Simple Trading Strategies Backtester

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MATH 209

Initial Problem: Analyzing Stock Data with Trading Strategies:

- Load historical time series data of a stock or option into Python. Test five trading strategies based on past data, such as "sell if daily change exceeds 3%" or "buy on dips." Choose one strategy and evaluate its performance on historical data. Your code should rely solely on Python libraries (excluding external software).
- Suggested Skills: Data analysis, algorithmic trading strategies, handling time series data in Python.

Requirements: Python 3.9+ recommended, pip install numpy pandas matplotlib yfinance.

Project Structure:

1. Imports & settings
2. Data loading helpers
3. Strategy definitions
4. Backtesting logic
5. Visualization

Market Data Used:

Default ticker: SPY (S&P 500 ETF)

Data source: Yahoo Finance

Price used: Adjusted Close (accounts for dividends & splits)

Daily Returns Formula: (today's price / yesterday's price) - 1

Implemented Strategies:

1. **Buy & Hold**

- Always invested
- Baseline comparison

2. **Moving Average Crossover**

- Buy when short-term trend > long-term trend
- Exit when trend weakens (when 20-day average is above the 50-day average: we buy the stock because it's likely in an uptrend. If the 20-day average is below the 50-day average: we sell and move to cash because the trend may be going down.

  Uses:
- 20-day moving average
- 50-day moving average

3. **Sell Big Up Days**

- If the stock's return yesterday is greater than +3%, -> Sell (move to cash) for the next day. This prevents the strategy from holding the stock right after a sharp spike that may reverse.
- If the strategy is in cash and yesterday's return is less than –1%, -> Buy back in. A small dip after being out of the market may offer a better entry point.
- If neither condition is met, -> Continue with the previous day's position.

4. **Buy the Dip**

- If yesterday's return is less than –2% (a significant drop), -> Buy the stock and hold it for the next three days, regardless of what happens.
- During the 3-day holding period: -> Stay fully invested.
- When the holding period expires: -> Return to cash and wait for another dip signal.
- This strategy looks for big down days and tries to take advantage of a quick bounce back.

5. **Rolling Regression (Advanced)**

- Warm-up period: First ~1 year (252 trading days) strategy is always invested. The goal is to collect enough data to understand the trend.
- Every day after warm-up we look at all past prices and draw a best-fit straight line through them -> this is the “fair value trend”. Then we are calculating how much price usually deviates from the trend -> This gives a typical range above and below the trend. Then we draw upper band = trend + 2×normal deviation and lower band = trend + 2×normal deviation.
- Buy when price <= lower band and sell when price >= upper bound.
- While in cash, for realism, we decided to add 2.5% constant APR. We decided to take short-term (3 month) T-Bills as a base for our APR and calculated an average yield from 2018 to present day.

This strategy introduces:

- Linear Regression
- Volatility bands
- Opportunity cost of holding cash