Backtesting of a Moving Average Crossover Trading Strategy

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1 Definition

The **Short-Term Exponential Moving Average (EMA)** is defined as:

$$\text{EMA}_t^S = \alpha_S P_t^c + (1 - \alpha_S)\text{EMA}_{t-1}^S \tag{1}$$

Similarly, the **Long-Term Exponential Moving Average (EMA)** is given by:

$$\text{EMA}_t^L = \alpha_L P_t^c + (1 - \alpha_L)\text{EMA}_{t-1}^L \tag{2}$$

where:

- EMA_t^S : Short-Term Exponential Moving Average at time t.
- EMA_t^L : Long-Term Exponential Moving Average at time t.
- P_t^c : Closing price of the asset at time t.
- α_S : Smoothing factor for the short EMA, defined as $\alpha_S = \frac{2}{N_S+1}$, where N_S is the period of the short EMA.
- α_L : Smoothing factor for the long EMA, defined as $\alpha_L = \frac{2}{N_L+1}$, where N_L is the period of the long EMA.
- EMA_{t-1}^S : Previous value of the short-term EMA.
- EMA_{t-1}^L : Previous value of the long-term EMA.

The **Moving Average Convergence Divergence (MACD)** is computed as:

$$\text{MACD}_t = \text{EMA}_t^S - \text{EMA}_t^L \tag{3}$$

The MACD provides a measure of momentum by indicating the relationship between the short-term and long-term EMAs. A positive MACD suggests an uptrend, while a negative MACD indicates a downtrend.

2 Strategy

- Go long at time $t+1$ if $MACD_t > 0$ and $MACD_{t-1} < 0$
- Go short at time $t+1$ if $MACD_t < 0$ and $MACD_{t-1} > 0$