

1. Summary

The project's primary goal is to identify stocks with a high historical intraday volatility and use a long/short statistical arbitrage strategy to capture price movements, with the ultimate aim of generating profit. We designed a combined trading strategy incorporating several established individual strategies (Z-Score, Mean Reversion, Moving Average Crossover, RSI, and Bollinger Bands) and applied them to the most volatile S&P 500 stocks. The strategy's efficacy was assessed through backtesting using historical data, where it was found to outperform individual strategies.

2. Introduction

The foundation of this project lies in the belief that past intraday volatility can be used to predict future price swings. Through the long/short statistical arbitrage strategy, the project intends to profit from these anticipated price fluctuations. The strategy assumes that extreme deviations from the historical average are transient and will revert to the mean in due time.

3. Steps

Here is a detailed description of the steps involved in executing this project:

- 1 **Data Acquisition:** Using the yfinance library, we collected data on S&P 500 constituents and their 2022 hourly historical data.
- 2 **Volatility Calculation:** For each stock, we calculated the intraday volatility and identified the top 10 most volatile stocks.
- 3 **Strategy Definition and Evaluation:** We defined and assessed individual strategies on the historical data. This provided us with insights into how each strategy performs under different market conditions.
- 4 **Cumulative Return Calculation:** For each strategy, we calculated the cumulative return, serving as a performance metric for the individual strategies.
- 5 **Strategy Weight Determination:** Based on the performance of individual strategies, we calculated weights for the combined strategy.
- 6 **Combined Strategy Implementation and Evaluation:** The combined strategy was implemented and evaluated on the historical data. This allowed us to see how well the combined strategy performs in comparison to each individual strategy.

4. Outcomes

Our combined strategy managed to utilize the strengths of each individual strategy effectively. It achieved this by weighting them according to their respective performance metrics. For instance, for one particular stock (MRNA), the combined strategy yielded a cumulative return of 1.0195 and a Sharpe Ratio of 0.2963. For the ten most volatile stocks,

the combined strategy had a cumulative return of 0.9569 and a Sharpe Ratio of -1.1198, indicating its superior performance over individual strategies.

5. Potential Downsides and Enhancements

Despite the promising results, we must acknowledge certain limitations and potential areas of enhancement:

Cons:

- The hourly tick data is from yfinance for 2022, but the index weights are obtained from WRDS, potentially leading to inconsistencies in the analysis.
- We assumed the average index weight of the stocks throughout 2022, which may not reflect the quarterly rebalancing of the S&P 500, leading to deviations from actual market conditions.

Enhancements:

- We can incorporate risk mitigation strategies such as stop-loss orders or portfolio diversification to shield the portfolio from sudden market downturns.
- The optimization of weights can be refined using more sophisticated techniques based on factors like risk-adjusted performance, correlations between strategies, and more.
- The incorporation of additional trading strategies or alternative weighting methods could further improve overall performance.
- Dynamic rebalancing of signal weights in response to live news or sentiment analysis or through the application of machine learning algorithms could lead to better profits in varying market dynamics.
- To ensure the robustness of the combined strategy, we could perform further research on different timeframes or market conditions and backtest the strategy over multiple years, giving us a better understanding of its performance in different market cycles.

The walk-forward method can be considered for a more rigorous backtesting process.

In conclusion, this project represents a promising step in combining multiple trading strategies to create a more effective and resilient approach to profit from high intraday volatility. As with all financial models, continuous refining and backtesting are key to staying relevant in the ever-changing market landscape.

7 STRATEGY -

Z-Score: The Z-score is a measure of how many standard deviations an element is

from the mean. In the context of stock prices, if the Z-score is high (e.g., above 1), it indicates that the price is significantly above the mean and might drop soon (a signal to sell or go short), while a low Z-score (e.g., below -1) means the price is significantly below the mean and might increase soon (a signal to buy or go long).

- 8 **Mean Reversion:** This is a financial theory suggesting that asset prices and returns eventually return back to their long-term mean or average. An example of a simple strategy is to measure the current price against its historical average. If it's significantly above the average, expect it to drop (go short), and if it's below the average, expect it to rise (go long).
- 9 **Moving Average Crossover:** This strategy involves two moving averages: one short-term and one long-term. When the short-term average crosses above the long-term average, it's a signal to buy (go long), as it indicates upward momentum. Conversely, when the short-term average crosses below the long-term average, it's a signal to sell (go short) as it indicates downward momentum.
- 10 **Relative Strength Index (RSI):** This is a momentum oscillator that measures the speed and change of price movements. It oscillates between 0 and 100, and traditionally, the asset is considered overbought (and a sell signal is generated) when the RSI is above 70 and oversold (a buy signal) when it's below 30.
- 11 **Bollinger Bands:** These are volatility bands placed above and below a moving average. The bands widen when volatility increases and narrow when it decreases. Typically, prices are considered high when touching the upper band (a sell signal) and low when touching the lower band (a buy signal).