Backtesting Report: Pairs Trading Algorithm

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Abstract

This report presents the backtesting results of a pairs trading algorithm using intraday data from Yahoo Finance. The strategy's methodology, performance metrics, and analysis are detailed for both long-term and short-term pairs with 15-minute intervals. Machine learning (Logistic Regression) was utilized for backtesting the short-term strategy.

Introduction

Objective

The objective of this report is to evaluate the performance of a pairs trading algorithm using intraday data from Yahoo Finance for both long-term and short-term pairs.

Methodology

- **Data Collection**: Intraday adjusted closing prices for selected stocks were obtained from Yahoo Finance.
  - **Long-term Pairs**: Historical intraday data for ADBE and AMZN from 2013 to 2023 with 15-minute intervals.
  - **Short-term Pairs**: Recent intraday data for AMD and ORCL over the past month with 15-minute intervals.
- **Pair Selection**:
  - Cointegration tests were performed on the intraday data to identify pairs with statistically significant relationships.
  - Pairs were selected based on a significance level (p-value ¡ 0.05).
- **Trading Strategy Implementation**:
  - Calculate the Ratio of Adjusted Prices (RV) for each selected pair.
  - Use z-score thresholds to determine buy and sell signals for the pairs.
  - Implement trade execution rules based on z-score signals to capture mean reversion opportunities.
- **Backtesting Approach**:

  - Backtest the trading signals for both long-term and short-term pairs to evaluate their effectiveness.
  - Calculate performance metrics such as cumulative return, accuracy of trade signals, and risk-adjusted returns (Sharpe ratio).

- **Machine Learning Application**:
  - Utilized Logistic Regression for backtesting the short-term pairs trading strategy.
  - Mean accuracy of the logistic regression model: 0.9013.

Pairs Trading Strategy Overview

Description

The pairs trading strategy involved the following steps:

- **Long-term Pairs**:
  - Pair Selection: Cointegration test to identify pairs (ADBE and AMZN) with statistically significant relationships based on intraday data.
  - Ratio Calculation: Calculate the Ratio of Adjusted Prices (RV) for ADBE and AMZN.
  - Profit from backtesting (2013-2023 data): $2665.81.
- **Short-term Pairs**:
  - Pair Selection: Cointegration test to identify pairs (AMD and ORCL) with statistically significant relationships based on intraday data.
  - Ratio Calculation: Calculate the Ratio of Adjusted Prices (RV) for AMD and ORCL.
  - Mean Accuracy of Logistic Regression Model: 0.9013.
  - Profit from backtesting (last month): $89.72.
- Mean Reversion Strategy: Use z-score thresholds to determine buy and sell signals for both long-term and short-term pairs.
- Trade Execution: Execute trades based on z-score signals, buying one stock and selling the other to profit from mean reversion.

Data Used

Data Source

Yahoo Finance for intraday adjusted closing prices of selected stocks.

Time Periods

- **Long-term Pairs**: Historical intraday data from 2013 to 2023 with 15-minute intervals (ADBE and AMZN).
- **Short-term Pairs**: Recent intraday data over the past month with 15-minute intervals (AMD and ORCL).

Performance Metrics

Key Metrics

The following key metrics were used to evaluate the performance of the pairs trading strategy:

- Mean Accuracy: Accuracy of predicted buy/sell signals compared to actual market movements.
- Cumulative Return: Total return generated by the strategy over the respective timeframe.
- Sharpe Ratio: Measure of risk-adjusted returns.
- Signal Effectiveness: Accuracy in identifying profitable trading opportunities based on z-score thresholds.

Results Analysis

Cointegration Test Results

- Cointegration test results for selected pairs (brief summary of findings for both long-term and short-term pairs).

Trading Signals and Backtesting Results

- Visual representation of intraday price movements for selected pairs.
- Charts showing RV, z-score, and trade signals for both long-term and short-term pairs.
- Backtested results including cumulative return, Sharpe ratio, and trade effectiveness.
- Profit generated from backtesting:
  - Long-term pairs (ADBE and AMZN): $2665.81.
  - Short-term pairs (AMD and ORCL): $89.72.

Conclusion

Appendix

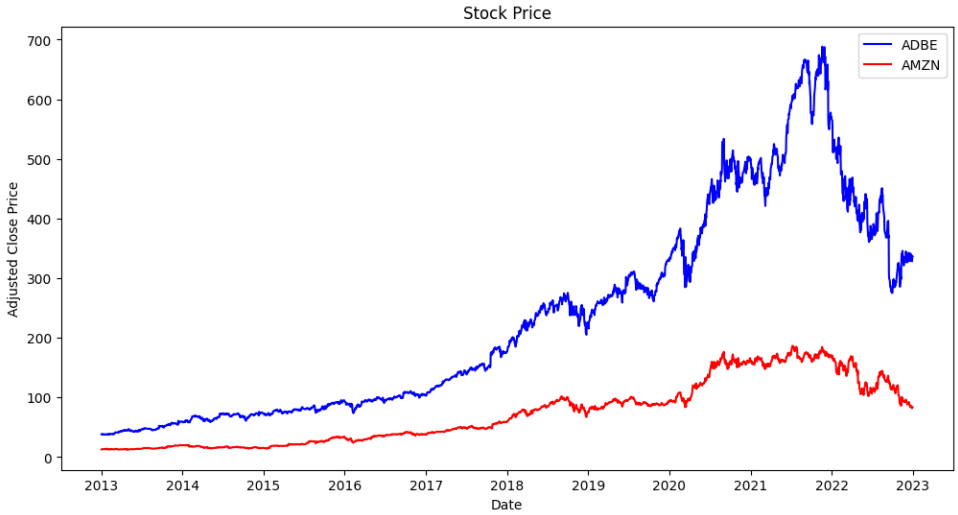

Figure 1: Amazon and Adobe Co-integration

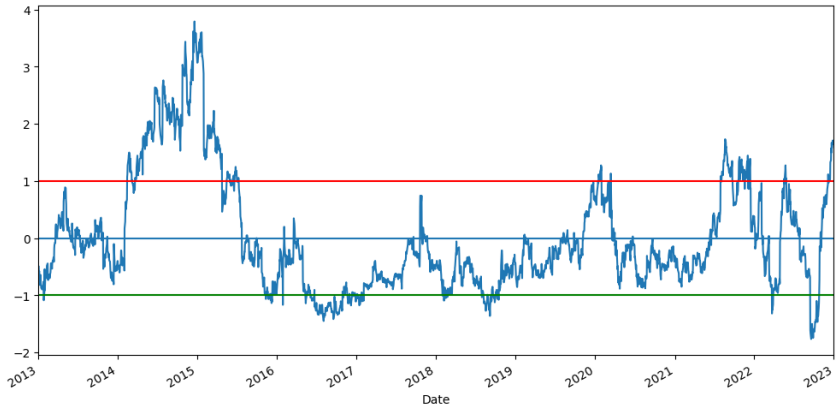

Figure 2: Mean Reversion

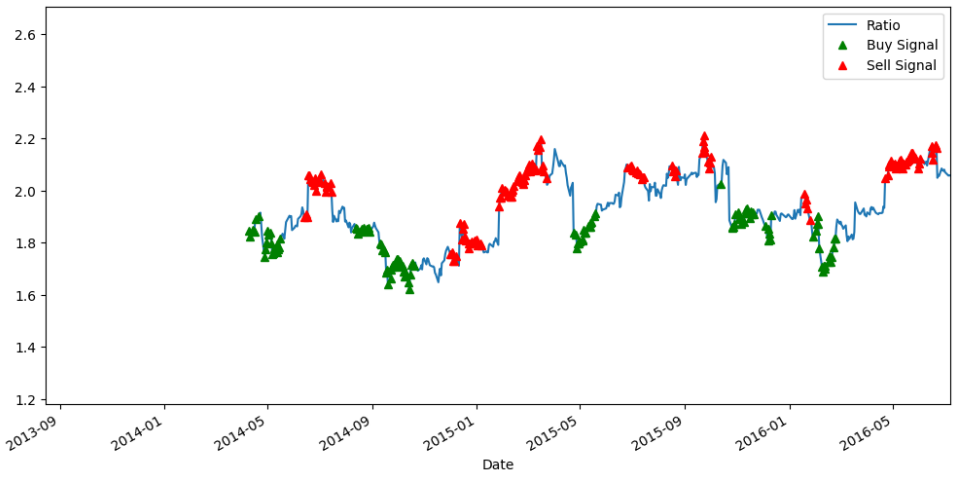

Figure 3: Buy and Sell Signals Generated

Figure 4: Long and Short for Individual Stocks

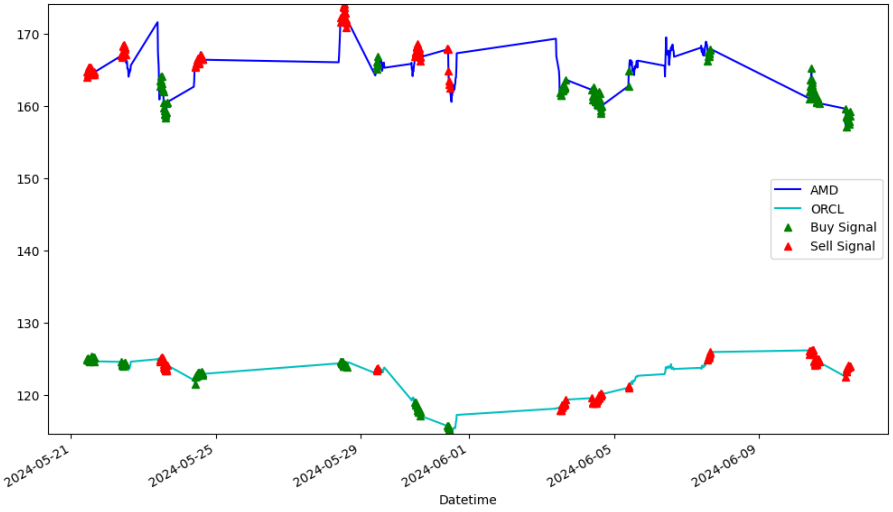

Figure 5: Short Term Identified Stocks