MAROON ALGO GROUP

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Predicting VIX (Volatility Index)

- VIX is an index created by the Chicago Board of Exchange that measures expectations of market volatility
- The goal is to predict next-day VIX returns using carefully selected factors
  - Previous day VIX returns
  - SPY ETF returns (representative of US Markets)
  - EAFE Index returns (representative of non-US Markets)
  - Days until high impact economic event
  - SPY ETF volume

Strategy Intuition

- When VIX is high, general sentiment about the economy is worse which can affect the trading habits and prices of certain assets
- VIX is a volatility index, so a predicted increase in VIX is a predicted increase in market volatility
- When people have negative views on the economy, they want stable and safe assets
- If the model predicts VIX return for the following day reaches some threshold, a trade is executed to take advantage of the next day's volatility
- Positions are held for 1 day only, regardless of outcome, as the model only predicts short term volatility change

Strategy Intuition Contd.

- The assets selected to trade when VIX goes up include:
  - Options: the price of options are directly impacted by their underlying asset's volatility and movement. The strategy leverages this fact to profit on options prices
    - The value of call option goes up when the underlying asset's price increases and goes down when the price decreases
  - SPY ETF: To offset directional movement risk from owning options, you can short a quantity of the underlying stock. This strategy trades SPY ETF Call Options and the underlying ETF
  - Futures Contracts (Silver, Crude Oil): Commodities such as silver and crude oil tend to be purchased as stable assets when market sentiment is negative
    - A futures contract is a legal agreement to buy or sell a commodity or financial instrument at a predetermined price and date in the future.
  - Long Term Bond ETF: An exchange traded fund which holds a position in long term Treasury bonds which tend to see an increase in price when market volatility is high

Predictive Model

- Model type adopted from Ahoniemi (2009)
- Predicts VIX returns for the following trading day
- Competitive advantage over other time-series predicting models due to extensive research and parameter testing
- High predictive accuracy when VIX returns are predicted to be over/under our threshold

Back-testing

- The strategy was back-tested for 7 years (2015-2021)
- Incorporated all fees and transaction costs
  - Shorting fees
  - Transaction fees
  - Management fees
- Conservative margin requirements for futures positions
- Position sizing is based on how closely the tradeable asset's returns have tracked VIX changes over the last 30 days (i.e. a rolling correlation)

Investment Universe

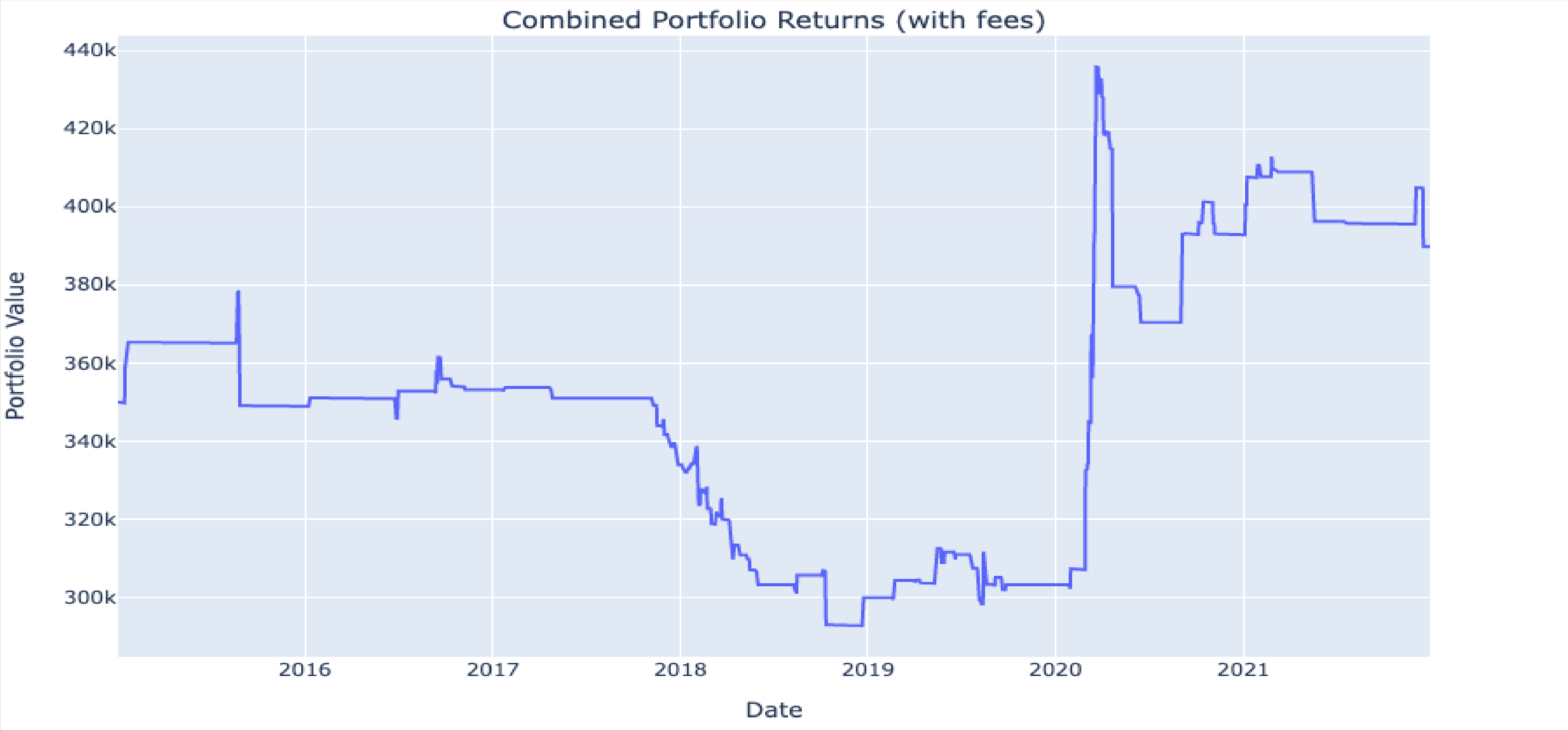
- The investment universe consists of futures, ETFS, and options
- When volatility goes past the chosen upper and lower bounds, trading on these assets can be profitable
- The strategy takes:
  - Long or short positions in SPY options
  - Long or short positions in ETFs
  - Long or short positions in futures
- Assets selected through the back-testing process
  - Silver futures (SI)
  - Crude Oil Futures (CL)
  - iShares 20+ Year Treasury Bond ETF (TLT)
  - SPY Options
  - SPY ETF (SPY)
    - Tracks the S&P 500 index

Risk Management

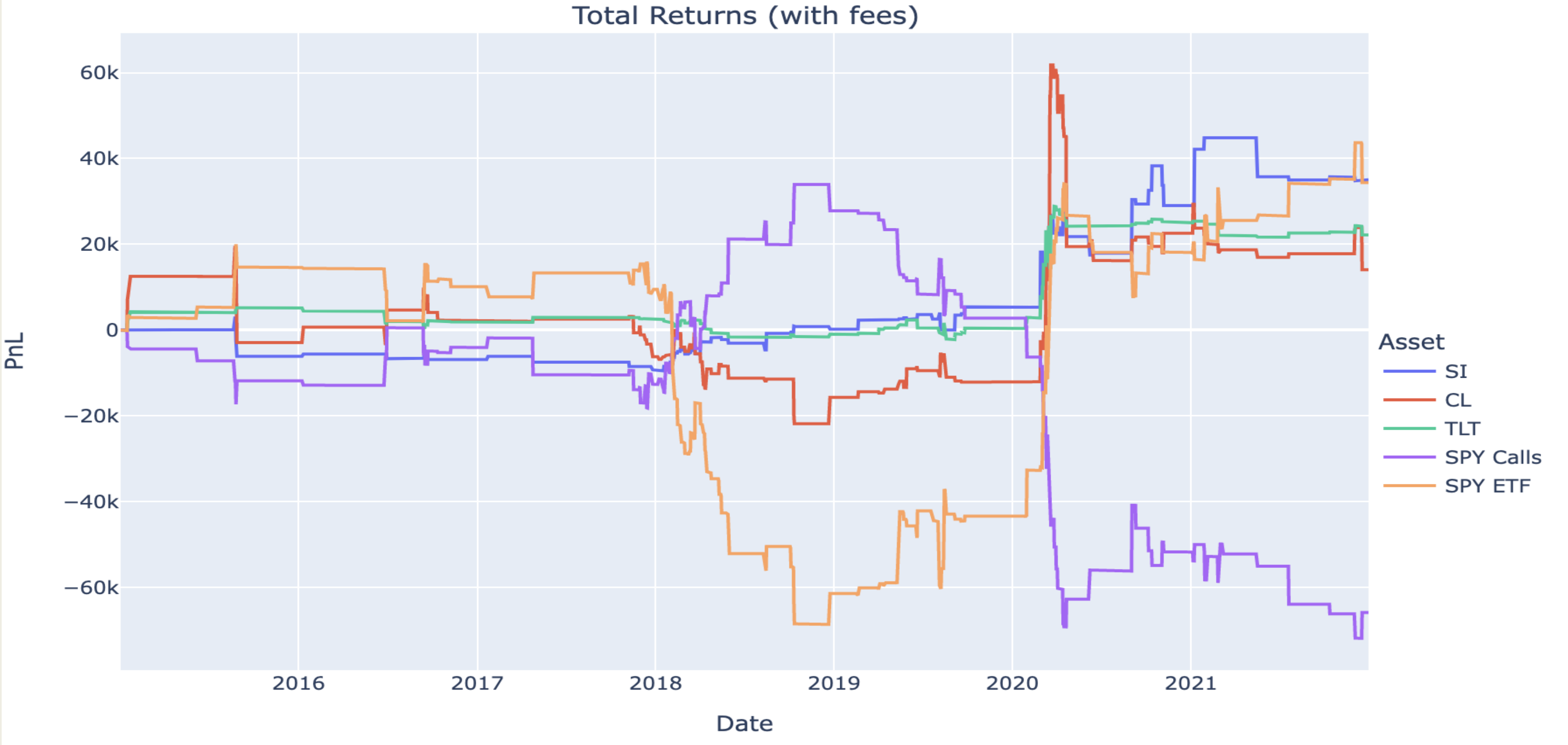
- Positions are held for only one day
  - This limits extreme swings that last multiple trading days
- SPY option and SPY ETF long/short positions cancel out the risk imposed by changes in SPY price
- Trades are only conducted when a strong VIX prediction is present (at or above the 75th percentile of the previous 125 days VIX values)
- Extensive research on model parameters reduces the risk of inaccurate VIX predictions

Portfolio Returns

- The graph shows the trading strategy's profit and loss over the sample 2015-2021
  - Initial capital of $350,000
  - Exiting at the end of 2021 with $39,783 in profit

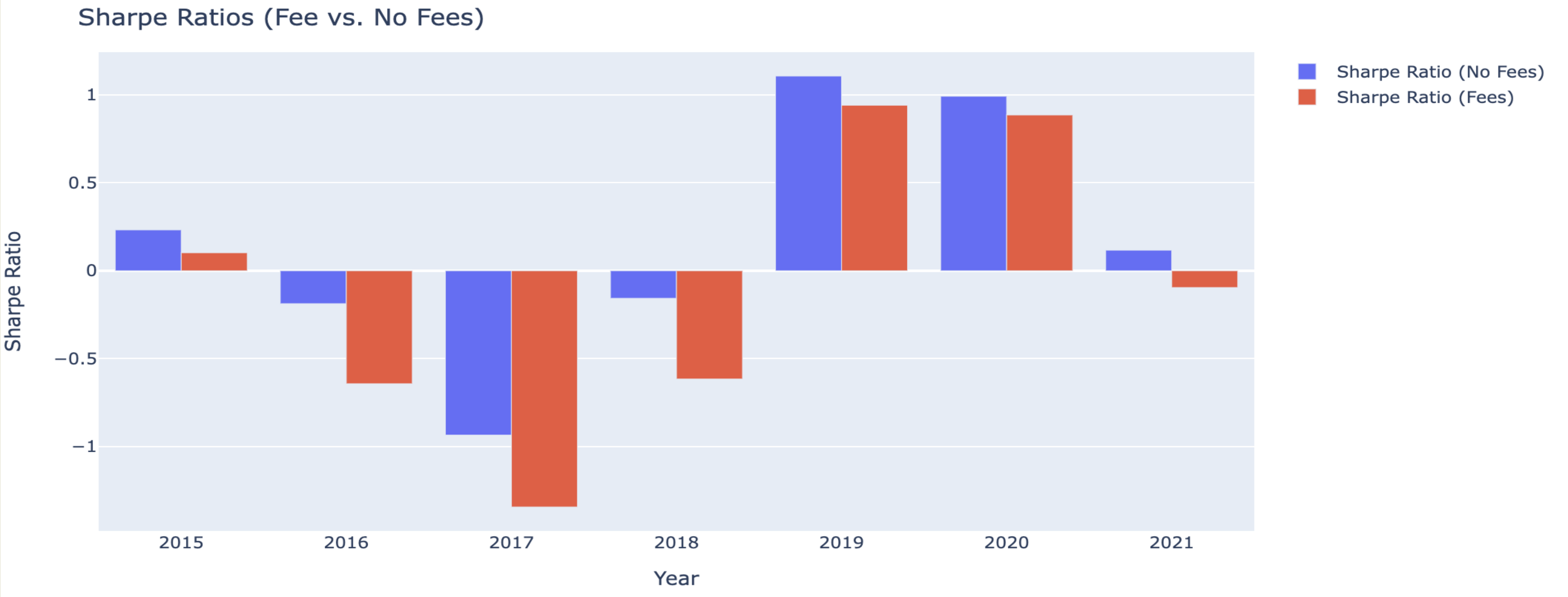


Portfolio Returns By Asset



- Profit made by every asset besides the SPY calls (which is counteracted by the SPY ETF)

Year By Year Returns



- Sharpe ratio is a risk vs return metric (higher is better)
- Important to note that the strategy performs very well in times of political and macroeconomic uncertainty (2019, 2020)

Return Correlations

- Correlation of returns to other important factors
  - Fama French market factor: -0.12
  - Fama French size factor: -0.078
  - Fama French value factor: -0.035
  - Risk-free rate: 0.034

Strategy Takeaways

- Strategy performs well under extreme market conditions
- Assets in strategy are uncorrelated to market factors

- Though the strategy did not beat the market, it could be useful for diversifying a portfolio
    - Strategy returned 2% annualized
    - SPY ETF returned 15% annualized

- Further investigation could be done on other assets and asset classes that are correlated to volatility
    - For example, the Japanese Yen

- The strategy should be deployed when world events indicate a period of high volatility, which cannot be accurately represented in the factors we used to predict VIX (ex: COVID, Russia-Ukraine War, etc.)