

Report- Volatility Voyage Assignment 3

1. Overview of the Strategy

This code implements a rule-based algorithmic trading strategy applied to Bitcoin (BTC-USD) historical data from January 1, 2018 to December 1, 2022. It uses a combination of technical indicators to generate buy/sell signals, executes trades based on these signals, applies risk management (stop-loss), and evaluates the performance of the trades with detailed metrics.

2. Trading Indicators Used

The strategy employs three common technical indicators to generate trading signals:

a. Simple Moving Average (SMA) Crossover

- **Fast SMA:** 10-day
- **Slow SMA:** 30-day
- Signal is bullish (long) when $\text{SMA}(10) > \text{SMA}(30)$ and bearish (short) when $\text{SMA}(10) < \text{SMA}(30)$.

b. MACD (Moving Average Convergence Divergence)

- Calculated using:
 - Fast EMA: 12-day
 - Slow EMA: 26-day
 - Signal Line: 9-day EMA of the MACD line
- Long position is supported when $\text{MACD} > \text{Signal Line}$; short when $\text{MACD} < \text{Signal Line}$.

c. RSI (Relative Strength Index)

- Period: 14 days
- Prevents entry during overbought or oversold conditions:
 - Only enter **long** if $RSI < 70$ (not overbought)
 - Only enter **short** if $RSI > 30$ (not oversold)

3. Signal Generation Logic

A trading signal (`signal` column) is set based on the combined output of SMA crossover, MACD confirmation, and RSI filter:

- +1 (long) if:
 - `SMA_fast > SMA_slow`
 - `MACD > MACD_signal`
 - $RSI < 70$
- -1 (short) if:
 - `SMA_fast < SMA_slow`
 - `MACD < MACD_signal`
 - $RSI > 30$
- 0 (no action) otherwise.

4. Trade Execution and Risk Management

a. Backtesting Engine

- Iterates over the price data and simulates trade execution based on signal changes.

- Holds only one position at a time: either long, short, or none.
- Stops and reverses position when opposing signal is detected.

b. Stop Loss Mechanism

- Fixed percentage stop-loss at 2%:
 - Long positions are exited if price drops 2% from entry.
 - Short positions are exited if price rises 2% from entry.
- This protects against extreme downside risk.

c. Exit Conditions

- Stop-loss hit.
- Opposite signal generated.
- Previous signal turns neutral (0), indicating trend weakness.

5. Key Strengths of the Strategy

- Multi-indicator Confirmation: Reduces false signals by aligning SMA, MACD, and RSI.
- Dynamic Positioning: The strategy can go both long and short, increasing opportunity.
- Risk Management: Implements clear stop-loss to cap losses.
- Performance Evaluation: Provides extensive metrics for profitability and risk.

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