



Real-time Trading Risk Management

Project Title: Options Trading Strategies Analyzer - Emphasizing Market Volatility

– Aum Biyani

Executive Summary

Objective:

The Options Trading Strategies Analysis Tool is crafted to aid investors and traders in evaluating potential outcomes of various options trading strategies.

By leveraging historical stock data and option chain information, the tool provides valuable insights into the associated risk and reward across different market scenarios.

Key Features:

Data Fetching:

- Utilizes Yahoo Finance API to fetch historical stock data and option chain details.
- Offers a user-friendly interface for seamless entry of the ticker symbol and relevant dates.

Options Trading Strategies:

- Implements popular strategies like straddle, strangle, iron condor, iron butterfly, and ratio call spread.
- Allows users to analyze strategies tailored to specific market scenarios - bullish, bearish, or choppy.

Payoff Calculation:

- Calculates potential payoffs for each strategy based on user-defined market scenarios.
- Visualizes payoffs using matplotlib, providing a clear representation of potential gains or losses.

Market Scenarios and Future Stock Prices:

- Considers three market scenarios: bullish, bearish, and choppy.
- Estimates future stock prices based on user-specified percentage increases or decreases.

User Interaction:

- Prompts users to input the ticker symbol, buy date, and expiry date for option analysis.
- Enables users to make informed decisions by visualizing potential outcomes.

Structure

Data

- Functions for fetching stock data and option chain details.
- Integration with the Yahoo Finance API.
- Input validation for user-provided data (ticker, dates, etc.).
- Defining the market scenarios. (Bullish, Bearish, Choppy).

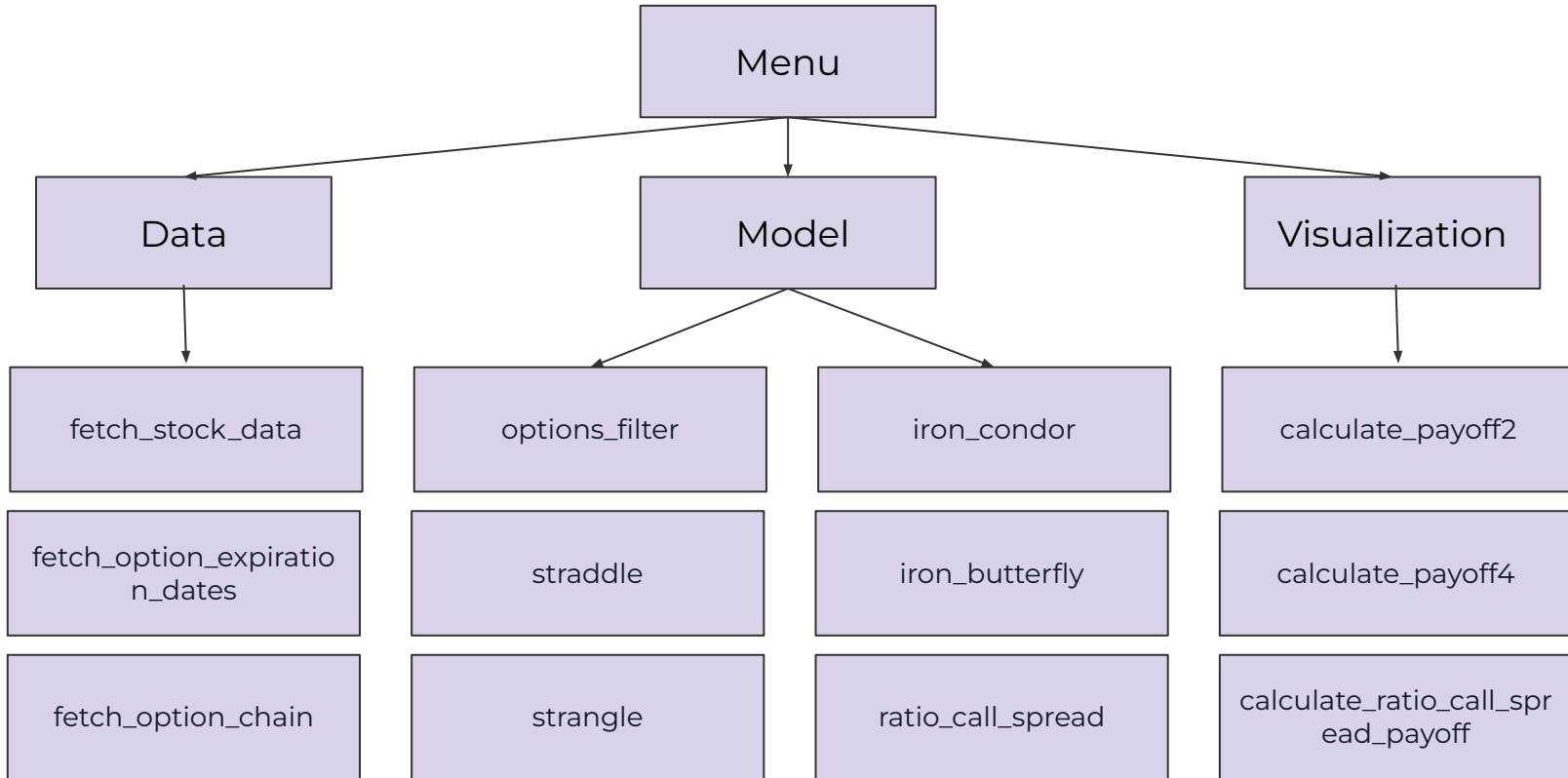
Model

- Functions for calculating payoffs for each strategy based on user-defined market scenarios.
- Strategy-specific logic for filtering options and determining strike prices.
- Integration of strategy calculations with fetched option chain data.
- Defining the initial position of the strategy.

Visualization

- Functions for creating visual representations of payoff diagrams for each strategy.
- Logic for calculating final positions and P&L calculations for each market scenario.
- Tabulating the results of each strategy for the market scenarios.
- Creating a summary table for the final results.

Project Design





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Implemented Functions

Data Fetching Functions

1. `fetch_stock_data(symbol, period='1d')`:

Description: Fetches historical stock data for a specified symbol and time period.

Key Components:

- Utilizes the Yahoo Finance API for historical stock data retrieval.
- Accepts a user-defined time period, defaulting to '1d' (1 day).

2. `fetch_option_expiration_dates(symbol)`:

Description: Retrieves available option expiration dates for a given symbol.

Key Components:

Interfaces with the Yahoo Finance API to obtain option expiration dates.

Transforms and formats data for user-friendly presentation.

3. `fetch_option_chain(symbol, expiration_date)`:

Description: Fetches option chain data for a specified expiration date.

Key Components:

- Utilizes the Yahoo Finance API to acquire detailed option chain information.
- Ensures user-provided expiration date aligns with available options.

Options Trading Strategies Functions

1. `options_filter(options, current_stock_price, n=10):`

Description: Filters options based on their proximity to the at-the-money (ATM) strike.

2. `straddle(call_options, put_options, current_stock_price, stock_prices):`

Description: Implements a straddle options trading strategy by identifying the ATM option contracts.

3. `strangle(call_options, put_options, current_stock_price, stock_prices):`

Description: Implements a strangle options trading strategy by identifying the OTM strikes for maximum volatility.

4. `iron_condor(call_options, put_options, current_stock_price, stock_prices):`

Description: Implements an iron condor options trading strategy.

5. `iron_butterfly(call_options, put_options, current_stock_price, stock_prices):`

Description: Implements an iron butterfly options trading strategy.

6. `ratio_call_spread(call_options, current_stock_price, stock_prices, ratio):`

Description: Implements a ratio call spread options trading strategy.

Payoff Calculations Functions

1. `calculate_payoff2(stock_prices, current_stock_price, long_call_strike, long_put_strike, long_call_price, long_put_price)`:

Description: Calculates the payoff for a combination of long call and long put options. (2-legged options)

Functionality: Computes the total payoff for long call and long put (straddle and strangle).

2. `calculate_payoff4(stock_prices, current_stock_price, long_call_strike, long_put_strike, short_call_strike, short_put_strike, long_call_price, long_put_price, short_call_price, short_put_price)`:

Description: Calculates the payoff for a combination of long and short call and put options. (4-legged options)

Functionality: Computes the total payoff for long call, long put, short call and short put (iron condor and iron butterfly).

3. `calculate_ratio_call_spread_payoff(stock_prices, current_stock_price, long_call_price, short_call_price, long_call_strike, short_call_strike, ratio)`:

Description: Calculates the payoff for a ratio call spread strategy.

Functionality: Computes the total payoff for long call and short call.

User Interaction

The user interaction in this project is designed to provide a straightforward and interactive experience for individuals interested in analyzing options trading strategies for a specific stock. Below is a detailed breakdown of the user interaction process:

Ticker Symbol Entry:

- The user is prompted to input a ticker symbol representing a specific stock or financial instrument they wish to analyze.

Fetching Historical Stock Data and Option Chain:

- Upon receiving the ticker symbol, the tool utilizes the Yahoo Finance API (yfinance) to fetch historical stock data and option chain information for the specified symbol.
- The historical stock data includes details such as opening, closing, high, and low prices for each trading day.
- The option chain information consists of call and put option details for different expiration dates.

User Input for Option Analysis:

- After fetching the necessary data, the user is prompted to input two important dates: the buy date (entry date) and the option expiration date (expiry date).
- The user is required to enter these dates in the format "yyyy-mm-dd" for proper processing.

```
Enter a ticker symbol: spy
Available Expiration Dates: ['2023-12-18', '2023-12-19', '2023-12-20', '2023-12-21', '2023-12-22', '2023-12-29', '2024-01-05', '2024-01-12', '2024-01-19', '2024-01-26', '2024-01-31', '2024-02-16', '2024-02-29',
Enter the buy date (yyyy-mm-dd): 2023-12-22
Enter the expiry date (yyyy-mm-dd): 2024-01-19
```

Future Market Scenarios

Volatility as the Basis:

- Volatility is a measure of the degree of variation of a trading price series over time, representing the market's uncertainty or risk.
- The basis for determining market scenarios is the implied volatility of options, which is reflected in the calculated future stock prices.
- Higher implied volatility in the option market may indicate an expectation of larger price swings, contributing to a more bullish or bearish outlook.
- Lower implied volatility may suggest a market with less uncertainty, leading to a choppy or stable scenario.

Bullish Scenario:

Definition: A bullish market scenario implies an expectation of increasing stock prices. It suggests optimism among investors, anticipating positive market trends.

Calculation: The future stock price for the bullish scenario is estimated by applying a predefined bullish factor (e.g., 1.05, indicating a 5% increase) to the current stock price.

Bearish Scenario:

Definition: A bearish market scenario indicates a pessimistic outlook with an expectation of decreasing stock prices. Investors in a bearish market may anticipate negative market trends.

Calculation: The future stock price for the bearish scenario is estimated by applying a predefined bearish factor (e.g., 0.95, indicating a 5% decrease) to the current stock price.

Choppy Scenario:

Definition: A choppy market scenario implies a lack of clear direction in stock prices. It reflects market conditions characterized by uncertainty, indecision, or a balanced mix of positive and negative factors.

Calculation: The future stock price for the choppy scenario remains the same as the current stock price, indicating no significant change.



Visualization



Straddle

A straddle is an options trading strategy where an investor holds long positions in both a call and a put at the ATM strike and have the same expiration date. This strategy is designed to profit from significant price movement in either direction, regardless of whether it's bullish or bearish.

Bullish Market:

Long Call becomes profitable while **Long Put** expires worthless. **Profit = Premium of Long Call - Initial Premium**

Bearish Market:

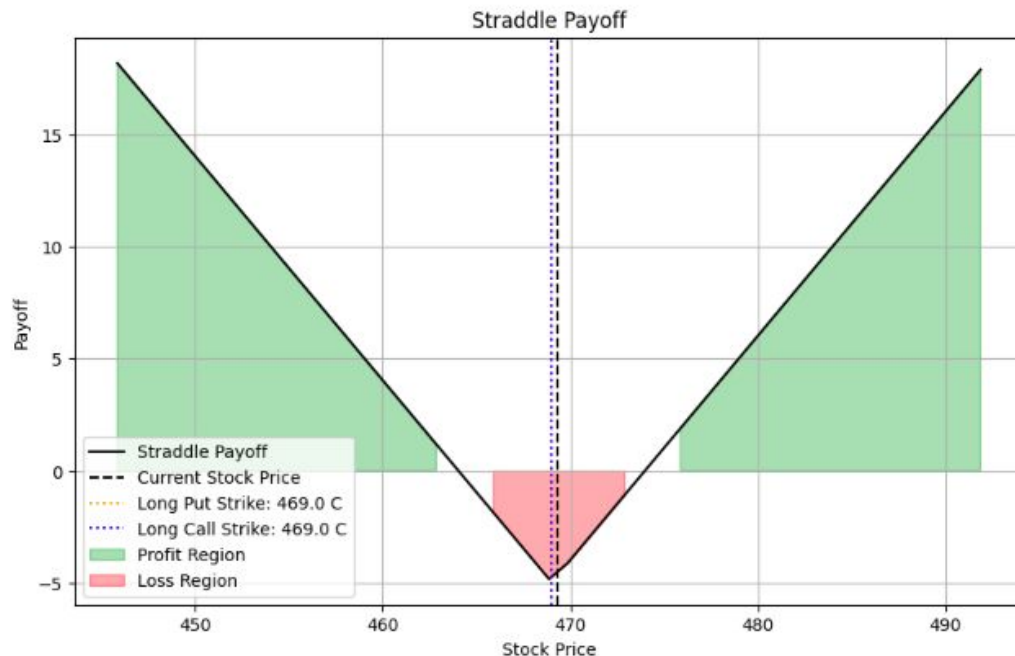
Long Put becomes profitable while **Long Call** expires worthless. **Profit = Premium of Long Put - Initial Premium**

Choppy or Sideways Market:

Both options expire worthless resulting in a loss.

Maximum Profit: Unlimited

Maximum Loss: Capped at the initial premium paid



Strategy	Long Call Strike	Long Put Strike	Stock Price	Position	Potential Profit	Maximum Profit	Maximum Loss
Entry	469.0	469.0	469.33	-4.97			
Bullish	469.0	469.0	492.8	26.26	2129.0	Unlimited	497.0
Bearish	469.0	469.0	445.86	23.05	1808.0	Unlimited	497.0
Choppy	469.0	469.0	469.33	0	-497.0	Unlimited	497.0

Strangle

In a strangle, an investor simultaneously buys an out-of-the-money (OTM) call option and an OTM put option with different strike prices, but the same expiration date. The idea behind a strangle is to profit from significant price movement, but it allows for a wider range of price movement compared to a straddle.

Bullish Market:

Long Call becomes profitable while **Long Put** expires worthless. **Profit = Premium of Long Call - Initial Premium**

Bearish Market:

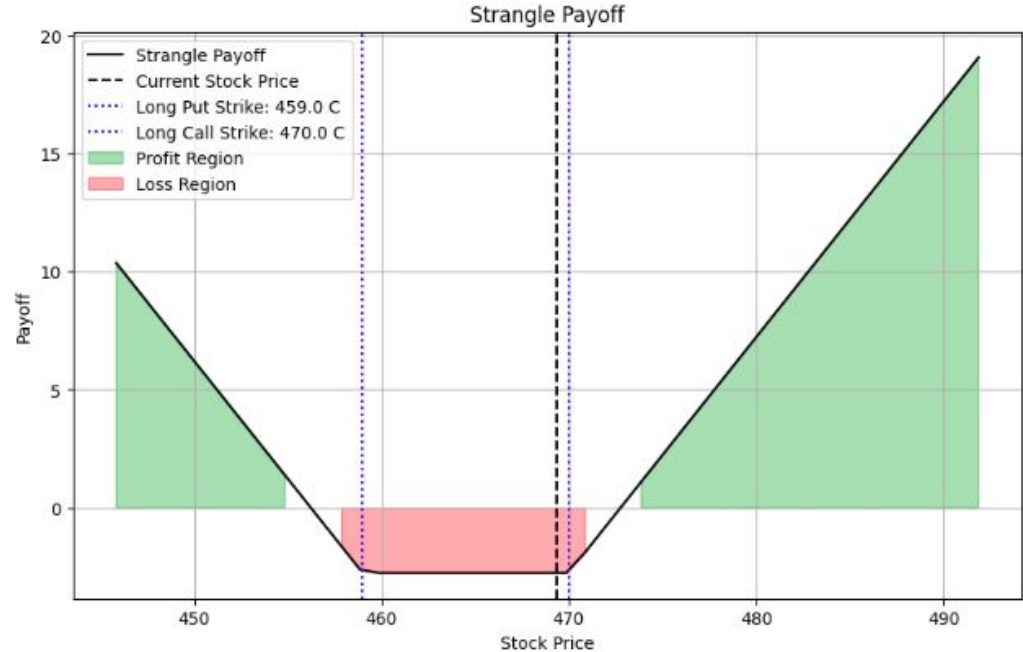
Long Put becomes profitable while **Long Call** expires worthless. **Profit = Premium of Long Put - Initial Premium**

Choppy or Sideways Market:

Both options expire worthless resulting in a loss.

Maximum Profit: Unlimited

Maximum Loss: Capped at the initial premium paid



Strategy	Long Call Strike	Long Put Strike	Stock Price	Position	Potential Profit	Maximum Profit	Maximum Loss
Entry	470.0	459.0	469.33	-2.77			
Bullish	470.0	459.0	492.8	26.26	2349.0	Unlimited	277.0
Bearish	470.0	459.0	445.86	23.05	2028.0	Unlimited	277.0
Choppy	470.0	459.0	469.33	0	-277.0	Unlimited	277.0

Iron Condor

An iron condor is an options trading strategy that involves the simultaneous use of two vertical spreads, one using call options and the other using put options. The strategy is designed to profit from low volatility in the underlying asset. (**Bear Call Spread + Bull Put Spread**) It is a market-neutral strategy that benefits from the price of the underlying staying within a certain range.

Bullish Market:

Bull Put becomes profitable while **Bear Call** expires worthless. **Loss = Bull Put - Bear Call**

Bearish Market:

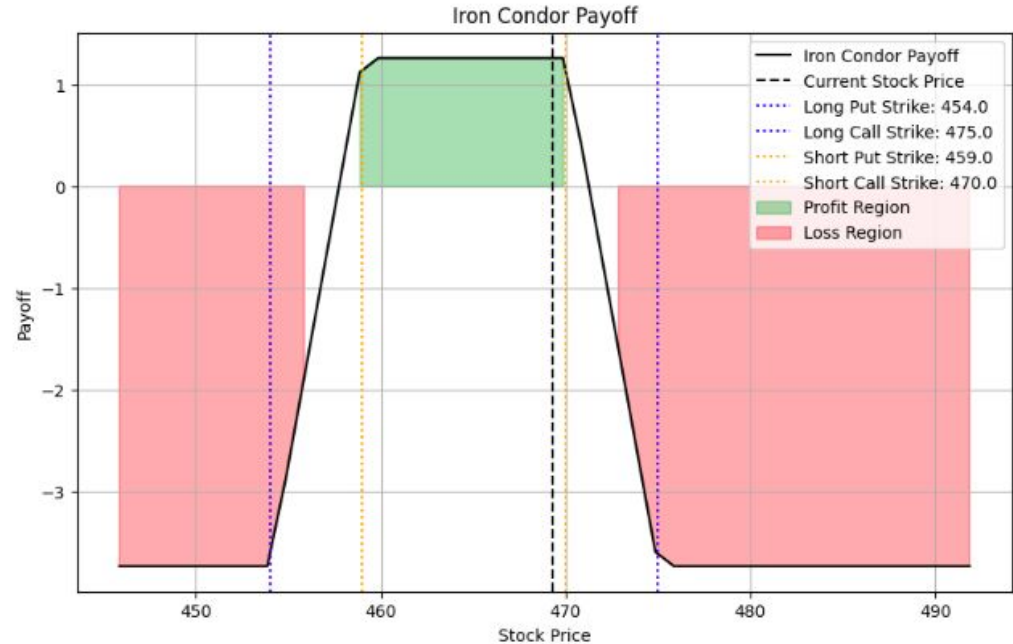
Bear Call becomes profitable while **Bull Put** expires worthless. **Loss = Bear Call - Bull Put**

Choppy or Sideways Market:

All options expire worthless resulting in a profit.

Maximum Profit: Capped at the initial premium received.

Maximum Loss: Capped within range of strikes.



Strategy	Long Call Strike	Long Put Strike	Short Call Strike	Short Put Strike	Stock Price	Position	Potential Profit	Maximum Profit	Maximum Loss
Entry	475.0	454.0	470.0	459.0	469.33	1.26			
Bullish	475.0	454.0	470.0	459.0	492.8	-3.71	-245.0	126.0	-319.0
Bearish	475.0	454.0	470.0	459.0	445.86	-4.45	-319.0	126.0	-319.0
Choppy	475.0	454.0	470.0	459.0	469.33	0	126.0	126.0	-319.0

Iron Butterfly

An iron butterfly is an options trading strategy that involves using both calls and puts to create a position with limited risk and limited profit potential.

The strategy profits when the underlying asset's price remains within a specific range. (**Short Straddle + Long Strangle**).

Bullish Market:

Short Straddle becomes profitable while **Long Strangle** expires worthless. **Loss = Short Straddle - Long Strangle**

Bearish Market:

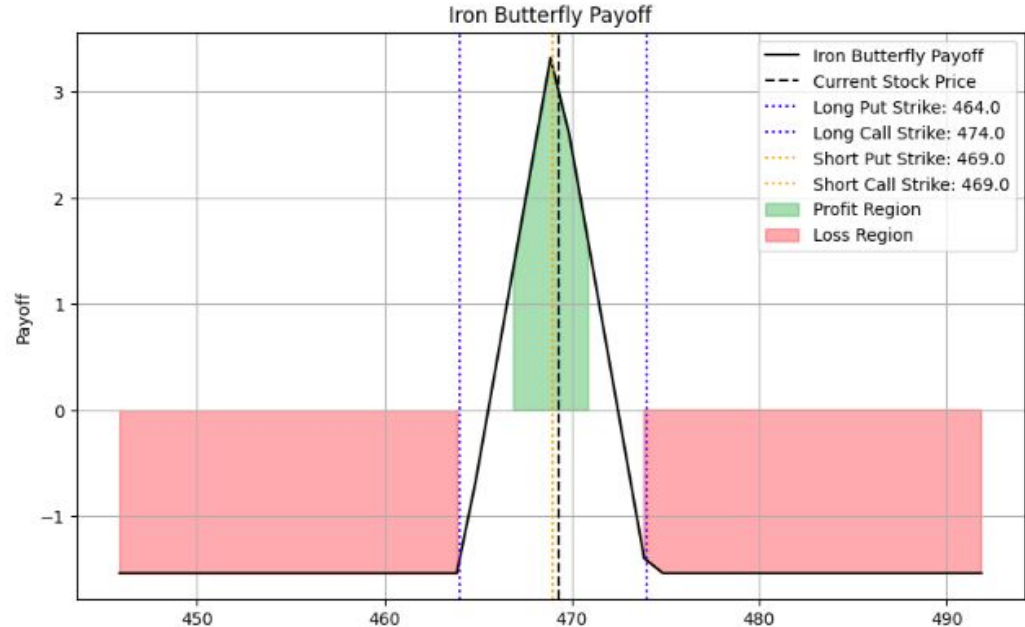
Long Strangle becomes profitable while **Short Straddle** expires worthless. **Loss = Long Strangle - Short Straddle**

Choppy or Sideways Market:

All options expire worthless resulting in a profit.

Maximum Profit: Capped at the initial premium received.

Maximum Loss: Capped within range of strikes.



Strategy	Long Call Strike	Long Put Strike	Short Call Strike	Short Put Strike	Stock Price	Position	Potential Profit	Maximum Profit	Maximum Loss
Entry	474.0	464.0	469.0	469.0	469.33	3.46			
Bullish	474.0	464.0	469.0	469.0	492.8	-3.71	-25.0	346.0	-99.0
Bearish	474.0	464.0	469.0	469.0	445.86	-4.45	-99.0	346.0	-99.0
Choppy	474.0	464.0	469.0	469.0	469.33	0	346.0	346.0	-99.0

Ratio Call Spread

A ratio call spread is an options trading strategy that involves an imbalance in the number of long and short call options.

It typically consists of selling more call options than the number of call options being purchased.

The strategy aims to take advantage of a moderate bullish price movement in the underlying asset while still providing some downside protection.

Bullish Market:

Long Call becomes profitable while **Short Call** results in losses. **Loss = Premium (Long Call - Short * Ratio)**

Bearish Market:

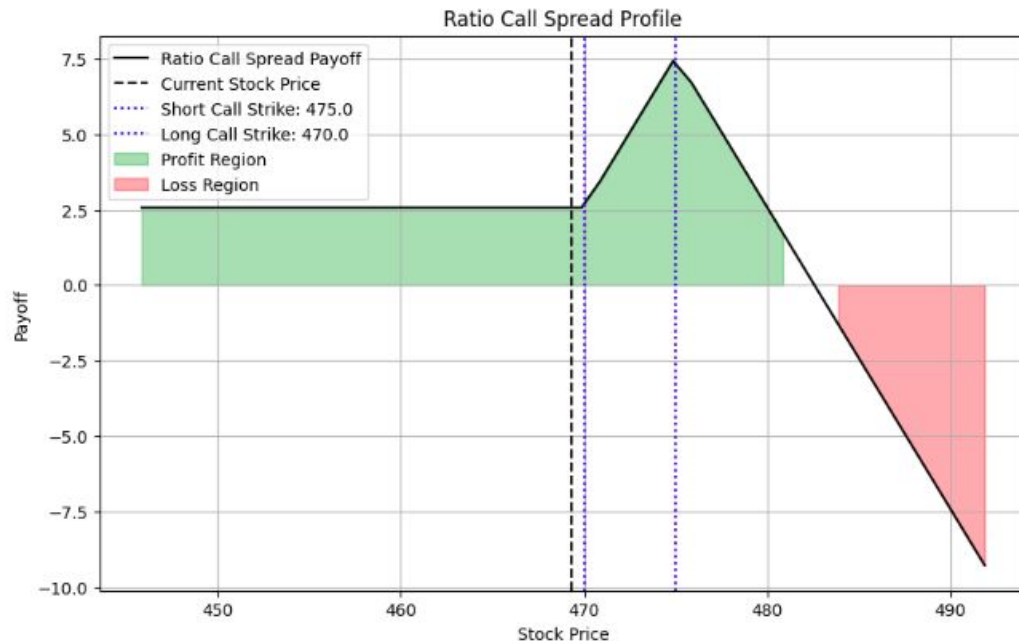
Both options expire worthless resulting in a profit..

Choppy or Sideways Market:

Short Call becomes profitable while **Long Call** results in losses.. **Profit = Premium (Short * Ratio - Long Call)**

Maximum Profit: Capped at the initial premium received.

Maximum Loss: Unlimited



Strategy	Long Call Strike	Short Call Strike	Stock Price	Position	Potential Profit	Maximum Profit	Maximum Loss
Entry	470.0	475.0	469.33	2.57			
Bullish	470.0	475.0	492.8	-26.26	-2369.0	1000.0	Unlimited
Bearish	470.0	475.0	445.86	0	257.0	1000.0	Unlimited
Choppy	470.0	475.0	469.33	7.43	1000.0	1000.0	Unlimited

Conclusion

The implemented tool serves as a powerful platform for comprehensive analysis and visualization of diverse options trading strategies, encompassing straddle, strangle, iron condor, iron butterfly, and ratio call spread. Leveraging historical stock data and option chain information, the tool delivers a nuanced understanding of potential payoffs for each strategy across varied market scenarios.

User empowerment is a key focus, allowing individuals to make informed decisions through interactive exploration of their chosen options strategies. Considering bullish, bearish, and choppy market scenarios, the tool dynamically adjusts future stock prices, enabling users to adapt strategies based on evolving market conditions.

Furthermore, the tool provides valuable insights into the risk and reward profiles of each trading strategy, aiding users in assessing potential gains or losses. With user-friendly flexibility and customization options, users can input preferred ticker symbols and dates, tailoring analyses to specific stocks and timeframes.

The tool's modular structure not only ensures adaptability but also positions it for future enhancements and feature additions, fostering continuous improvement. As an educational resource, the project offers hands-on experience in the analysis and visualization of different options trading strategies, contributing to a deeper understanding of the complex dynamics involved.

Strategy	Long Call Strike	Long Put Strike	Short Call Strike	Short Put Strike	Current Stock Price	Bullish Profit	Bearish Profit	Choppy Profit
Straddle	469.0	469.0			469.33	2129.0	1808.0	-497.0
Strangle	470.0	459.0			469.33	2349.0	2028.0	-277.0
Iron Condor	475.0	454.0	470.0	459.0	469.33	-245.0	-319.0	126.0
Iron Butterfly	474.0	464.0	469.0	469.0	469.33	-25.0	-99.0	346.0
Ratio Call Spread	470.0		475.0		469.33	-2369.0	257.0	1000.0

Future Enhancements

In future enhancements, the project aims to enhance its analytical capabilities and user experience.

Firstly, by incorporating real-time data, the tool can provide more up-to-date insights, allowing users to make timely decisions in the rapidly changing financial markets.

Additionally, expanding the range of supported options trading strategies will provide users with a more comprehensive toolkit for crafting diverse and sophisticated trading approaches.

Finally, improving the user interface aims to create a more user-friendly experience, ensuring that both novice and experienced users can easily navigate and leverage the tool's functionalities.

The references to documentation for key libraries such as yfinance, matplotlib, numpy, and tabulate underscore the project's reliance on well-established and reputable resources, contributing to the robustness and reliability of the implemented functionalities.



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Thank You!