Comparing the Effectiveness of Christmas Tree and Condor Spreads for Hedging LSTR Stock

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Abstract

Option trading strategies are crucial instruments for portfolio optimization, particularly in the context of the increasing complexity of financial markets. While most existing studies have focused on the effectiveness of these strategies under high-volatility conditions, this study seeks to address a gap by examining the performance of the Christmas tree and condor spread strategies as hedging tools in a low-volatility environment, using Landstar System Inc. (LSTR) as a case study. The Black-Scholes Merton model is employed to price the options, utilizing daily stock price data. The results indicate that the Christmas tree strategy provides higher profit potential in stable market conditions, while the condor strategy proves more appropriate for investors seeking value protection and stability. These findings offer significant insights for investors looking to enhance their decision-making and risk management practices amidst market fluctuations.

Keywords: hedging strategy, low volatility, christmas tree spread, condor spread

1. Introduction

Modern economies are dependent on the efficient operation of the transport and logistics sector to ensure the supply chain is maintained and the basic requirements of society are met. Landstar System Inc. (LSTR), a North American logistics provider headquartered in Jacksonville, Florida, was recognized by Forbes as one of America's Best Midsize Employers for 2024, ranking 55th overall and earning the top spot in the Transportation and Logistics category. As noted by Rahman (2025) supply chain management and logistics play an essential role in ensuring the smooth flow of goods and services across borders, particularly in times of uncertainty. In this context, organizations such as Landstar System Inc. (LSTR), operating within increasingly globalized and interconnected supply chains, exemplify the critical role logistics providers fulfill in maintaining operational continuity (Luo & Tsang, 2020). Landstar provides freight transportation services throughout the United States through a network of independent agents and carriers. Its top ranking on the 2024 ACT Transport 50 list by American Cranes & Transport, which evaluates companies based on fleet capacity and performance, is indicative of its reputation for operational reliability (Landstar, 2024).

Landstar's business model, which entails the collaboration with independent drivers and logistics agents to transport products across North America, renders it susceptible to market dynamics, including fluctuations in fuel prices and seasonal demand. Landstar's stock price (LSTR) is subject to volatility as a consequence of this operational exposure, which poses a potential risk to investors. Risks are classified into two categories, systematic and unsystematic. Diversifying investments can mitigate unsystematic risk, which is specific to specific assets or sectors. Conversely, systematic risk necessitates active management through hedging, as it impacts the broader market (Zhichun, 2023).

Stock is a financial instrument, signifies ownership in a company and represents a claim on part of the company's assets and earnings (Miller & Roberts, 2021). As the financial market has developed, stock is no longer only traded directly but can also serve as the basis for the creation of derivative instruments traded by companies and investors. Derivative instruments are contracts or agreements whose value depends on the performance of the underlying asset, such as options, forward and futures contracts, swaps, and warrants (Lesmana et al., 2024)

Options are used as derivative instruments in this investigation for the purpose of hedging. Specifically, the Christmas tree spread and Condor spread strategies are implemented. The Christmas tree spread is a sophisticated strategy that is intended to take advantage of limited price fluctuations by utilising multiple call or put options with varying strike prices. In contrast, the Condor spread is a neutral strategy that entails four option positions with distinct strike prices but the same expiration date. Both strategies are implemented as hedging strategies against fluctuations in the price of the underlying asset, which in this instance is LSTR stock. In order to effectively manage risk and implement effective hedging strategies, it is essential to comprehend and model returns volatility, as Nugrohom (2019) have emphasized. Their research underscored the significance of modelling volatility in financial markets, which provides a basis for the implementation of hedging strategies such as those employed in this study.

The present study compares the effectiveness of the Christmas tree spread and Condor spread strategies, both of which have limited research available. Previous studies have extensively examined option strategies such as Butterfly, Strangles, and Bull spreads under conditions of high market volatility (Hasanah, 2024; Lesmana et al., 2024). However, limited empirical work has compared the performance of more complex strategies like the Christmas tree and Condor spread in stable, low-volatility environments.

This study addresses a significant gap in the literature by empirically evaluating the effectiveness of two options strategies, Christmas tree spread and Condor spread, on LSTR stock, using actual market data and the Black-Scholes Merton model. With limited comprehensive research on these strategies, this analysis provides a practical comparison under controlled low volatility conditions, as LSTR is a suitable underlying asset for this purpose. The findings are expected to enhance understanding of optimal strategies for investors seeking optimized portfolio protection in stable markets, serving as a valuable reference for more informed investment decisions.

Literature Review

In capital markets, options are one of the derivative instruments used for hedging and speculation purposes. According to (Hull, 2022), an option is a contract in which the holder has the right, but not the obligation, to buy or sell an asset at a specified strike price within a predetermined period. Options are categorized into call options (right to buy) and put options (right to sell). In this study, European-style vanilla call options are used, which can only be exercised at expiration (Stamatopoulos et al., 2020; Wang, 2024)

Options are important for portfolio optimization, particularly for mitigating systematic risk, i.e. risk that cannot be eliminated through diversification (Zhichun, 2023). Therefore, a well-constructed hedging strategy using options can reduce the adverse impact of price fluctuations on investments. Hedging aims to reduce risk by minimizing a risk measure such as the variance of a portfolio (Matic et al., 2023).

Volatility and Option Pricing

Market volatility is a key factor in determining option values and hedging performance. This study applies the Black-Scholes Merton (BSM) model, a widely accepted model for pricing European options introduced in 1973. The BSM model assumes that stock prices follow a Geometric Brownian Motion (GBM) with constant drift and volatility, continuous trading, no transaction costs, and no arbitrage opportunities (Hull, 2022).

The BSM formula utilizes inputs such as the initial stock price, strike price, risk-free interest rate, time to expiration, and volatility. In this study, the underlying asset is Landstar System Inc. (LSTR) stock, using daily data from November 2023 to November 2024 with a volatility of 21.08%, categorized as low volatility. The normality of LSTR stock returns was confirmed using the Shapiro-Wilk test (p-value $= 0.5018 > 0.5$), validating the use of the BSM model.

Spread Strategies

This study compares two multi-leg option strategies:

- Christmas tree spread: A strategy designed to benefit from limited upward movement in stock price by purchasing one call at a low strike, selling three calls at a mid-strike, and purchasing two calls at a higher strike (Fidelity, 2025).
- Condor spread: A neutral strategy using four call options with equidistant strike prices, constructed by buying two outer calls and selling two inner calls. This strategy profits when the asset price stays between the two middle strikes (Lu & Tema, 2025; Natenberg, 2015)

Both strategies aim to limit losses while maximizing potential gain in low-volatility environments and are constructed using vanilla options priced via the BSM model.

Previous Studies

Prior research has predominantly focused on straightforward spread strategies such as Butterfly, Bull, and Strangle spreads under conditions characterized by high volatility (Hasanah, 2024;

Lesmana et al., 2024). Nevertheless, there is a lack of empirical studies involving more sophisticated strategies like the Christmas tree and Condor spreads, particularly in low-volatility environments. (Nugrohom et al., 2019) highlighted the importance of modeling volatility to enhance effective hedging strategies.

This research addresses that gap by empirically evaluating these two strategies using actual market data. Both strategies are analyzed regarding their profit potential, risk, and costs (both secured and unsecured) across a variety of strike configurations.

Research Framework

The research model is developed based on a quantitative comparative approach, with the objective of evaluating profit potential and risk characteristics of the two strategies using LSTR stock data. The stages include:

1. Data Collection: LSTR stock prices from Investing.com and a risk-free interest rate of 4.4% from Bank of America (Investing, 2025; Trading Economics, 2025). Return Calculation and Normality Testing: Logarithmic return computation and Shapiro-Wilk test to confirm suitability for BSM model.
2. Option Pricing: Call option prices calculated using the BSM formula across multiple strike price levels.
3. Strategy Simulation: Simulation of Christmas tree and Condor spreads under three strike configurations: narrow, medium, and wide intervals.
4. Profit Analysis: Evaluating maximum profit, maximum loss, and cost under secured and unsecured scenarios.
5. Strategy Evaluation: Interpretation of strategy performance and market suitability.

Hedging

Hedging is a risk management strategy used to protect a financial position against adverse market movements. Any hedging strategy's target is to protect against market movements and to minimize profit and loss of the hedged position. Hedges either reduce risk by eliminating market risk related sensitivities or by minimising a risk measure, such as a hedged position's variance (Matic et al., 2023). By implementing hedge accounting, organizations can more accurately match the timing of gains or losses related to the hedging instrument with the timing of the impact on the hedged item, resulting in more consistent and useful financial information for decision making (Blackburn et al., 2024).

Vanilla Option

Vanilla options are some of the most basic and commonly traded derivative products in financial markets (Bollin & Ślepaczuk, 2020). This encompasses European style call and put options, with their payoff relying exclusively on the underlying asset's price at expiration (Stamatopoulos et al., 2020). Vanilla options play an important role in hedging and speculating in the financial and energy markets. Their simplicity makes them a great entry point for researchers and practitioners to understand more complex instruments (Fabbiani et al., 2020).

Call and Put Option

According to Hull (2022) an option is defined as a contract between a holder and a writer, in which the writer grants the holder the right (but not the obligation) to buy or sell an asset from the writer at a specified price (strike or exercise price) and at a predetermined time in the future (expiry date or maturity time). Based on its right, options can be classified into two types: call options (buy options) and put options (sell options). A call option gives the right to buy an asset at a certain price at certain date.

A European call option is a type of call option that can only be exercised at the time of maturity (Wang, 2024). The payoff of a European call option can be represented by the following equation:

$$C_T = \max\{S_T - K, 0\}\#(1)$$

where

$C_T =$ payoff of the call option at time T,

$S_T =$ underlying asset market price at time T,

$K =$ strike price.

Option Position

Option positions are generally categorized into two types: long (buy) and short (sell) positions. In conventional markets, transactions typically begin with a purchase followed by a sale. However, in the derivatives market, this sequence can be reversed, selling can occur first, followed by a subsequent purchase. When a trader purchases an option contract, this is referred to as taking a long position. Conversely, when a trader sells an option contract, it is referred to as taking a short position (Natenberg, 2015).

Black-Scholes Merton Model

The Black-Scholes model, introduced in 1973, is a foundational pricing model that has shaped the evolution of many later option pricing models. Initially designed for pricing European options, it became the first widely accepted mathematical approach for valuing options. This model is often seen as a catalyst for the expansion of options trading and is recognized as a significant achievement in modern financial theory. It determines the fair value of options using six main variables: volatility, the type of option, the price of the underlying asset, the strike price, time to expiration, and the risk-free interest rate.

This research applies the model to determine the prices of call option on vanilla options. The Black-Scholes Merton model is based on several assumptions, as outlined in (Hull, 2022):

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1. The stock price follows Geometric Brownian Motion (GBM) model with μ and σ constant.

$$dS = \mu S\, dt + \sigma S\, dz \#(2)$$

   where
   μ = drift rate,
   σ = volatility.
   dz = Wiener process.
2. The short selling of securities with full use of proceeds is permitted.
3. There are no transaction costs or taxes. All securities are perfectly divisible.
4. There are no dividends during the life of the derivative.
5. There are no riskless arbitrage opportunities.
6. Security trading is continuous.
7. The risk-free rate of interest, r, is constant and the same for all maturities.

Mathematically, the Black-Scholes Merton model can be expressed as follows:

$$c = S_0 N(d_1) - Ke^{-rT} N(d_2) \#(3)$$
$$p = Ke^{-rT} N(-d_2) - S_0 N(-d_1) \#(4)$$

with

$$d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} \#(5)$$
$$d_2 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T} \#(6)$$

where
S_0 = initial stock price,
T = expiration date,
K = strike price,
σ = volatility price,
r = risk-free rate,
c = call option price,
p = put option price,
N = cumulative probability distribution function of the standard normal distribution with mean 0 and variance 1.

Christmas Call Tree Spread

The long call Christmas tree spread is an options trading strategy that involves purchasing one call option at a lower strike price, selling three call options at a middle strike price, and purchasing two more call options at a higher strike price. This strategy provides the maximum potential profit, which is twice the difference between the higher strike price and the strike price of the three sold call options. Profit occurs when the stock price is at the strike price of the sold call options at expiration (Fidelity, 2025).

For the Christmas call spread:

$$P_{ch}(S_T) = \begin{cases} -c_1 + 3c_3 - 2c_4 & \text{if } S_T < K_1 \\ S_T - K_1 - c_1 + 3c_3 - 2c_4 & \text{if } K_1 \leq S_T < K_3 \\ -2S_T - K_1 + 3K_3 - c_1 + 3c_3 - 2c_4 & \text{if } K_3 \leq S_T < K_4 \\ -K_1 + 3K_3 - 2K_4 - c_1 + 3c_3 - 2c_4 & \text{if } S_T \geq K_4 \end{cases} \quad (7)$$

where
P_{ch} = profit of Christmas tree spread,
S_T = underlying asset market price at time T,
c_1 = call option price at K_1,
c_2 = call option price at K_2,
c_3 = call option price at K_3,
c_4 = call option price at K_4,
K_1 = first strike price,
K_2 = second strike price,
K_3 = third strike price,
K_4 = fourth strike price, and
$K_1 < K_2 < K_3 < K_4$

Condor Call Spread

Condor spread is a Strangle strategy with limited risk or reward. This strategy consists of 4 options with a ratio of always $1 \times 1 \times 1 \times 1$. This strategy consists of two options with strike prices that are closer together, representing the "body" of the Condor, and two options with strike prices that are farther apart, representing the "wings" of the Condor. The distance between the two lower strike prices must be the same as the distance between the two higher strike prices. However, the distance between the two options in the body can vary. All options in this strategy must be of the same type (either call or put) and have the same expiration date.

In a long Condor, the two options at the outermost strike prices are bought, while the two options in the middle are sold. Traders who buy Condors hope that the price of the underlying asset will end up between the two middle strikes in order to maximize their profit (Natenberg, 2015). The choice of strike price ranges in a long call Condor greatly impacts its risk-return characteristics. Wider spreads between strikes enhance the potential returns but also lower the chances of realizing maximum profit. On the other hand, narrower strike ranges diminish return potential but provide a greater likelihood of profitability (Lu & Tema, 2025).

For the Condor call spread:

$$P_c(S_T) = \begin{cases} -c_1 + c_2 + c_3 - c_4 & \text{if } S_T < K_1 \\ S_T - K_1 - c_1 + c_2 + c_3 - c_4 & \text{if } K_1 \leq S_T < K_2 \\ K_2 - K_1 - c_1 + c_2 + c_3 - c_4 & \text{if } K_2 \leq S_T < K_3 \\ K_4 - S_T - c_1 + c_2 + c_3 - c_4 & \text{if } K_3 \leq S_T < K_4 \\ -c_1 + c_2 + c_3 - c_4 & \text{if } S_T \geq K_4 \end{cases} \quad (8)$$

where

P_c = profit of condor spread,

S_T = underlying asset market price at time T,

c_1 = call option price at K_1,

c_2 = call option price at K_2,

c_3 = call option price at K_3,

c_4 = call option price at K_4,

K_1 = first strike price,

K_2 = second strike price,

K_3 = third strike price,

K_4 = fourth strike price, and

$K_1 < K_2 < K_3 < K_4$

2. Method

This study adopts a quantitative descriptive research design to assess the effectiveness of Christmas tree and Condor spread strategies for hedging stock positions under low volatility conditions. The focus is on providing empirical comparisons of the risk-return profiles of each strategy using historical stock data and computational simulations.

The population in this study comprises option strategies applied to equities in the U.S. stock market. A purposive sampling technique is used to select Landstar System Inc. (LSTR) stock due to its recognition as a low-volatility asset and relevance to the logistics sector, which is sensitive to market changes and suitable for hedging strategy evaluation.

This research utilizes secondary data in the form of daily stock prices of Landstar System, Inc. (LSTR) collected from November 1, 2023, to November 1, 2024. The stock price data was obtained from the investing.com website (Investing, 2025). In addition, the U.S. risk-free interest rate, used in the calculation at 4.4%, was sourced from (Trading Economics, 2025).

The primary instrument in this study is a computational model based on the Black-Scholes Merton model, which is used to price European vanilla call options. The calculation is supported by Microsoft Excel and RStudio for computing logarithmic returns, testing data normality (Shapiro-Wilk test), estimating historical volatility, and simulating profit/loss scenarios for each strategy.

This research process utilizes Microsoft Excel and RStudio, with the following steps:

1. This step involves calculating the continuous compounding return (R_t), which is obtained by taking the natural logarithm of the ratio between the current stock price (S_t) and the previous period's stock price (S_{t-1}), using the formula:

$$R_t = \ln\left(\frac{S_t}{S_{t-1}}\right)\#(9)$$

2. A normality test is performed on the stock returns using the Shapiro-Wilk test, and historical volatility is calculated with the assistance of RStudio.

$$W = \frac{\left(\sum_{i=1}^{n} a_i y_i\right)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2}\#(10)$$

   where
   W = the Shapiro-Wilk statistic,
   y_i = ordered data values, from smallest to largest,
   a_i = coefficients based on the normal distribution and sample size,
   $\bar{y}$ = mean of the data.

3. Several parameters, including the current stock price (S_0), strike price (K), risk-free interest rate (r), and time to maturity (T), are determined for three different scenarios in order to calculate potential profits.
4. To calculate σ (volatility), which represents the annualized volatility in the context of the Black-Scholes Merton (BSM) model, the following process is:

$$\sigma = s \times \sqrt{N}\#(11)$$

   where
   σ = annualized volatility,
   s = standard deviation of daily log returns,
   N =number of trading days in a year (typically 252 days).

5. The price of a European call option using Equation (1) is calculated for each scenario using the Black-Scholes Merton model using Equation (3), Equation (5), and Equation (6).
6. Profit functions are developed for each scenario, after which the most favorable scenario is selected and the portfolio values of both option strategies are constructed.
7. Comparison of the profit potential and portfolio values of the two strategies is conducted to identify the most optimal strategy.

3. Results and Discussion

The results presented in this section follow the sequential flow of the research process, starting from the validation of input data through statistical analysis, followed by the computation of option prices, simulation of strategy performance, and evaluation of cost structures for both secured and unsecured positions.

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LSTR Stock Price and Return Behavior

The daily price movement to LSTR stock over 253 days at the period of November 1, 2023 to November 1, 2024 is shown in Figure 1. Figure 2 presents the distribution of LSTR stock returns, which also suggests that the returns are normally distributed.

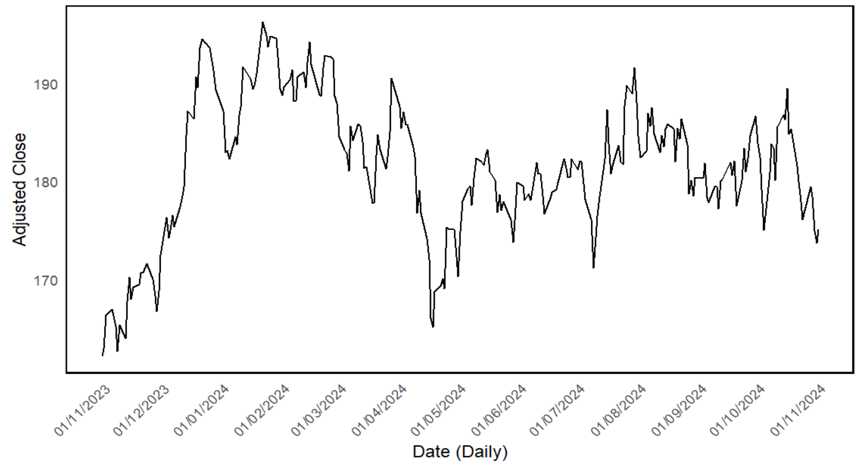

Figure 1. LSTR Stock Price Movement

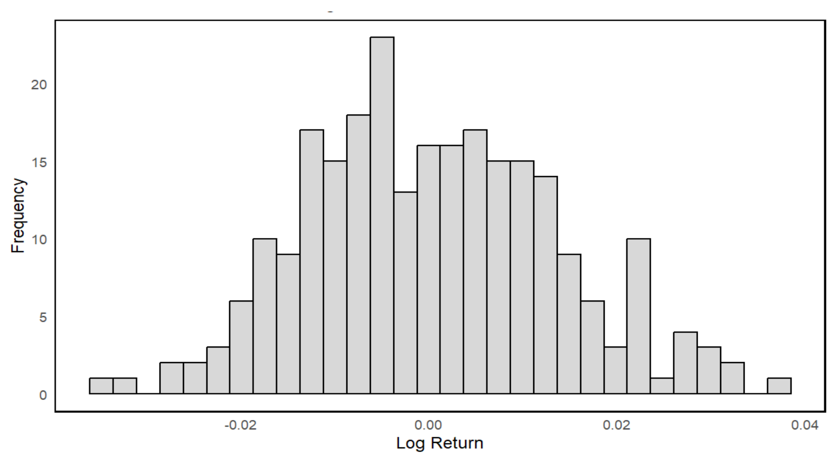

Figure 2. LSTR Stock Price Return Histogram

To utilize the Black-Scholes Merton model, it is necessary for the foundational data to conform to a normal distribution. Consequently, a normality assessment was carried out on the LSTR stock employing the Shapiro-Wilk approach. The resulting p-value was 0.5018, which is greater than the significance level of $\alpha = 0.5$. This indicates that the data follows a normal distribution, making it suitable for the Black-Scholes Merton model to price options. Subsequently, the stock's volatility was calculated using Equation (10), yielding an annual volatility of σ =21.08%. Since a volatility value below 25% is categorized as low, LSTR stock is considered to have low volatility.

Vanilla Option Price Calculation

The Black-Scholes Merton model is employed to determine the vanilla call option price based on Equation (1), Equation (3), Equation (5), and Equation (6), using the input parameters summarized in Table 1. By utilizing RStudio, the computation was conducted with these inputs, and the resulting option prices are detailed in Table 2.

Table 1. Input Parameters for Black-Scholes Merton Model

Parameter	**Value**
Initial Stock Price (S_0)	$175.11
Expiration date (T)	1 year
Risk-free rate (r)	4.4%
Volatility (σ)	21.08%

Table 2. Price of Call Options

Strike Price (*K*)	**Call Option Price (*c*)**
145.11	38.493
152.61	32.691
160.11	27.389
165.11	24.158
167.61	22.638
170.11	21.182
172.61	19.790
177.61	17.201
180.11	16.002
182.61	14.866
185.11	13.791
190.11	11.822
197.61	9.292
205.11	7.222

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Table 2 presents the call option prices computed using the Black-Scholes Merton model for a range of strike price variations. As the strike price increases, a corresponding decrease in the call option value is observed, consistent with the fundamental concept that a call option grants the right to purchase a derivative at a predetermined strike price in the future. These calculated option values will serve as the basis for determining the profit and cost associated with the Christmas and Condor strategies.

Comparison of Condor and Christmas Strategies Advantages

The profit and loss calculations for both strategies are presented in three scenarios based on varions in the stock index price at time T (S_T), ranging from \$130 until \$220, as shown in Table 3 and Table 4.

Table 3. Maximum Profit and Loss with Condor Spread Strategy

K_1	K_2	K_3	K_4	Max Profit	Max Loss
160.11	170.11	180.11	190.11	7.973	2.027
152.61	167.61	182.61	197.61	10.521	4.480
145.11	165.11	185.11	205.11	12.234	7.766

The selection of strike price ranges in Condor strategy directly influences the potential profit and risk levels. A strike price combination of $K_1 = 145.11, K_2 = 165.11, K_3 = 185.11$, and $K_4 = 205.11$ (with 20 point intervals between strikes) yields both the highest maximum profit potential of \$12.234 and the highest maximum loss potential of \$7.766. Conversely, a narrower strike price configuration of $K_1 = 160.11, K_2 = 170.11, K_3 = 180.11$, and $K_4 = 190.11$ (with 10 point intervals between strikes) produces the smallest maximum profit of \$7.973 and loss potentials of \$2.027. This demonstrates a positive correlation between the width of the K_1 until K_4 range and the magnitude of both profit and risk potentials, the wider the range, the higher the potential gains and losses. Conversely, the narrower the range, the lower the potential returns and risks involved.

Table 4. Maximum Profit and Loss with Christmas Tree Strategy

K_1	K_2	K_3	K_4	Max Profit	Max Loss
160.11	170.11	180.11	190.11	16.863	3.027
152.61	167.61	182.61	197.61	22.713	6.677
145.11	165.11	185.11	205.11	28.326	11.564

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The strike price combination for the Christmas tree strategy with $K_1 = 145.11$, $K_2 = 165.11$, $K_3 = 185.11$, and $K_4 = 205.11$ (with 20 point intervals between strikes) generates both the highest maximum profit potential of $28.326 and the highest maximum loss potential of $11.564. Conversely, a narrower strike price configuration of $K_1 = 160.11$, $K_2 = 170.11$, $K_3 = 180.11$, and $K_4 = 190.11$ (with 10 point intervals between strikes) delivers the smallest maximum profit of $16.863 and loss potentials of $3.027. Similar to the Condor strategy, there exists a positive correlation between the width of the K_1until K_4 range and the magnitude of both profit potential and risk, the wider the range, the higher the potential gains and losses. Conversely, the narrower the range, the lower the potential returns and associated risks.

Figures 3 – 5 provide additional visualization of the profitability comparison between Condor spread and Christmas tree strategies across varying stock index prices (ranges $130 until $220) at time T (S_T).

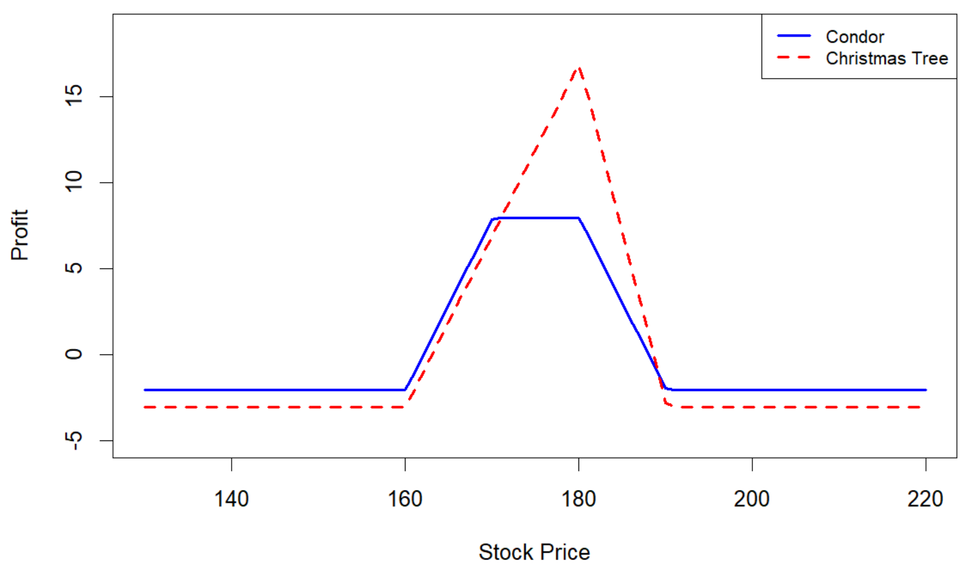

Figure 3. Profit Comparison between Condor and Christmas Strategies Using $K_1 = 160.11$ and $K_4 = 190.11$

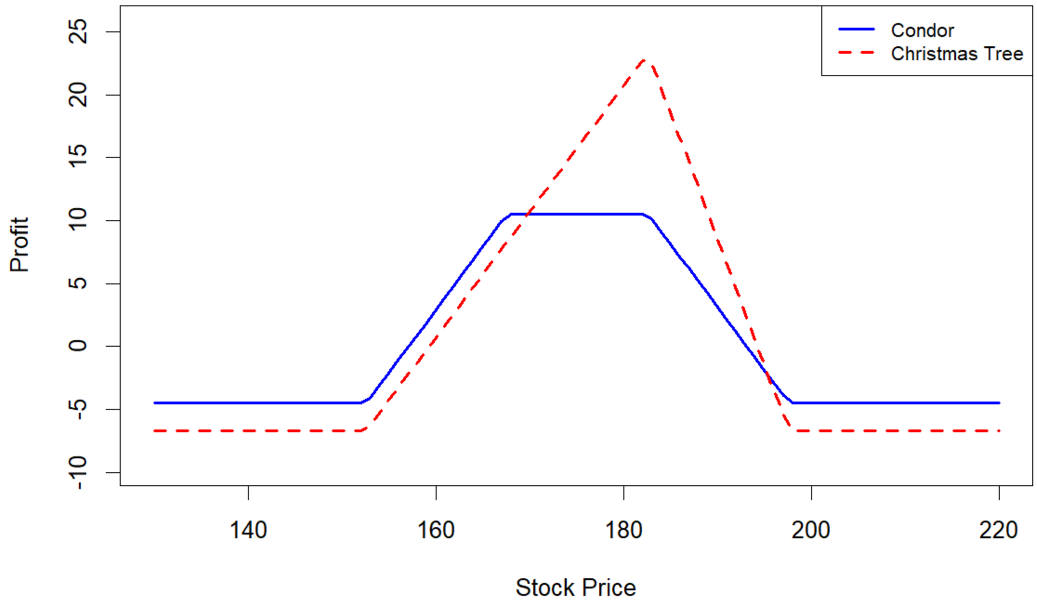

Figure 4. Profit Comparison between Condor and Christmas Strategies Using $K_1 = 152{,}61$ and $K_4 = 197.61$

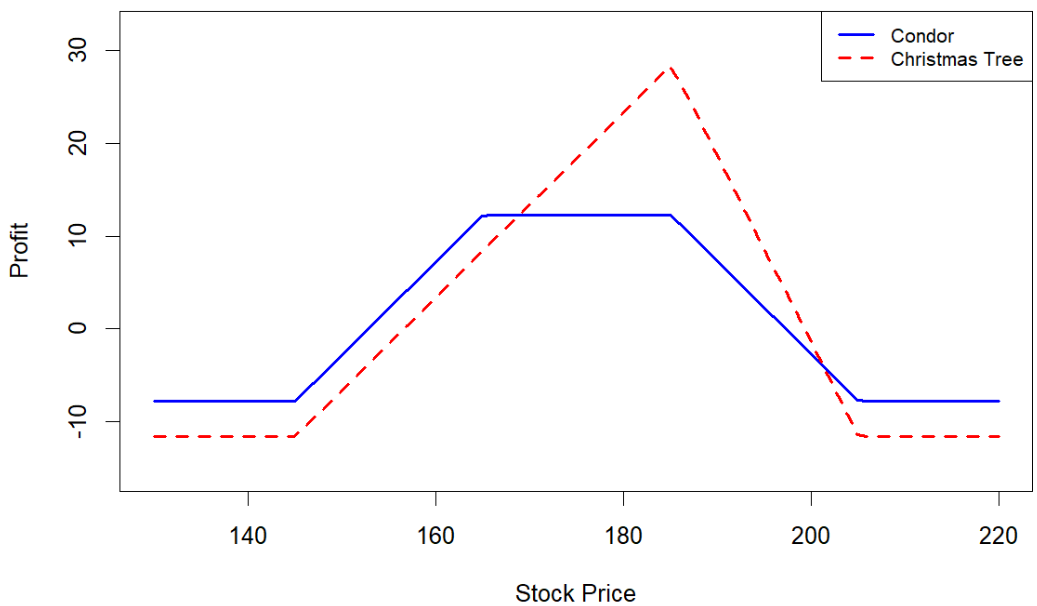

Figure 5. Profit Comparison between Condor and Christmas Strategies Using $K_1 = 145.11$ and $K_4 = 205.11$

Analysis of scenarios 1 – 3 visually contrasts the condor spread and Christmas tree strategies, examining different strike price spacing configurations. Although both strategies utilize call

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options, their distinct structures lead to differing performance outcomes shaped by stock price movements and market volatility.

In Scenario 1 (Figure 3) with narrow strike price spacing, the Condor strategy provides better risk protection as it has a lower maximum loss potential compared to the Christmas tree. On the other hand, the Christmas tree strategy offers slightly higher profit potential but comes with greater loss risk. Moving to Scenario 2 (Figure 4), when the strike intervals are widened, the Christmas tree strategy begins to show advantages in terms of return potential, although its risk remains higher than the Condor spread. Meanwhile, the Condor maintains its low maximum loss limit, but its profit potential increases relatively modestly.

Progressing to Scenario 3 (Figure 5), the Christmas tree continues to demonstrate superiority in terms of maximum profit potential, while the Condor spread shows limitations in return potential despite having more controlled risk. Under low market volatility conditions where the initial stock price sits between the four strikes, the Christmas tree strategy is theoretically more profitable as the probability of extreme losses is relatively small. To consolidate the results, Table 5 summarizes the optimal profit, risk exposure, and market suitability of each trading strategy, categorized by strike price ranges.

Table 5. Summary of Profitability and Risk Comparison between Condor Spread and Christmas tree Strategies

Strike Price (K)	**Strategy**	**Max Profit (USD)**	**Max Loss (USD)**	**Profitability**	**Market Suitability**
160.11 - 190.11	Condor	7.973	2.027	Low moderate return, low risk	Sideways
	Christmas tree	16.863	3.027	Higher return, slightly higher risk	Mild bullish
152.61 - 197.61	Condor	10.521	4.480	Increased return, moderate risk	Sideways to slightly bullish
	Christmas tree	22.713	6.677	Significantly higher return	Bullish
145.11 - 205.11	Condor	12.234	7.766	Highest return but higher risk	Slightly volatile market

Strike Price (K)	Strategy	Max Profit (USD)	Max Loss (USD)	Profitability	Market Suitability
160.11 - 190.11	Condor	7.973	2.027	Low moderate return, low risk	Sideways
	Christmas tree	16.863	3.027	Higher return, slightly higher risk	Mild bullish
	Christmas tree	28.326	11.564	Highest return with highest risk	Bullish

The Cost of the Condor Spread and Christmas Tree Strategy for Unsecured And Secured Positions

For unsecured positions, costs are calculated to compare Condor spread and Christmas tree strategies using vanilla options. At time T, n underlying assets at price (S_T) will be sold, offset by the initial stock purchases cost (S_0). The unsecured position cost formula is as follows:

$$C(S_T) = n(S_T - S_0)$$

This study utilizes a single asset unit. Thus, the cost function for an unsecured position is defined as follows:

$$C(S_T) = (S_T - S_0)$$

The cost function for the secured position in a Condor spread strategy combines the unsecured position and the profit function using Equation (8), as defined below:

$$P_c(S_T) = \begin{cases} S_T - S_0 - c_1 + c_2 + c_3 - c_4 & \text{if } S_T < K_1 \\ 2S_T - S_0 - K_1 - c_1 + c_2 + c_3 - c_4 & \text{if } K_1 \leq S_T < K_2 \\ S_T - S_0 + K_2 - K_1 - c_1 + c_2 + c_3 - c_4 & \text{if } K_2 \leq S_T < K_3 \\ S_0 + K_4 - c_1 + c_2 + c_3 - c_4 & \text{if } K_3 \leq S_T < K_4 \\ S_T - S_0 - c_1 + c_2 + c_3 - c_4 & \text{if } S_T \geq K_4 \end{cases}$$

where

P_c = profit for secured position with Condor spread.

The cost function for the secured position in a Christmas tree strategy combines the unsecured position and the profit function using Equation (7), as defined below:

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$$P_{sch}(S_T) = \begin{cases} S_T - S_0 - c_1 + 3c_3 - 2c_4 & \text{if } S_T < K_1 \\ 2S_T - S_0 - K_1 - c_1 + 3c_3 - 2c_4 & \text{if } K_1 \leq S_T < K_3 \\ -S_T - S_0 - K_1 + 3K_3 - c_1 + 3c_3 - 2c_4 & \text{if } K_3 \leq S_T < K_4 \\ S_T - S_0 - K_1 + 3K_3 - 2K_4 - c_1 + 3c_3 - 2c_4 & \text{if } S_T \geq K_4 \end{cases}$$

where

P_{sch} = profit for secured position with Christmas tree spread

Assume that the hedger purchases a Condor spread strategy consisting of four call options with different strike prices. The hedger buys a call option with a strike price of $K_1 = \$145.11$ at a premium of $c_1 = \$38.493$, sells a call option with a strike price of $K_2 = \$165.11$ at a premium of $c_2 = \$24.158$, sells another call option with a strike price of $K_3 = \$185.11$ at a premium of $c_3 = \$13.791$, and buys a final call option with a strike price of $K_4 = \$205.11$ at a premium of $c_4 = \$7.222$. Then, the cost function for the secured portfolio at time T is:

$$P_{sc}(S_T) = \begin{cases} S_T - 182.876 & \text{if } S_T < 145.11 \\ 2S_T - 327.986 & \text{if } 145.11 \leq S_T < 165.11 \\ S_T - 162.876 & \text{if } 165.11 \leq S_T < 185.11 \\ 22.234 & \text{if } 185.11 \leq S_T < 205.11 \\ S_T - 182.876 & \text{if } S_T \geq 205.11 \end{cases}$$

Suppose that the hedger constructs a Christmas tree strategy by taking positions on call options with different strike prices. In this strategy, the hedger purchases one call option with a strike price of $K_1 = \$145.11$ at a premium of $c_1 = \$38.493$, skips the call option at a strike price $K_2 = \$165.11$, then sells three call options with a strike price of $K_3 = \$185.11$, each priced at $c_3 = \$13.791$, and finally purchases two call options with a strike price of $K_4 = \$205.11$, each priced at $c_4 = \$7.222$. Then, the cost function for the secured portfolio at time T is given by:

$$P_{sch}(S_T) = \begin{cases} S_T - 186.674 & \text{if } S_T < 145.11 \\ 2S_T - 331.784 & \text{if } 145.11 \leq S_T < 185.11 \\ -S_T + 223.546 & \text{if } 185.11 \leq S_T < 205.11 \\ S_T - 186.674 & \text{if } S_T \geq 205.11 \end{cases}$$

Figures 6 – 8 depict the cost function. In these figures, the profits of unsecured and secured positions are compared.

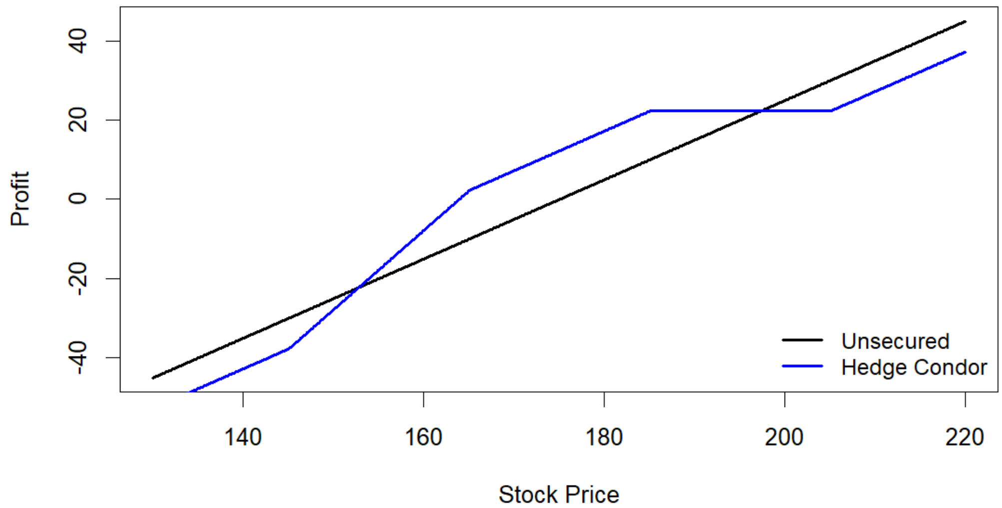

Figure 6. Condor Spread Strategy on Secured Position

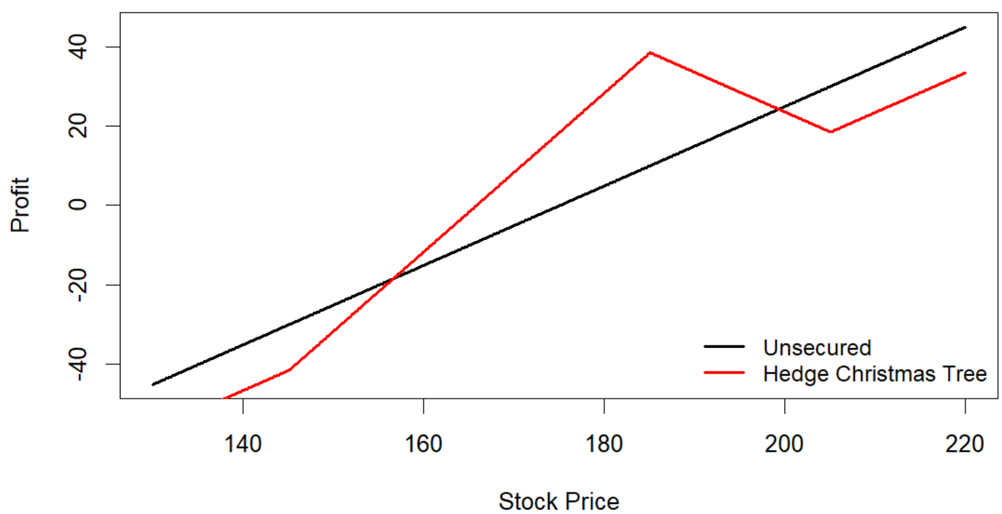

Figure 7. Christmas Tree Strategy on Secured Position

Under a secured position, the Condor spread and Christmas tree strategies exhibit different profit structures but share the same goal of limiting losses through systematically designed option combinations. The Condor spread tends to produce a symmetrical profit profile with a flat peak, reflecting a conservative approach suitable for low volatility markets. In contrast, the Christmas tree presents a more asymmetrical profit shape, offering greater profit potential but limited to a specific price range.

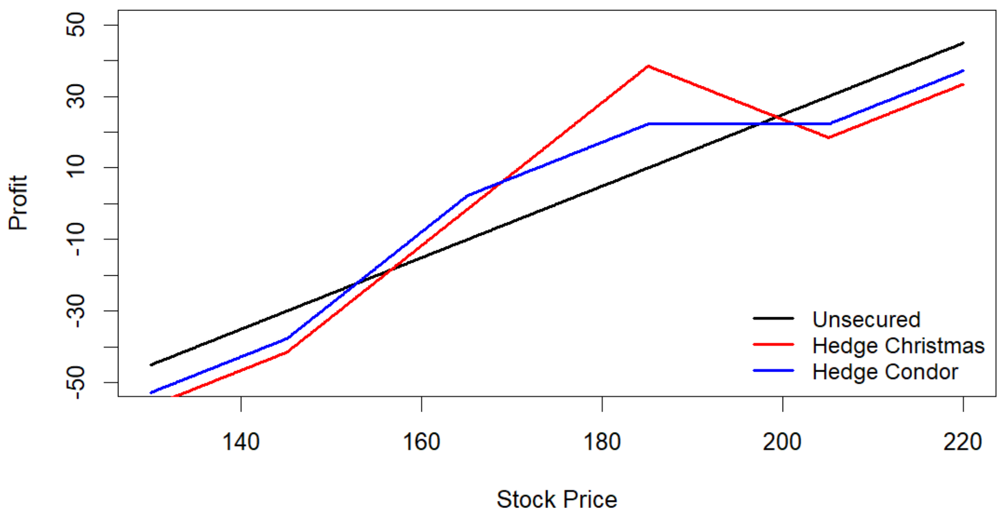

Figure 8. Comparison of Condor Spread with Christmas Tree Strategy on Secured Position

The profit from the secured position strategies of Condor and Christmas tree shows different patterns in response to stock price movements. In the condor strategy, profit remains negative when $S_T < 164$, and turns positive when $S_T \geq 164$. Profit stays constant at 22.234 within the range $185.11 \leq S_T < 205.11$, then increases again when $S_T \geq 205.11$. Meanwhile, the Christmas tree strategy yields negative profit when $S_T < 166$, and continuously increases as S_T rises beyond that point. This indicates that the Condor strategy is more suitable for a sideways market, while the Christmas tree strategy is better suited for a bullish market, as shown in Figure 8.

4. Conclusion

This study examines the performance of Condor spread and Christmas tree strategies in hedging LSTR stock under low volatility conditions using the Black-Scholes Merton model. The Christmas tree strategy generates higher maximum profits compared to the Condor strategy. In the widest spread configuration, the Christmas tree strategy achieves a maximum profit of USD 28.33. The Condor strategy under similar conditions only reaches USD 12.23. However, the Christmas tree strategy also involves larger potential losses. Its maximum loss amounts to USD 11.56, whereas the Condor strategy limits losses to USD 7.77.

These findings suggest the Christmas tree strategy works best for investors expecting mild bullish movements and willing to accept higher risk for greater returns. The Condor strategy suits conservative investors who prioritize capital protection and stable results within narrow price ranges. The practical implication highlights the need to match strategy selection with market expectations and risk appetite. This study provides empirical evidence on multi leg option spreads in low volatility markets, offering valuable insights for portfolio risk management.

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