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Methodology

TradingEdge.Pro's methodology describes a multi-step process for building and validating trading strategies, structured into two parts: strategy development and testing, and practical use. In the testing phase, a strategy is defined as a set of objective rules, validated through initial tests, optimised, and assessed for stability (robustness), and then evaluated using Walk-Forward Analysis. The detailed testing assumptions (including the instrument universe, in-sample/out-of-sample periods, data sources, transaction costs, and execution rules) are described in the "Testing Specification" document. The full methodology and metric definitions are available on the TradingEdge.Pro "Methodology" page.

2-RSI v.3

Investment Strategy Testing Summary

The 2-RSI strategy is a swing trading investment technique that uses **the short-term RSI (Relative Strength Index)** and a downward correction of an instrument in **an upward trend** (quotes above **the long-term moving average)**. The key assumption of the strategy is **to open long positions during a correction** and then **close them after the price increases.**

Compared to version 2-RSI v.1 in this strategy, **the two RSI levels** (Entry Threshold and Exit Threshold) **are replaced by one, symmetrical one.**

It should be noted that while the strategy's results on in-sample data are decent, <u>the strategy failed the stability test in a wide range of optimized parameters.</u> This means that the strategy loses its profitability and generates a significantly larger drawdown when tests are conducted on suboptimal parameters. Therefore, <u>it is not recommended to use it in real transactions.</u>

Our goal is to have a strategy that remains **profitable and effective over a wide range of parameters,** because the market is a changing organism and the optimal parameters can change over different periods. <u>**I cannot**</u> <u>emphasize enough that for</u> **a strategy to work** in real conditions, it must also work on **suboptimal parameters** <u>and in</u> **suboptimal conditions.** In a word - **it must be stable** to changing market conditions.

I don't know who said these words, but they perfectly reflect the problem of many optimizations:

"I've never seen a strategy that didn't work in backtests."

We don't know the future, we don't know future market conditions, but if we know that our strategy **has historically generated acceptable results** in various market conditions and across various parameter ranges, then we are **one step ahead of other** market participants.

Contents

Step 1: Formulate an investment strategy

2-RSI v.3 Strategy was developed by Larry Connors and Cesar Alvarez as a **short-term mean-reversion system** that uses **extreme readings of the 2-period RSI indicator.** In this approach, the strategy takes **only long positions** in markets that have a **historical tendency to quick rebounds,** i.e. major stock indices, Treasury bond futures, gold, US dollar index.

The aim of the strategy is **to join a pullback after a short-term, sharp price drop** within a dominant uptrend.

Compared to version 2-RSI v.1 in this strategy, **the two RSI levels** (Entry Threshold and Exit Threshold) **are replaced by one, symmetrical one.**

The strategy uses:

- **Extreme RSI oversold** – the indicator value below the established threshold signals a potential rebound;
- **SMA Direction Filter** – positions are only taken when the price closes above the long-term moving average;
- **Pre-defined exit point** – the trade lasts until the RSI returns to the neutral zone.

Characteristics of the strategy and its strengths and weaknesses:

- **Simple, quantitative logic** – two main conditions (RSI & SMA) simplify testing and automation;
- **Natural mean-reversion environment** – the indicated asset classes historically rebound after short corrections;
- **Small number of transactions** – clear filters reduce commission costs;
- **Risk during violent bear markets** – during heavy sell-offs, the price may fall significantly before recovering (2020);
- **Less activity during periods of low volatility** – extreme RSI values are rare then.

The 2-RSI strategy, while simple to implement, requires caution due to its susceptibility to false signals and **lack of stop losses.** Its application requires careful optimization and risk management, especially in volatile market conditions.

Step 2: Define investment principles

Below is **the pseudocode** for the **2-RSI v.3 strategy** on daily data:

1. **Calculating Indicators:**
   a. **X-Day RSI:** Used to identify short-term oversold market conditions.
   b. **YY-day SMA:** Determines the long-term trend of the market. If the price is above the SMA, it is considered to be in an uptrend.
2. **Generating Entry Signals – Long Position:**
   a. It is opened only when the market is in an uptrend (Price > SMA) and the RSI falls below ZZ, which indicates an oversold condition.
   b. A position is opened at the opening of the next day on which the conditions are met.
3. **Generating Output Signals:**
   a. The position is closed when the RSI rises above 100-ZZ (symmetry).
   b. The close occurs at the opening price of the next day, after the signal is generated.
4. **Loss Management:**
   a. Loss orders, which means that potential losses are not limited by automatic closing of positions.
   b. This is an important consideration for risk management and requires discipline from the trader and the possible introduction of his own capital protection mechanisms.
5. **Daily Monitoring:**
   a. RSI and SMA values are calculated every day.
   b. The system checks whether the entry or exit conditions are met and takes appropriate action the next day upon opening.
6. **Additional Notes:**
   a. **No Short Positions:** The strategy focuses only on long positions in an uptrend.
   b. **Financial Instruments:** For the purposes of this test, **long positions** on **stock indices, bonds, gold** and **the dollar index were used.**

The above rules have been described in a way that allows them to be directly converted into a script in the chosen testing platform, which ensures the accuracy of the historical simulation and the reliability of the test results.

The tests are carried out assuming that the risk of one position is **1.0% of the total capital,** with **a hypothetical stop loss order located 2 x ATR (40 days)** away from the position opening point.

Step 3: Conduct a preliminary test of the investment strategy

Below are some purchase and sale transactions that allow you to verify the following aspects:

- **Correctness of generated signals;**
- **Direction of opening position;**
- **Moment of opening a position;**
- **Position opening price;**
- **Moment of closing the position;**
- **Closing price of the position;**
- **Compliance of the transaction with the theoretical assumptions of the investment strategy.**

At this stage **it does not matter** whether the transactions are **profitable,** what **instrument was used** or whether they took place **recently** or **in the distant past.** The key is **to check whether the transactions are generated correctly** and in accordance with the assumptions described in the previous step.

The first transaction was made on the Nasdaq100 index futures contract. At the end of June 2018, the quotes were above **the 150-day moving average,** and the **2-day indicator value RSI fell below the 20 level,** which generated a signal to open a long position (**the first candle in the rectangle on the left**). The position was opened the next day at the opening price (**the second candle in the rectangle on the left**).

After several days of sideways movement, in early July 2018 the market rose, raising the **RSI value to 80** (symmetry: 100 - 20), which signaled the closing of the position (**the first candle in the rectangle on the right**). The position was closed the next day at the opening price (**the second candle in the rectangle on the right**). **The system worked correctly.**

Once we are sure that the transactions are generated correctly, we can proceed to the first test of the strategy on the full **in-sample data set.** These tests are performed on **the basic parameters,** which – according to my assessment – should correspond to the assumed goals of the strategy.

First of all, **we reject strategies that linearly lose capital.** If a strategy exhibits such a pattern, it is a clear signal that any parameter optimization does not make sense.

Our basic expectation is that the strategy generates **positive results,** even if they are at a low level.

Tested base parameters:

- **Length of the moving average (SMA):** 150 days;
- **RSI Lengths:** 2 days;
- **RSI Entry Threshold:** 20;
- **RSI Exit Threshold (take profit):** 80 (symmetric; 100 - RSI Entry Threshold);
- **Stop loss:** none;
- **Method of opening a position:** at the opening price of the next day;
- **Position size:** corresponding to the risk of 1.0% of the total capital, with a hypothetical stop loss order located 2 x ATR (40 days) away from the position opening position;
- **Position direction:** long positions (buy) only.

The test result is shown below.

Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.
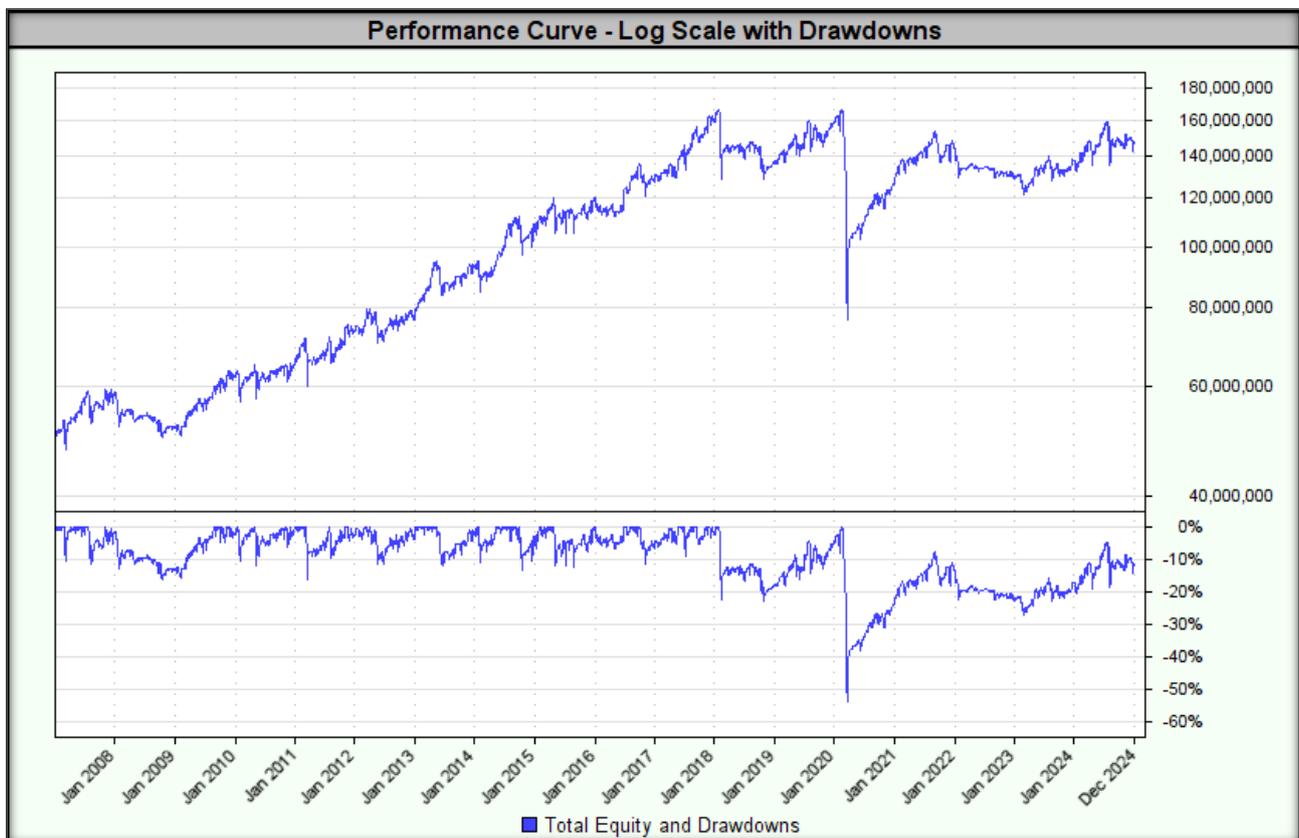
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Indicators/Measures	Concluding a transaction at the opening price
CAGR%	6.2%
MAR Ratio	0.11
RAR%	6.8%
R-Cubed	0.18
Robust Sharpe Ratio	0.50
Max Drawdown	54.0%
Wins	67.1%
Losses	32.9%
Average Win%	0.53%
Average Loss %	0.85%
Win/Loss Ratio	0.62
Average Trade Duration (days)	11
Percent Profit Factor	1.27
SQN	-
Number of transactions	1682

In summary, the system works properly and generates signals as expected. Additionally, tests on basic parameters have yielded satisfactory results. We can now move on to the most interesting stage of creating an investment strategy – **optimization.**

Step 4: Optimization and assessment of investment strategy stability

This stage of strategy creation and testing is **crucial,** as it determines how **effective** the strategy will be in **real conditions.** I cannot emphasize enough that for **a strategy to work** in real conditions, it must also work on **suboptimal parameters** and in **suboptimal conditions.** In a word – **it must be stable** to changing market conditions.

I don't know who said these words, but they perfectly reflect the problem of many optimizations:

"I've never seen a strategy that didn't work in backtests."

My goal is not to find **optimal parameter values** – my goal is to find **a wide range of parameters** for which the strategy will generate **acceptable results.** **We don't know the future,** we don't know future market conditions, but if we know that our strategy **has historically generated acceptable results** in various market conditions and across various parameter ranges, then we are **one step ahead of other** market participants.

What **parameters to choose** for the next period is the subject of considerations in **Step 5 of the "Walk-Forward Analysis",** but before we get to that, **we need to know whether our strategy is stable** at all.

1. **Stability across a wide range of optimized parameters**

2-RSI v.3 Strategy in this version it assumes **optimization of parameters using The Grid** method **Search.** It consists of **full optimization of all indicated parameters by creating a wide range of possible combinations.** Our goal is to find such **parameter ranges** that **the strategy remains stable (robust),** which will allow us to assess its usefulness in real market conditions.

The key criterion for assessing stability is that all test results must show a positive MAR value and the maximum drawdown must not exceed 250% of the drawdown value for the result with the highest MAR. If any test generates a negative MAR value or if the drawdown exceeds 250% of the drawdown value for the result with the highest MAR, the strategy is rejected completely.

In the first step, we test the stability of the parameters on **the in-sample data.** For this purpose, we determine the ranges of parameter **values** so that **the quotient of the highest and lowest values of the range was at least 150%.**

In the tested strategy, the ranges defined in this way are:

- **Moving average lengths (SMA):** range **80-150 days (step: 2);**
- **RSI Lengths: 2-3 day** range **(step: 1);**
- **RSI Entry & Exit Threshold:** range **13-20 (step: 0.5);**

The lowest MAR value of 0.09 was achieved for the following parameters:

- **Length of the moving average (SMA):** 80;
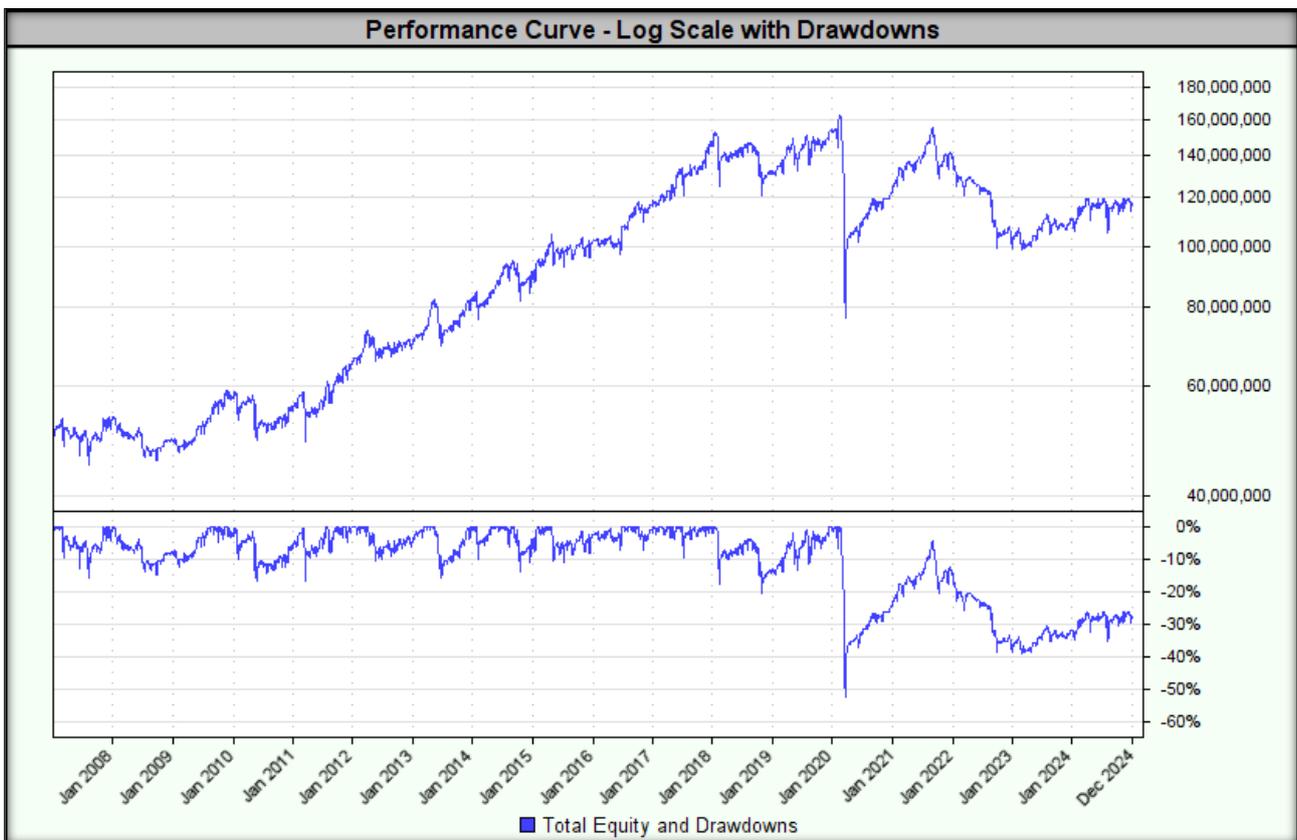- **RSI lengths:** 2;
- **RSI Entry & Exit Threshold:** 16.

Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Test	Moving Average Long (bars)	RSI (bars)	RSI Threshold Entry & Exit	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3
7	80	2	16.0	$116,840,950.97	4.83%	0.09	0.42	0.35	52.6%	58.7	1307	0.16
37	82	2	16.0	$118,718,360.55	4.92%	0.09	0.43	0.37	52.6%	58.7	1305	0.16
283	98	2	19.0	$126,268,736.43	5.28%	0.10	0.44	0.37	54.0%	58.7	1565	0.17
163	90	2	19.0	$130,246,474.86	5.46%	0.10	0.46	0.38	55.4%	83.4	1549	0.17
1057	150	2	16.0	$137,667,290.38	5.79%	0.10	0.47	0.46	58.7%	58.7	1371	0.16
907	140	2	16.0	$139,339,856.35	5.86%	0.10	0.47	0.46	58.7%	58.7	1370	0.15
10	80	2	17.5	$125,825,684.78	5.26%	0.10	0.46	0.39	52.6%	58.7	1416	0.19
313	100	2	19.0	$129,031,463.74	5.41%	0.10	0.45	0.37	54.0%	83.2	1564	0.18
67	84	2	16.0	$126,121,031.46	5.27%	0.10	0.45	0.40	52.6%	58.7	1312	0.17

Below is a graph of the equity curve for **the strategy with the lowest MAR.**

Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

The highest MAR value of 0.54 was achieved for the following parameters:

- **Length of the moving average (SMA):** 88;
- **RSI lengths:** 3;
- **RSI Entry & Exit Threshold:** 19.

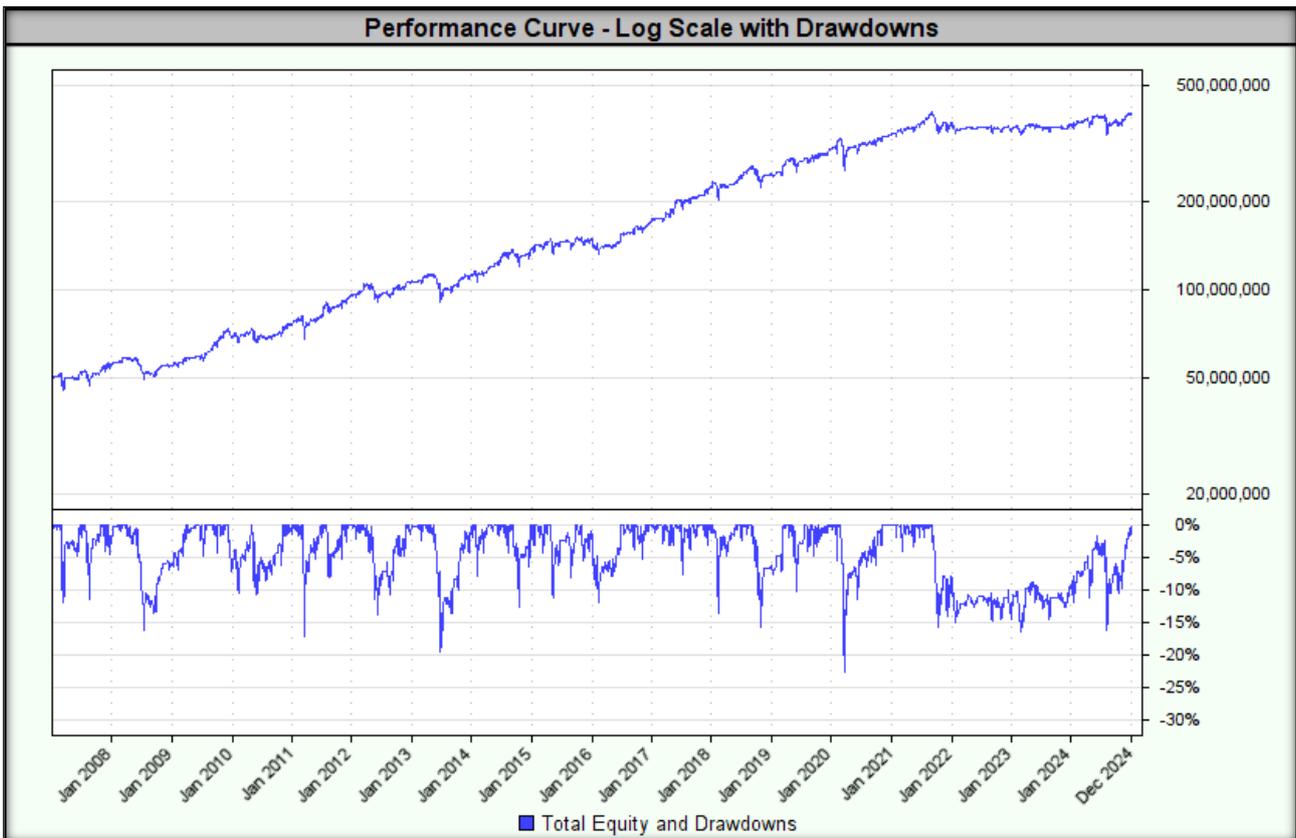**The highest MAR value** was accompanied by **a drawdown of 22.7%.**

Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Test	Moving Average Long (bars)	RSI (bars)	RSI Threshold Entry & Exit	End Balance	CAGR%	MAR ▽	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3
148	88	3	19.0	$399,023,069.43	12.23%	0.54	1.03	1.28	22.7%	40.0	712	0.81
178	90	3	19.0	$386,037,360.98	12.03%	0.53	1.00	1.24	22.7%	39.8	713	0.74
118	86	3	19.0	$385,002,435.76	12.01%	0.53	1.02	1.25	22.7%	40.0	707	0.78
28	80	3	19.0	$376,971,585.30	11.88%	0.52	1.01	1.21	22.7%	40.0	700	0.73
149	88	3	19.5	$381,986,487.96	11.96%	0.52	1.01	1.32	22.9%	33.1	744	0.88
150	88	3	20.0	$379,177,324.86	11.91%	0.52	0.99	1.28	22.8%	33.1	769	0.84
238	94	3	19.0	$372,148,164.03	11.80%	0.52	0.99	1.22	22.7%	32.7	717	0.79
180	90	3	20.0	$374,387,956.45	11.84%	0.52	0.98	1.28	22.8%	32.7	770	0.80
179	90	3	19.5	$371,960,592.18	11.79%	0.52	0.99	1.31	22.8%	32.7	744	0.80

Below is a graph of the equity curve for **the strategy with the highest MAR.**

Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

For all combinations of tested parameter ranges, **the highest drawdown was 58.7%.**

Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

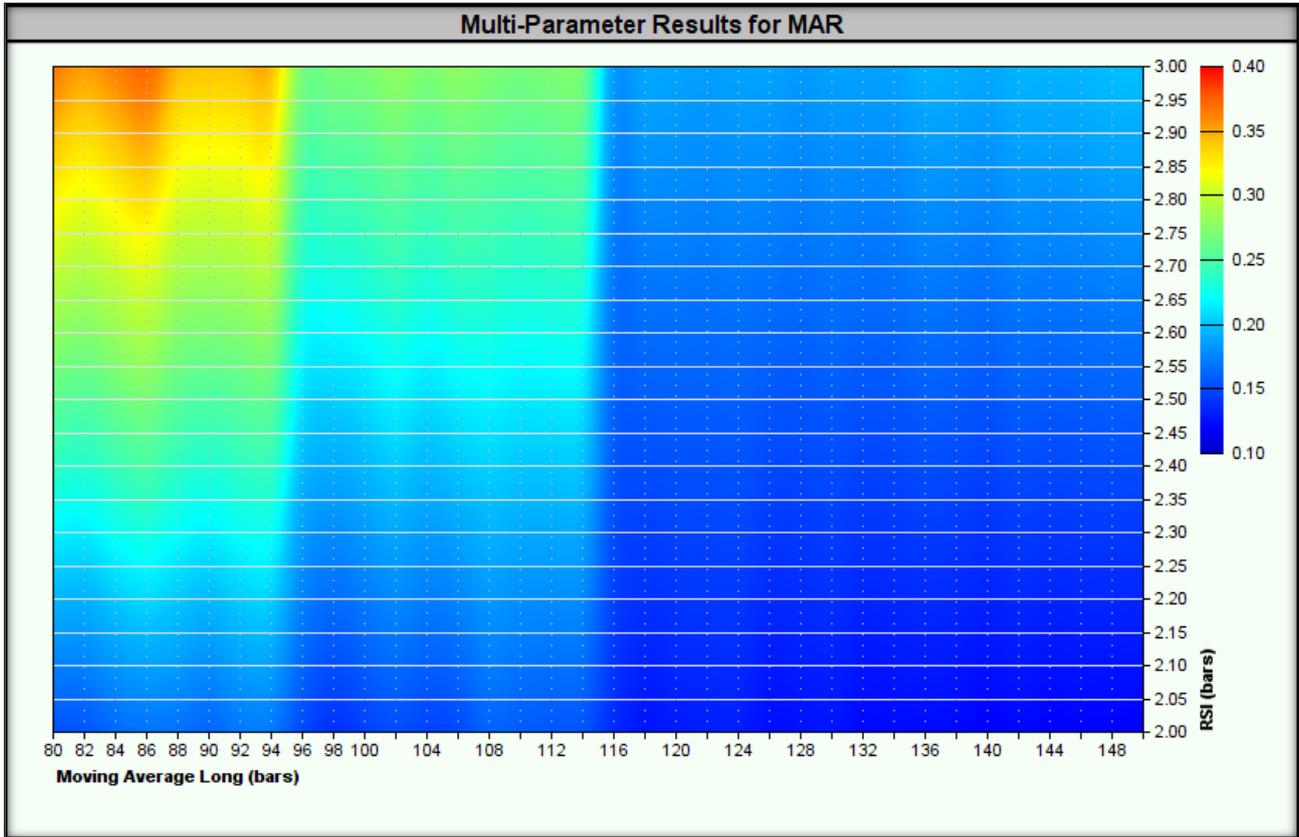| Test	Moving Average Long (bars)	RSI (bars)	RSI Threshold Entry & Exit	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD ▽	Longest DD	Trades	R3
1027	148	2	16.0	$140,241,298.82	5.90%	0.10	0.48	0.46	58.7%	58.7	1373	0.16
997	146	2	16.0	$141,986,175.19	5.97%	0.10	0.48	0.47	58.7%	58.7	1372	0.16
878	138	2	16.5	$146,144,934.72	6.14%	0.10	0.50	0.51	58.7%	58.7	1421	0.19
607	120	2	16.0	$151,458,877.43	6.35%	0.11	0.51	0.48	58.7%	58.7	1346	0.18
697	126	2	16.0	$145,130,581.73	6.10%	0.10	0.49	0.47	58.7%	58.7	1358	0.17
608	120	2	16.5	$156,806,456.87	6.56%	0.11	0.53	0.52	58.7%	58.7	1396	0.21
938	142	2	16.5	$147,019,506.50	6.18%	0.11	0.50	0.51	58.7%	58.7	1423	0.20
1057	150	2	16.0	$137,667,290.38	5.79%	0.10	0.47	0.46	58.7%	58.7	1371	0.16
1058	150	2	16.5	$144,334,389.05	6.07%	0.10	0.49	0.50	58.7%	58.7	1423	0.18

In summary, the strategy **failed the stability test** over a wide range of optimized parameters because:
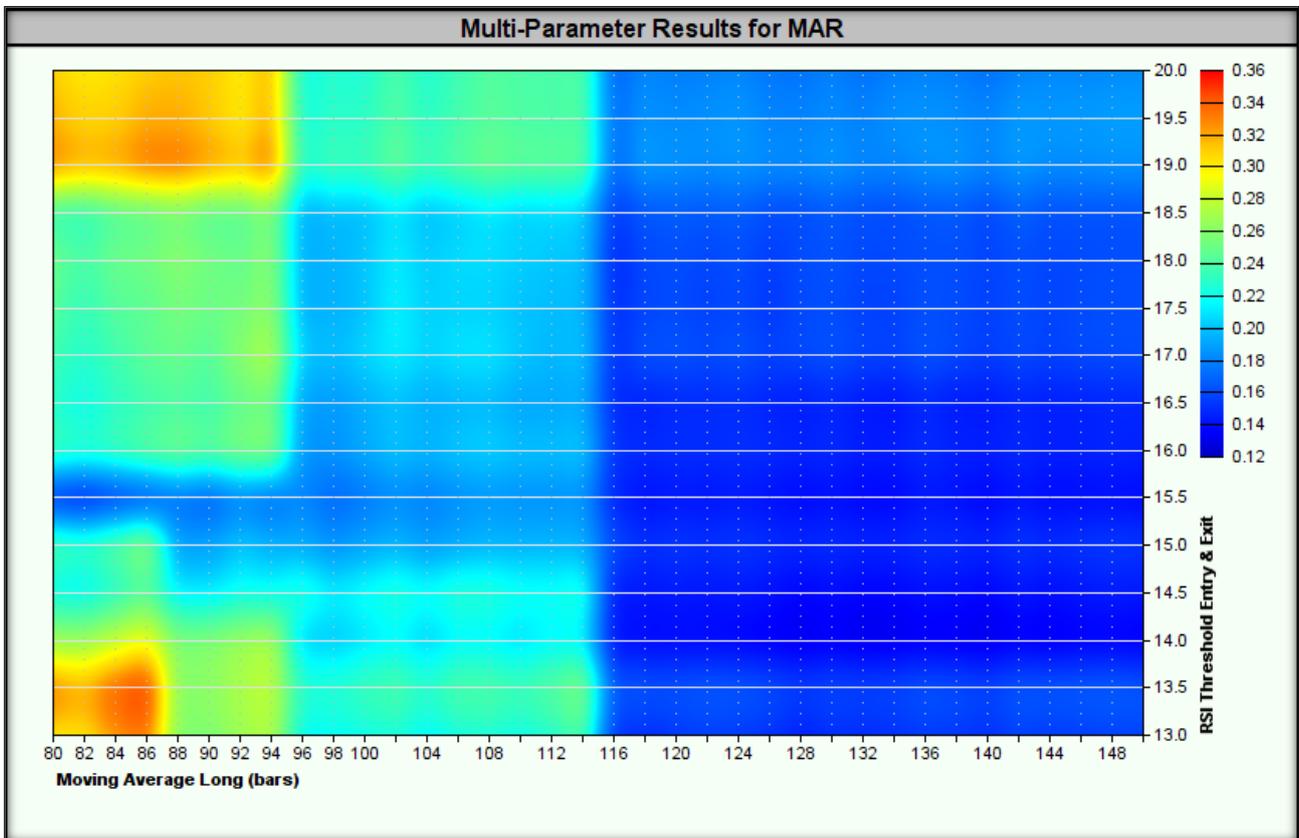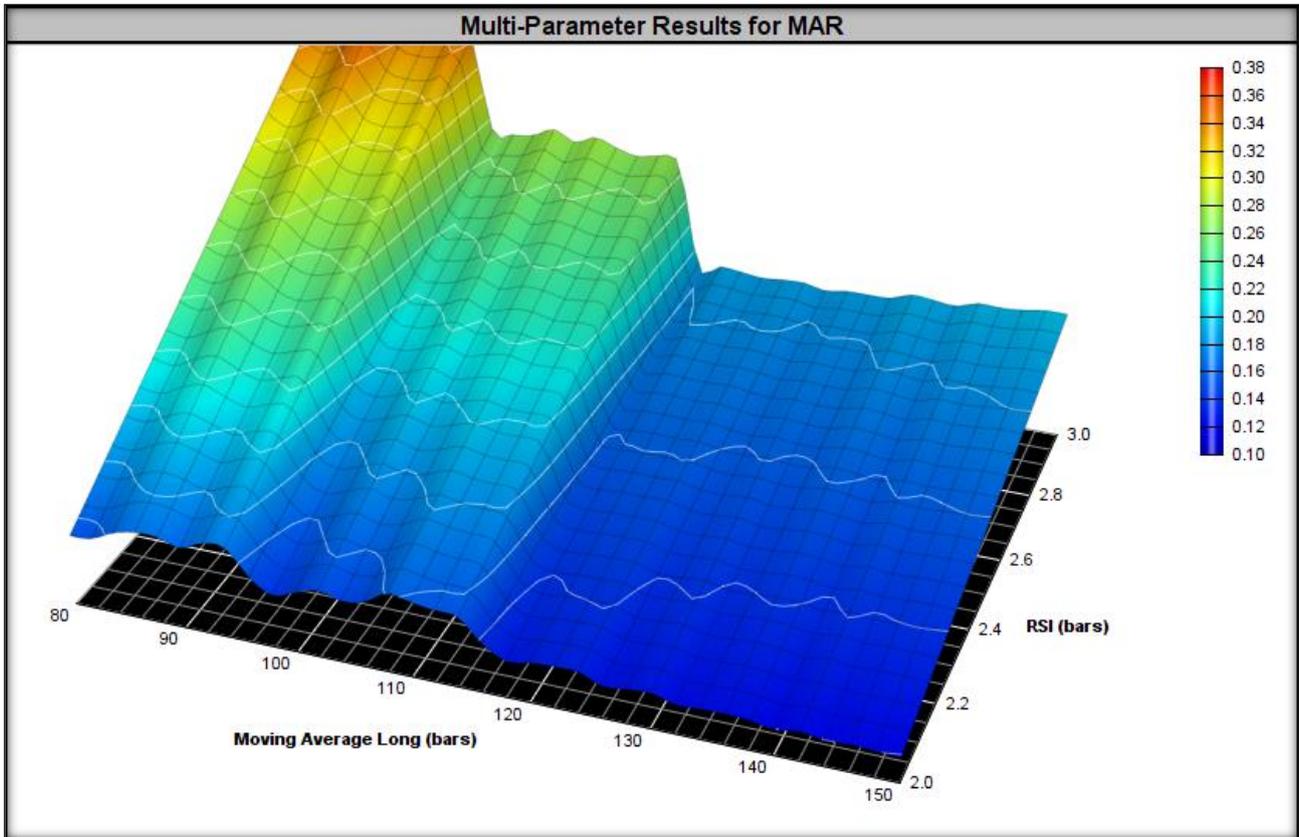
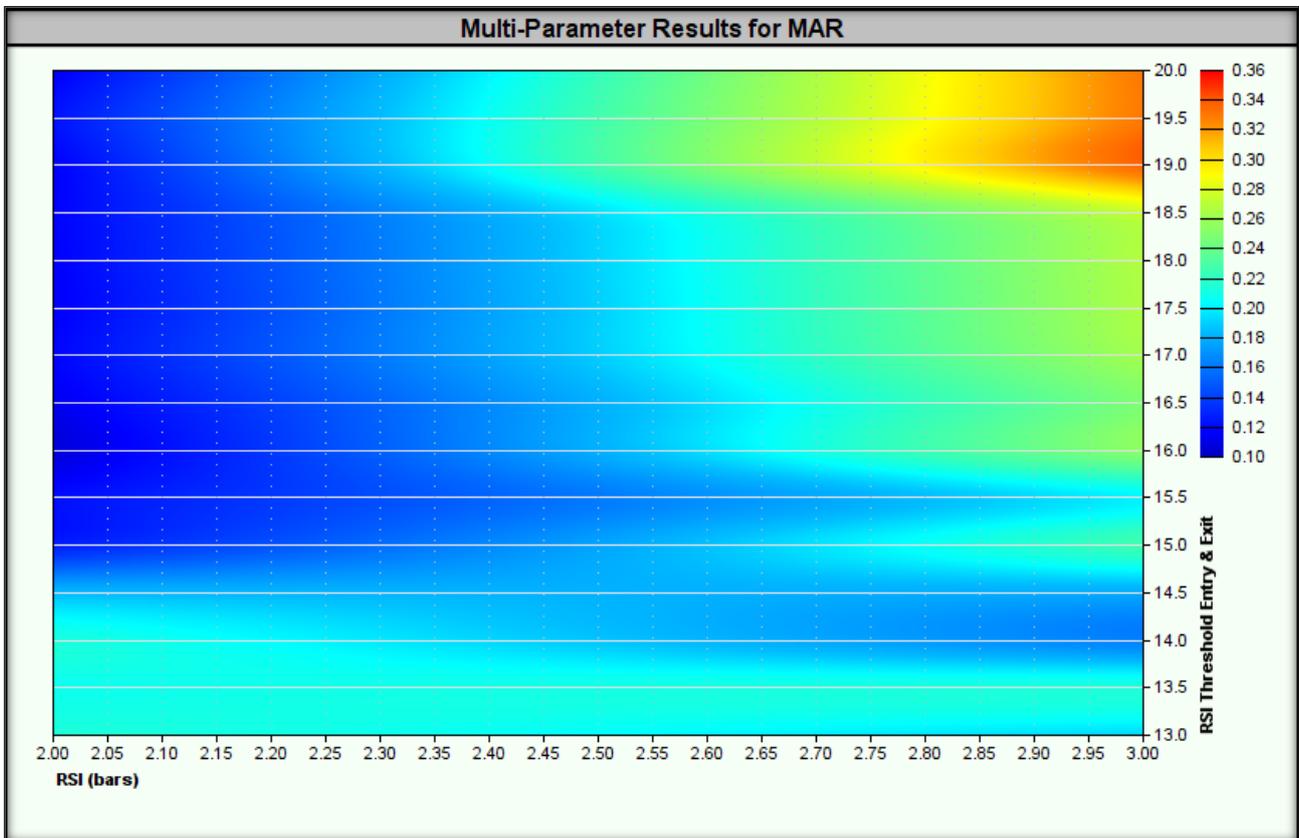- **The maximum drawdown exceeded 250% of the drawdown value** for the result with the highest MAR (**58.7% vs. 22.7%**) – which means a high risk of deep capital drawdowns.
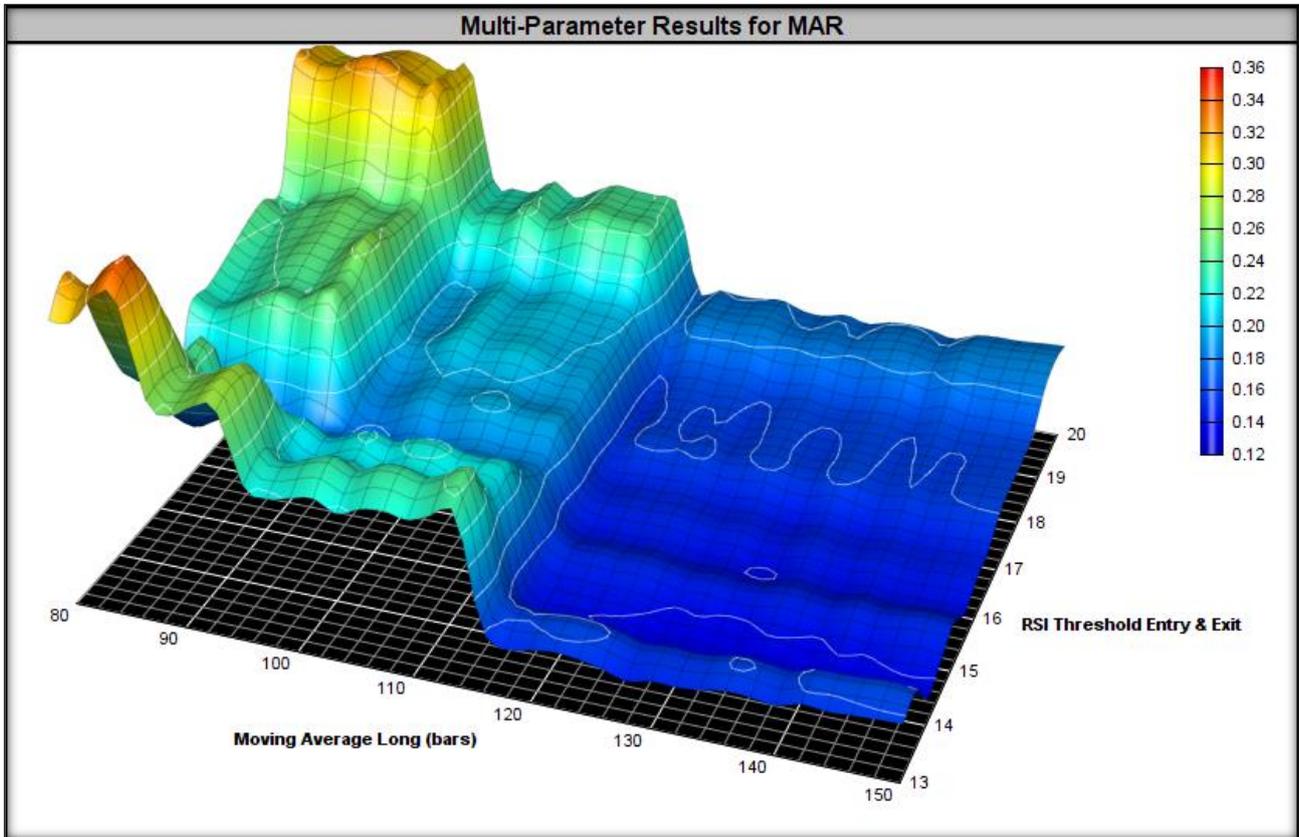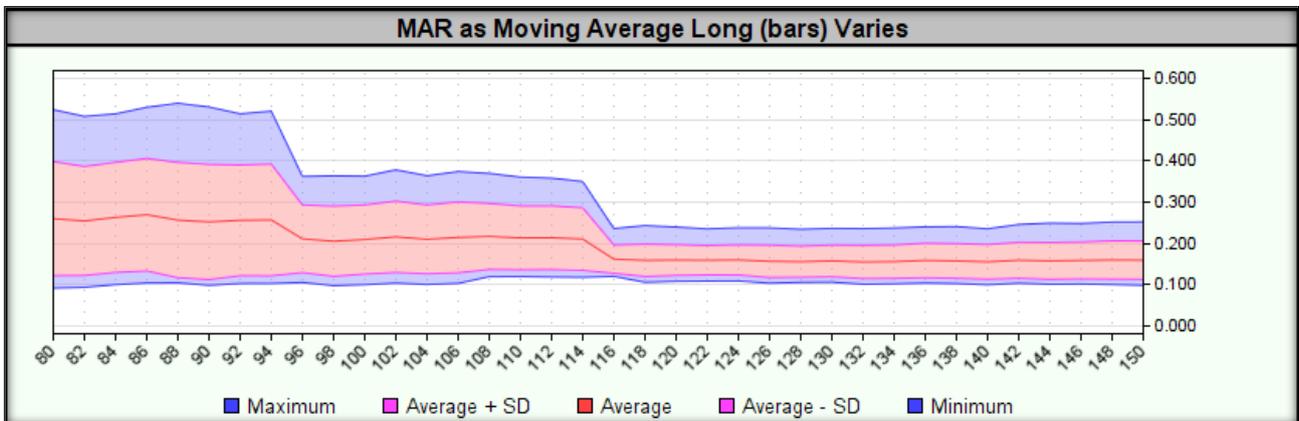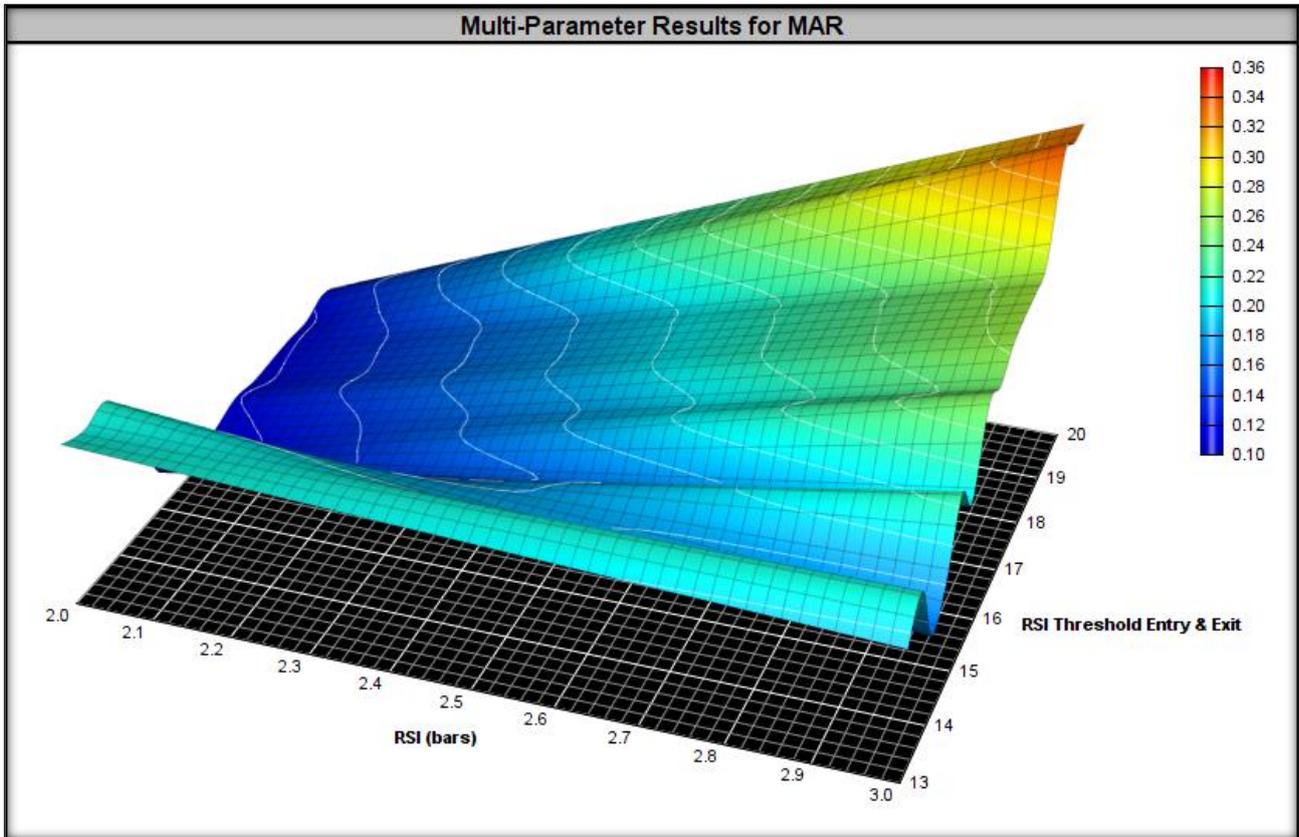
Therefore, <u>**further testing of the strategy is not justified,**</u> as its use in real transactions **is highly questionable.**

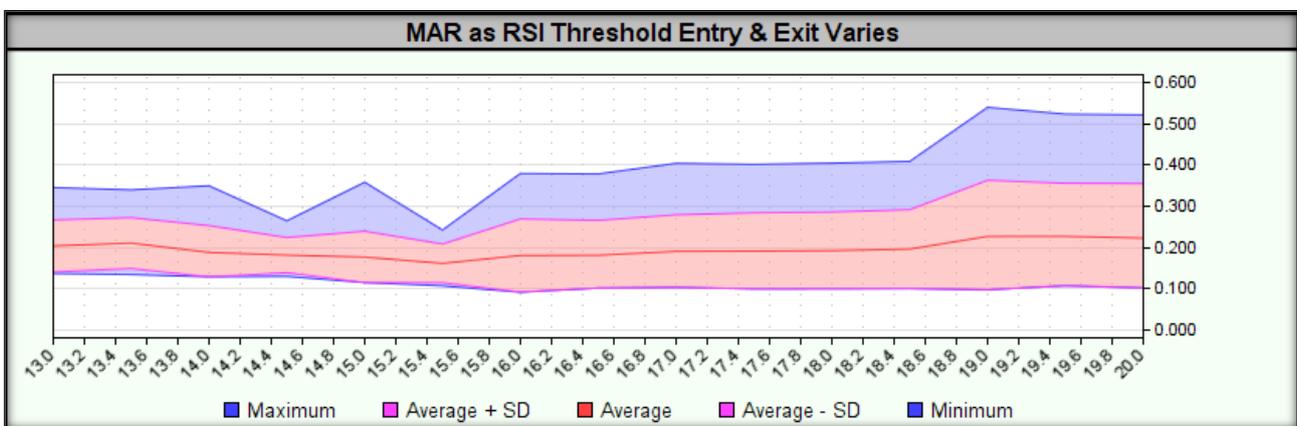**Heatmaps for the tested ranges** are presented below.

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

MAR as Moving Average Long (bars) Varies

■ Maximum   ■ Average + SD   ■ Average   ■ Average - SD   ■ Minimum

MAR as RSI (bars) Varies

Maximum ■ Average + SD ■ Average ■ Average - SD ■ Minimum

MAR as RSI Threshold Entry & Exit Varies

Maximum ■ Average + SD ■ Average ■ Average - SD ■ Minimum

2. **Monte Carlo simulation**

This step was skipped due to failure of previous stability tests.

3. **Stability over a moving time window**

This step was skipped due to failure of previous stability tests.

4. **Stability long/short**

This step was skipped due to failure of previous stability tests.

5. **Stability in the portfolio of financial instruments**

This step was skipped due to failure of previous stability tests.

6. **Money Management (Position Sizing)**

This step was skipped due to failure of previous stability tests.

7. **Strategy Risk Management**

This step was skipped due to failure of previous stability tests.

Step 5: Walk-Forward Analysis

This step was skipped due to **failure of previous stability tests.**

Step 6: Using the strategy in real time

This step was skipped due to **failure of previous stability tests.**