Designing and Testing a Quantitative Stock Trading Strategy with Basic Mathematical Tools

Objective:

To implement a basic yet complete quantitative trading strategy using mathematical and statistical techniques. The goal is to experience in the quantitative investment process, from data acquisition to backtesting.

Rough Methodologies Outline:

Week 1:

1. Data Collection and Stock Selection

Objective: Select a manageable set of stocks (e.g., S&P 500 or NASDAQ-100) based on liquidity and availability of historical data.

Data Source: Yahoo Finance or Finnhub.

Tools: Python (with pandas, numpy).

2. Signal Design

Calculate Signals:

Momentum

Volatility

Valuation

Standardization

Predictions based on models such as Lasso, ARIMA, and GARCH

Sentiment Indicator From FinBert

Week 2 :

3. Signal Combination and Ranking

Approach:

Standardize the signals, and assign them equal weights

Create a composite score for each stock.

Rank stocks based on score.

1. Portfolio Construction

Selection Rule: Pick top 10 stocks to long, and optionally bottom 10 to short.

Apply Black litterman or other models to find the optimal allocation of asset based on the signals of each trading day.

Week 3

1. Backtesting and Optimization

Frequency: Approximately Weekly

Duration: Use past 5–10 years of data.

Evaluation:

Sharpe ratio

Annualized return and volatility

Max drawdown

Use the result of backtesting to apply walk forward optimization to find the parameters that yields the best evaluation result (based on some weight).

The parameters would include:

Weight of the trading signals

Frequency of Trades

The number of top/bottom stock to include in our proforlio.