types of risks may require different hedging strategies. If the hedging strategy does not match the actual risk, it may lead to poor hedging results. In the case of severe economic fluctuations, hedging strategies may also need to be adjusted frequently, thereby increasing management complexity and costs. Therefore, companies need to carefully weigh costs and benefits when formulating risk management strategies. In general, risk hedging in financial derivatives investment can effectively manage and reduce various types of risks through the use of various financial tools and strategies, thereby protecting the interests of investors and companies. The rational use of hedging strategies can provide greater financial stability and security in an uncertain market environment.

3. The role of arbitrage strategy in financial derivatives investment

3.1. Basic principles and Types of arbitrage strategy

In theory, the price of the same asset in different markets or between similar assets should be consistent, but price differences can occur due to market inefficiencies, liquidity issues, or information asymmetry. Arbitrage traders exploit these discrepancies by simultaneously buying and

selling related assets or contracts to secure low-risk or risk-free profits. This trading behavior typically causes market prices to converge quickly, narrowing or eliminating price differences. However, transaction costs are crucial in arbitrage strategies; successful arbitrage requires net profits after accounting for fees. Therefore, low transaction costs and high-frequency trading are particularly important.

Common types of arbitrage strategies include cross-market arbitrage, which involves exploiting price differences for the same or similar commodities across different exchanges; time arbitrage, which takes advantage of price differences over time, such as between spot and futures prices; and risk arbitrage, often related to mergers and acquisitions, where profits are made by buying the target company's stock and selling the acquirer's stock. Conversion arbitrage involves holding convertible bonds and corresponding stocks simultaneously, profiting from bond returns while hedging stock price fluctuations. Lastly, statistical arbitrage uses mathematical models to identify price discrepancies between related assets and profits by predicting mean reversion [6].

3.2. Application Cases of Arbitrage Strategies

3.2.1. Cross-market Arbitrage Using Futures Markets

Cross-market arbitrage using futures markets involves taking advantage of price differences in different markets to make a profit. Cross-market cash-futures arbitrage refers to buying a spot asset in one market and selling a futures contract in another market, or vice versa, to take advantage of price differences between different markets. For example, consider the gold futures market. Assume that the spot gold price is \$1,800 per ounce and the three-month futures contract price is \$1,850, and the holding cost is \$20 per ounce. Since the futures price is higher than the spot price plus the holding cost ($\$1,850 > \$1,820$), this indicates an arbitrage opportunity. The arbitrageur can buy 10 ounces of gold in the spot market, spending \$18,000, and short 10 ounces of gold futures contracts in the futures market, earning \$18,500. The holding cost is \$200, so the total profit is \$18,500 (futures contract revenue) minus \$18,000 (spot cost) and \$200 (holding cost), or \$300. In this way, the arbitrageur realizes a risk-free profit of \$300 by taking advantage of the difference between the market price difference and the holding cost.

3.2.2. Volatility arbitrage using the options market

E. Robert Fernholz, Ioannis Karatzas and Johannes Ruf discussed several volatility arbitrage strategies [7]. First, option combination arbitrage uses a variety of option strategies, such as spreads, butterflies, and iron condors, to arbitrage through differences in implied volatility in the market. Second, volatility arbitrage strategies are based on the gap between implied volatility and actual volatility, buying or selling options to realize returns. In addition, VIX option arbitrage uses price differences in the VIX index options market to make profits. These strategies can effectively capture market opportunities when implied volatility does not match actual volatility. Volatility arbitrage funds implement these strategies through complex models and high-frequency trading to obtain stable profits. Finally, using different volatility estimation models (such as the GARCH model and the Stochastic Volatility model), the actual volatility of the underlying asset can be predicted and compared with the implied volatility in the options market to adjust trading strategies.

3.3. Advantages and limitations of arbitrage strategies

3.3.1. Advantages

Arbitrage strategies are generally considered to be low-risk or risk-free. In addition, arbitrage trading helps improve market pricing efficiency by quickly capturing and correcting price deviations in the market. Arbitrage strategies require frequent transactions. The active trading behavior of arbitrageurs in the market increases market liquidity and makes it easier for other investors to buy and sell, which plays an important role in the healthy operation and stability of the market. By implementing different arbitrage strategies, investors can diversify and manage the risks in their portfolios to a certain extent. Arbitrage trading usually involves multiple markets and multiple assets, which can effectively reduce the impact of price fluctuations in a single market or a single asset on the portfolio. The application of arbitrage strategies has promoted the innovation of financial instruments and trading strategies. In order to capture arbitrage opportunities in the market, financial institutions and investors continue to develop new derivatives and trading strategies, such as statistical arbitrage and high-frequency trading. These innovations have played an important role in the development and progress of financial markets.

3.3.2. Limitations

However, arbitrage strategies are not completely risk-free. They are subject to execution risk, liquidity risk, and model risk. In addition, improved market efficiency and increased transaction costs may also weaken arbitrage opportunities. Sheldon mentioned that arbitrage strategies also have interest rate risk, pin risk, settlement risk in the futures market, and dividend risk in the stock market [8]. In addition, the costs faced by arbitrageurs include multiple factors: the first is risk. Arbitrageurs need to deal with basis risk and non-basis risk. The former involves the uncertainty of asset returns, while the latter stems from price fluctuations caused by demand shocks. Secondly, the cost of short selling is also an important factor. The high cost of short-selling certain assets may hinder arbitrageurs from conducting arbitrage transactions. In addition, leverage and margin restrictions are also issues that arbitrageurs need to consider. Margin requirements may limit their use of capital, thereby affecting the implementation of leveraged transactions. Finally, capital restrictions may also become a challenge for arbitrageurs. Limited capital will limit their ability to exploit market imbalances and affect the execution of the overall arbitrage strategy. These costs faced by arbitrageurs limit their ability to eliminate mispricings and provide liquidity to outside investors [8].

4. Conclusion

Based on the research results, the study concludes that both hedging and arbitrage strategies play significant roles in financial derivatives investment. Hedging strategies, through tools like futures, options, and credit default swaps, help manage and mitigate various types of risks, providing stability and predictability to investors. On the other hand, arbitrage strategies exploit market inefficiencies to achieve low-risk or risk-free profits, contributing to market efficiency and liquidity. However, the study identifies several limitations. One of the key limitations is the complexity and cost associated with hedging instruments, which can reduce their effectiveness. Additionally, the rapidly changing market conditions often require frequent adjustments to hedging positions, increasing management complexity and costs. For arbitrage strategies, risks such as execution risk, liquidity risk, and model risk can impact their success. Moreover, as market efficiency improves, arbitrage opportunities diminish, making it harder to achieve profits.

However, the limitation of this study is that it is mainly based on theoretical analysis and literature review, and lacks the support of empirical data. In addition, current research has not fully explored the specific performance of strategies under different market conditions, especially the effect of extreme market conditions. Future research should focus on validating the effectiveness of these strategies through empirical analysis while exploring how to optimize these strategies in a market environment with high volatility and increased uncertainty. In addition, in-depth research on the impact of financial technology (such as high-frequency trading, and algorithmic trading) on risk hedging and arbitrage strategies will also be an important research direction.

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