Volatility-Based Put Credit Spread Trading with LSTMs

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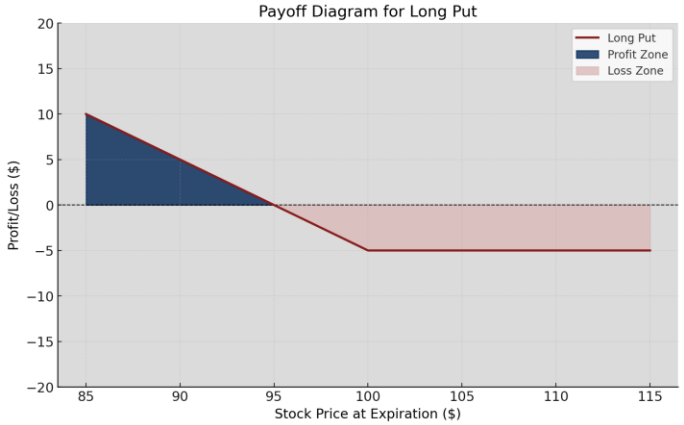
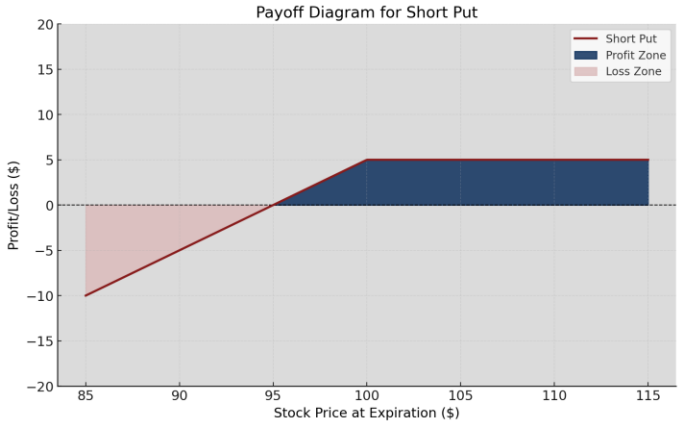
Background

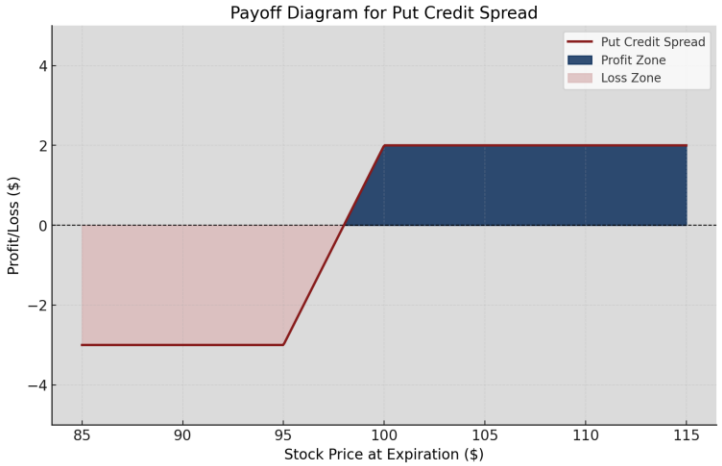
What is a Put Credit Spread?

Put Credit Spread

- Short Put for Premium
- Long Put for Hedge
- Capped Profit
- Capped Risk
- Useful when you believe there is a lower bound to an asset







Volatility and the VIX

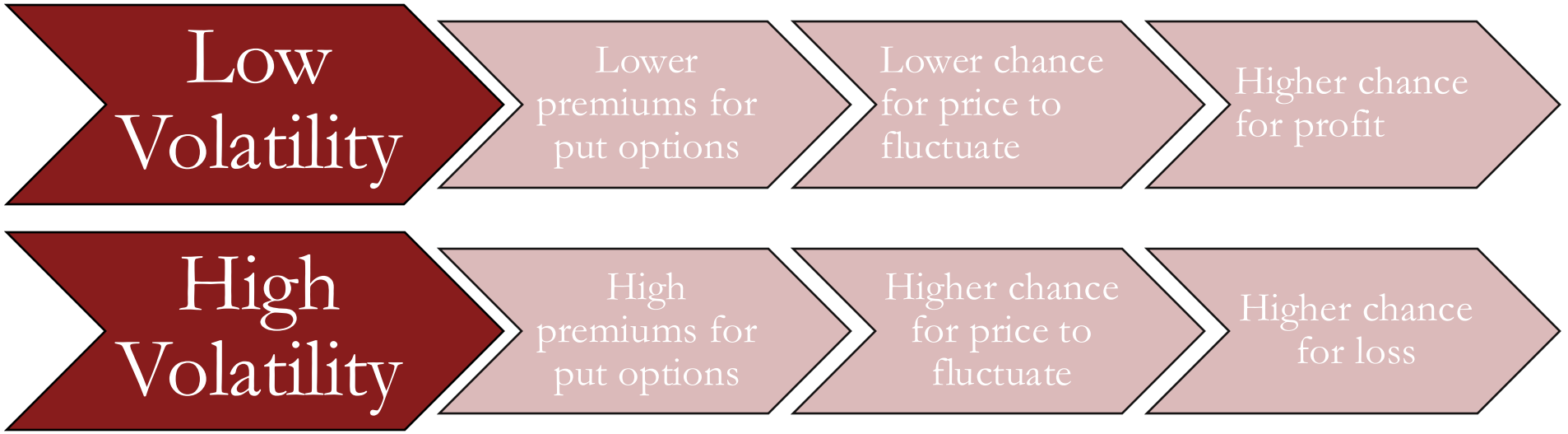
Volatility

- Measures the rate and magnitude of price fluctuations in financial markets.
- Indicates the level of uncertainty or risk in asset price movements.
- Higher volatility = larger, unpredictable price swings; lower volatility = more stable prices.

VIX Index

- Known as the "fear index," it reflects market expectations of 30-day volatility based on S&P 500 options.
- A rising VIX signals increased market uncertainty or risk aversion.
- A declining VIX suggests calmer, more stable market conditions.

Put Credit Spreads under different volatility conditions



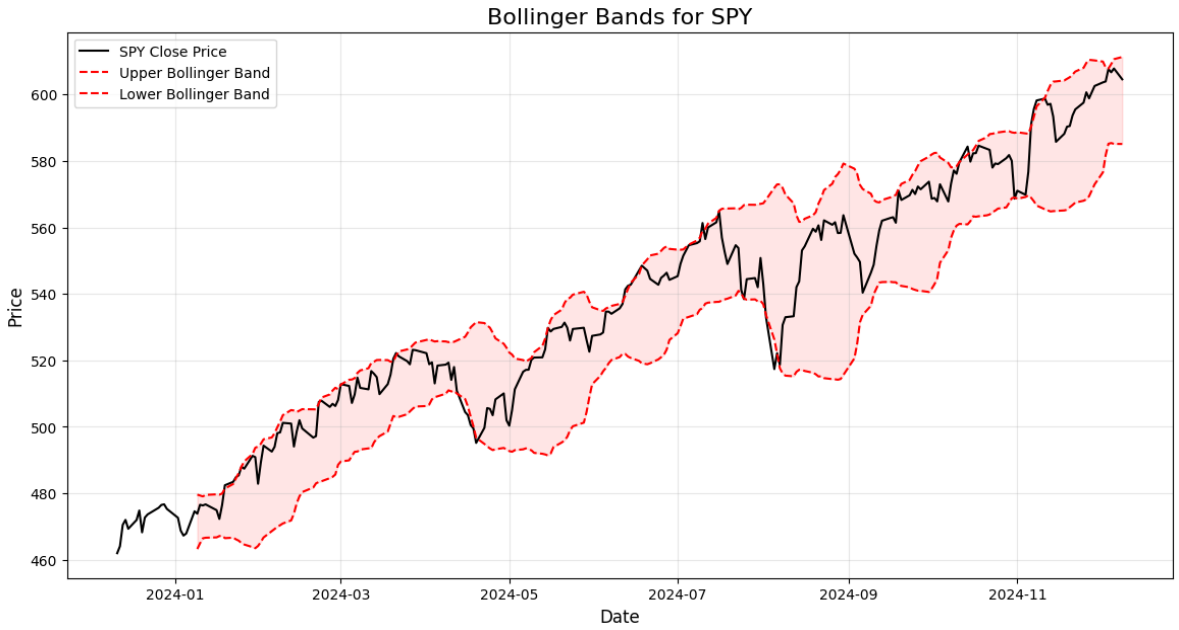
Other Technical Indicators

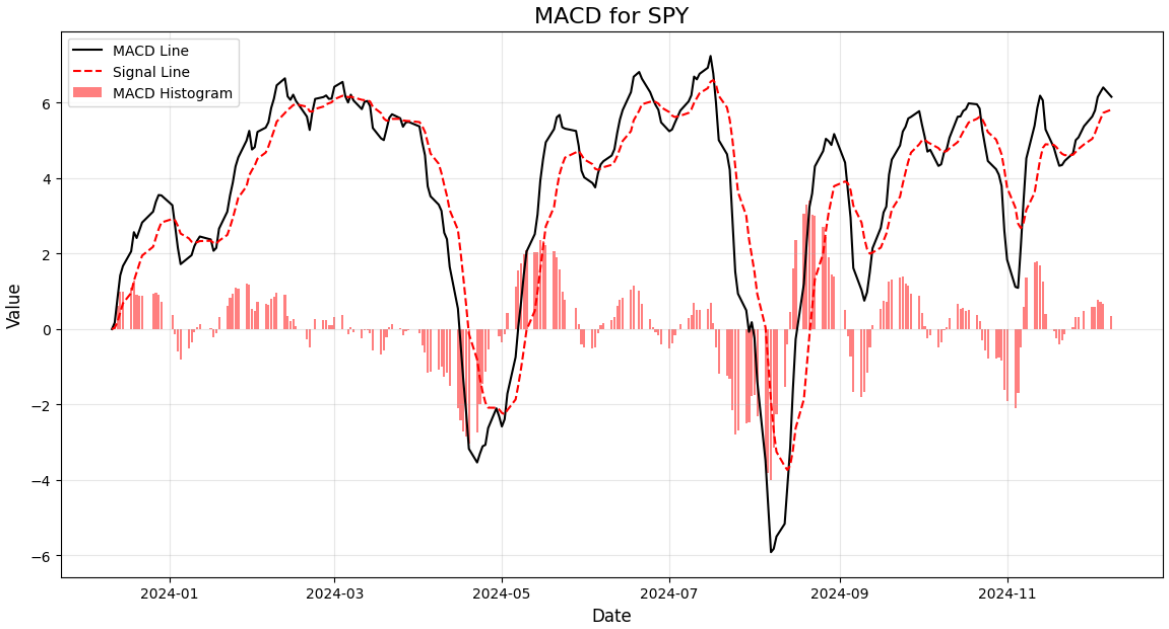
Bollinger Bands

- Measures volatility with a middle 20-day SMA and upper/lower bands based on standard deviations.
- Identifies overbought (near upper band) and oversold (near lower band) conditions.
- Helps spot potential trend reversals or price breakouts.

MACD (Moving Average Convergence Divergence)

- Tracks momentum using the difference between two EMAs (12-day and 26-day).
- Signal Line (9-day EMA) triggers buy (MACD above) or sell (MACD below) signals.
- Histogram visualizes the strength and direction of momentum changes.





Research

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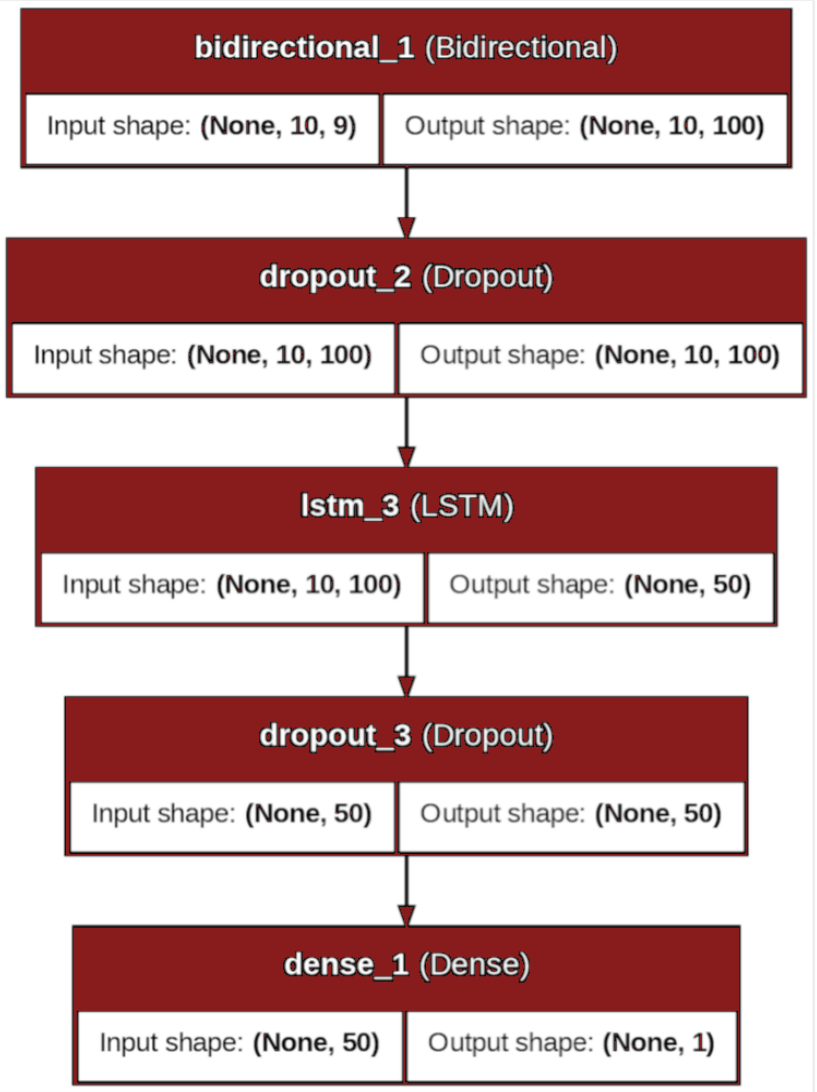
Long Short-Term Model

An LSTM is a type of Machine Learning model that uses feedback loops to identify patterns in time-series data.

LSTMs actively decide what information is to keep, what information to pass on, and discards anything it does not need.

In our context there are a few reasons that LSTMs are particularly useful:

1. Sequential Analysis
2. Prevents Model Tunnel Vision
3. Efficient data usage



Our Model

Inputs

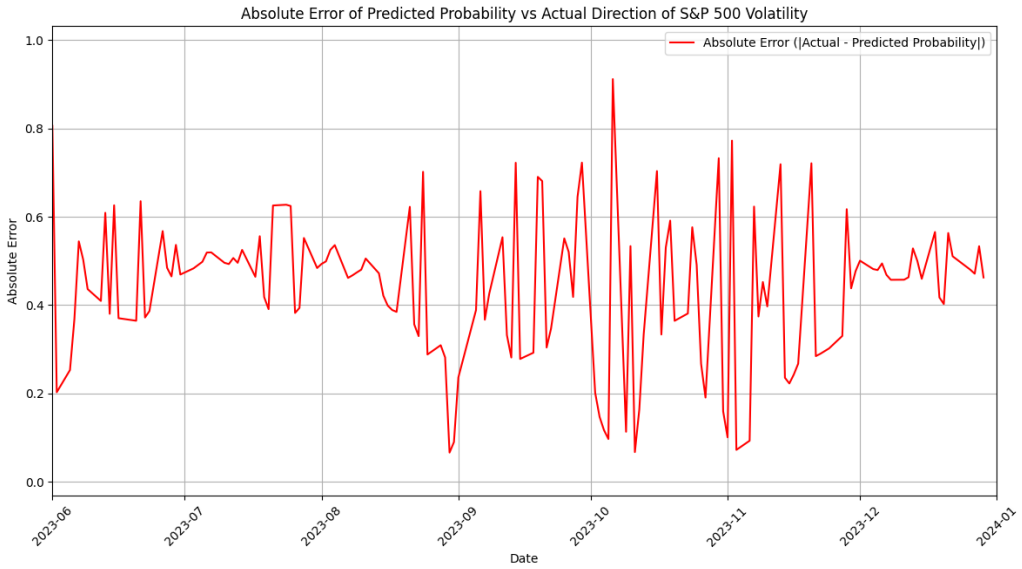
- S&P500
- VIX
- MACD
- Bollinger Bands

Outputs

- Probability of the next day's implied volatility being higher
- Spread of the assets' returns over the last 30 days

Results

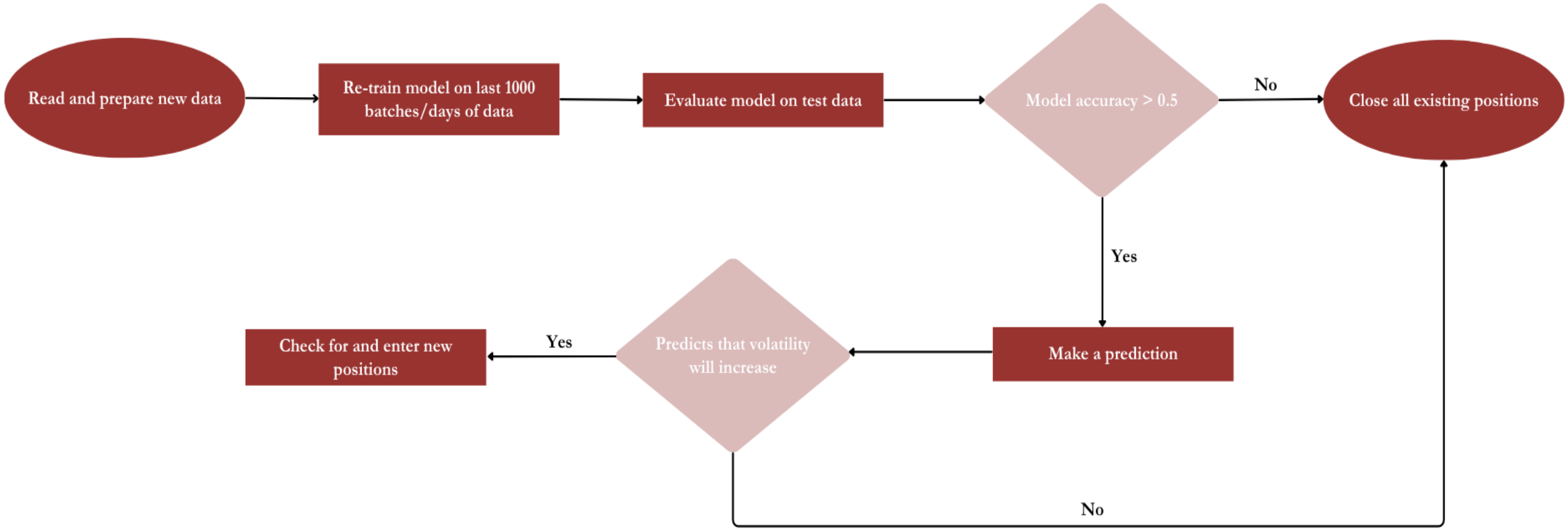
- Accuracy Level: 61%
- Loss: 26%



Mean-Squared Error

The Algorithm

Control Flow



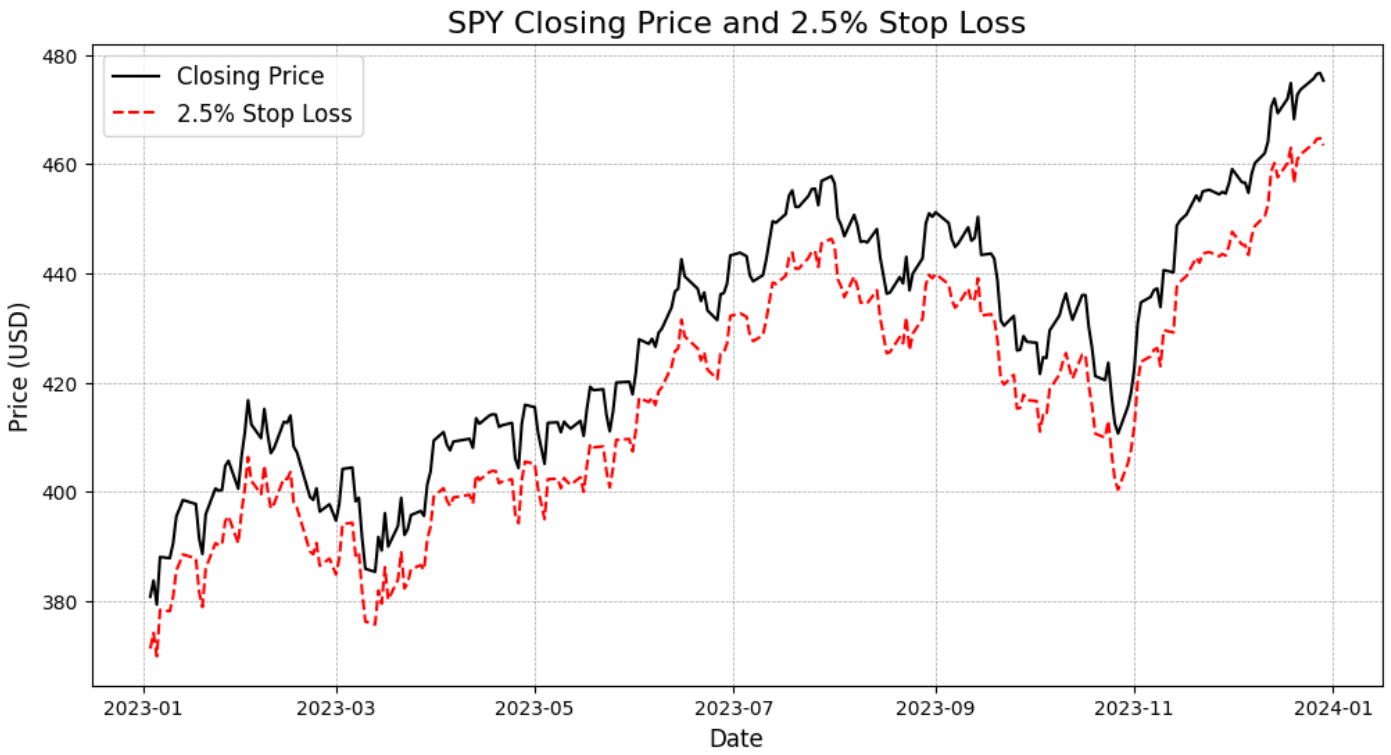
Risk Management

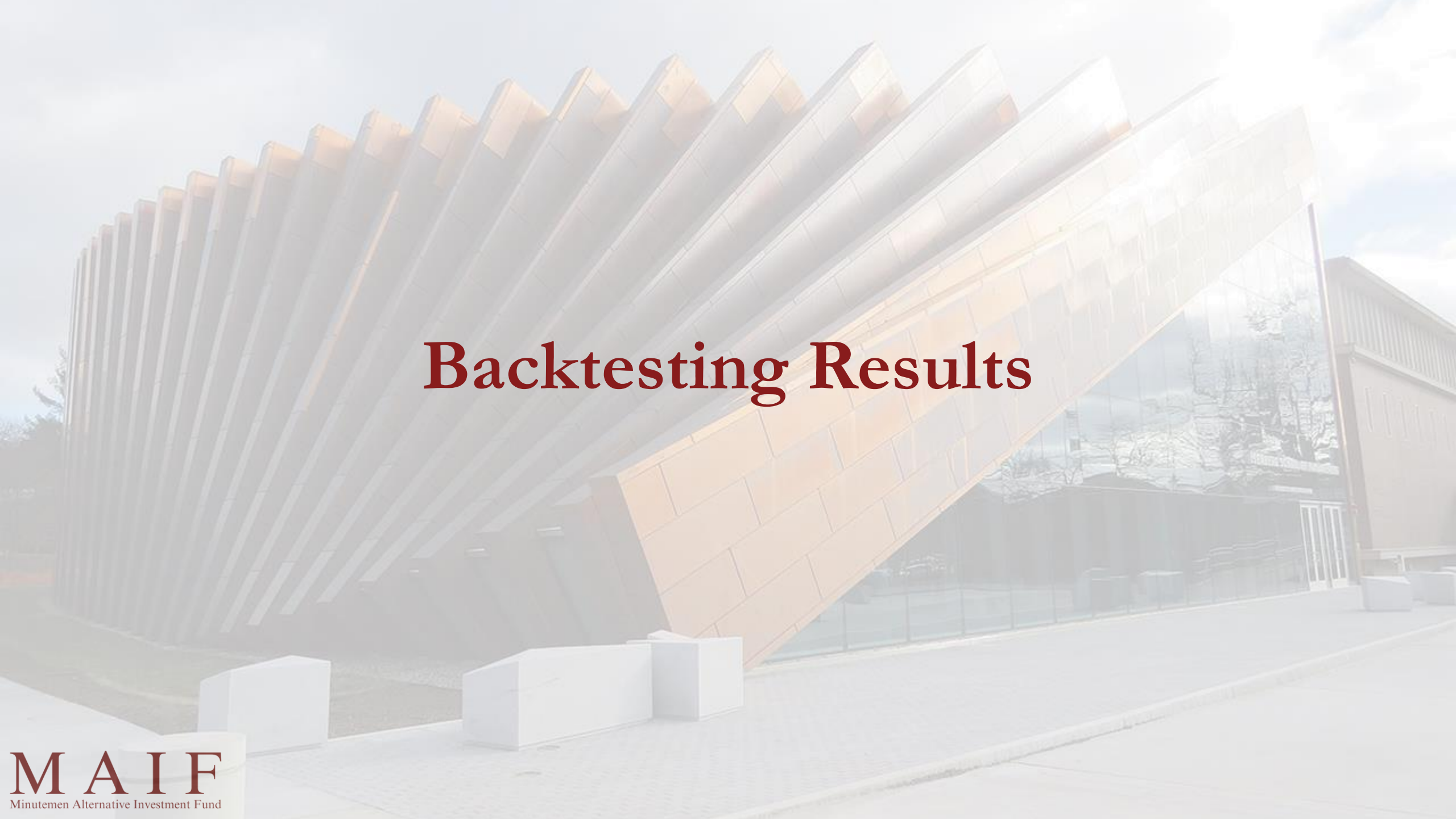
2.5% Stop Loss

- Checked every two hours
- 2.5% is purposefully risk-averse
- Forces losses to be "death by papercuts"
- 5% and 10% stop-loss fared worse, allowing for higher losses with no additional benefits

Position Liquidation Timing

- Positions are liquidated when:
  - Model predictions are unreliable
  - A decrease in volatility over the next day is predicted
- Trading only occurs when a volatility increase over the next day is predicted with sufficient confidence





Backtesting Results

Why our strategy works

High Volatility = Higher premium on put credit spreads

Allows us to capitalize high volatility periods with a positive outlook

We identify when the market is likely to increase, and in the event it goes down, we remove our positions to avoid loss

Examples

- Recovery from March 2020 Crash
- 2024 Election period

6 Month Backtest: January – June 2024

Results (39 orders)

- 15.10% Returns
- Sharpe Ratio: 2.714
- Max Drawdown: 2.4%
- Excluding warm-up period: SPY returns of 10.95%

11 Month Backtest: July 2023 – June 2024

Results (55 orders)

- 22.47% Returns
- Sharpe Ratio: 0.96
- Max Drawdown: 13%
- Excluding warm-up period: SPY returns of 25.28%

COVID Rebound Case Study: March – August 2020

Results (36 orders)

- 29.79% Returns
- Sharpe Ratio: 2.204
- Max Drawdown: 12%
- Excluding warm-up period: SPY returns of 23.63%

Summary

- Trading put credit spreads based on volatility deploys trading in favorable scenarios
- Works well in high volatility and bullish market conditions, outperforming its underlying asset
- With higher compute we could handle more data and:
  - Trade multiple assets
  - Trade with higher frequency
  - Create a model that can predict next-day volatility changes with a greater accuracy

Thank You! Questions?

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