

Interview Question: Create Trading Strategy

February 2, 2025

Exercise 1: Statistical Arbitrage

Problem Statement

You are given historical price data for two currency pairs, EURUSD and GBPUSD, which are believed to be co-integrated.

Tasks

1. Verify if the two pairs are indeed co-integrated.
2. Construct a statistical arbitrage trading strategy by defining a mean-reverting spread based on the data.

Deliverables

- Use the Engle-Granger two-step method or another statistical test for co-integration.
- Calculate the spread and propose entry/exit points based on thresholds.
- Discuss the mathematical rationale and potential limitations.

Input Data

A CSV file containing EURUSD and GBPUSD price data: https://drive.google.com/drive/folders/1pZPRy_xWmZdmpWA4s28HZfJ57Y1AQSD8

Follow-Up Questions

- What are the potential risks of statistical arbitrage strategies?
- How would you adapt the strategy if the co-integration relationship changes over time?
- How would you incorporate transaction costs into your model?

Exercise 2: Algorithm Development

Problem Statement

Write a Python algorithm to implement a trading strategy based on moving average crossovers.

Tasks

1. Fetch historical OHLC (open, high, low, close) price data for an asset.
2. Implement a trading strategy using a moving average crossover (e.g., 10-period vs. 50-period).
3. Buy when the short-term moving average crosses above the long-term, and sell when it crosses below.
4. Backtest this strategy over the given dataset.

Deliverables

- A functional, well-commented script.
- Performance metrics such as total returns, Sharpe ratio, and maximum drawdown.

Input Data

Historical OHLC price data.

Follow-Up Questions

- How would you optimize execution to reduce slippage?
- How would you modify the strategy to incorporate risk management measures?
- What other indicators could you use to improve the performance of the strategy?

Exercise 3: Commodity Trading Case Study

Problem Statement

You are a quantitative analyst working for a commodity trading desk. Your task is to extrapolate existing natural gas market data to improve pricing accuracy.

Tasks

- Analyze seasonal trends affecting natural gas prices.
- Study the impact of macroeconomic factors (IPI and CPI) on price fluctuations.
- Develop a predictive model for future gas prices based on historical trends and macroeconomic effects.
- Provide a price estimate for any given date, whether in the past or the future.
- Create an advanced visualization showing the relationships between natural gas prices and macroeconomic factors (IPI and CPI), highlighting temporal variations.
- Perform a sensitivity analysis to identify the most impactful factors on price forecasts.
- Implement cross-validation to evaluate the performance of your predictive model.

Deliverables

- Exploratory Analysis: Visualizations and commentary on historical trends, variable relationships, and seasonal effects.
- Estimation and Projection: Predictive model in Python.
- Sensitivity Analysis: Identification of key variables affecting price fluctuations.

Input Data

A CSV file containing natural gas price quotes: <https://drive.google.com/drive/folders/1YknQjYchXr165Q6AKSJhCu>

Follow-Up Questions

- How would you handle missing or unreliable data in your analysis?
- What are the main risks involved in pricing natural gas contracts based on historical trends?
- How would you adapt your model to incorporate real-time market changes?

Exercise 4: Portfolio Optimization

Problem Statement

Given the assets discussed in the previous exercises (EURUSD, GBPUSD, Natural Gas Futures), construct the optimal portfolio allocation.

Tasks

- Compute the historical return and risk (standard deviation) of each asset.
- Construct the efficient frontier using mean-variance optimization.
- Identify the optimal portfolio based on the Sharpe ratio.
- Discuss how correlations between the assets influence portfolio allocation.

Deliverables

- A Python script performing portfolio optimization.
- A visualization of the efficient frontier.
- A discussion on risk-adjusted returns and diversification benefits.

Input Data

Historical price data for EURUSD, GBPUSD, and Natural Gas Futures.

Follow-Up Questions

- How would you adjust the portfolio for changing market conditions?
- How do you incorporate transaction costs into portfolio optimization?
- How would you optimize the portfolio using a dynamic strategy instead of a static allocation?