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The results shown in the reports are indicative only and depend on the adopted methodology, data selection, parameters, assumptions, and the way risk and return measures are calculated. Actual results may differ materially from historical or simulated results.

The author may hold positions in the instruments discussed or may apply a similar approach in practice. The information contained in the reports may change without prior notice.

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.

180's Pivots v.1

Investment Strategy Testing Summary

The 180's Pivots strategy is a short-term **a swing trading** investment technique based on **Jeff Cooper's 180's strategy.** It uses **a two-day reversal pattern** within an ongoing trend, and its goal is to identify when **a short-term pullback presents an opportunity to open a long position.** This is **an approach that follows the prevailing trend but uses short-term corrections** to enter a position at a more favorable price.

Compared to version 180's v.2 of this strategy, a requirement has been added for the second candle of a two-day reversal pattern to also be **the largest candle in several days.** Although **the strategy results on in-sample data are acceptable, the strategy failed the stability test in a wide range of optimized parameters.** This means that the strategy loses its profitability when tests are performed on a suboptimal set of parameters. Therefore, **it is not recommended to use it in real transactions.**

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. **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."

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

180's Pivots is a short-term swing **trading investment strategy** based on the 180's strategy developed by **Jeff Cooper.**

The strategy uses **a two-day reversal pattern** within an ongoing trend, and its goal is to identify when **a short-term retracement to the mean presents an opportunity to open a long position.** This is **an approach that follows the prevailing trend but uses short-term pullbacks** to enter a position at a more favorable price.

Strategy assumptions:

- The strategy identifies **short-term reversals** after which **the trend should resume;**
- Positions are opened **only in the direction of the trend** – the strategy focuses on **long positions;**
- Key entry conditions are based on **the closes of the candles relative to the daily range** (candlestick formation) and **the price range of the second candle of the formation.**

Characteristics of the strategy and its strengths and weaknesses:

- **Simple signal identification** – based on price analysis and moving averages, without the need to use additional indicators;
- **Using market momentum** – positions are opened based on strong price movements, which increases the probability of a successful trade;
- **Clear risk management rules –** using stop loss orders allows you to limit losses in the event of a signal failure;
- **False signals in case of a dynamic trend change** – during periods of a rapid trend change the strategy may generate losing signals.

The 180's Pivots strategy is **a one-day reversal and trend continuation approach.** It uses **simple but effective price rules** and, by filtering positions with **moving averages,** avoids false signals.

Its main advantages are **ease of implementation, clear rules and compliance with market momentum, but appropriate risk management** remains crucial.

Step 2: Define investment principles

Below is **the pseudocode** for the **180's strategy Pivots** on daily data:

1. **Candlestick pattern (candle formation):**
    a. **On the first day,** the closing price must be within **the lower XX% of the daily range and below the opening price.**
    b. **On the second day,** the closing price must be in **the upper XX% of the daily range and above the opening price.** In addition, this candle must be the largest of YY-days (the number of days is analogous to the YY-day moving average)
    c. **The low on the first or second day** must be below the YY day moving average.
2. **Trend Confirmation:** The second day's closing price must be above both the YY-day and ZZ-day moving averages, confirming an uptrend.
3. **Entry into position:** On the third day, a position is opened one tick above the high of the candlestick formation.
4. **Conditions for closing a position:**
    a. **Loss Order:** Initial stop loss is set at 1 tick below the price low of the candlestick formation.
    b. **Trailing stop:** Price falls below the ZZ daily moving average.
5. **Daily monitoring:**
    a. The conditions for opening positions and executing orders are checked every day.
    b. The system checks whether the entry conditions are met and whether the stop loss should be moved.
6. **Additional notes:**
    a. **No Short Positions:** The strategy focuses only on long positions in an uptrend.
    b. **Financial Instruments: A wide range of futures contracts** were used for the purposes of this test.

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 **0.5% of the total capital,** with **a stop loss order** set below **the price low of the candlestick formation.**

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:

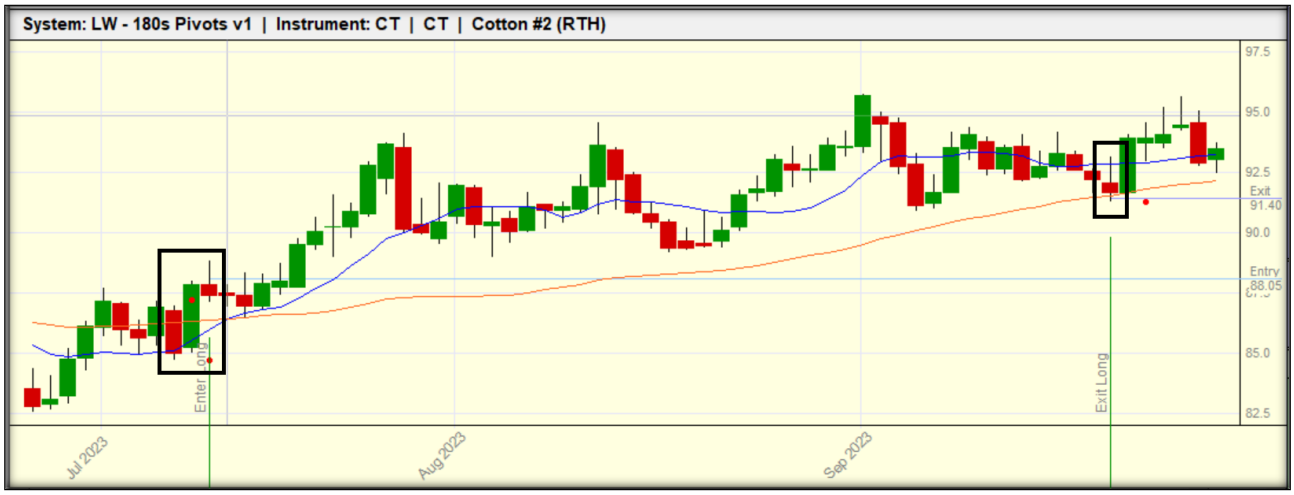
- **Correctness of generated signals;**
- **Direction of opening position;**
- **Moment of opening a position;**
- **Position opening price;**
- **Moment of closing the position;**
- **Closing price of the position;**
- **Compliance of the transaction with the theoretical assumptions of the investment 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 a **cotton futures contract.** In early July 2023, **the contract fell** and **the closing price was in the lower 25% of the daily range** (the first candle in the rectangle on the left). Additionally, **the closing price of this candle was lower than the opening price,** confirming short-term downward pressure. The next day, **the closing price was in the upper 25% of the daily range** and **exceeded the opening price** (the second candle in the rectangle on the left). It was also **the largest candle in 10 days,** while its **low violated the 10-day moving average (as did the candle the day before).** In addition, the closing price of this candle fell **above the 10 -day and 50-day moving averages. The position was opened the next day** when the price rose **above the high of both candles** (the third candle in the rectangle on the left). **The stop loss was set at the minimum of both candles (red dot),** which limited the risk of loss in case of signal failure.

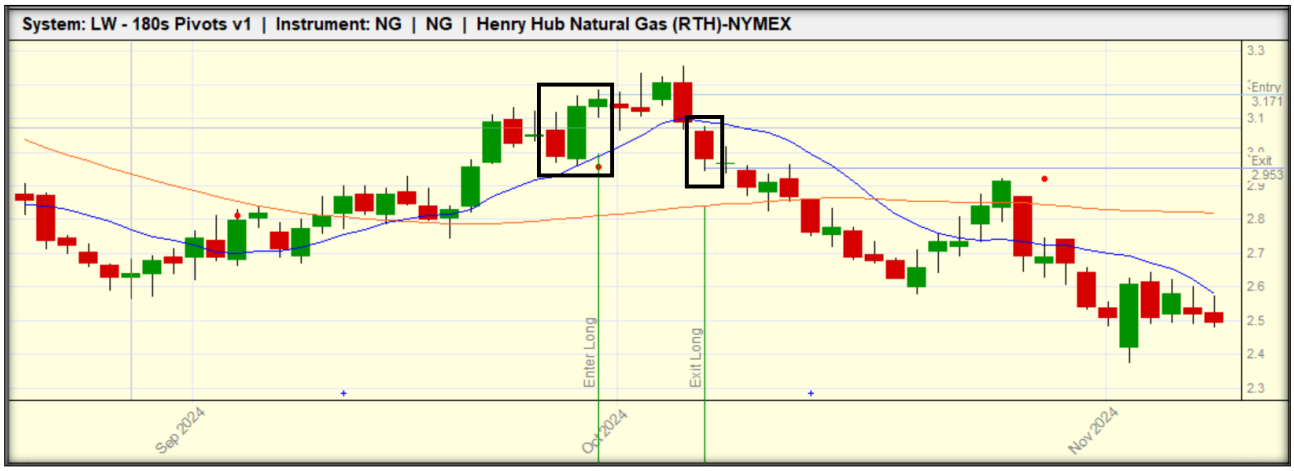
In mid-September 2023, **after several dozen days of growth, the price of the futures contract fell,** which led to the activation of the **Trailing Stop order,** which was set at the level of **the 50-day moving average. The position was closed** (candle in the rectangle on the right). **The system worked correctly.**

A keen eye will notice that **the position was renewed two days later,** because **a large bullish candle with a high close appeared the day after the previous position was closed.** This was **preceded by a bearish candle with a low close,** which additionally **violated the 10-day moving average.** But let's move on to the next example.



The second transaction was made on a **natural gas futures contract.** At the end of September 2024, **the contract fell** and **the closing price was in the lower 25% of the daily range** (first candle in the rectangle on the left). Additionally, **the closing price of this candle was lower than the opening price,** confirming short-term downward pressure. The next day, **the closing price was in the upper 25% of the daily range** and **exceeded the opening price** (second candle in the rectangle on the left). It was also **the largest candle in 10 days,** while its **minimum violated the 10-day moving average.** In addition, the closing price of this candle fell **above the 10 -day and 50-day moving averages. The position was opened the next day** when the price rose **above the maximum of both candles** (third candle in the rectangle on the left). **The stop loss was set at the minimum of both candles (red dot),** which limited the risk of loss in the event of a signal failure.

After a few days, gold prices **fell, activating the original stop loss order. The position was closed** (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.

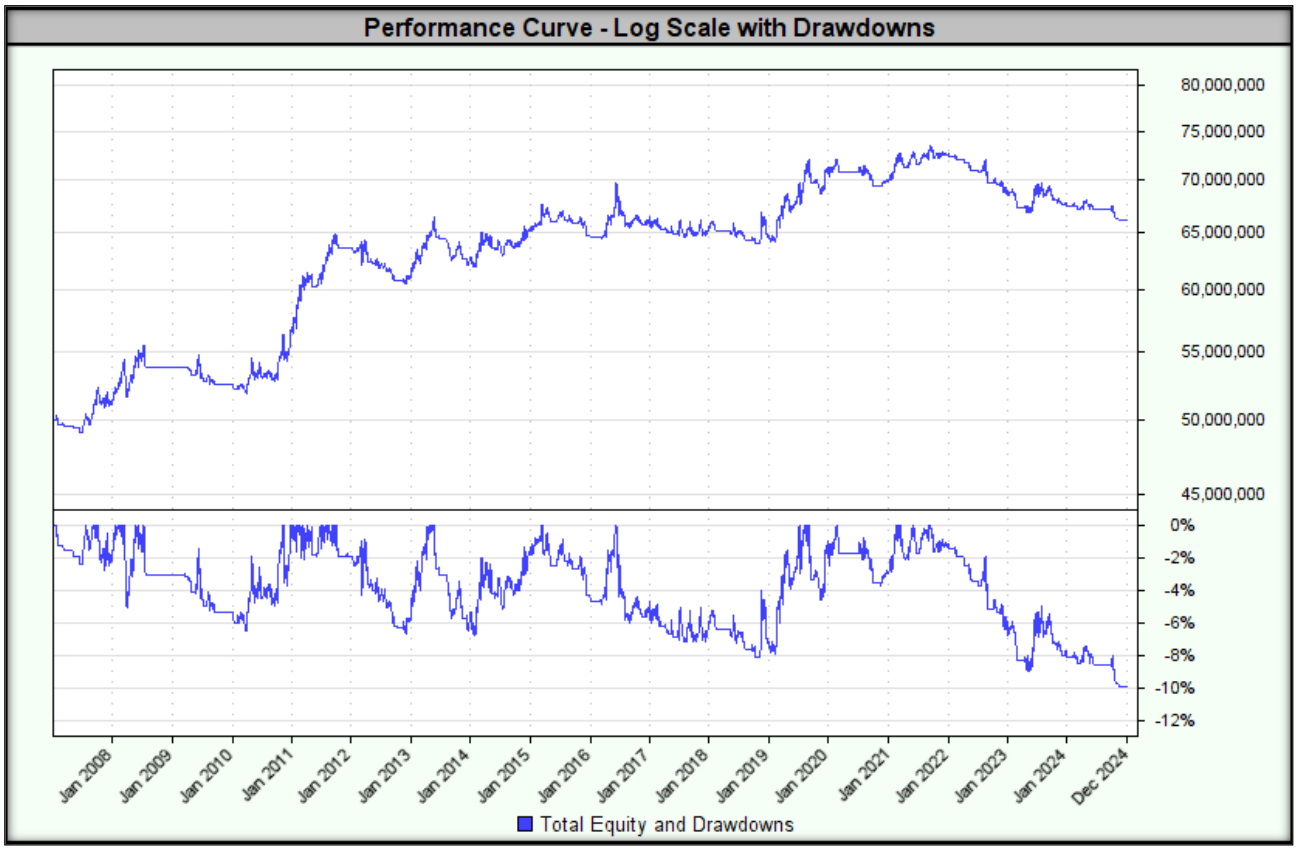
Our basic expectation is that the strategy generates **positive results,** even if they are at a low level.

Tested base parameters:

- **Short Moving Average (SMA) Length:** 10 days;
- **Long Moving Average (SMA) Length:** 50 days;
- **Formation candle:**
  - **The closing price of the first candle** is in **the lower 25% of the daily range and below the opening price;**
  - **The closing price of the second candle** must be within **the upper 25% of the daily range and above the opening price.** In addition, this candle must be **a 10-day high;**
  - **The closing price of the second candle** is **above both the 10-day and 50-day moving averages;**
  - **The first or second day's low** must be below **the 10-day** moving average.
- **Stop loss:** 1 tick below the price low of the candlestick formation;
- **Method of opening a position:** one tick above the high of the candlestick formation;
- **Position size:** corresponding to a risk of 0.5% of total capital;
- **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.



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Indicators/Measures	Concluding a transaction at the opening price
CAGR%	1.6%
MAR Ratio	0.16
RAR%	1.9%
R-Cubed	0.13
Robust Sharpe Ratio	0.42
Max Drawdown	9.9%
Wins	31.4%
Losses	68.6%
Average Win%	1.11%
Average Loss %	0.35%
Win/ Loss Ratio	3.19
Average Trade Duration (days)	32
Percent Profit Factor	1.46
SQN	0.43
Number of transactions	271

In summary, the system works properly and generates signals as expected. Additionally, tests on basic parameters have yielded acceptable 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

180's Pivots v.1 Strategy in this version it assumes **optimization of parameters using The Grid** method **Search,** which consists in **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:

- **Short Moving Average (SMA) Lengths:** Range **5-10 days (step: 1);**
- **Long Moving Average (SMA) Lengths: 40-70 day** range **(step: 2);**
- **Lower closing range of the first candle and upper closing range of the second candle:** range **20%-30% (step: 1 pp.).**

The purpose of this test is to check whether **the strategy remains stable (robust)** over a wide range of parameters, which will allow to assess its usefulness in real market conditions. **The key evaluation criterion is that all test results show a positive MAR value, and the maximum drawdown does 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 completely rejected.

The lowest MAR value of 0.03 was achieved for the following parameters:

- **Short Moving Average (SMA) Lengths:** 10;
- **Long Moving Average (SMA) Lengths:** 70;
- **The lower closing range of the first candle and the upper closing range of the second candle:** 21.

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

Test	Moving Average Short (days) & Largest bar (days)	Moving Average Long (days)	Top/Buttom Range Close (%)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD
1047	10	70	21%	$53,593,220.68	0.39%	0.03	0.12	0.12	12.6%	159.6
1046	10	70	20%	$53,800,281.19	0.41%	0.03	0.13	0.13	12.5%	166.4
1035	10	68	20%	$53,462,848.81	0.37%	0.03	0.12	0.12	11.3%	166.4
838	9	64	21%	$53,708,833.49	0.40%	0.03	0.11	0.11	11.5%	159.6
837	9	64	20%	$53,900,958.94	0.42%	0.04	0.12	0.12	11.3%	166.4
1036	10	68	21%	$53,559,195.70	0.38%	0.04	0.12	0.12	10.3%	159.6
1024	10	66	20%	$53,764,225.76	0.40%	0.04	0.13	0.13	10.5%	166.4
871	9	70	21%	$55,681,706.37	0.60%	0.04	0.16	0.17	15.3%	159.6
849	9	66	21%	$55,093,943.80	0.54%	0.04	0.15	0.15	12.7%	115.7
1025	10	66	21%	$53,966,145.09	0.43%	0.04	0.13	0.13	9.8%	159.6
870	9	70	20%	$56,457,654.00	0.68%	0.05	0.18	0.20	14.8%	166.4
860	9	68	21%	$55,778,292.34	0.61%	0.05	0.16	0.17	13.1%	115.9

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

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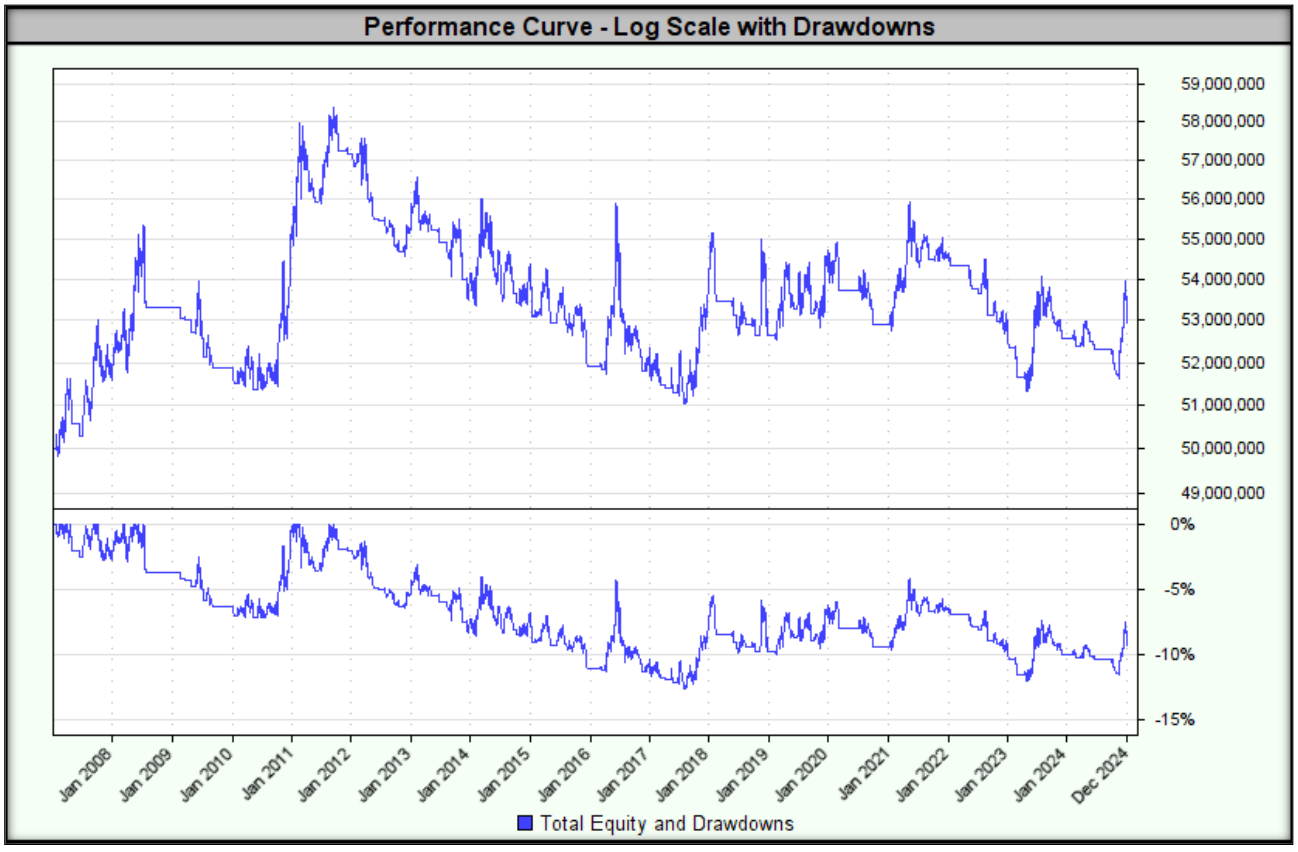

The highest MAR value of 0.47 was achieved for the following parameters:

- **Short Moving Average (SMA) Lengths:** 5;
- **Long Moving Average (SMA) Lengths:** 58;
- **Lower closing range of the first candle and upper closing range of the second candle:** 30%.

The highest MAR value was accompanied by **a drawdown of 14.7%.**

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

Test	Moving Average Short (days) & Largest bar (days)	Moving Average Long (days)	Top/Buttom Range Close (%)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD
110	5	58	30%	$168,271,891.01	6.98%	0.47	0.74	0.66	14.7%	37.6
109	5	58	29%	$164,965,996.78	6.86%	0.47	0.73	0.65	14.6%	37.1
97	5	56	28%	$149,176,644.19	6.26%	0.46	0.70	0.65	13.5%	38.8
108	5	58	28%	$148,944,418.59	6.25%	0.46	0.70	0.65	13.6%	38.8
99	5	56	30%	$152,337,421.48	6.39%	0.45	0.70	0.64	14.2%	27.2
121	5	60	30%	$158,991,969.40	6.64%	0.45	0.71	0.63	14.9%	27.1
98	5	56	29%	$152,323,134.30	6.38%	0.44	0.70	0.64	14.4%	31.4
120	5	60	29%	$155,971,788.99	6.52%	0.44	0.70	0.63	14.8%	31.4
119	5	60	28%	$143,286,599.23	6.02%	0.44	0.67	0.62	13.8%	55.0
96	5	56	27%	$145,890,834.04	6.13%	0.43	0.70	0.66	14.3%	38.8
107	5	58	27%	$145,368,055.04	6.11%	0.42	0.70	0.66	14.7%	38.6
77	5	52	30%	$131,169,797.49	5.50%	0.42	0.65	0.66	13.3%	31.4

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

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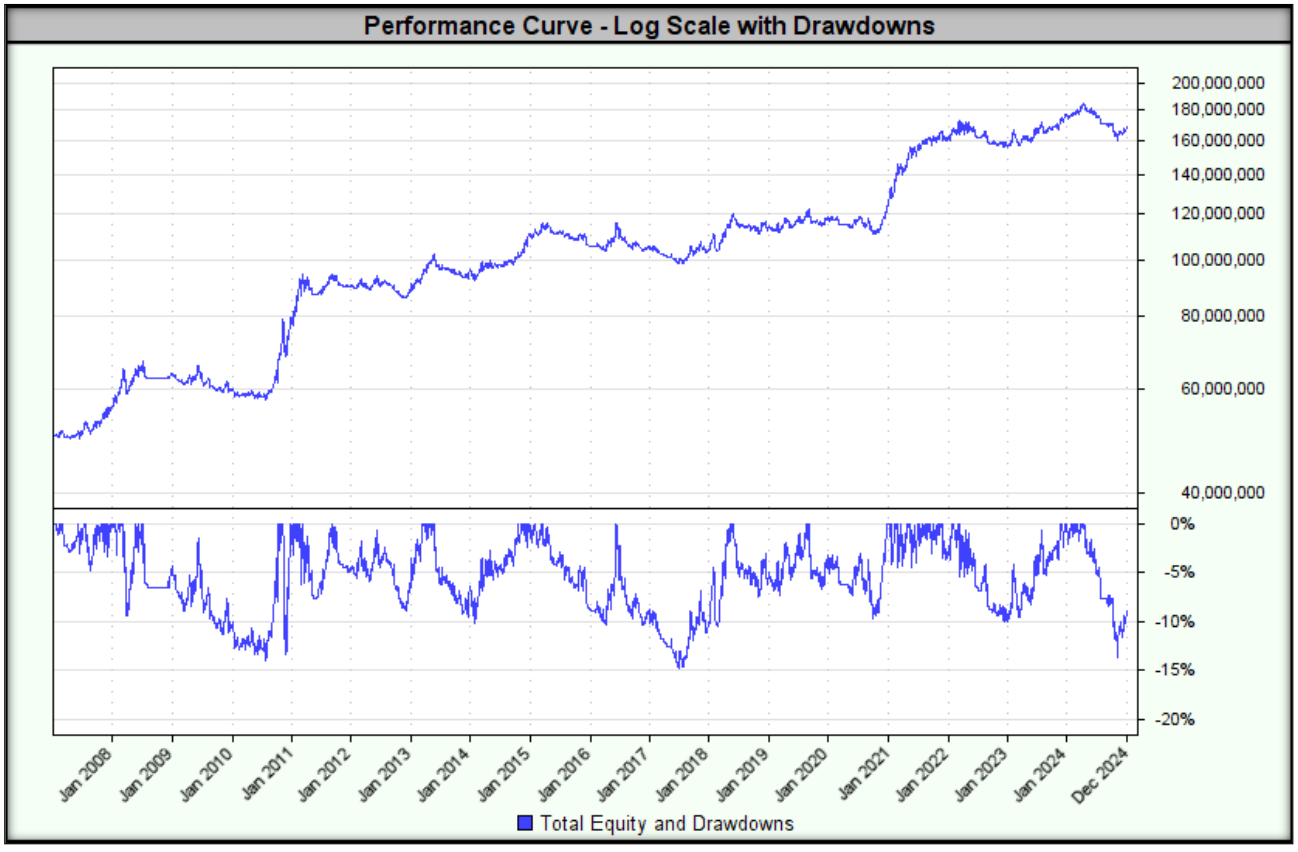


For all combinations of tested parameter ranges, **the highest drawdown was 24.4%.**

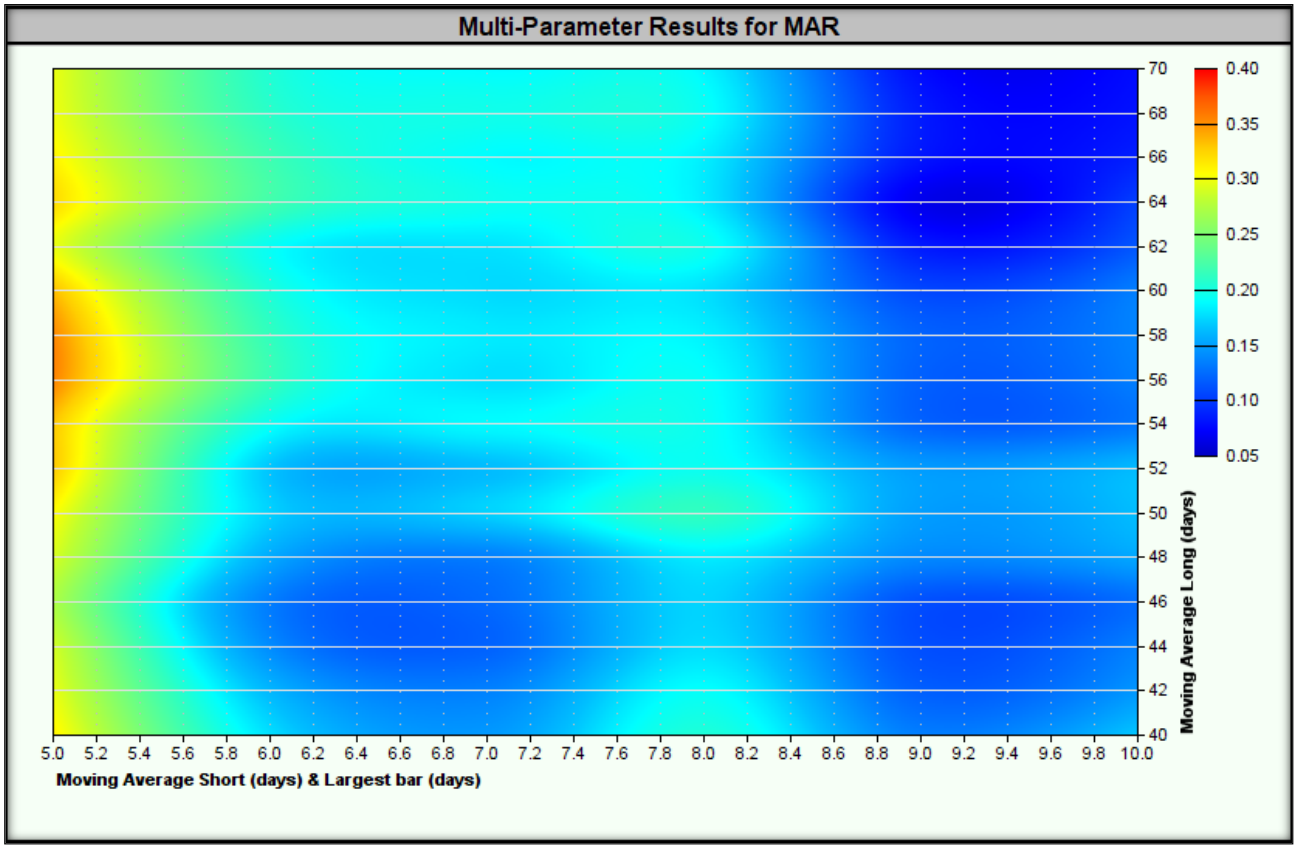
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

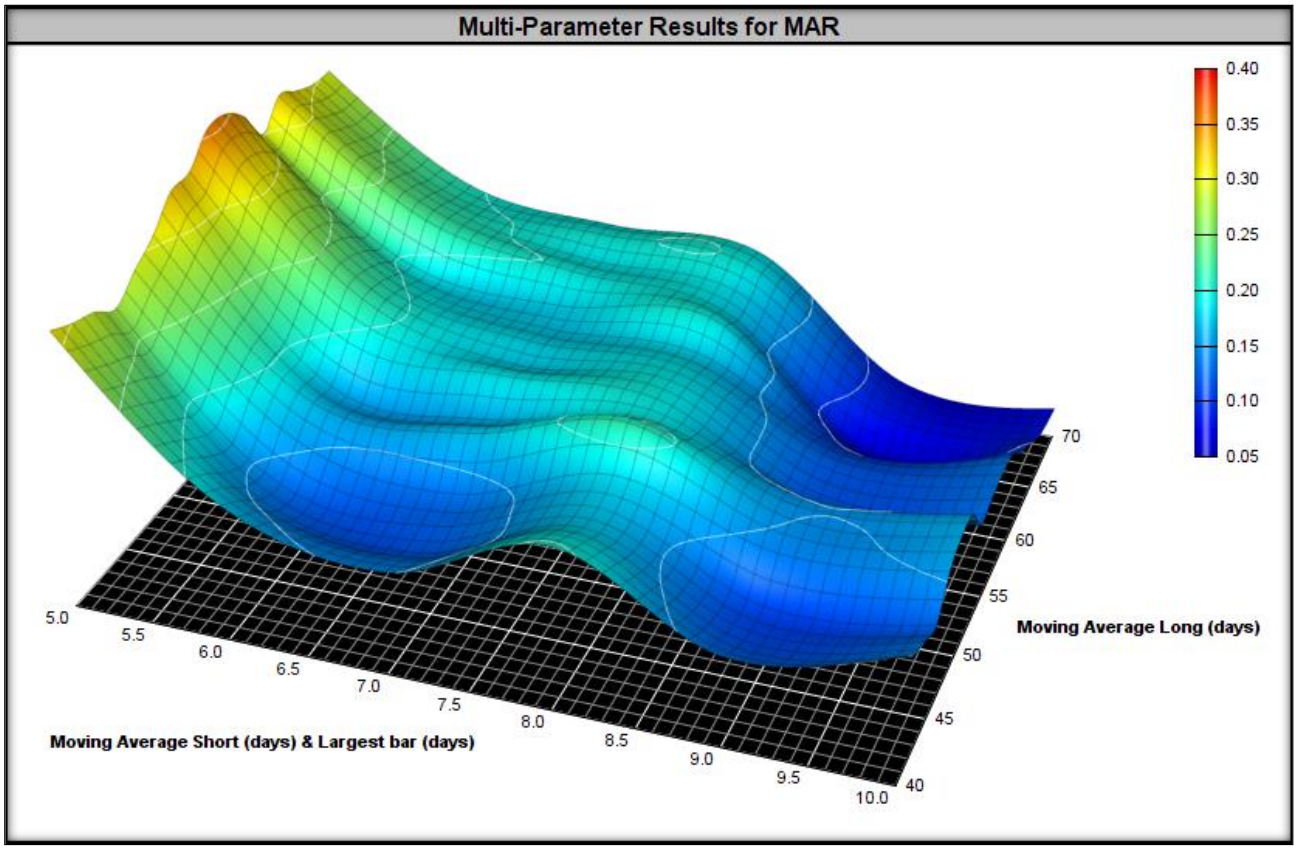
Test	Moving Average Short (days) & Largest bar (days)	Moving Average Long (days)	Top/Buttom Range Close (%)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max ...	Longest DD
176	5	70	30%	$197,438,966.21	7.93%	0.32	0.71	0.70	24.4%	40.4
165	5	68	30%	$189,899,538.79	7.70%	0.32	0.70	0.69	24.1%	27.1
175	5	70	29%	$194,636,365.94	7.84%	0.33	0.71	0.69	24.0%	37.4
154	5	66	30%	$194,521,947.28	7.84%	0.33	0.72	0.71	23.9%	40.4
164	5	68	29%	$186,904,868.71	7.60%	0.32	0.69	0.69	23.7%	27.1
153	5	66	29%	$191,184,874.08	7.74%	0.33	0.71	0.70	23.5%	37.4
174	5	70	28%	$167,586,537.30	6.95%	0.30	0.65	0.65	23.5%	70.5
143	5	64	30%	$195,836,214.95	7.88%	0.34	0.73	0.73	23.5%	26.7
163	5	68	28%	$166,505,841.19	6.91%	0.30	0.65	0.66	23.2%	56.5
142	5	64	29%	$191,818,207.54	7.76%	0.34	0.72	0.71	23.1%	31.6
152	5	66	28%	$169,852,910.62	7.03%	0.30	0.67	0.67	23.1%	69.9
132	5	62	30%	$190,184,097.28	7.71%	0.34	0.72	0.74	22.9%	36.8

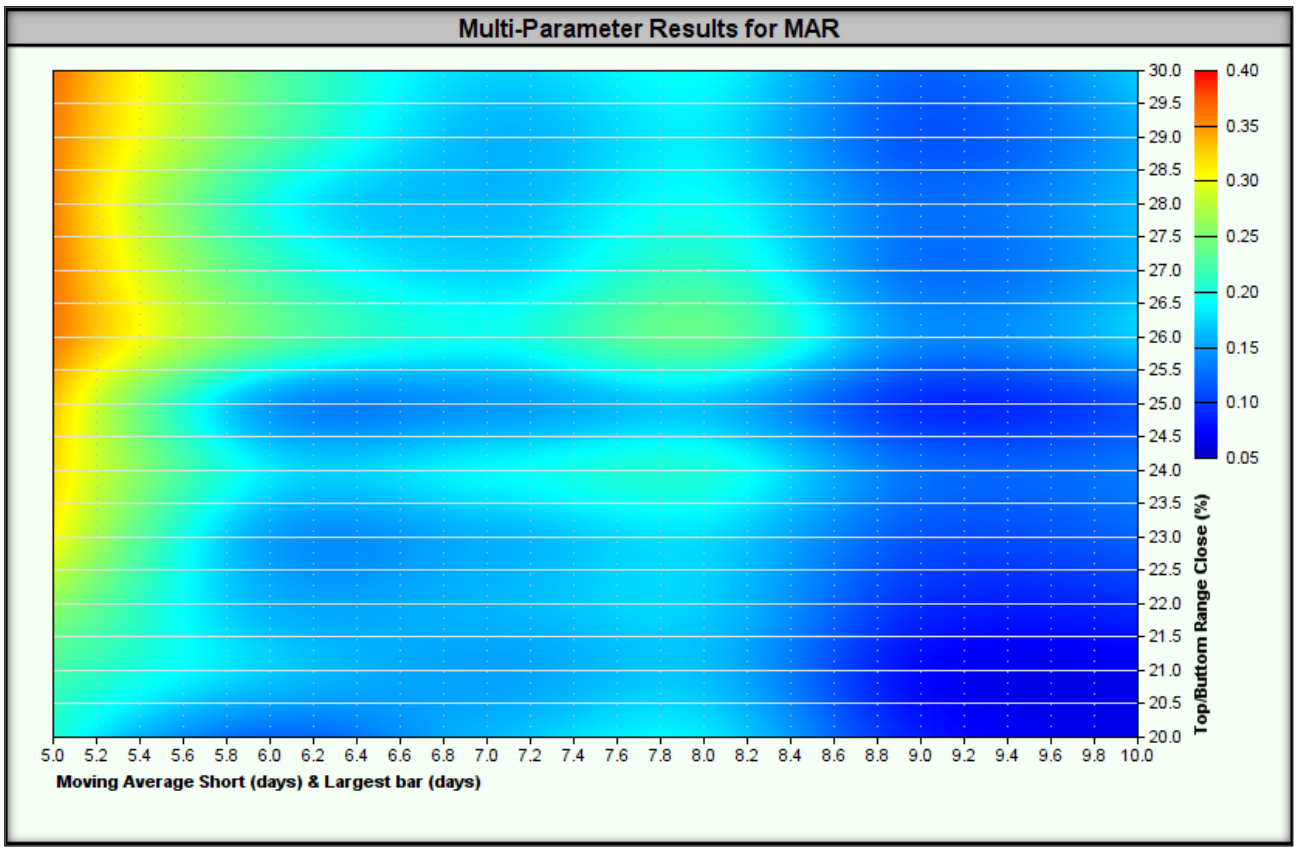
In summary, the strategy **passed the stability test** in a wide range of optimized parameters on in-sample data because:

- **MAR value** – which indicates the stability of the strategy in various market conditions.
- **The maximum drawdown did not exceed 250% of the drawdown value** for the result with the highest MAR (**24.4% vs. 14.7%)** – which means an acceptable risk of deep capital drawdowns.

Heatmaps for the tested ranges are presented below.




Multi-Parameter Results for MAR
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Moving Average Short (days) & Largest bar (days)
70
65
60
55
50
45
40
Moving Average Long (days)


Multi-Parameter Results for MAR
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
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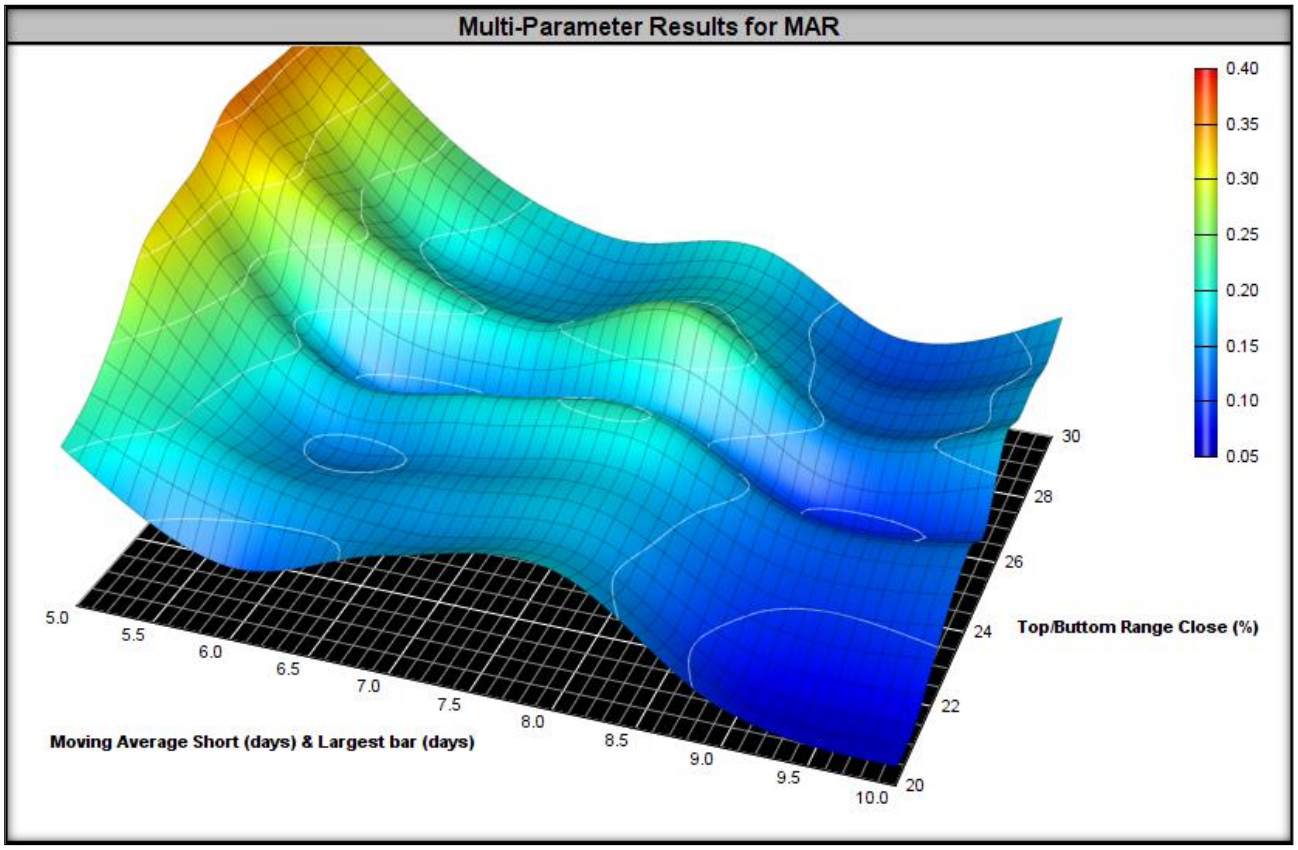
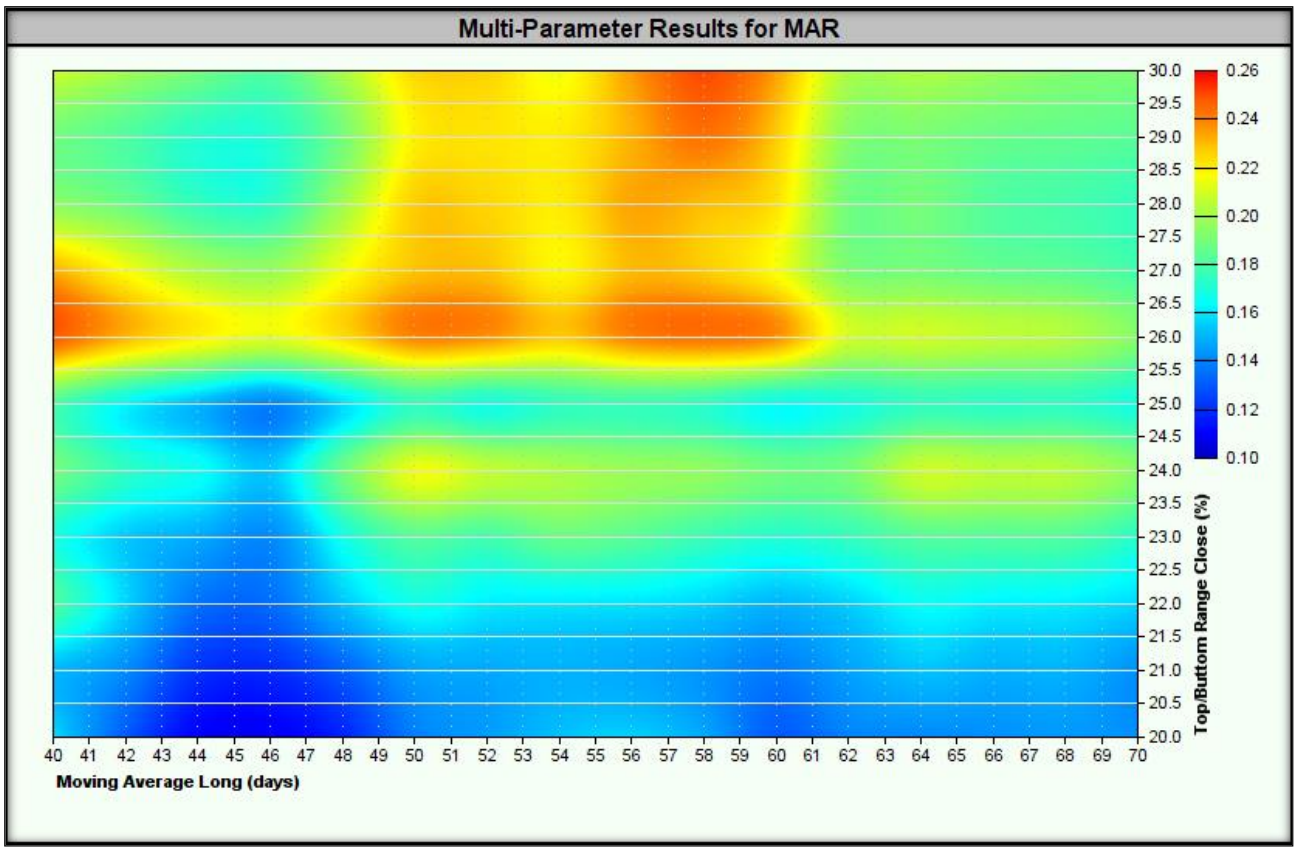
25.5
25.0
24.5
24.0
23.5
23.0
22.5
22.0
21.5
21.0
20.5
20.0
Top/Buttom Range Close (%)
5.0 5.2 5.4 5.6 5.8 6.0 6.2 6.4 6.6 6.8 7.0 7.2 7.4 7.6 7.8 8.0 8.2 8.4 8.6 8.8 9.0 9.2 9.4 9.6 9.8 10.0
Moving Average Short (days) & Largest bar (days)


Multi-Parameter Results for MAR
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
30
28
26
24
22
20
Top/Buttom Range Close (%)
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Moving Average Short (days) & Largest bar (days)


Multi-Parameter Results for MAR
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
Top/Buttom Range Close (%)
30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
26.0
25.5
25.0
24.5
24.0
23.5
23.0
22.5
22.0
21.5
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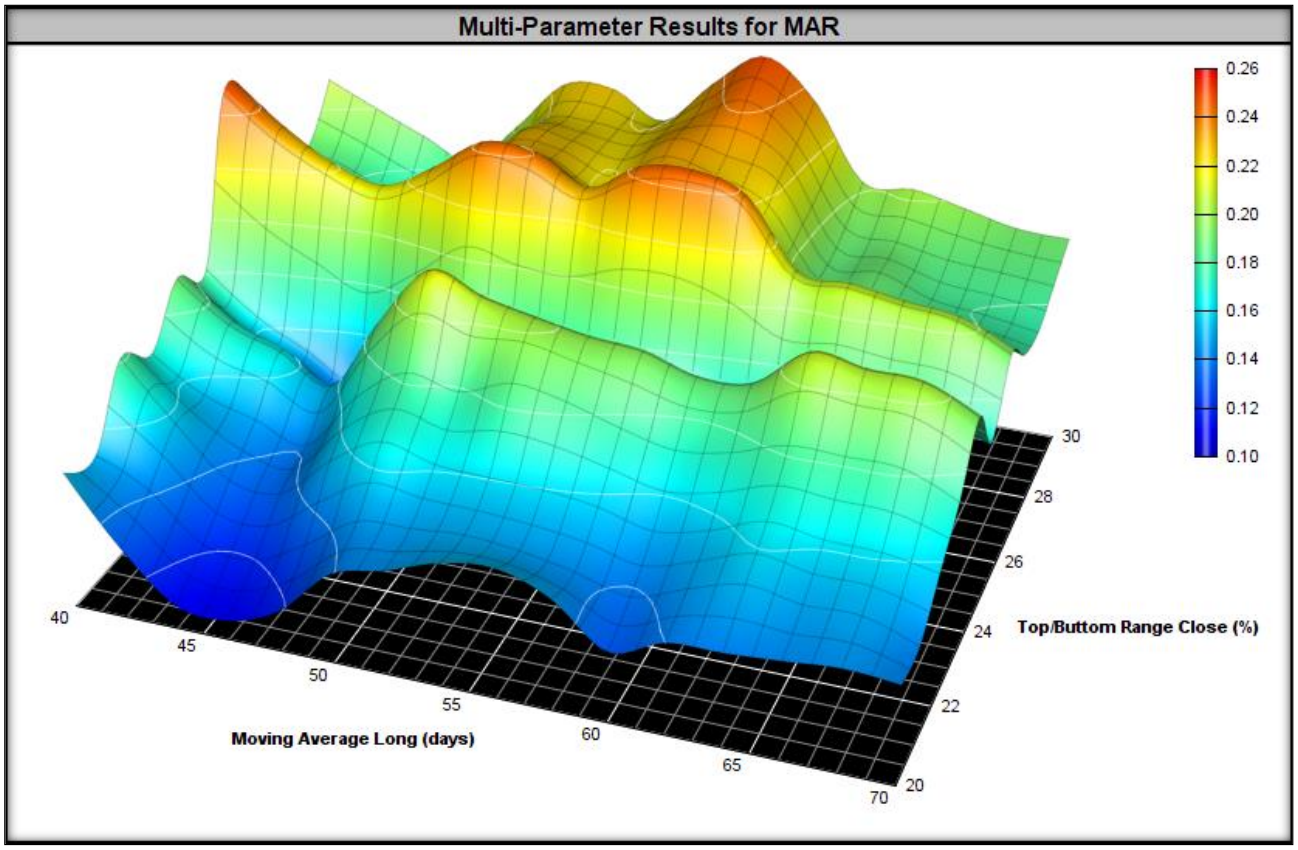
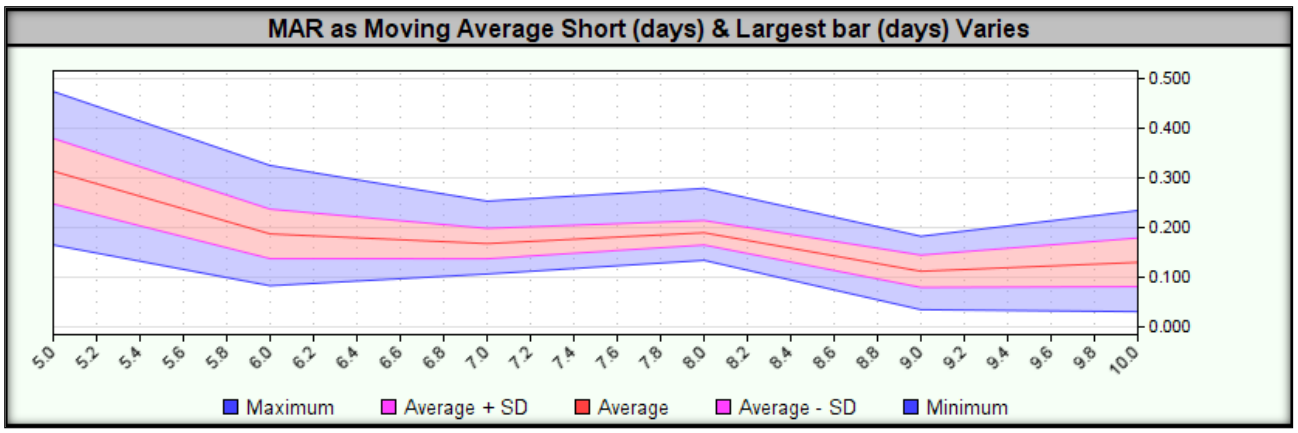
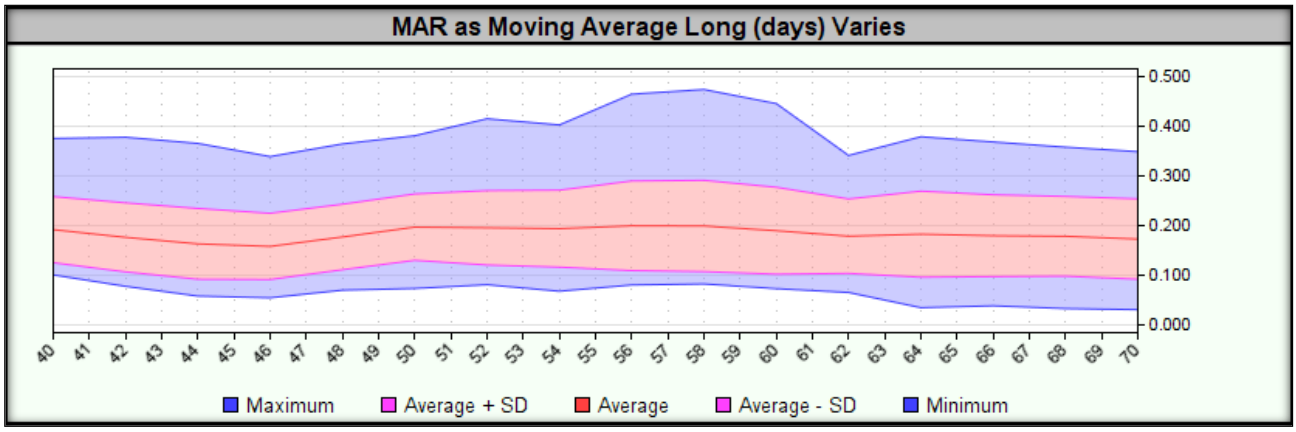
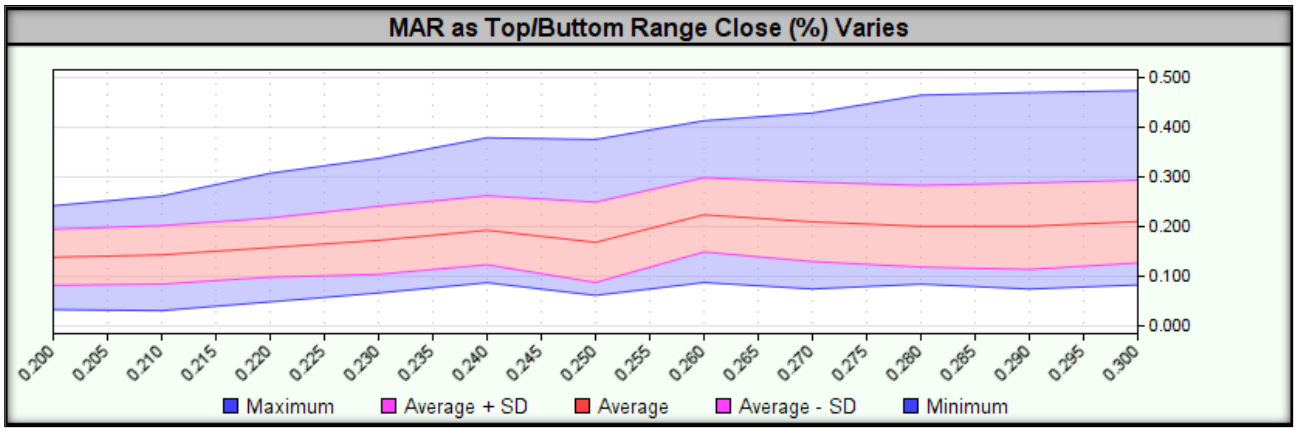
20.5
20.0
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
Moving Average Long (days)


Multi-Parameter Results for MAR
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
40
45
50
55
60
65
70
Moving Average Long (days)
30
28
26
24
22
20
Top/Buttom Range Close (%)


MAR as Moving Average Short (days) & Largest bar (days) Varies
0.500
0.400
0.300
0.200
0.100
0.000
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0
8.2
8.4
8.6
8.8
9.0
9.2
9.4
9.6
9.8
10.0
Maximum
Average + SD
Average
Average - SD
Minimum





After passing the stability tests on **the in-sample data,** it is time perform the same on **the out-of-sample data.** For this purpose, we use **the same range of parameters** as on the in-sample data:

- **Short Moving Average (SMA) Lengths:** Range **5-10 days (step: 1);**
- **Long Moving Average (SMA) Lengths: 40-70 day** range **(step: 2);**
- **Lower closing range of the first candle and upper closing range of the second candle:** range **20%-30% (step: 1 pp.).**

The lowest MAR value of -0.10 was achieved for the parameters:

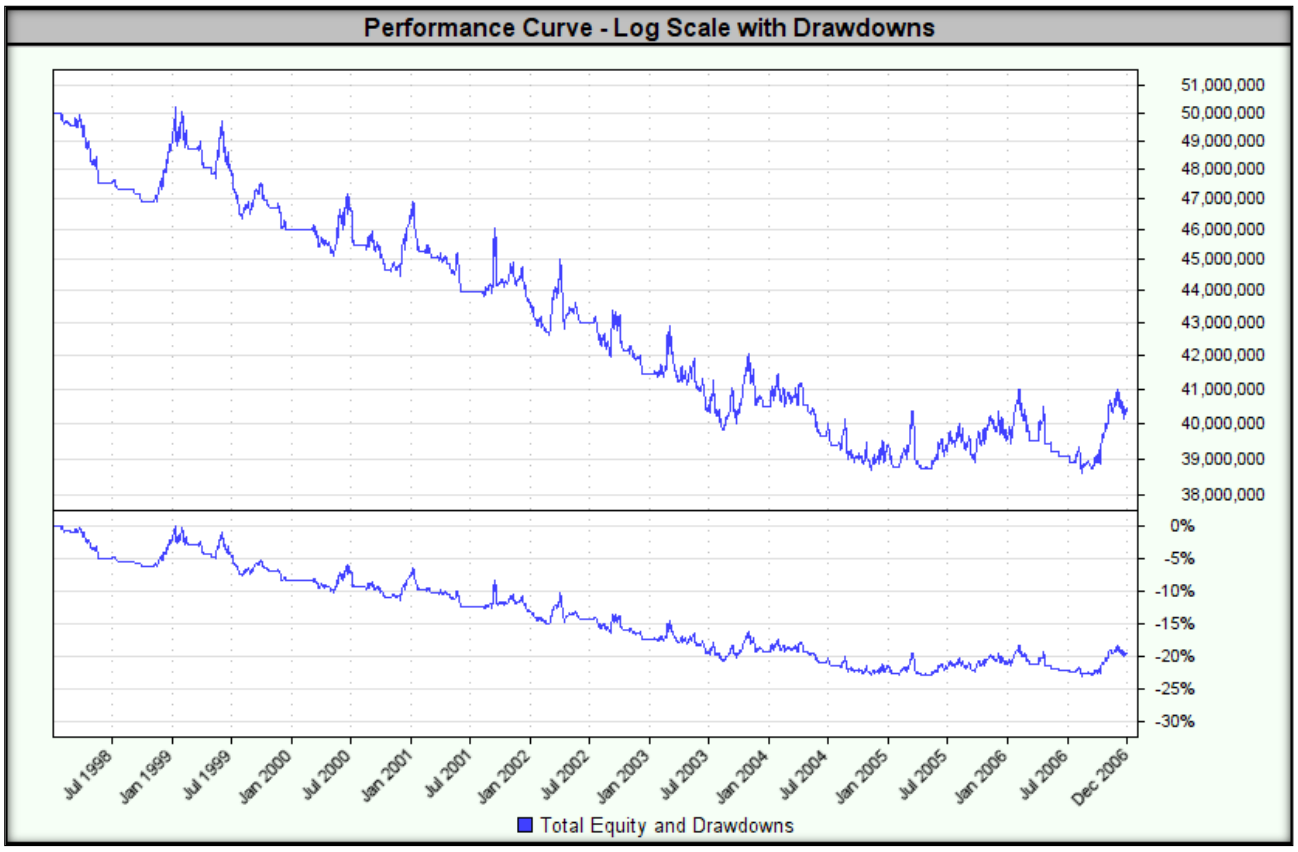
- **Short Moving Average (SMA) Lengths:** 6;
- **Long Moving Average (SMA) Lengths:** 42;
- **Lower closing range of the first candle and upper closing range of the second candle:** 23%.

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

Te...	Moving Average Short (days) & Largest bar (days)	Moving Average Long (days)	Top/Buttom Range Close (%)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD
191	6	42	23%	$40,354,583.69	-2.36%	-0.10	-0.43	-0.79	23.1%	95.6
192	6	42	24%	$40,319,385.63	-2.36%	-0.10	-0.42	-0.76	23.3%	95.6
16	5	42	24%	$41,042,225.39	-2.17%	-0.10	-0.33	-1.01	21.8%	95.6
180	6	40	23%	$40,698,120.96	-2.26%	-0.10	-0.42	-0.71	22.8%	95.6
247	6	52	24%	$39,735,054.40	-2.52%	-0.10	-0.45	-0.81	25.5%	94.9
913	10	44	30%	$44,498,957.65	-1.29%	-0.10	-0.32	-0.69	13.0%	77.9
181	6	40	24%	$40,543,037.28	-2.30%	-0.10	-0.41	-0.70	23.3%	95.6
891	10	40	30%	$45,186,136.85	-1.12%	-0.10	-0.28	-0.54	11.4%	77.9
5	5	40	24%	$41,450,894.55	-2.06%	-0.10	-0.31	-0.84	21.0%	95.6
15	5	42	23%	$40,935,301.93	-2.20%	-0.10	-0.34	-1.12	22.4%	95.6
246	6	52	23%	$40,047,352.60	-2.44%	-0.10	-0.45	-0.82	24.9%	94.9
71	5	52	24%	$40,023,641.02	-2.44%	-0.10	-0.35	-1.03	25.2%	94.9

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 0.39 was achieved for the following parameters:

- **Short Moving Average (SMA) Lengths:** 5;
- **Long Moving Average (SMA) Lengths:** 62;
- **Lower closing range of the first candle and upper closing range of the second candle:** 20%.

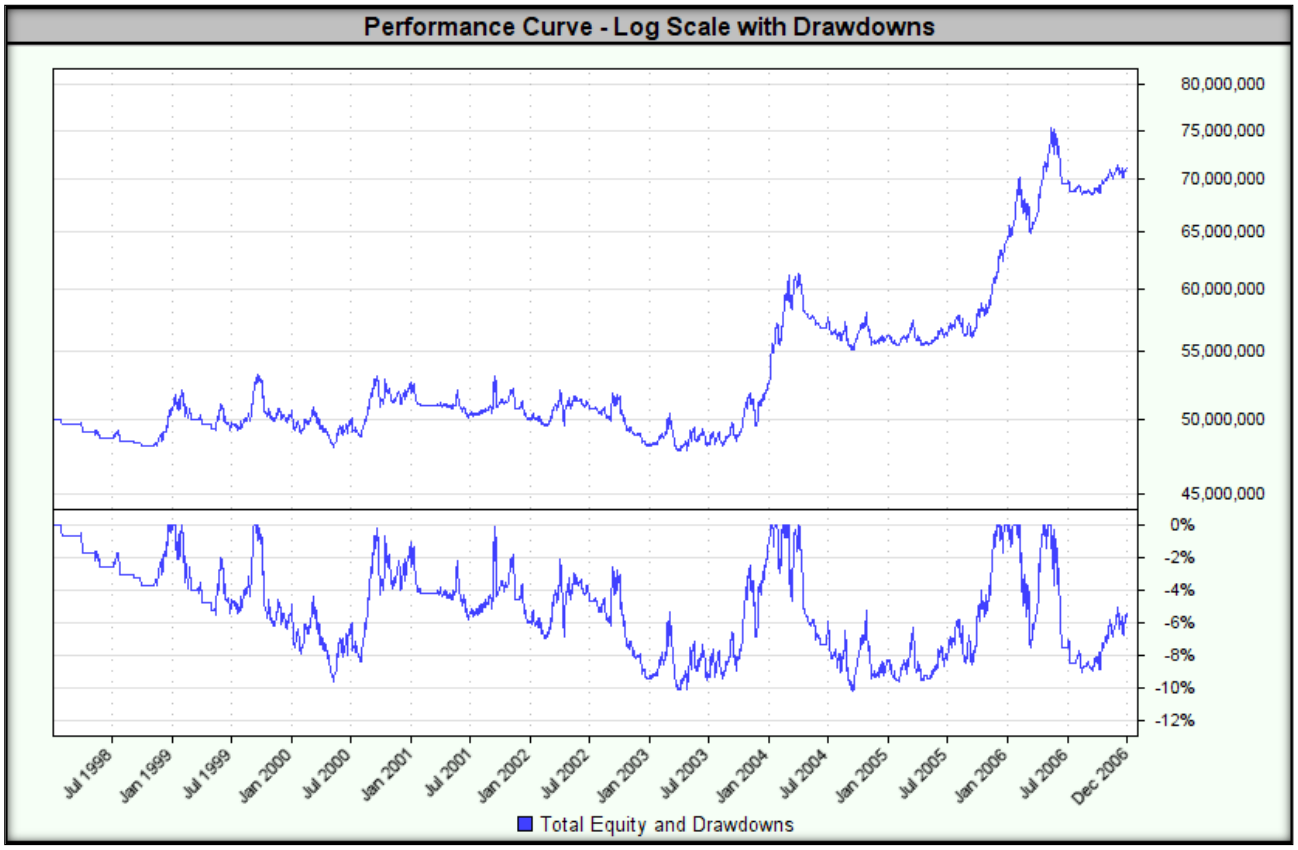
The highest MAR value was accompanied by **a drawdown of 10.2%.**

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

Te...	Moving Average Short (days) & Largest bar (days)	Moving Average Long (days)	Top/Buttom Range Close (%)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD
122	5	62	20%	$71,058,235.60	3.99%	0.39	0.49	0.64	10.2%	51.5
132	5	62	30%	$75,140,572.83	4.63%	0.38	0.49	0.69	12.1%	21.7
121	5	60	30%	$72,435,639.44	4.21%	0.38	0.46	0.61	11.1%	31.5
111	5	60	20%	$71,247,725.62	4.02%	0.36	0.50	0.63	11.2%	51.5
110	5	58	30%	$70,486,132.79	3.89%	0.34	0.43	0.54	11.4%	49.3
133	5	64	20%	$69,788,513.51	3.78%	0.34	0.46	0.61	11.0%	51.5
143	5	64	30%	$74,217,069.35	4.49%	0.33	0.47	0.67	13.5%	22.1
123	5	62	21%	$67,765,105.01	3.44%	0.31	0.42	0.58	11.0%	51.5
99	5	56	30%	$67,429,596.33	3.38%	0.31	0.40	0.51	10.9%	49.1
144	5	66	20%	$68,752,669.62	3.61%	0.30	0.44	0.57	11.9%	51.5
154	5	66	30%	$71,143,553.76	4.00%	0.30	0.42	0.62	13.2%	22.1
100	5	58	20%	$69,654,870.11	3.76%	0.30	0.47	0.57	12.5%	51.7

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 25.5%.**

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

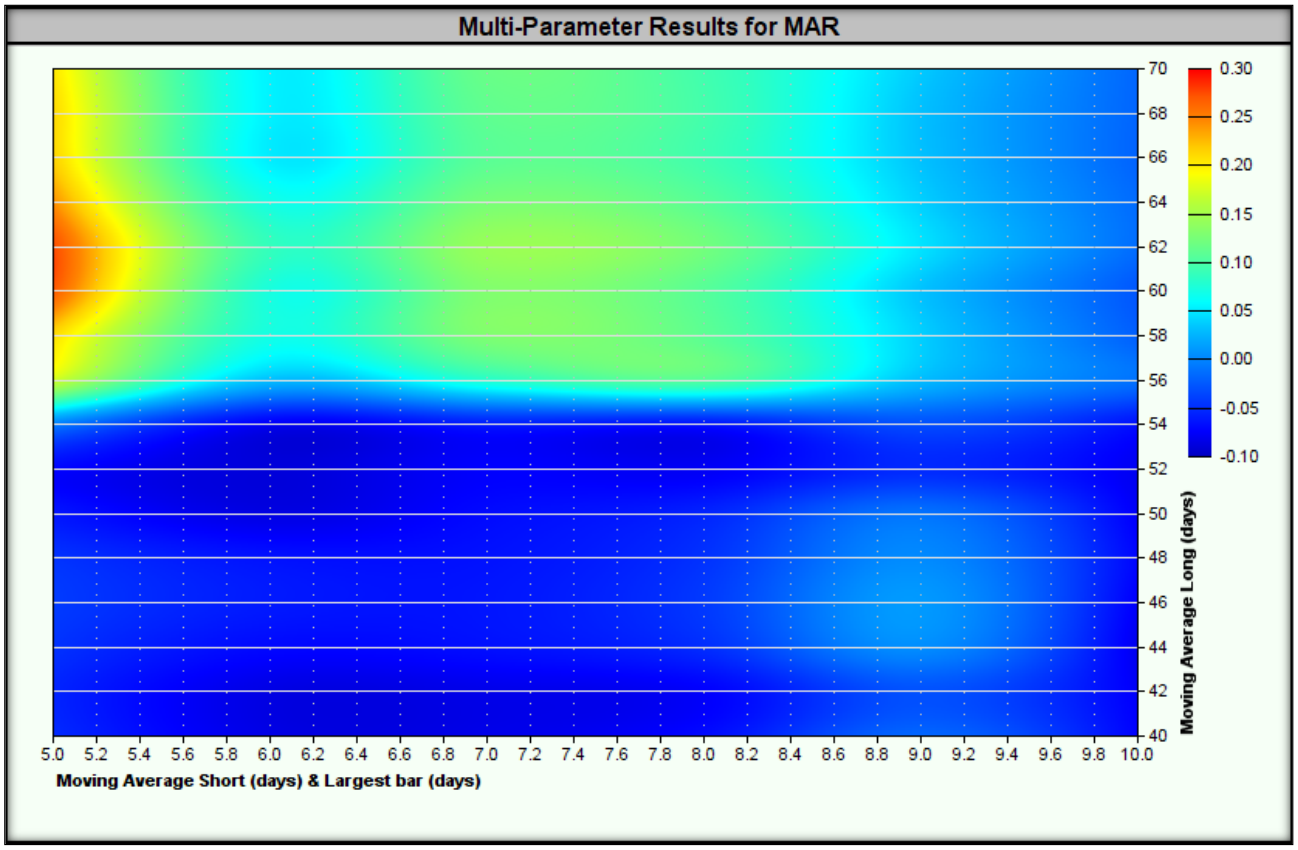
Te...	Moving Average Short (days) & Largest bar (days)	Moving Average Long (days)	Top/Buttom Range Close (%)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max ...	Longest DD
247	6	52	24%	$39,735,054.40	-2.52%	-0.10	-0.45	-0.81	25.5%	94.9
70	5	52	23%	$40,211,224.62	-2.39%	-0.10	-0.35	-1.06	25.2%	94.9
71	5	52	24%	$40,023,641.02	-2.44%	-0.10	-0.35	-1.03	25.2%	94.9
246	6	52	23%	$40,047,352.60	-2.44%	-0.10	-0.45	-0.82	24.9%	94.9
236	6	50	24%	$40,152,180.47	-2.41%	-0.10	-0.42	-0.73	24.8%	94.9
235	6	50	23%	$40,249,442.47	-2.38%	-0.10	-0.43	-0.75	24.6%	94.9
252	6	52	29%	$41,177,062.57	-2.14%	-0.09	-0.31	-0.57	23.7%	107.9
224	6	48	23%	$42,130,213.51	-1.89%	-0.08	-0.34	-0.51	23.4%	94.9
181	6	40	24%	$40,543,037.28	-2.30%	-0.10	-0.41	-0.70	23.3%	95.6
192	6	42	24%	$40,319,385.63	-2.36%	-0.10	-0.42	-0.76	23.3%	95.6
202	6	44	23%	$41,302,810.69	-2.10%	-0.09	-0.38	-0.58	23.2%	95.6
59	5	50	23%	$41,315,897.42	-2.10%	-0.09	-0.31	-0.95	23.2%	94.9

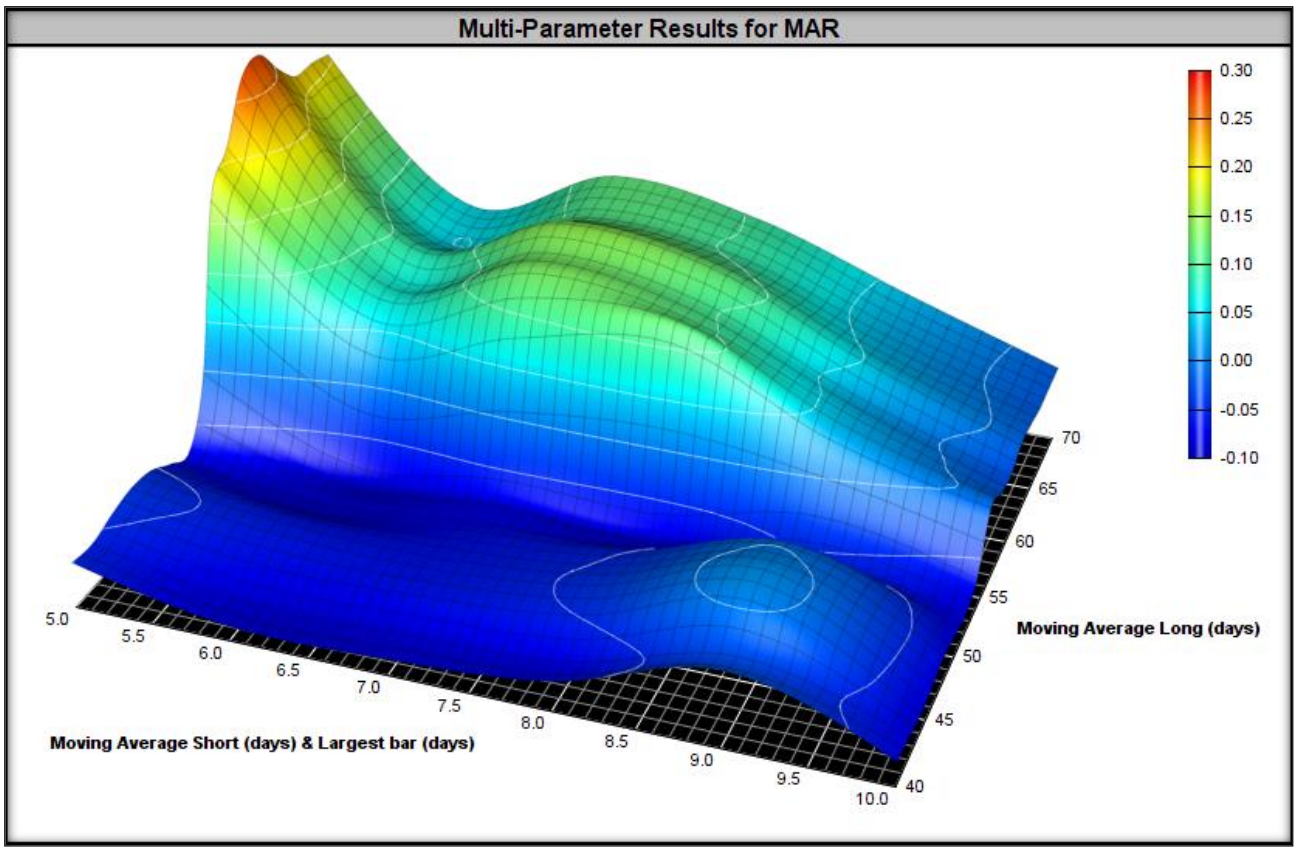
In summary, the strategy **failed the stability test** over a wide range of optimized parameters on out-of-sample data because:

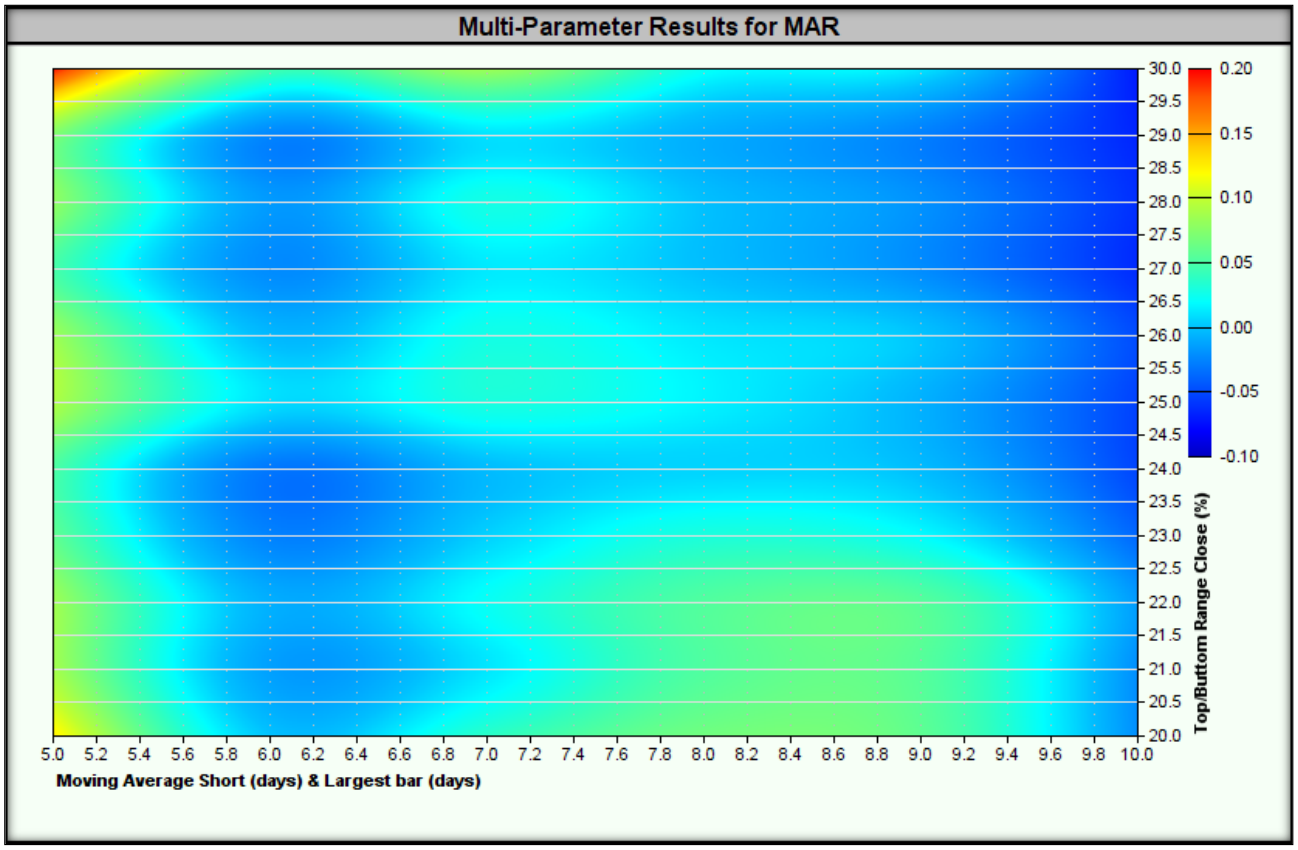
- **MAR value** – which indicates the instability of the strategy in different market conditions.

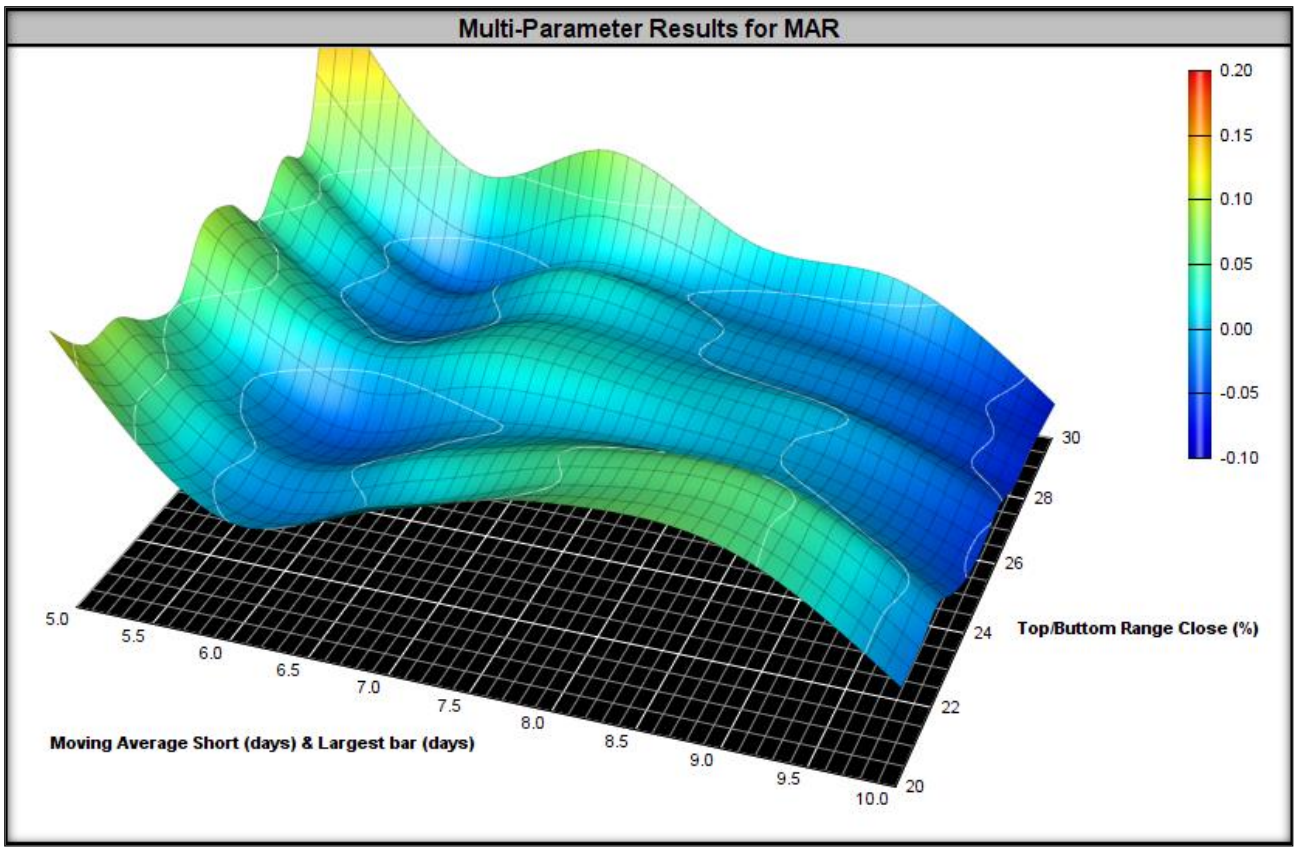
Therefore, **<u>further testing of the strategy is not justified,</u>** as its use in real transactions **is highly questionable.**

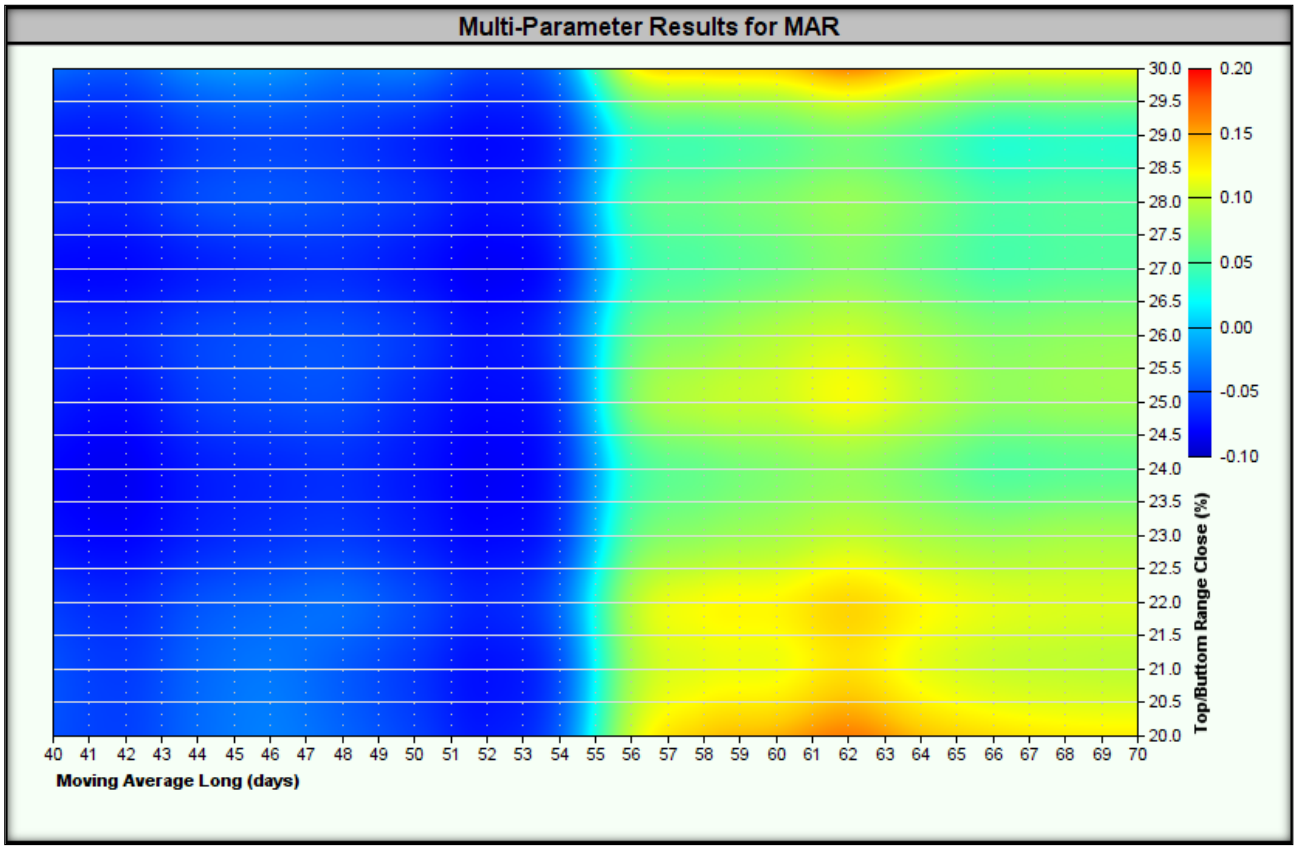
Heatmaps for the tested ranges are presented below.

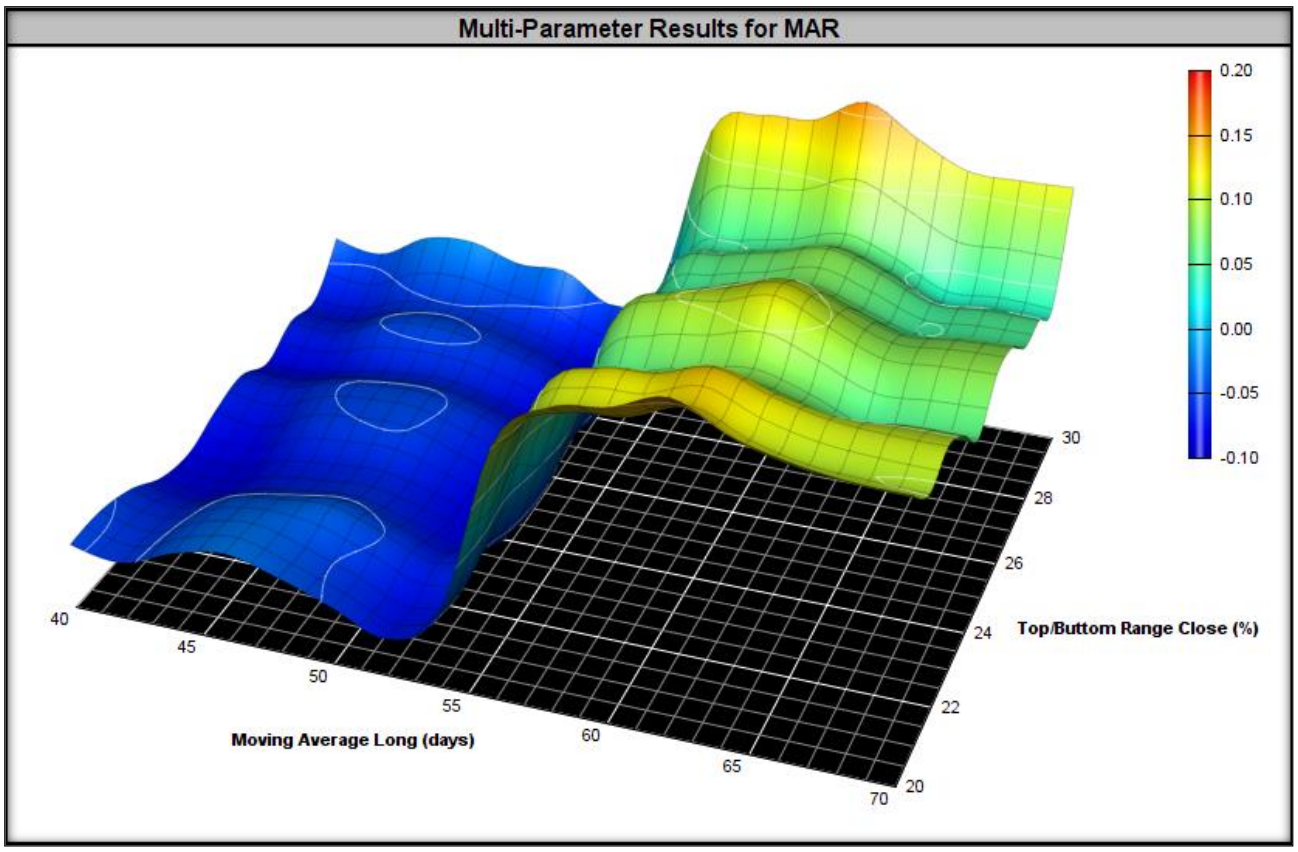

Multi-Parameter Results for MAR
Moving Average Short (days) & Largest bar (days)
Moving Average Long (days)
5.0 5.2 5.4 5.6 5.8 6.0 6.2 6.4 6.6 6.8 7.0 7.2 7.4 7.6 7.8 8.0 8.2 8.4 8.6 8.8 9.0 9.2 9.4 9.6 9.8 10.0
40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70
0.30 0.25 0.20 0.15 0.10 0.05 0.00 -0.05 -0.10

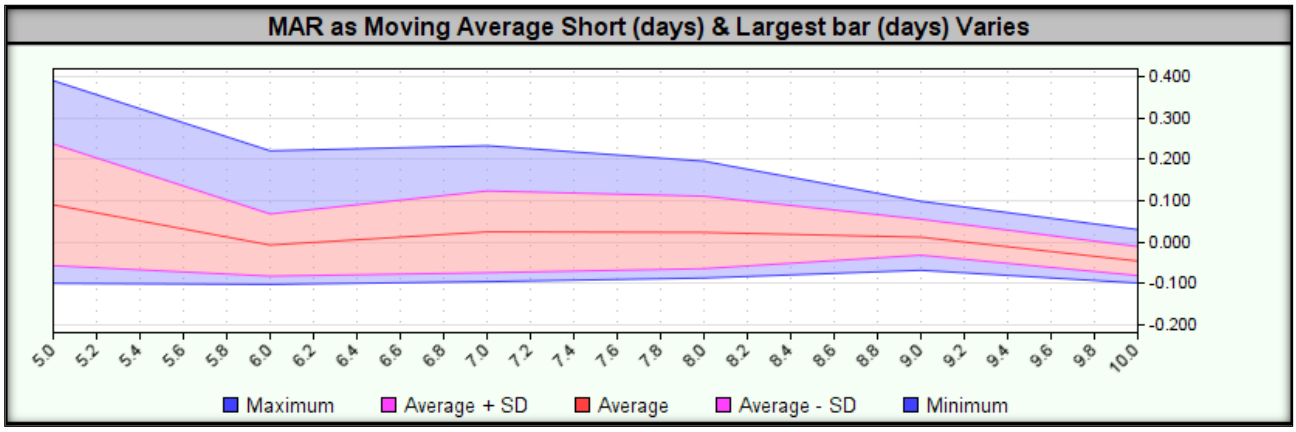

Multi-Parameter Results for MAR
Moving Average Short (days) & Largest bar (days)
Moving Average Long (days)
5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0
40 45 50 55 60 65 70
0.30 0.25 0.20 0.15 0.10 0.05 0.00 -0.05 -0.10

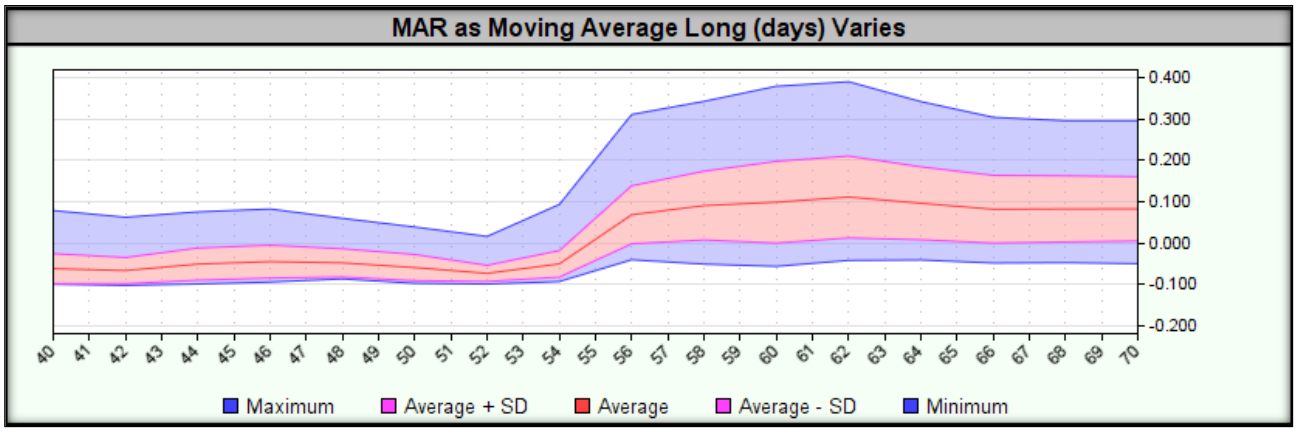

Multi-Parameter Results for MAR
Moving Average Short (days) & Largest bar (days)
Top/Buttom Range Close (%)

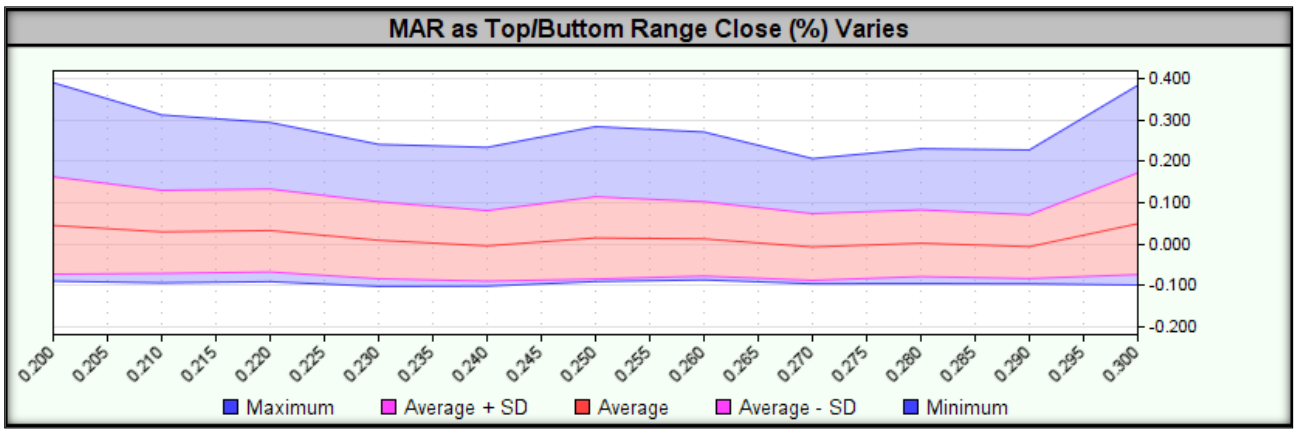

Multi-Parameter Results for MAR
Moving Average Short (days) & Largest bar (days)
Top/Buttom Range Close (%)


Multi-Parameter Results for MAR
Moving Average Long (days)
Top/Buttom Range Close (%)


Multi-Parameter Results for MAR
Moving Average Long (days)
Top/Buttom Range Close (%)







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.**

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Step 6: Using the strategy in real time

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