# Quantify Strategies

Sajay, Rhea and Elia

# Agenda

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2. Decision Strategies
    a. Institutional Holdings
    b. Time series Forecasting
    c. Analyst Recommendation
    d. Analyst EPS Estimates
    e. Short Data
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    g. Crypto
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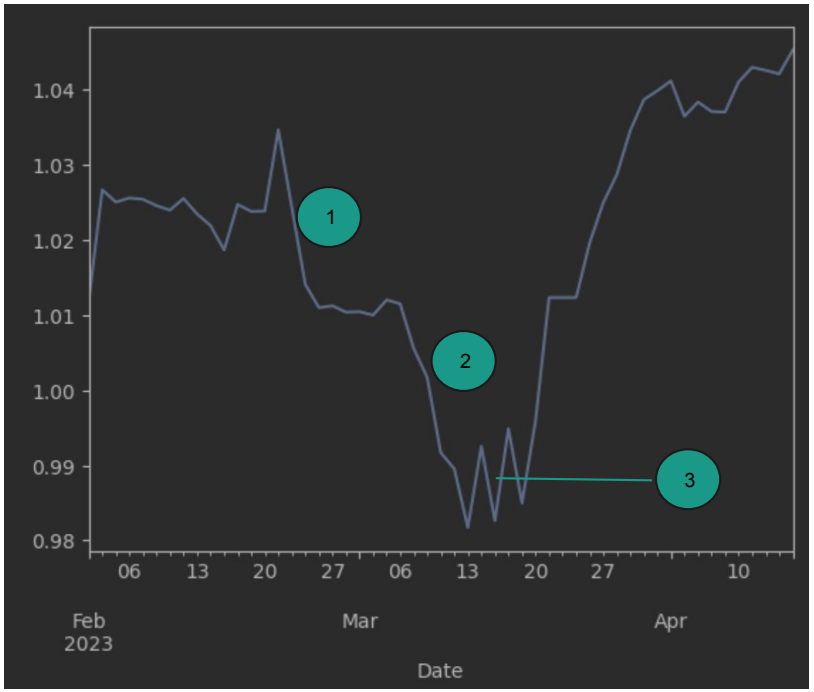
    i. Options
    j. Insider Transactions
3. Portfolio Optimisation
4. Forecast Ranking
5. Learnings

# Overall Performance

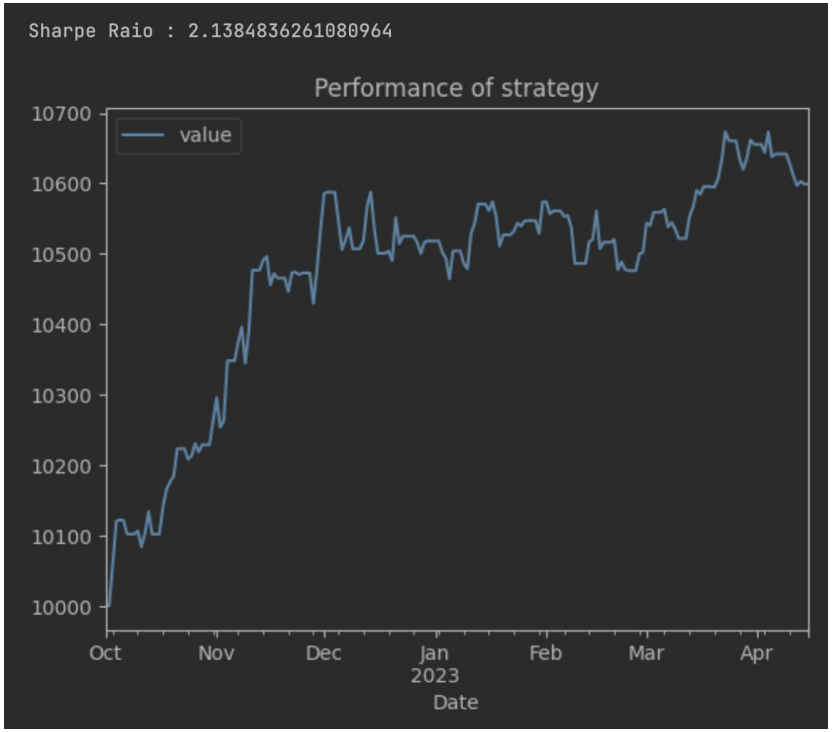



- Overall Returns : **4.12%**
- Out of 47 trading days, positive returns on 22 days (47%)
- Out of 110 stocks, 63 stocks provided positive returns to the portfolio
- Downfall Events
  - 1: Dominoes (DPZ) fell by 15% in 2 days post earnings release on Feb 22. Earnings surprise strategy had overweighted DPZ since it had continuously beat earnings estimates for the past few weeks.
  - 2: DOGE-USD fell by 13% between March 8 and March 9 and our price prediction using Prophet had predicted high returns for this Crypto. Crypto returns overall hit portfolio badly for this week
  - 3: SVB Crisis - Portfolio had VXX shorted but VXX rose by over 10% on one day which caused this downfall

| Sector | returns |
|---|---|
| Equities | 1.68% |
| Volatility | 1.20% |
| Communication Services | 0.81% |
| Financials | 0.49% |
| Fixed Income | 0.18% |
| Utilities | 0.18% |
| Commodities | 0.14% |
| Energy | 0.09% |
| Real Estate | 0.03% |
| Information Technology | -0.02% |
| Health Care | -0.12% |
| Industrials | -0.14% |
| Consumer Staples | -0.16% |
| Materials | -0.63% |
| Crypto | -1.12% |
| Consumer Discretionary | -2.37% |

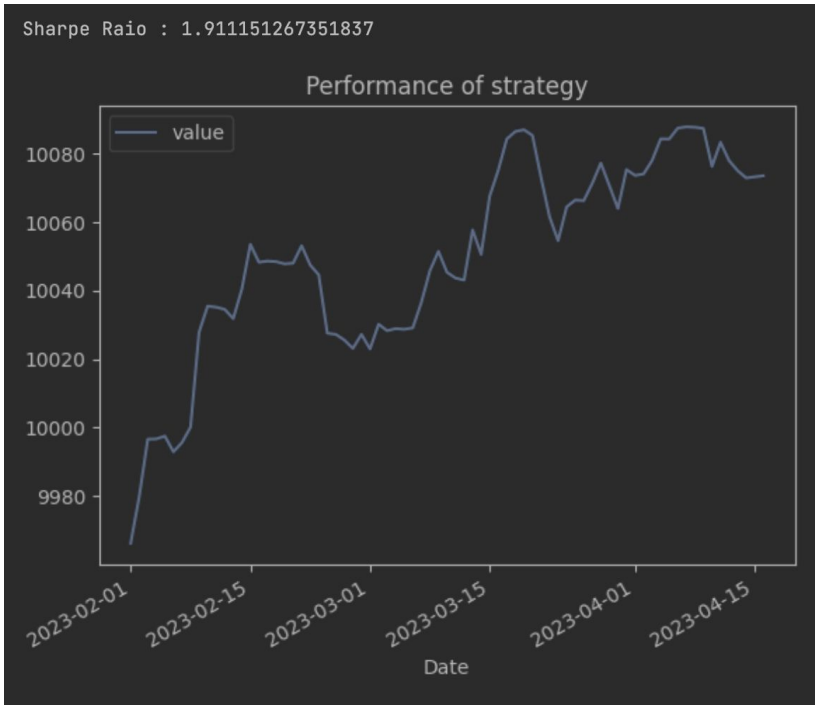
# Institutional Holdings

- Check how much  current month %holdings by institutions has changed as compared to average %holdings of institutions in past 3 months.
- If increased, take long positions and vice versa
- Also the relative % difference was weighted with current month %holdings
- Ideas to try:
  - Individual level fund data available for each stock.
  - Try to analyse how the activity of major funds affect the stock price in short term and then try replicating the major funds portfolio



# Time Series Forecasting

- **ARIMA Models**
  - Idea: Calculate expected returns using ARIMA models if model coefficients are significant
  - Initially used daily returns to predict next period return which we realised is wrong and updated to use weekly returns
  - Order of ARIMA model was selected based on AIC value
  - Used it for all the weeks
- **Could have tried:**
  - TS forecasting for factor models



# Earnings Surprise

- Implemented Idea:
  - Calculate Earnings Surprise

**Suprise_est_i = (EPS_est - EPS_act_past)/EPS_act_past**

  - **Portfolio_weight_i = (Holdings_i) * Suprise_est_i**
  - Initially used earnings announcements which are going to be released one week further.
  - Later increased the window to two weeks post analysing the returns in previous weeks before announcements
- Looked over past 3 years (12 periods) to see how many times earnings have beaten the estimates
- Could have tried
  - Tried to predict earnings surprise using sentiment analysis from news report


  - **Sharpe Ratio: 1.552**

# Short Data

- **Idea:** Mean reverting strategy based on short data
- **Strategy Used:**
  - Short Interest ratio = Short/Total Volume
  - Identify events when short term MA of short interest ratio goes above or below the long term MA of short interest ratio
  - If short MA goes above long MA, we buy and vice versa
  - Also weighted cross-sectionally using short term MA
- **Analysis**
  - Tends to perform better when the market was down in the previous week.


**Sharpe Ratio: 2.152**

# Options Data

- Expected value of stock over next was identified using three methods:
  - Call Strike weighted with call volume
  - Put Strike weighted with put volume
  - Call/Put Strike weighted with risk neutral probability
- With three expected value and standard deviation
  - Weighted average of expected value weighted inverse of standard deviation was found
- **Issues:**
  - Low volumes of options traded due to which some stocks were overweighted
- **Could have tried:**
  - With the implied distribution, find a set of probable price for next week and calculate rank based on it.

**THE BREEDEN-LITZENBERGER FORMULA**

$$p(S,t,K,T) = e^{r\tau}\frac{\partial^2 C(S,t,K,T)}{\partial K^2}$$

The risk-neutral probability of making a transition from $S$ at time $t$ to $K$ at time $T$ is proportional to the second partial derivative of the call price with respect to strike

# Insider Transactions

- **Idea:** Insiders' sentiment gives investors a glimpse at what the executives are thinking about the stock price and valuation in the near future.
- Only purchase shares were considered and not shared provided by bonus/compensation
- Not many stocks in the universe had insider transactions in the past two months. Also the number of insider shares traded were very low
- **Limitations:**
  - Less coverage of stocks
  - # Shares traded were very few to actually make an impact

Insider Sentiment - Monthly Share Purchase ratio

$$MSPR_{i,m} = \frac{\sum_0^D (PS_{i,d} - SS_{i,d})}{\sum_0^D (PS_{i,d} + SS_{i,d})}; PS_{i,d} \geqslant 0, SS_{i,d} \geqslant 0$$

PS and SS are the Purchasing Shares and Selling Shares of the company i in month m. (Only open market transactions)

*The closer this number is to 1 (-1) the more reliable that the stock prices of the firm increase (decrease) in the next periods.*

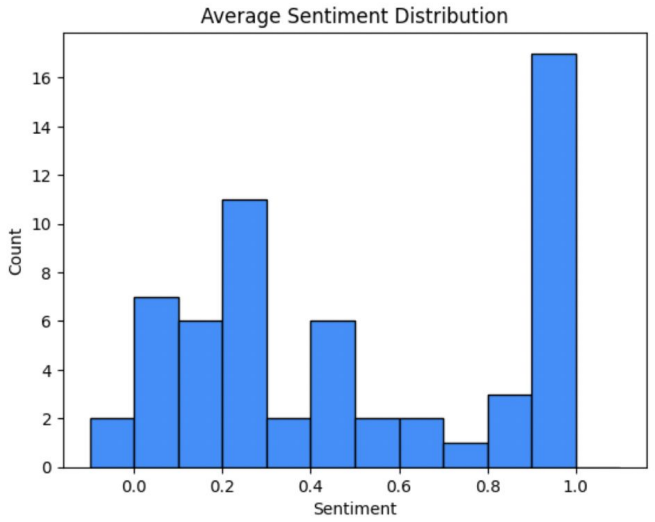
# Analyst Recommendation

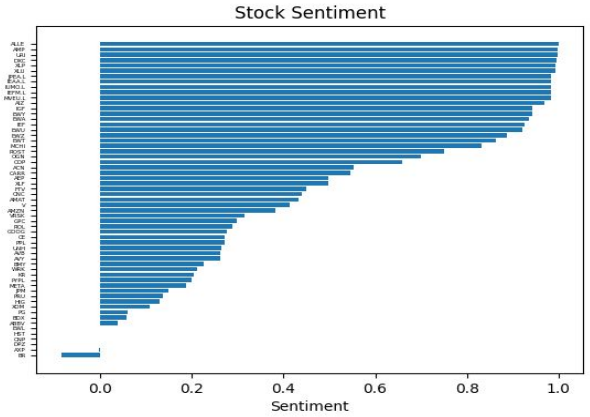
- **Idea:**
  - Check for analyst recommendation of buy/sell signal, upgrade/downgrade for signals and give weights based on the firm which provided rating
- **Strategy Used:**
  - Analysed the returns for the week post analyst recommendations and found %times stocks performed better than previous week was higher post a downgrade/sell recommendation
  - Based on historical data, found %times next week returns performed better than previous week for a combination of company/recommendation_type and brokerage_firm/recommendation_type
  - Identified assets which had recommendations in last weeks and used the above as scores for the assets
- **Results:**
  - Got contradicting results where the returns for the next week was better when target was lowered.

| Action | future_pct | better_future_pct ▼ 1 |
|---|---|---|
| Target Lowered by | 0.537461 | 0.618032 |
| Downgraded by | 0.531555 | 0.599330 |
| Dropped by | 0.000000 | 0.500000 |
| Reiterated by | 0.535281 | 0.464719 |
| Initiated by | 0.534357 | 0.463391 |
| Target Set by | 0.536565 | 0.462339 |
| Upgraded by | 0.560166 | 0.406353 |
| Target Raised by | 0.525387 | 0.348875 |

# Sentiment Analysis

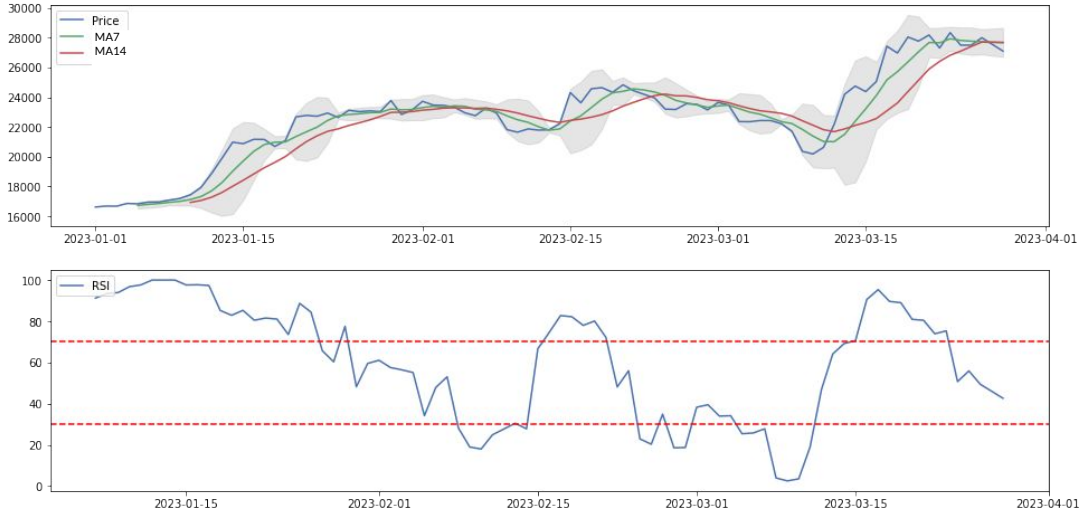
- **News Sentiment:** Extracted the average sentiment of weekend news for all stocks and ETFs by analyzing Refinitiv news data
- **Social Sentiment** - Reddit and Twitter
  - Tweepy library
  - Retrieved tweets containing a particular stock ticker symbol and analyzed the sentiment of the tweets to determine if they are positive, negative or neutral
- **Limitations:** sentiment data not available for every asset, only found data on 58 out of 110 assets
  - Found mostly positive sentiments
- **Improvement**:
  - Expand the sources to other social media platforms like Facebook or consider context in the sentiment analysis



# Cryptocurrency Strategies

- Prophet
  - Idea: Tried using prophet to model crypto prices
  - Prophet is a forecasting tool that capture trends, seasonality and changes in data patterns over time
  - Since crypto prices don't show seasonality, prediction using Prophet was giving poor performance
  - Stopped using for later weeks
- Technical Analysis
  - RSI and Moving Average
    - Calculate 7-day and 14-day simple moving averages
    - Generate buy/sell signals based on moving average crossover, RSI, MACD
  - Bollinger bands

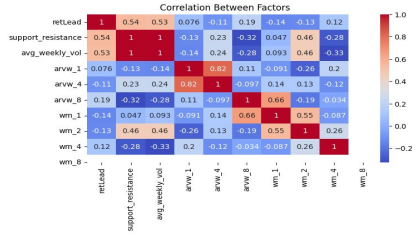


# Factor Models

$$r_i = \alpha_i + \beta_{i1} f_1 + \beta_{i2} f_2 + \cdots + \beta_{iK} f_K + \epsilon_i$$

**We use a factor model approach to predict next week's stock returns based on technical indicators**

- **Technical Indicators Used:**
  - Used price-based and volume-based technical indicators to construct a factor model
  - Different factors used for stocks and cryptocurrency
- **Model estimation:**
  - Factors used to estimate next week's return using a linear regression model
  - Principal Component Analysis (PCA) was used to remove correlated factors



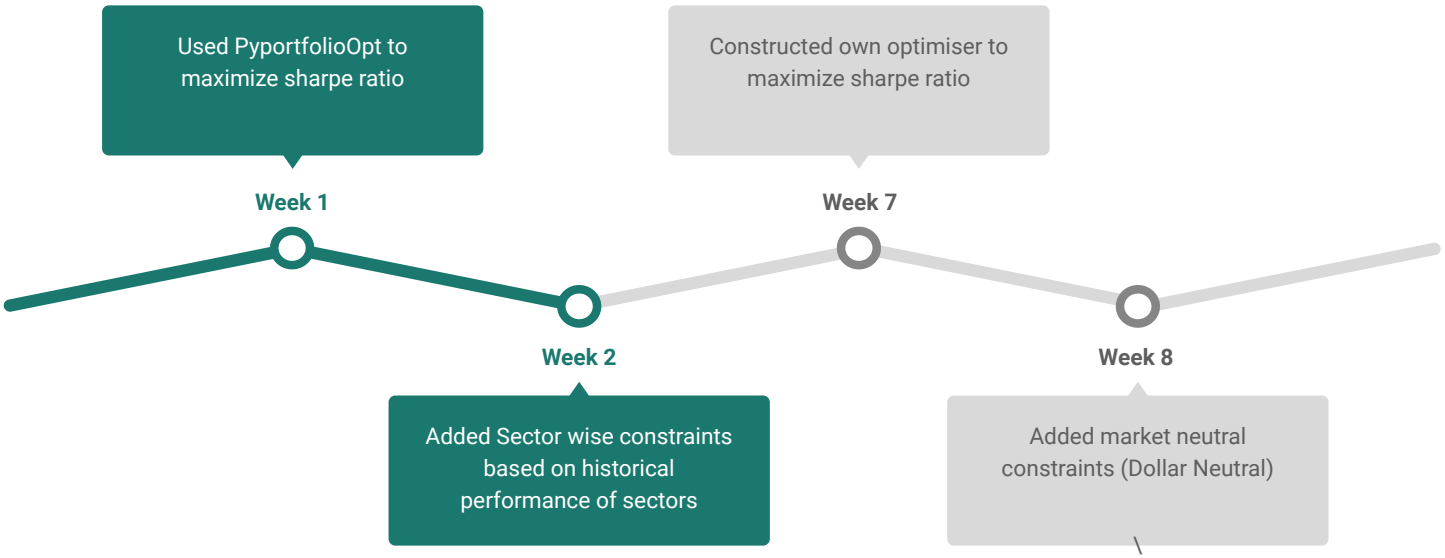

**Stock and ETFs Factors:**

- **Return Momentum:** 1 week, 2 week, 4 week, and 8 week momentum
- **Short Interest Ratio:** a measure of short interest relative to total shares outstanding
- **Technical Indicators:** MACD, RSI, support/resistance, and volume

**Cryptocurrency factors:**

- **Size:** measured by market capitalization — reflects that the smaller assets are assumed to have higher risk
- **Liquidity:** measured by the dollar trade volume
- **Momentum:** measured by a change in price during the previous month
- **Betting against Beta:** Find assets with high betas and short

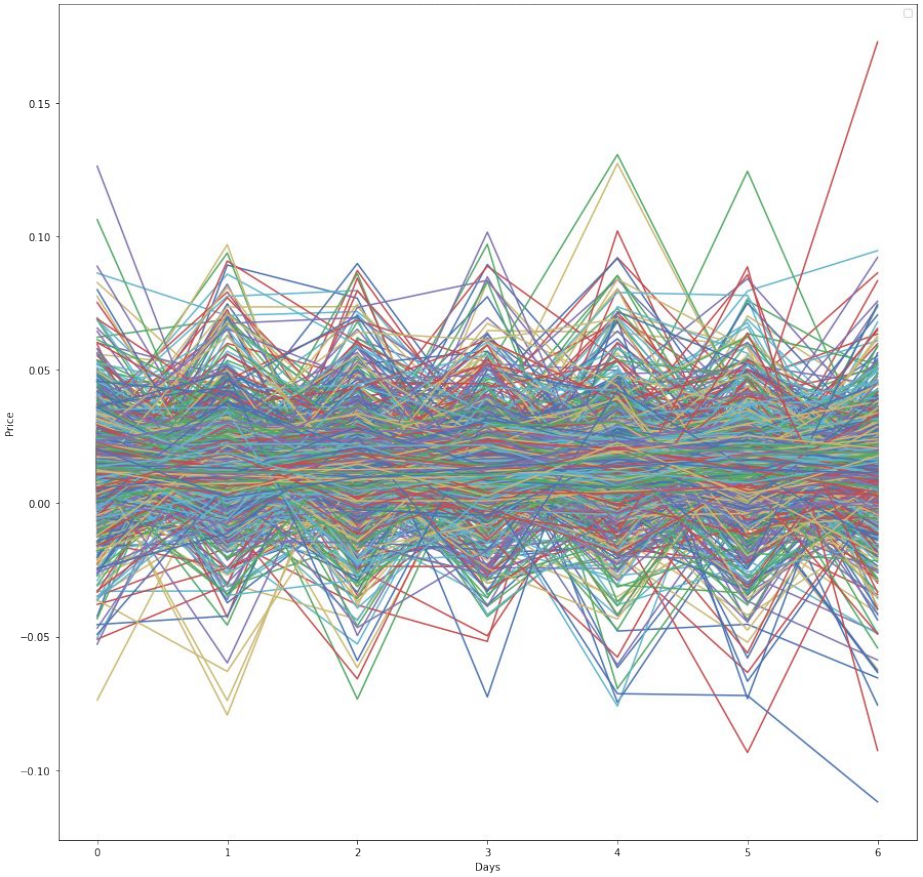
# Portfolio Optimization




Could have tried sector neutral portfolios

# Ranking

- 95% allocation using equal weighting
- Monte Carlo Simulation to generate weekly returns
- Performed linear regression analysis on the simulated prices to predict returns
- Categorized returns generated by each asset into five quintiles and calculated the frequency of their occurrences within each rank
- Used this strategy to account for 5% of the allocation to our ranks and 5% to our decision performance,
- Maintained this strategy throughout our portfolio submissions



# Things missed

- Strategy weighting
- Using LSTM for price prediction
- Better crypto strategy
  - Most data sets weren't applicable for  crypto
  - Lowering crypto weights and keeping them mostly in negatives