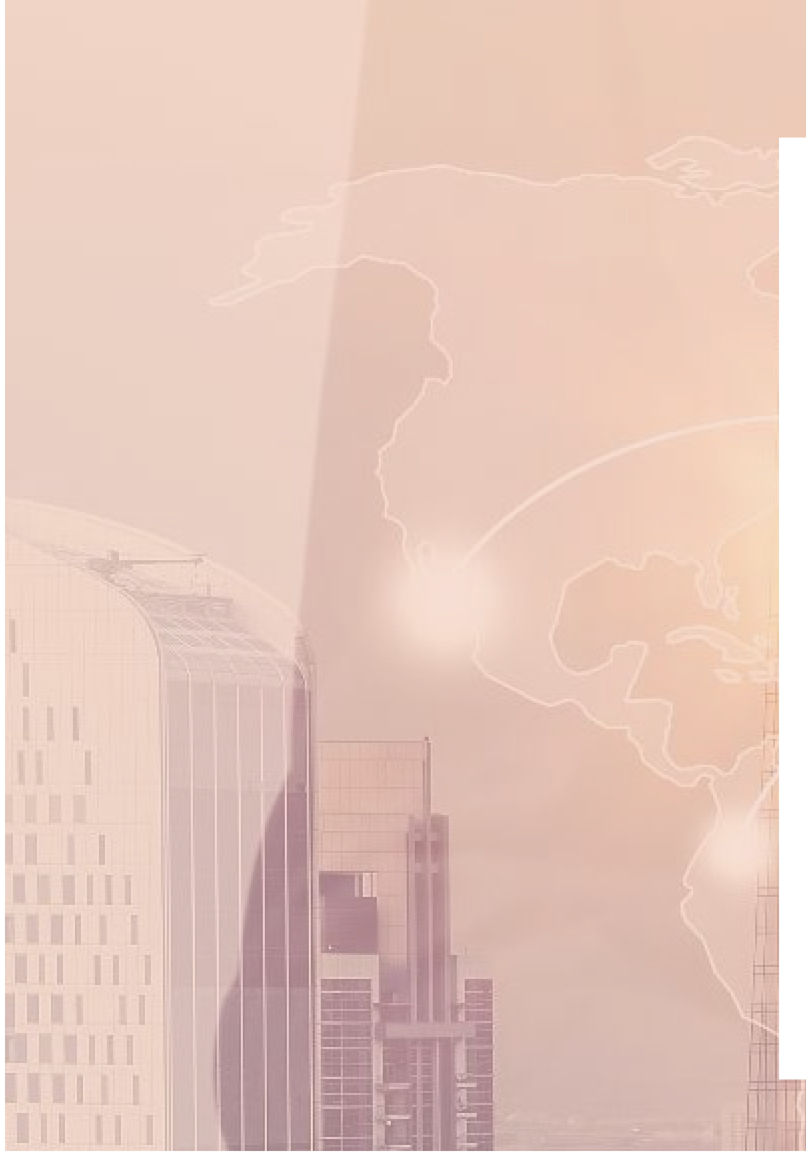


Backtesting

This project will focus on the foreign exchange market, particularly the exchange rate of EUR/USD.

111705035 曾楚翔

Project Requirements

Initial Capital

Starts with a initial trading capital of 100 million units.

Trading Instrument

The project focuses on the exchange rate of the Euro against the US Dollar (EUR/USD).

Backtesting Framework

Implement backtesting using the Backtesting library in Python.

Transaction Fees

A transaction fee of 0.005% will be charged for each trade

Data Time Range

Minute-level data from the year 2017 to 2022 must be used

1.SMA

Technical Indicator

A simple moving average (SMA) calculates the average of a selected range of prices, usually closing prices, by the number of periods in that range.

The formula for SMA is:

$$\text{SMA} = \frac{A_1 + A_2 + \ldots + A_n}{n}$$

where:

$A_n =$ the price of an asset at period n

$n =$ the number of total periods

Trading Logic

1.Golden Cross:

A bullish signal where the shorter-term moving average crosses above the longer-term moving average.

2.Death Cross:

A bearish signal where the shorter-term moving average crosses below the longer-term moving average.

1. SMA

Backtesting performance

Backtesting analysis:

Execute a buy if the shorter-term moving average crosses above the longer-term moving average.

Execute a sell if the shorter-term moving average crosses below the longer-term moving average.

Only long positions, no short positions.

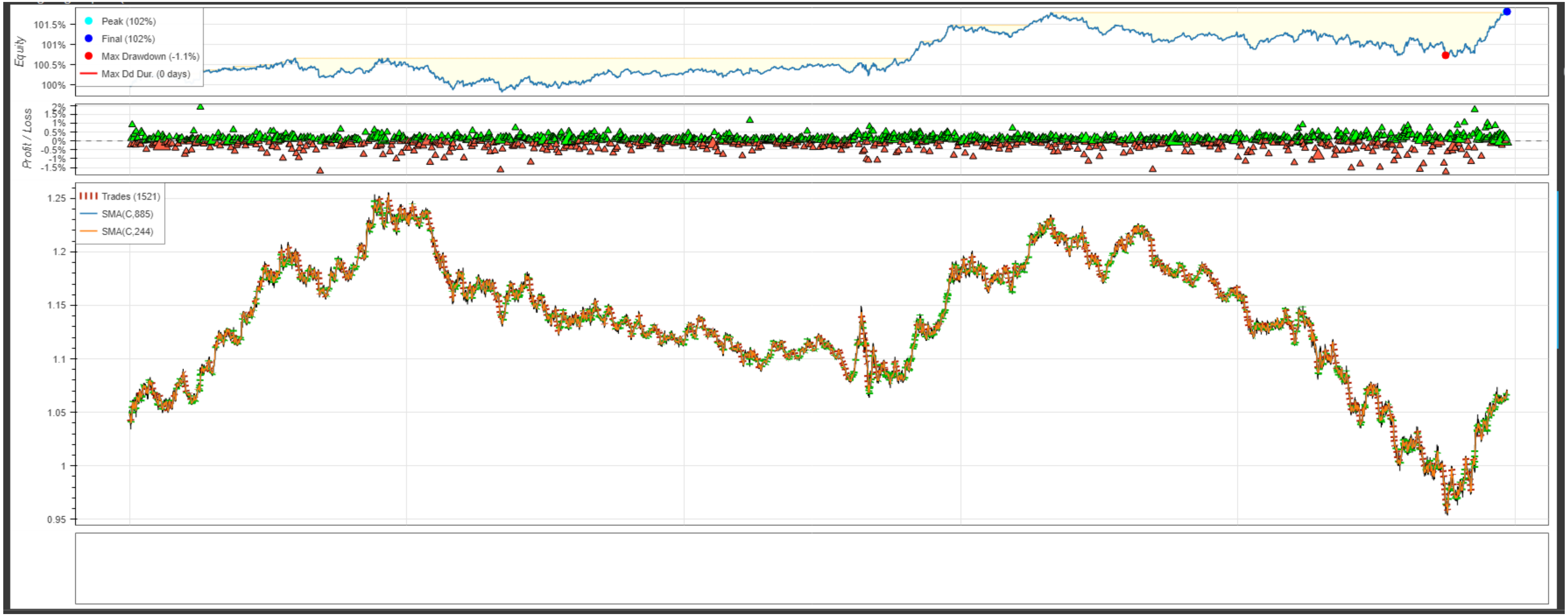
Problems:

Too much trades that the commission cost too high

```
Start                        2017-01-02 02:00:00
End                          2022-12-30 16:58:00
Duration                      2188 days 14:58:00
Exposure Time [%]                      50.059019
Equity Final [$]                101817982.154998
Equity Peak [$]                 101818482.154998
Return [%]                              1.817982
Buy & Hold Return [%]                   1.772032
Return (Ann.) [%]                       0.242565
Volatility (Ann.) [%]                   0.525986
Sharpe Ratio                            0.461163
Sortino Ratio                           0.623159
Calmar Ratio                            0.217564
Max. Drawdown [%]                      -1.114915
Avg. Drawdown [%]                      -0.013227
Max. Drawdown Duration         980 days 01:14:00
Avg. Drawdown Duration           3 days 11:05:00
# Trades                                    1583
Win Rate [%]                           65.319015
Best Trade [%]                          1.899676
Worst Trade [%]                         -1.73373
Avg. Trade [%]                          0.010791
Max. Trade Duration              4 days 19:56:00
Avg. Trade Duration              0 days 16:39:00
Profit Factor                           1.114203
Expectancy [%]                          0.011287
SQN                                     1.301242
_strategy                               SmaCross
_equity_curve                                ...
_trades                                 Size ...
dtype: object
```

1. SMA

Backtesting analysis:



2.TripleCross

Technical Strategy based on SMA

Triple Cross strategy involves using three different moving averages with varying time periods. The three moving averages are typically short-term, medium-term, and long-term moving averages.

The strategy focuses on the crossovers and relationships among these three moving averages to generate trading signals.

Trading logic

Golden Triple Cross: This signal occurs when the short-term SMA crosses above the medium-term SMA, and both are above the long-term SMA. This suggests a potential bullish trend, as the short-term momentum is strong, supported by the medium-term trend, and confirmed by the long-term trend.

Death Triple Cross: In contrast, the death triple cross happens when the short-term SMA crosses below the medium-term SMA, and both are below the long-term SMA. This signals a potential bearish trend, indicating that short-term momentum is weakening, supported by a medium-term downtrend, and confirmed by a long-term downtrend.

Neutral Zone: If the moving averages are entangled or closely spaced, it may indicate a period of consolidation or uncertainty in the market. Traders might choose to stay on the sidelines during such times.

2. TripleCross

Backtesting performance

Backtesting analysis:

The TripleCross strategy aims to capitalize on trends by using multiple moving averages.

The backtesting results show favorable performance metrics, including a positive return, good risk-adjusted performance (Sharpe Ratio), and a high win rate. However, the strategy's effectiveness may depend on the specific market conditions.

Hold and wait which is the Strategy does.

```
Start                     2017-01-02 02:00:00
End                       2022-12-30 16:58:00
Duration                   2188 days 14:58:00
Exposure Time [%]                     93.8883
Equity Final [$]             167278021.582676
Equity Peak [$]              167423373.365876
Return [%]                          67.278022
Buy & Hold Return [%]                1.772032
Return (Ann.) [%]                    7.163333
Volatility (Ann.) [%]                6.670765
Sharpe Ratio                          1.07384
Sortino Ratio                        1.811285
Calmar Ratio                          0.97313
Max. Drawdown [%]                   -7.361124
Avg. Drawdown [%]                   -0.141891
Max. Drawdown Duration      250 days 00:11:00
Avg. Drawdown Duration        1 days 03:22:00
# Trades                                   59
Win Rate [%]                         67.79661
Best Trade [%]                       8.714544
Worst Trade [%]                     -4.211618
Avg. Trade [%]                       0.875825
Max. Trade Duration         207 days 19:06:00
Avg. Trade Duration          34 days 20:15:00
Profit Factor                        3.178813
Expectancy [%]                       0.900228
SQN                                  2.949738
_strategy                         TripleCross
_equity_curve                             ...
_trades                             Size  E...
dtype: object
```

2. TripleCross

Backtesting analysis:

3.RSI

Technical Indicator

RSI stands for Relative Strength Index, and it's a popular momentum oscillator used in technical analysis to measure the speed and change of price movements.

RSI is often employed by traders and analysts to identify overbought or oversold conditions in a market, which can help in making trading decisions.

$$RSI = 100 - \frac{100}{1+RS}$$

Trading logic

RSI values range from 0 to 100.

Traditionally, an RSI above 70 is considered overbought, suggesting that the asset may be overvalued and a reversal or correction could be imminent.

Conversely, an RSI below 30 is considered oversold, indicating that the asset may be undervalued and a potential upward reversal may occur.

3. RSI

Backtesting performance

Backtesting analysis:

Buy Signal: If RSI drops below 30 and then crosses back above 30, it might generate a buy signal. This suggests that the asset was oversold and may be due for an upward movement.

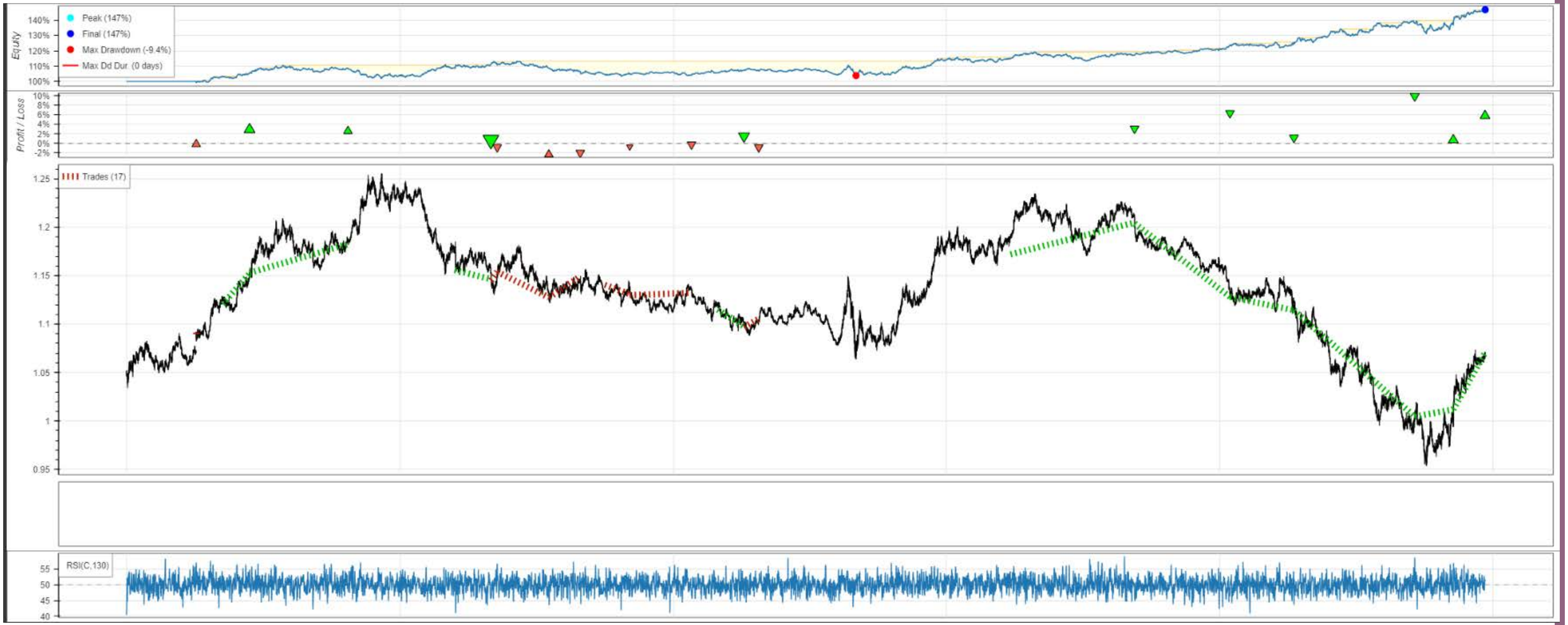
Sell Signal: If RSI rises above 70 and then crosses back below 70, it might generate a sell signal. This indicates that the asset was overbought and could experience a downward correction

Overall, the analysis indicates a positive return with a good risk-adjusted performance.

Start	2017-01-02 02:00:00
End	2022-12-30 16:58:00
Duration	2188 days 14:58:00
Exposure Time [%]	94.868862
Equity Final [$]	147085074.21467
Equity Peak [$]	147394281.45467
Return [%]	47.085074
Buy & Hold Return [%]	1.772032
Return (Ann.) [%]	5.325429
Volatility (Ann.) [%]	6.552399
Sharpe Ratio	0.812745
Sortino Ratio	1.290021
Calmar Ratio	0.568495
Max. Drawdown [%]	-9.367597
Avg. Drawdown [%]	-0.146168
Max. Drawdown Duration	671 days 22:35:00
Avg. Drawdown Duration	1 days 14:06:00
# Trades	25
Win Rate [%]	72.0
Best Trade [%]	9.850552
Worst Trade [%]	-2.309871
Avg. Trade [%]	1.555335
Max. Trade Duration	609 days 11:49:00
Avg. Trade Duration	83 days 01:56:00
Profit Factor	6.16527
Expectancy [%]	1.605084
SQN	2.448587
_strategy	RSICross

3. RSI

Backtesting analysis:



End