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The results presented may include historical simulations (backtests) and may not reflect all execution costs and constraints (including commissions, spreads, slippage, taxes, and liquidity limitations). Historical or simulated performance is not a guarantee of achieving similar results in the future.

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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.

Vol Trade v.2

Investment Strategy Testing Summary

Vol Trade v.2 strategy is a swing trading technique based on **volatility contraction** and **range expansion** in the direction of the prevailing trend. In the long version, it combines **a trend filter** (close above the long-term moving average) with the condition that **short-term volatility** falls to **a fraction of long-term volatility. After such a period of low volatility, a strong bullish candle** generates a signal, simultaneously setting **a new local high.**

The strategy **does not use stop loss orders;** the exit occurs when **short-term volatility exceeds long-term volatility** (volatility regime shift).

Compared to version v.1, **the requirement for low volatility to be maintained for a specified number of days has been removed.** This parameter added little to the strategy's functionality, only adding unnecessary complexity. The goal of removing this element was to reduce the number of parameters in the strategy and increase the number of test transactions, which **should improve the strategy's stability.**

The optimal optimization window for WFA tests is **2192/548 days,** and the results for the period **01/01/1995 – 31/12/2024** were:

- **Item size:** corresponding to a risk of 1.25% of the total capital, with a hypothetical stop loss order located 2 x ATR (40 days) away from the position opening point;
- **CAGR:** 10.7%
- **MAR:** 0.48;
- **Maximum drawdown:** 22.2%.

It's worth noting that **with a position size of 1.25% of equity, the drawdown in 99% of Monte Carlo simulations was 51% or less,** which compares **favorably** to **the in-sample and out-of-sample data,** which **had a drawdown of 21.2%.** Ultimately, **position sizing should be adjusted to an acceptable drawdown level consistent with your individual risk profile.**

The strategy passed both stability and Walk-Forward Analysis (WFA) tests. However, **it has some significant limitations** that should be considered:

- **The lack of stop loss orders** means that the strategy should only be used as part of a diversified portfolio of different investment strategies.
- **The long holding time of the position** causes the strategy to often change its profile from short-term swing trading to medium/long-term trend following.
- **The long drawdown,** which can last up to several years, means that you need to have a lot of confidence in this strategy and treat it as one of many in your portfolio.

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Despite these limitations, the Vol Trade v.2 strategy **can be an effective tool for investors who prefer swing trading strategies,** as it remains stable across a variety of market conditions and a wide range of parameters. **I cannot** emphasize enough that for **a strategy to work** in real-world conditions, it must also perform under **suboptimal parameters** and **conditions.** In short, **it must be stable** to changing market conditions.

I don't know who said these words, but they perfectly capture 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

Vol Trade v.2 strategy joins **an ongoing trend** when the market transitions from **a low-volatility regime** to **an impulse.** The trend context is confirmed by **the long-term moving average** – long positions are only considered when the price closes **above** this average. The preparatory condition is **a decline in short-term volatility below the long-term.** The confirmation of the breakout is a candle, which establishes **a new local extreme** and closes in the direction of the prevailing trend. Entry is executed **at the open of the following day.**

Exiting the position occurs **only** when **the volatility regime changes** – **short-term volatility above long-term.** The lack of a stop loss emphasizes the need for conservative position sizing and consistent exposure management.

The strategy uses:

- **Trend Filter (SMA Long)** – selection of direction according to the dominant movement;
- **Variation ratio** – VolShort/VolLong ≤ threshold;
- **Extreme** – the signal candle is in line with the dominant trend and establishes a local high;
- **Entry T+1** – opening a position at the start of the next session;
- **Regime Change Reach** – close when short-term volatility ≥ long-term volatility.

Characteristics – strengths and weaknesses:

- **Quantitative, simple rules** (trend, contraction, breakout) – facilitate automation and testing;
- **Entry after confirmation –** reducing "false starts" typical of catching traffic early;
- **Lack of stop loss increases the risk of drawdowns and gaps** – strict control of position size is necessary;
- **Sensitivity to the definition of variability** – parameter sensitivity analysis recommended.

Vol Trade v.2 strategy, while simple, provides **a solid foundation for building algorithmic portfolios.** However, it requires **discipline and strict adherence to risk management methods.**

Step 2: Determine investment principles

Below is **the pseudocode** for the **Vol Trade v.2 strategy** on daily data:

1. **Calculating Indicators:**
    a. **XXX-MALong –** XXX day moving average closing price.
    b. **XXX-VolLong** – XXX day variability (sum of squared deviations).
    c. **YY-VolShort** – YY day variability (sum of squared deviations).
    d. **WW-VolRatio** – VolShort/VolLong variability ratio below WW%.
    e. **YY-HighestHigh** – YY daily highest high.
2. **Generating Entry Signals – Long Position:**
    a. **Trend:** closing price above MALong.
    b. **Volatility contraction:** VolShort/VolLong below WW%.
    c. **Extreme:** Today's high is the highest high in YY days (HighestHigh) and today's candle is bullish.
    d. **Entry:** Once the conditions are met, a long position is opened at the opening of the next session.
3. **Generating Output Signals:**
    a. **Volatility regime change:** close all positions at the opening of the next session when VolShort > VolLong.
4. **Daily Monitoring:**
    a. Every day calculate MALong, VolShort, VolLong, VolRatio, HighestHigh.
    b. The system verifies entry/exit conditions and sets appropriate orders for the opening of the next session; it monitors the volatility regime.
5. **Additional Notes:**
    a. **No Short Positions:** The strategy focuses solely 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 are 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: Pre-test your investment strategy

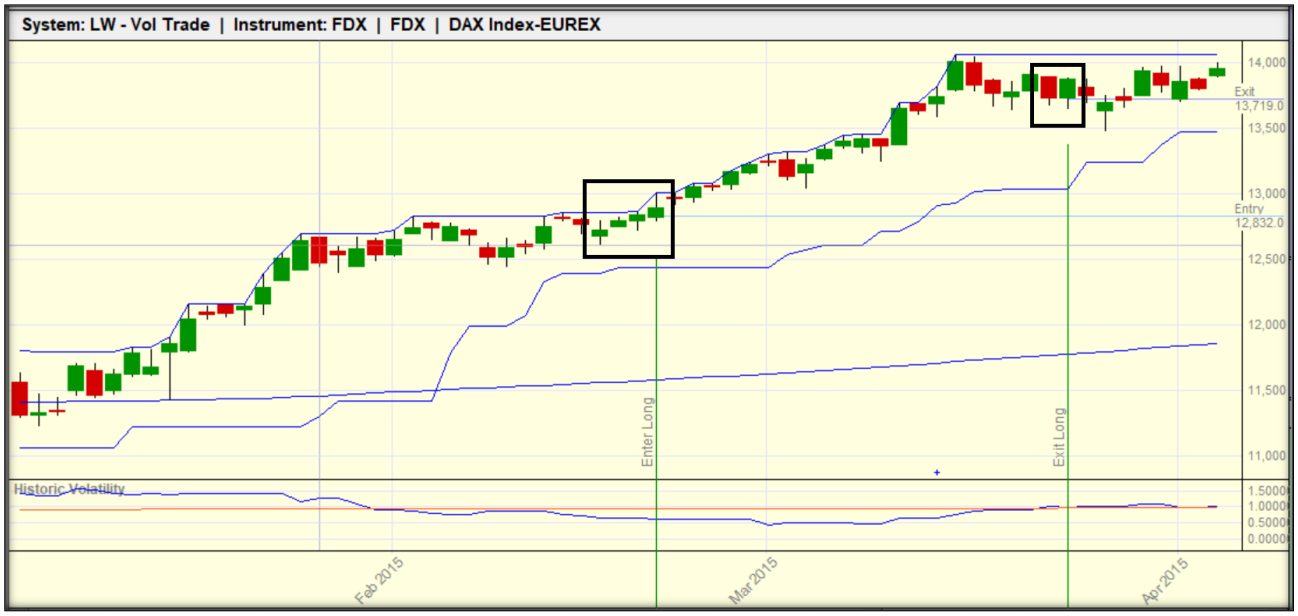
Below are some purchase and sale transactions that allow you to verify the following aspects:

- **Correctness of generated signals;**
- **Direction of opening a position;**
- **Moment of opening the position;**
- **The opening price of the position;**
- **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 doesn't matter** whether the trades are **profitable,** what **instrument was used,** or whether they occurred **recently** or **in the distant past.** The key is **to verify that the trades are generated correctly** and in line with the assumptions described in the previous step.

The first transaction was made on a DAX futures contract. At the end of February 2015, the price remained in **an uptrend** (price above the long-term average), and **short-term volatility fell below long-term volatility ("Historic Volatility" panel). At that time, a volatility contraction** was formed – **short-term volatility fell below 80% of long-term volatility** (the first candle in the left-hand rectangle). A buy signal requires that such a drop in volatility be followed by **a candle that will establish a new local maximum.** This condition was met after a few days (the third candle in the rectangle on the left), which **generated a signal to open a long position.** According to the strategy rules, **the position was open at the opening of the next session** (fourth candle in the rectangle on the left). The strategy **does not use stop loss orders. The system worked correctly.**

The strategy calls for **an exit when short-term volatility exceeds long-term volatility.** This signal appeared at the end of March 2015 (the first candle in the right-hand rectangle), so the position was closed at the opening of the next session (the second candle in the right-hand rectangle). **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 conducted on **baseline parameters** that, in my opinion, should align with the strategy's stated goals.

First, **we reject strategies that linearly lose capital.** If a strategy exhibits this pattern, it's a clear signal that any parameter optimization is pointless.

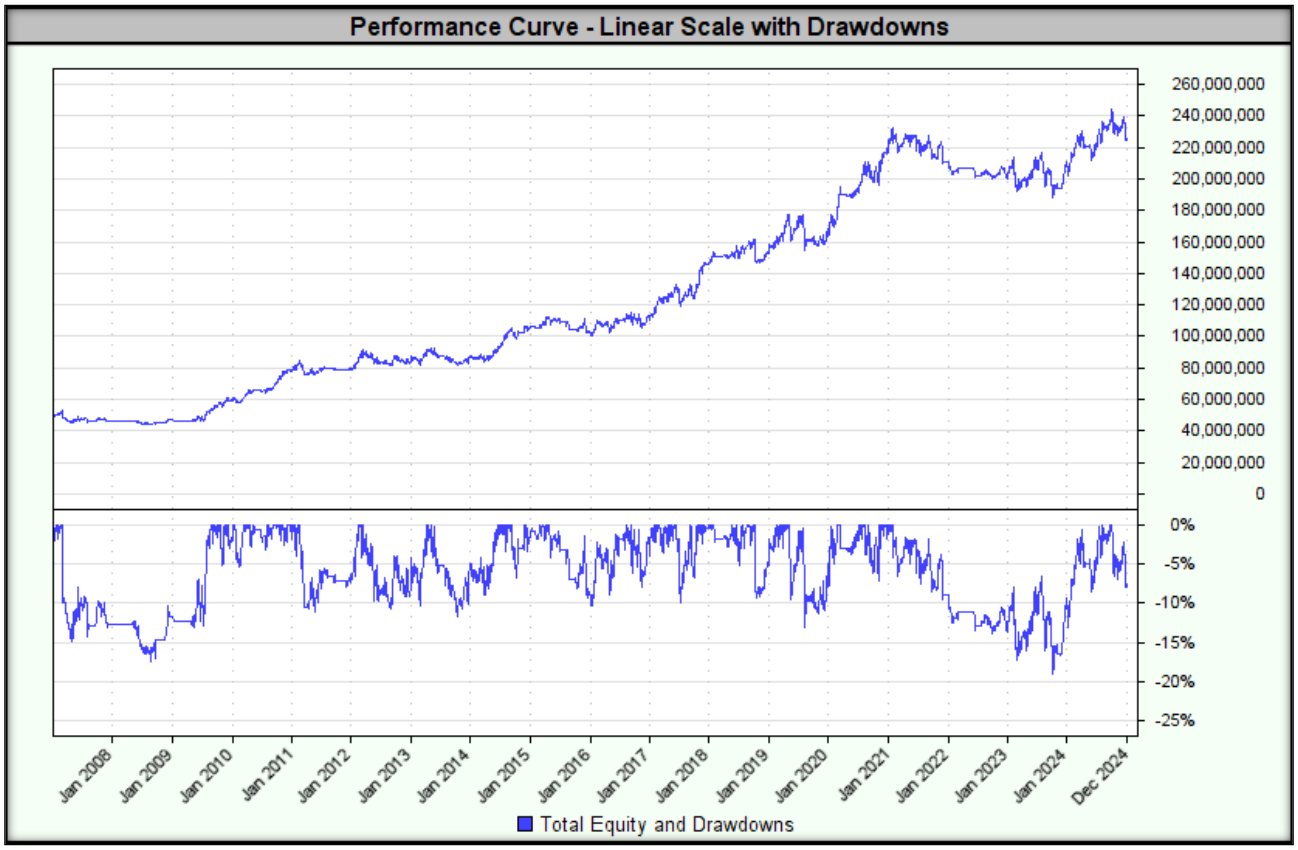
Our basic expectation is that the strategy generates **positive results,** even if they are at a low level.

Tested base parameters:

- **MALong –** 200-day moving average closing price.
- **VolLong** – 200-day volatility (sum of squared deviations).
- **VolShort** – 15-day volatility (sum of squared deviations).
- **VolRatio** – the variability ratio: VolShort/VolLong is at most 80%.
- **HighestHigh** – 15 day highest high.
- **How to open a position** – once the conditions are met, a long position is opened at the opening of the next session.
- **Stop loss** – lack.
- **Closing a position** – all positions are closed at the opening of the next session when VolShort > VolLong.
- **Position size** – corresponding to a 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 point.
- **Direction of position** – only long positions (buy).

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%	8.7%
MAR Ratio	0.46
RAR%	10.5%
R-Cubed	0.38
Robust Sharpe Ratio	0.95
Max Drawdown	19.0%
Wins	55.6%
Losses	44.4%
Average Win%	1.83%
Average Loss%	1.26%
Win/Loss Ratio	1.46
Average Trade Duration (days)	66
Percent Profit Factor	1.82
SQN	-
Number of transactions	360

In summary, the system is working properly and generating signals as expected. Furthermore, tests on the baseline parameters yielded satisfactory results. We can now move on to the most interesting stage of creating an investment strategy – **optimization.**

Step 4: Optimizing and assessing the stability of the investment strategy

This stage of strategy development and testing is **crucial** because it determines how **effective** the strategy will be in **real-world conditions. I cannot** emphasize enough that for **a strategy to work** in real-world conditions, it must also perform under **suboptimal parameters** and **conditions.** In short, **it must be stable** to changing market conditions.

I don't know who said these words, but they perfectly capture 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 topic of consideration in **Step 5,"Walk-Forward Analysis",** but before we get to that, **we need to know** whether our strategy is even **stable.**

1. Stability across a wide range of optimized parameters

This version of **the Vol Trade v.2 strategy utilizes the Grid Search** method **to optimize parameters.** This method **fully optimizes all specified parameters by creating a wide range of possible combinations.** Our goal is to find **parameter ranges** that **will keep the strategy stable (robust),** allowing us to assess its suitability in real-world market conditions.

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

In the first step, we test the stability of the parameters on **in-sample data.** To do this, we define **ranges of** parameter values so that **the ratio of the highest to lowest value of the range is at least 150%.**

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

- **VolShort & HighestHigh:** range **11-17 days (step: 1);**
- **MALong & VolLong:** range **165-250 days (step: 5);**
- **VolRatio:** range **70%-90% (step: 2.5 pp).**

The lowest MAR value of 0.15 was achieved for the following parameters:

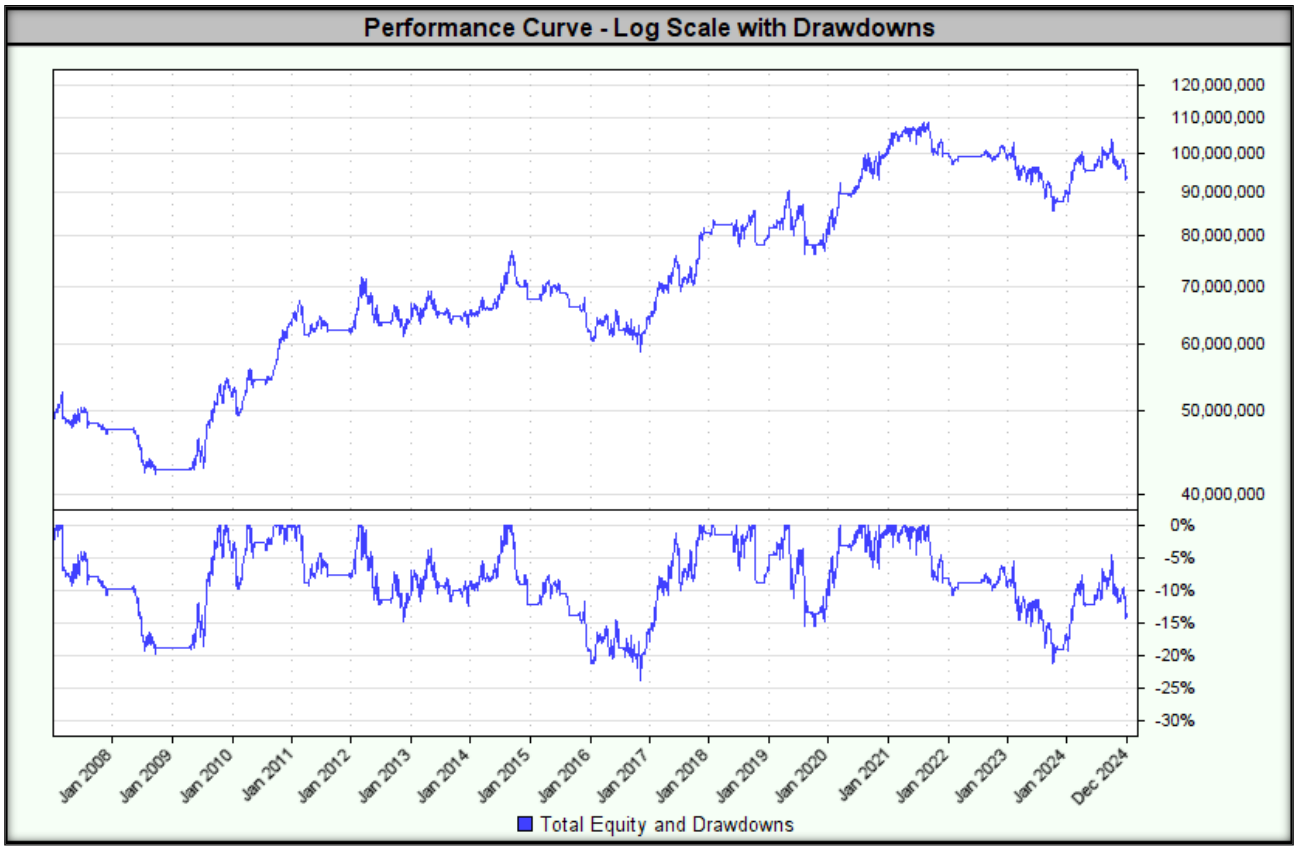
- **VolShort & HighestHigh:** 16 days;
- **MALong & VolLong:** 165 days;
- **VolRatio:** 70%.

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

Test	Volatility Short (Bars)	Volatility Long (bars)	Volatility Threshold (Vol Short/Vol Long)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades
811	16	165	70.0%	$93,457,221.98	3.54%	0.15	0.39	0.31	23.7%	40.0	267
820	16	170	70.0%	$104,221,861.66	4.17%	0.18	0.45	0.36	22.8%	41.7	266
816	16	165	82.5%	$133,225,916.29	5.60%	0.19	0.53	0.36	28.9%	43.0	380
973	17	165	70.0%	$103,583,766.66	4.13%	0.20	0.47	0.36	21.0%	40.0	250
9	11	165	90.0%	$134,353,756.97	5.65%	0.20	0.55	0.43	27.8%	47.2	603
991	17	175	70.0%	$105,575,430.68	4.24%	0.21	0.47	0.38	20.5%	38.4	247
812	16	165	72.5%	$109,762,585.40	4.47%	0.21	0.46	0.33	21.6%	40.0	297
974	17	165	72.5%	$121,477,016.92	5.06%	0.21	0.53	0.38	24.1%	40.0	280
818	16	165	87.5%	$145,874,731.90	6.13%	0.21	0.57	0.40	29.1%	43.0	419
979	17	165	85.0%	$143,596,971.37	6.04%	0.21	0.57	0.41	28.3%	40.0	384
813	16	165	75.0%	$116,605,350.45	4.82%	0.21	0.49	0.35	22.4%	40.0	319
1004	17	180	80.0%	$148,262,549.87	6.23%	0.22	0.61	0.43	28.8%	37.6	338
995	17	175	80.0%	$148,842,539.03	6.25%	0.22	0.61	0.43	28.7%	39.2	340

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 0.70 was achieved for the following parameters:

- **VolShort & HighestHigh:** 13 days;
- **MALong & VolLong:** 220 days;
- **VolRatio:** 85%.

The highest MAR value was accompanied by **a drawdown of 14.5%.**

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

Test	Volatility Short (Bars)	Volatility Long (bars)	Volatility Threshold (Vol Short/Vol Long)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades
430	13	220	85.0%	$283,470,333.09	10.12%	0.70	0.92	0.83	14.5%	29.1	432
139	11	240	77.5%	$275,660,325.87	9.95%	0.69	0.93	0.77	14.4%	37.3	429
421	13	215	85.0%	$269,700,121.09	9.82%	0.68	0.89	0.79	14.4%	29.1	442
486	13	250	90.0%	$304,243,009.15	10.55%	0.68	0.96	0.80	15.5%	29.1	458
475	13	245	85.0%	$275,088,750.47	9.94%	0.66	0.92	0.81	15.0%	38.0	418
466	13	240	85.0%	$260,674,232.23	9.61%	0.66	0.89	0.79	14.6%	41.4	425
412	13	210	85.0%	$279,330,913.59	10.03%	0.66	0.93	0.82	15.2%	31.6	439
138	11	240	75.0%	$245,311,723.13	9.24%	0.65	0.87	0.72	14.1%	37.2	410
477	13	245	90.0%	$285,826,842.87	10.17%	0.64	0.94	0.77	15.9%	37.8	456
140	11	240	80.0%	$272,688,618.78	9.88%	0.64	0.91	0.73	15.4%	37.8	448
801	15	245	90.0%	$306,595,213.55	10.60%	0.64	0.98	0.79	16.6%	36.4	399
476	13	245	87.5%	$270,291,237.93	9.83%	0.64	0.91	0.78	15.5%	38.1	437
309	12	245	75.0%	$267,100,086.34	9.76%	0.64	0.91	0.76	15.4%	37.1	376

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

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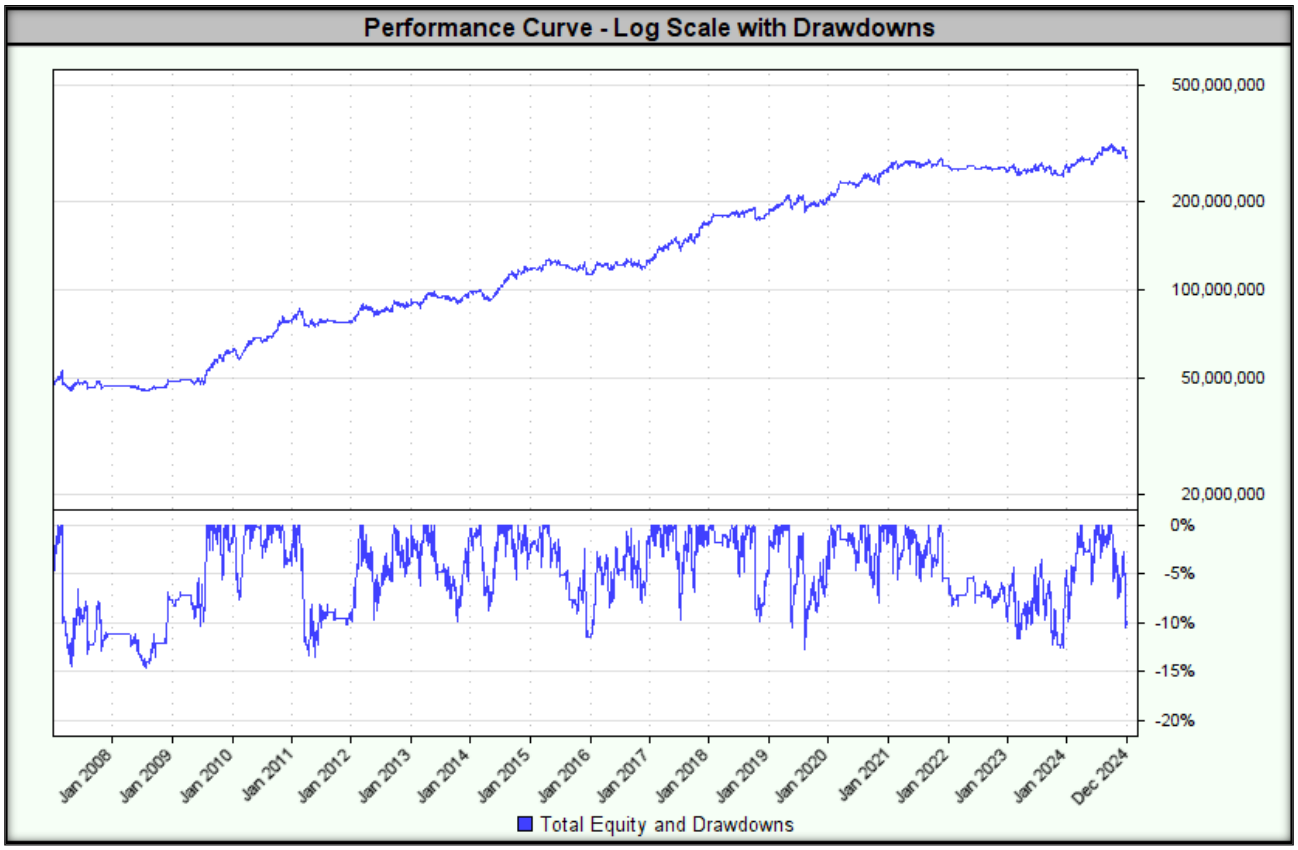


For all combinations of tested parameter ranges, **the highest drawdown was 29.4%.**

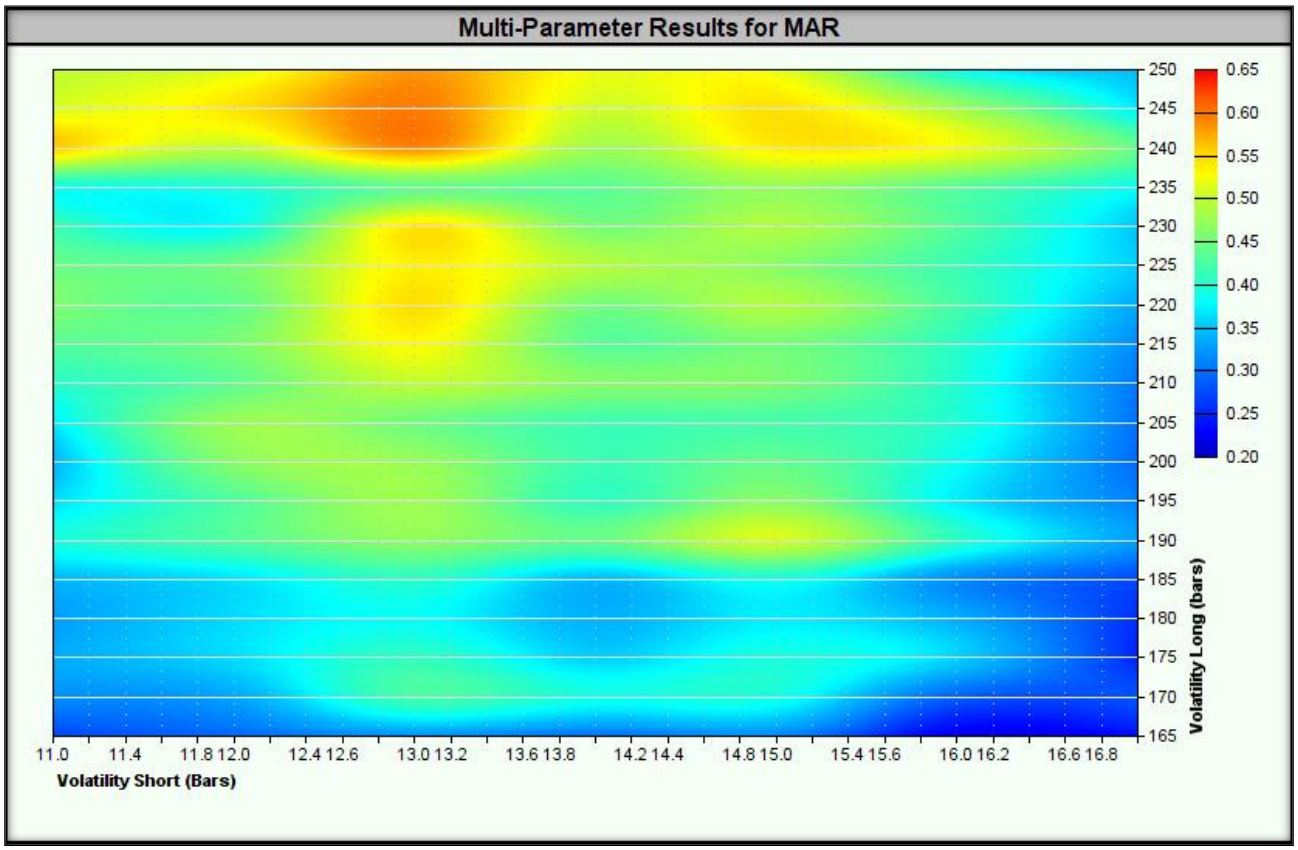
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

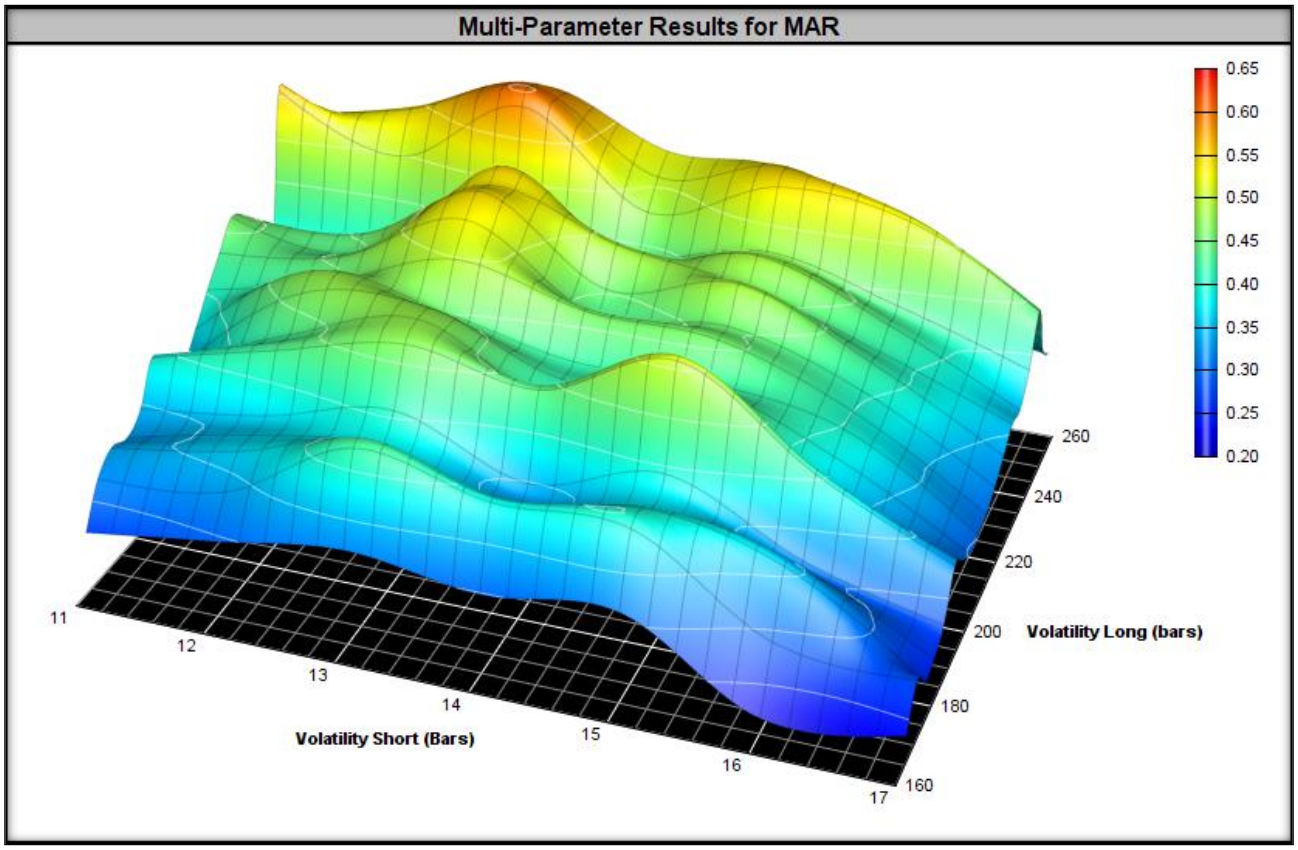
Test	Volatility Short (Bars)	Volatility Long (bars)	Volatility Threshold (Vol Short/Vol Long)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades
819	16	165	90.0%	$156,004,686.68	6.53%	0.22	0.60	0.43	29.4%	43.0	437
818	16	165	87.5%	$145,874,731.90	6.13%	0.21	0.57	0.40	29.1%	43.0	419
816	16	165	82.5%	$133,225,916.29	5.60%	0.19	0.53	0.36	28.9%	43.0	380
1004	17	180	80.0%	$148,262,549.87	6.23%	0.22	0.61	0.43	28.8%	37.6	338
1007	17	180	87.5%	$165,458,236.25	6.87%	0.24	0.63	0.45	28.7%	42.6	388
995	17	175	80.0%	$148,842,539.03	6.25%	0.22	0.61	0.43	28.7%	39.2	340
980	17	165	87.5%	$166,878,290.85	6.93%	0.24	0.64	0.47	28.4%	40.0	397
1049	17	205	80.0%	$161,306,532.79	6.72%	0.24	0.63	0.45	28.4%	37.4	317
979	17	165	85.0%	$143,596,971.37	6.04%	0.21	0.57	0.41	28.3%	40.0	384
998	17	175	87.5%	$168,124,536.11	6.97%	0.25	0.65	0.47	28.2%	42.6	392
18	11	170	90.0%	$154,747,677.89	6.48%	0.23	0.62	0.47	28.2%	47.2	601
1058	17	210	80.0%	$164,585,282.08	6.84%	0.24	0.64	0.46	28.1%	38.0	314
1008	17	180	90.0%	$187,245,720.49	7.61%	0.27	0.68	0.52	28.1%	43.1	411

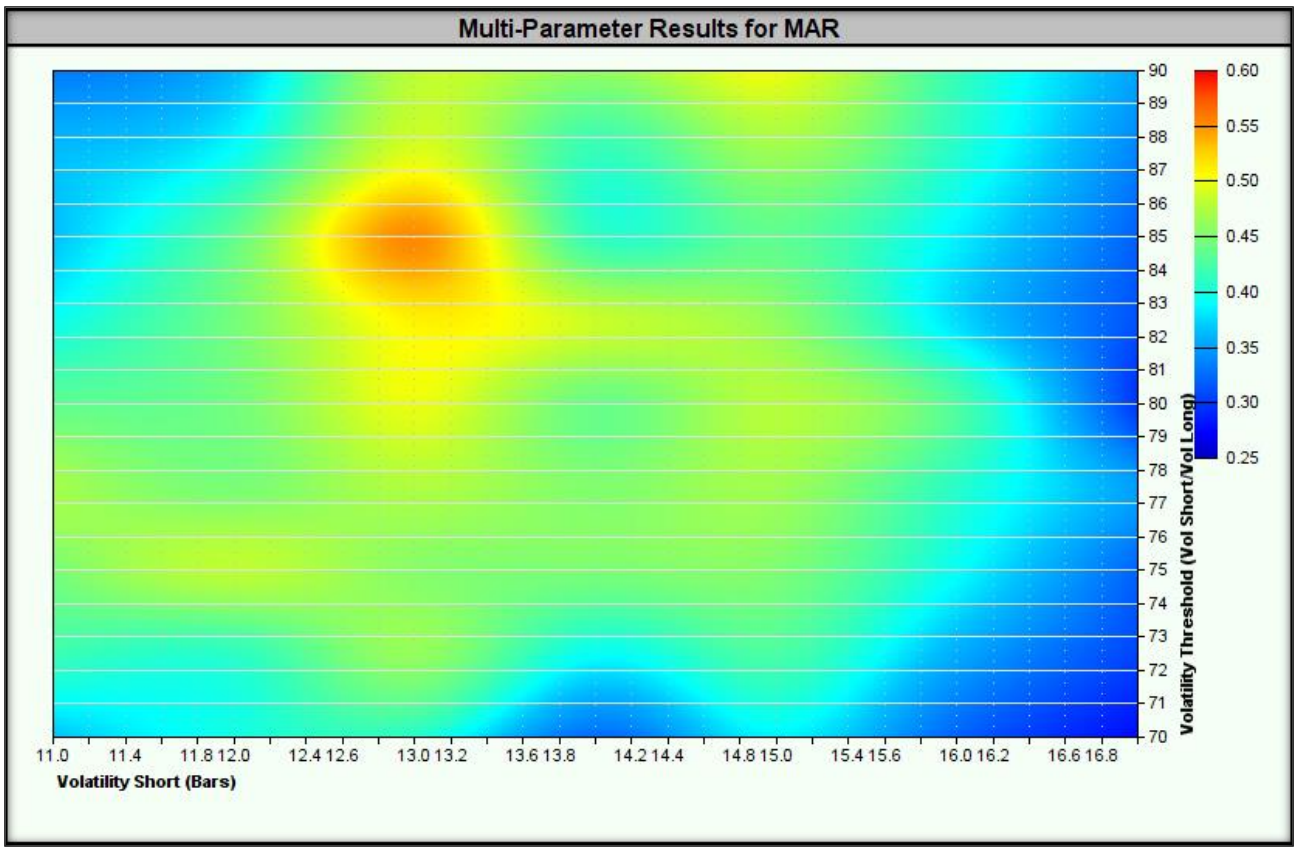
In summary, the strategy **passed the stability test** over a wide range of optimized parameters on in-sample data because:

- **All test results showed a positive 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 (**29.4% vs. 14.5%)** – which means an acceptable risk of deep capital drawdowns.

Heatmaps for the tested ranges are shown below.




Multi-Parameter Results for MAR
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
260
240
220
200
180
160
Volatility Long (bars)
11
12
13
14
15
16
17
Volatility Short (Bars)


Multi-Parameter Results for MAR
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
90
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86
85
84
83
82
81
80
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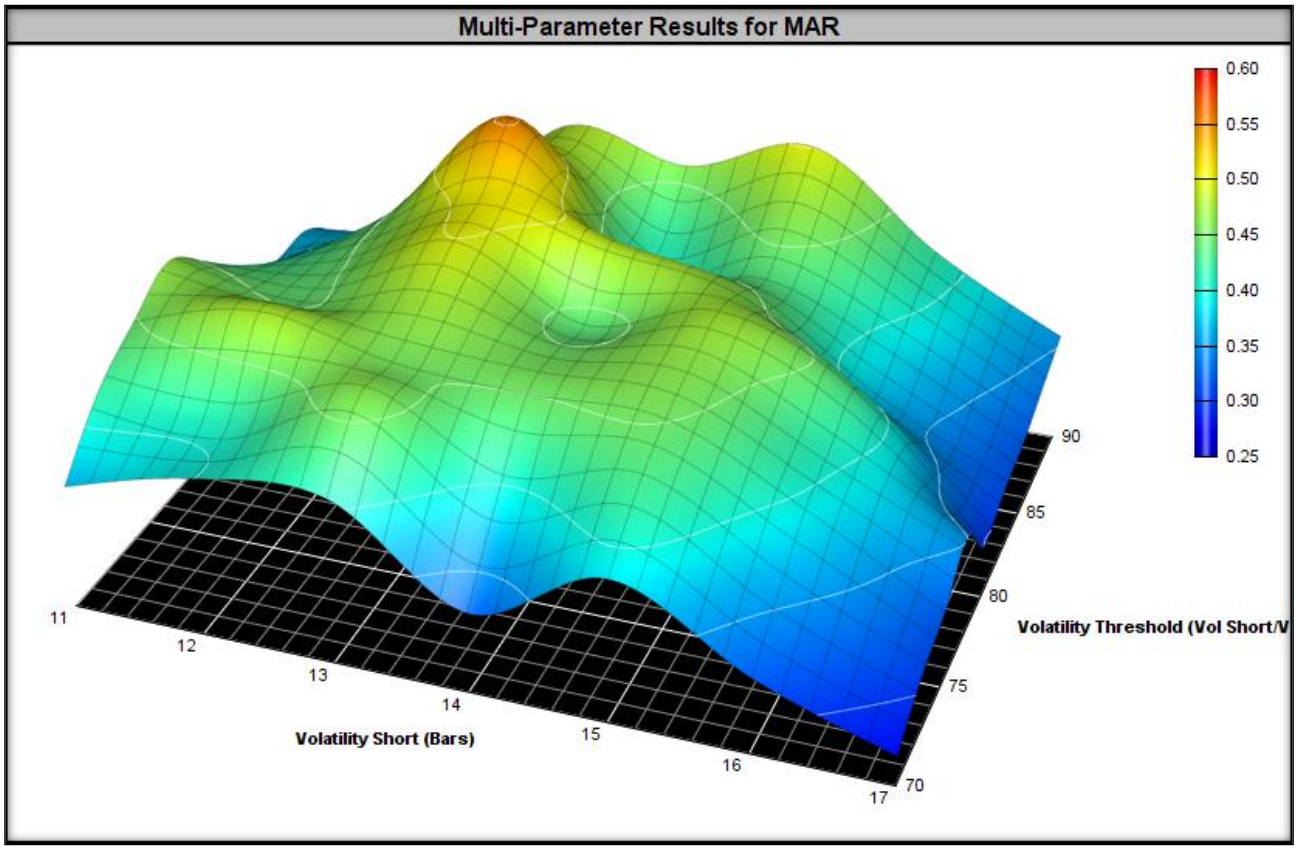
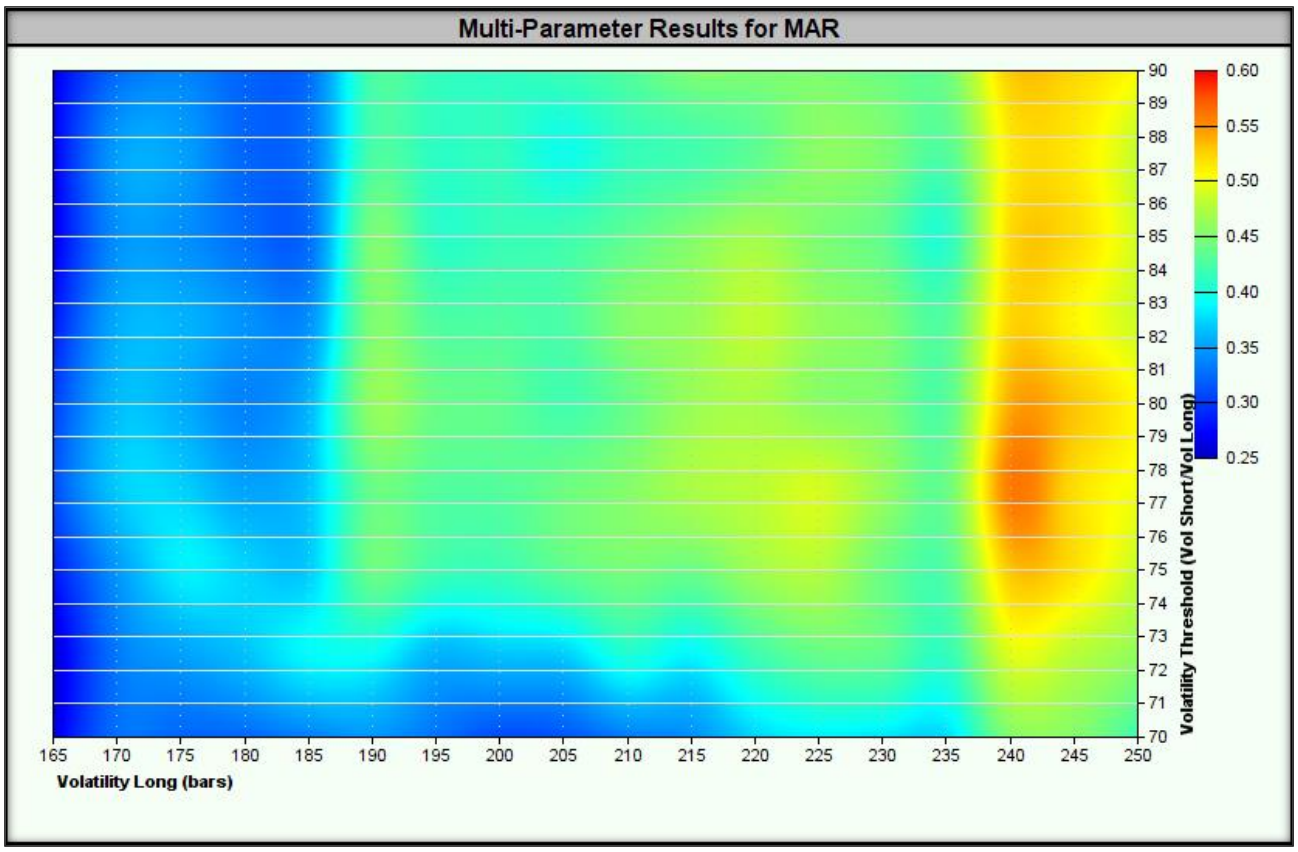
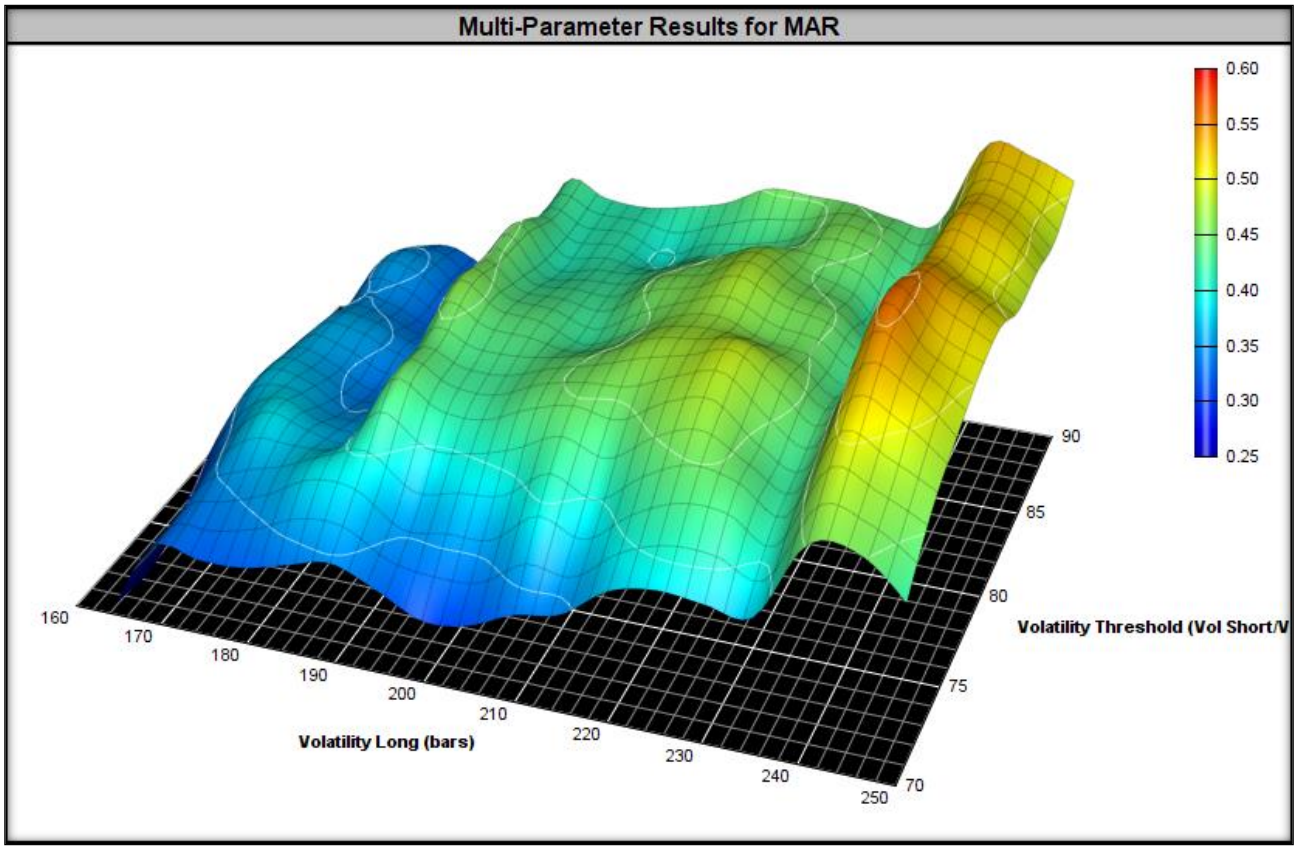
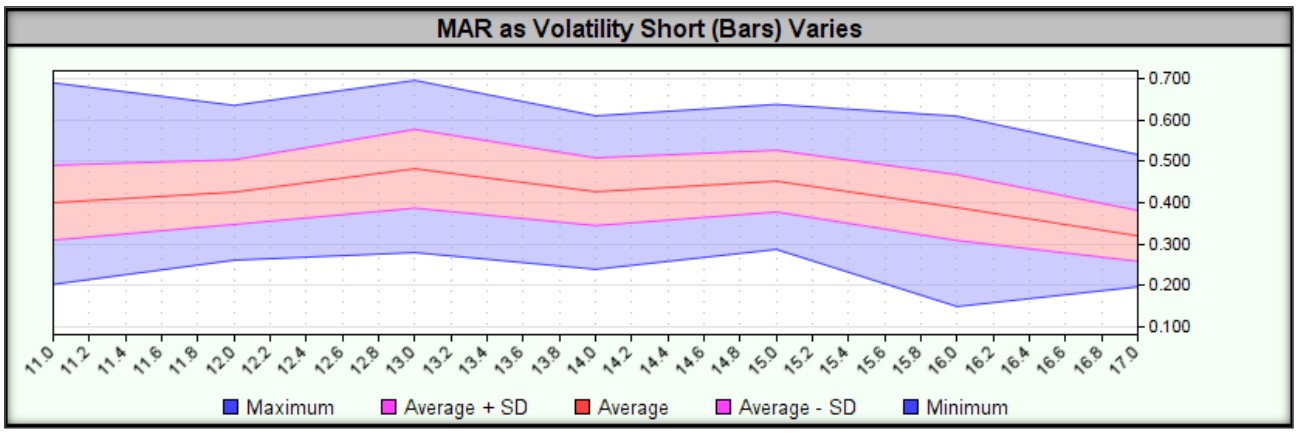
78
77
76
75
74
73
72
71
70
Volatility Threshold (Vol Short/Vol Long)
11.0
11.4
11.8 12.0
12.4 12.6
13.0 13.2
13.6 13.8
14.2 14.4
14.8 15.0
15.4 15.6
16.0 16.2
16.6 16.8
Volatility Short (Bars)


Multi-Parameter Results for MAR
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
11
12
13
14
15
16
17
Volatility Short (Bars)
70
75
80
85
90
Volatility Threshold (Vol Short/V


Multi-Parameter Results for MAR
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
90
89
88
87
86
85
84
83
82
81
80
79
78
77
76
75
74
73
72
71
70
Volatility Threshold (Vol Short/Vol Long)
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
Volatility Long (bars)





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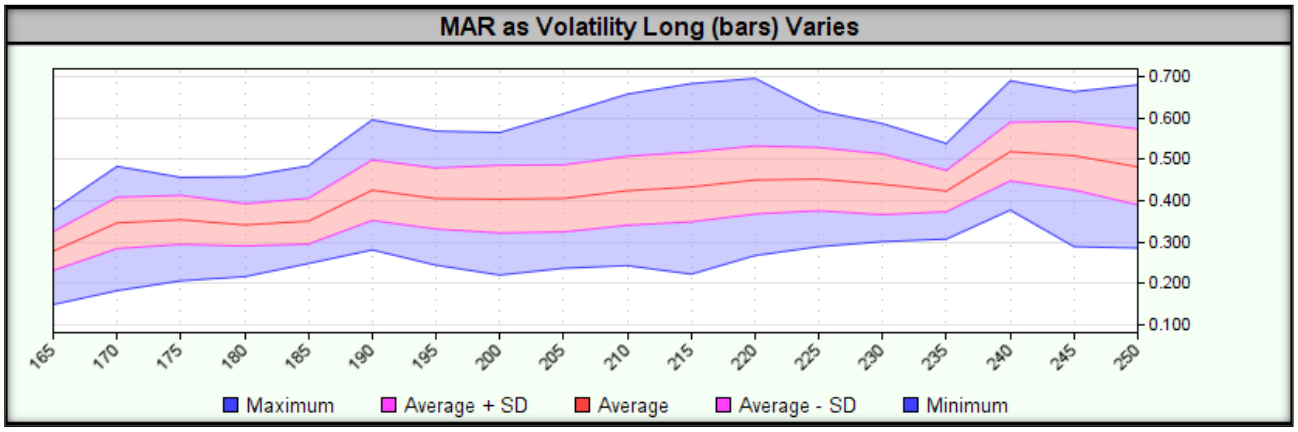
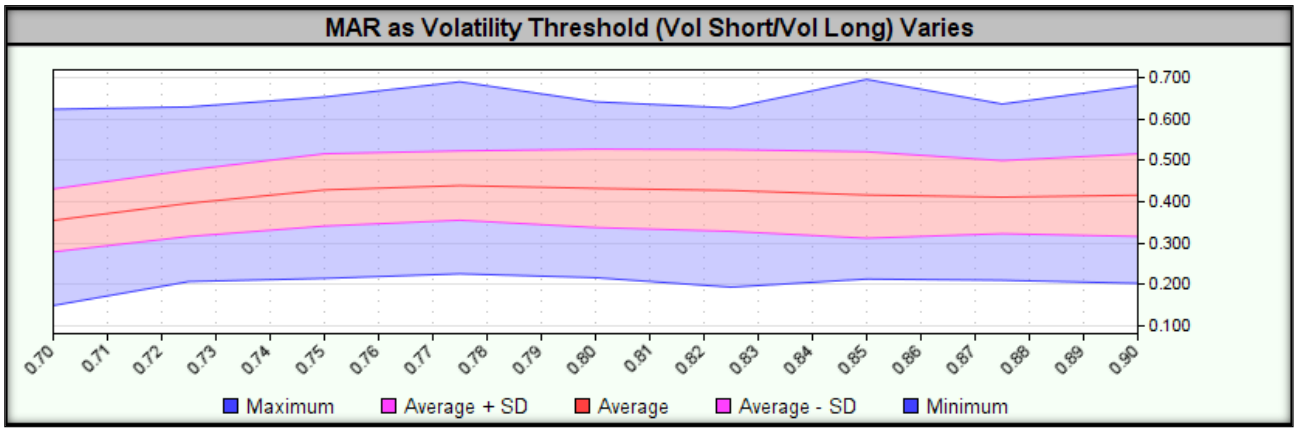




After passing the stability tests on **in-sample data,** it is time perform the same on **out-of-sample data.** For this purpose, we use **the same range of parameters** as on in-sample data:

- **VolShort & HighestHigh:** range **11-17 days (step: 1);**
- **MALong & VolLong:** range **165-250 days (step: 5);**
- **VolRatio:** range **70%-90% (step: 2.5 pp).**

The lowest MAR value of 0.20 was achieved for the following parameters:

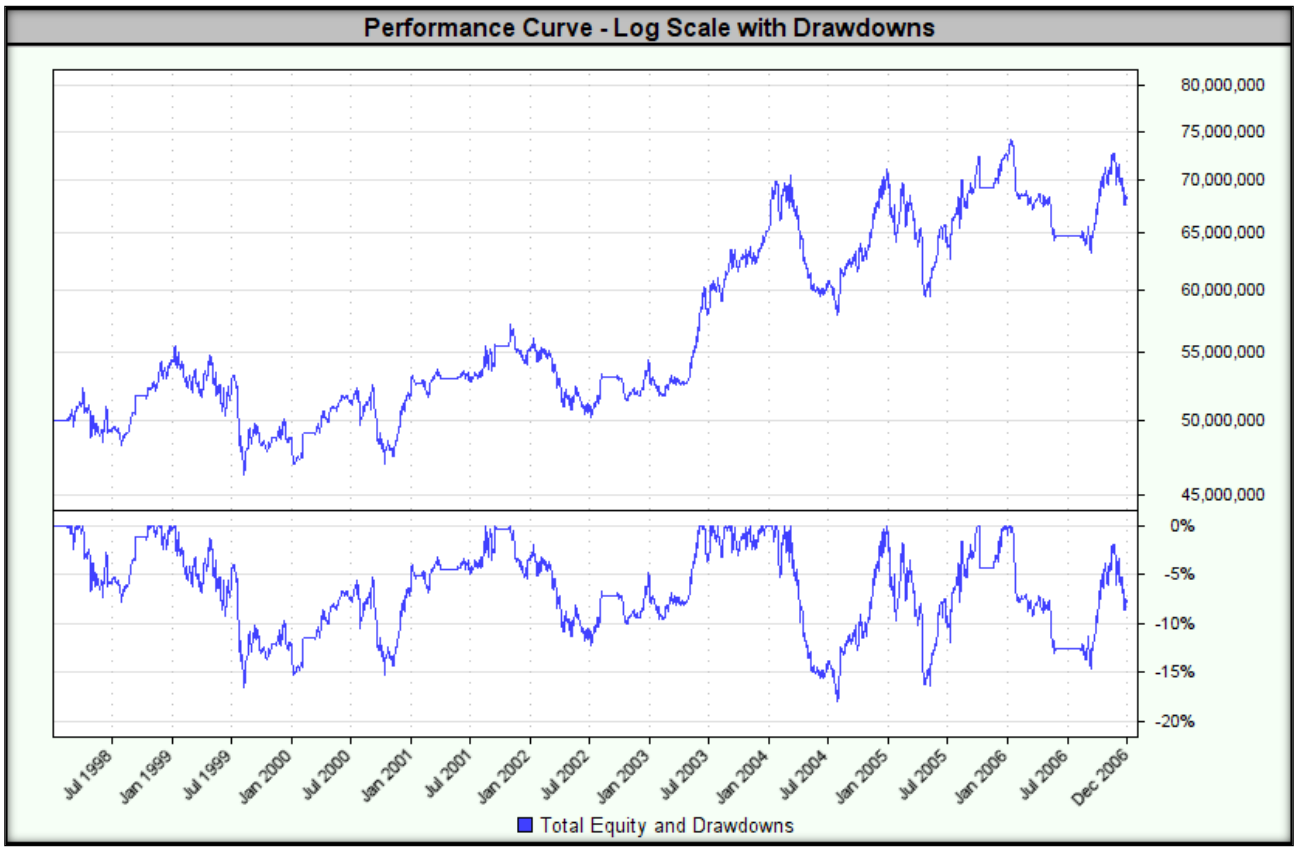
- **VolShort & HighestHigh:** 17 days;
- **MALong & VolLong:** 165 days;
- **VolRatio:** 77.5%.

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

Test	Volatility Short (Bars)	Volatility Long (bars)	Volatility Threshold (Vol Short/Vol Long)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades
976	17	165	77.5%	$68,345,258.18	3.54%	0.20	0.39	0.41	17.9%	31.2	141
1022	17	190	80.0%	$75,397,345.00	4.67%	0.21	0.47	0.58	22.2%	18.0	143
985	17	170	77.5%	$72,553,804.73	4.23%	0.22	0.44	0.51	19.0%	33.7	143
1031	17	195	80.0%	$78,838,204.84	5.20%	0.22	0.51	0.55	23.1%	18.0	140
973	17	165	70.0%	$73,302,209.97	4.35%	0.24	0.55	0.58	18.2%	33.7	101
1093	17	230	77.5%	$73,945,274.81	4.45%	0.24	0.46	0.46	18.5%	19.4	127
869	16	195	80.0%	$80,838,902.43	5.49%	0.24	0.55	0.69	22.7%	16.8	150
1067	17	215	80.0%	$76,357,279.87	4.82%	0.24	0.50	0.49	19.8%	18.4	136
984	17	170	75.0%	$71,169,858.70	4.00%	0.25	0.45	0.53	16.3%	33.7	130
1094	17	230	80.0%	$76,469,521.44	4.84%	0.25	0.50	0.53	19.5%	14.7	138
870	16	195	82.5%	$83,944,296.41	5.93%	0.26	0.57	0.72	23.2%	16.6	158

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 0.75 was achieved for the following parameters:

- **VolShort & HighestHigh:** 12 days;
- **MALong & VolLong:** 185 days;
- **VolRatio:** 87.5%.

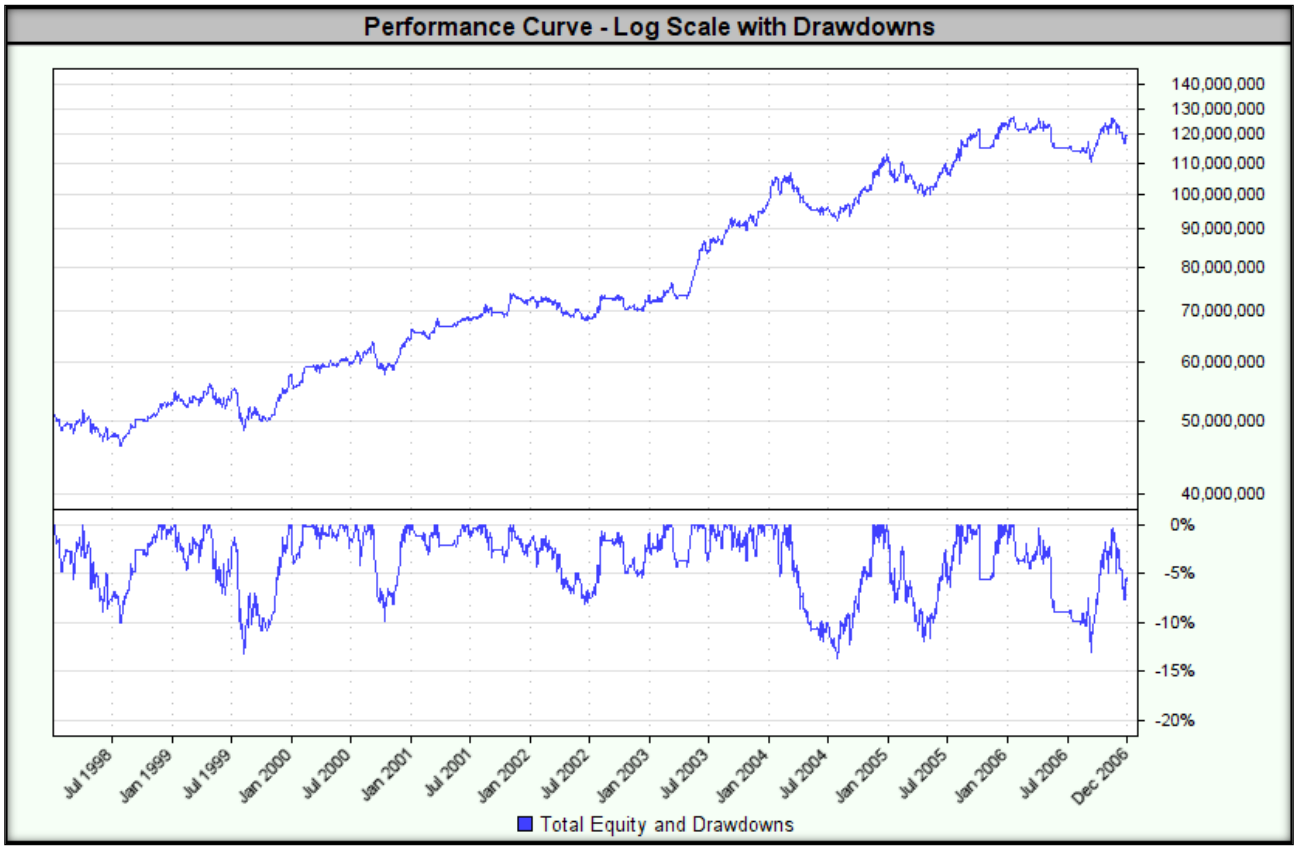
The highest MAR value was accompanied by **a drawdown of 13.6%.**

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

Test	Volatility Short (Bars)	Volatility Long (bars)	Volatility Threshold (Vol Short/Vol Long)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades
206	12	185	87.5%	$119,461,096.32	10.17%	0.75	0.99	1.05	13.6%	15.2	221
207	12	185	90.0%	$119,465,401.80	10.17%	0.75	0.98	1.07	13.6%	15.2	229
216	12	190	90.0%	$117,285,831.61	9.95%	0.73	0.97	0.99	13.6%	15.7	231
45	11	185	90.0%	$119,735,049.32	10.20%	0.72	1.00	1.10	14.2%	9.9	247
188	12	175	87.5%	$116,547,699.92	9.87%	0.71	0.98	1.04	13.8%	15.1	230
135	11	235	90.0%	$126,387,395.87	10.86%	0.70	1.00	1.21	15.4%	12.2	225
144	11	240	90.0%	$124,710,730.69	10.70%	0.70	1.00	1.19	15.2%	12.3	221
204	12	185	82.5%	$113,908,691.44	9.59%	0.70	0.95	1.07	13.7%	13.3	206
134	11	235	87.5%	$124,237,136.80	10.65%	0.69	0.98	1.13	15.4%	12.2	218
126	11	230	90.0%	$124,273,678.75	10.66%	0.69	0.97	1.15	15.4%	12.2	224
44	11	185	87.5%	$117,183,918.17	9.94%	0.69	0.98	1.06	14.4%	10.1	238

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 24.0%.**

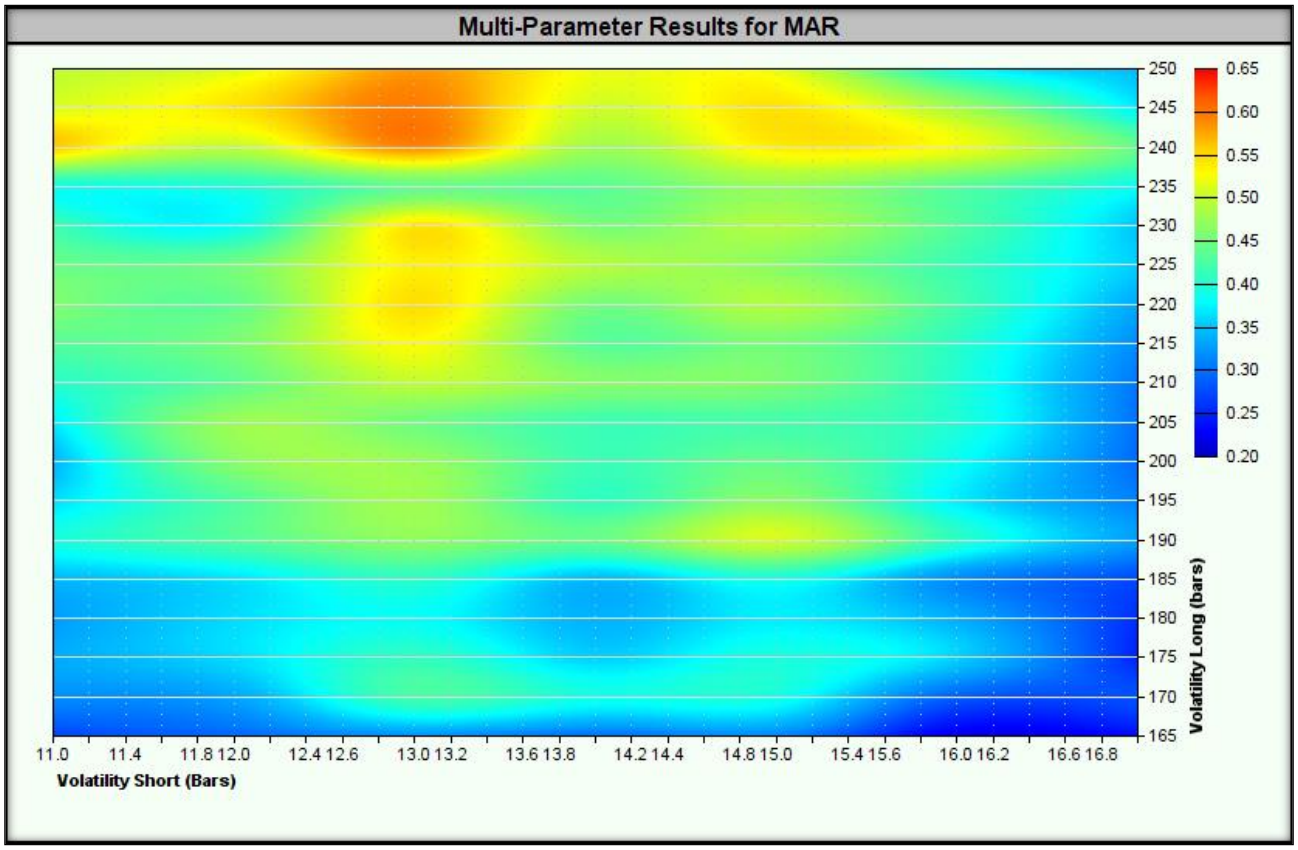
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

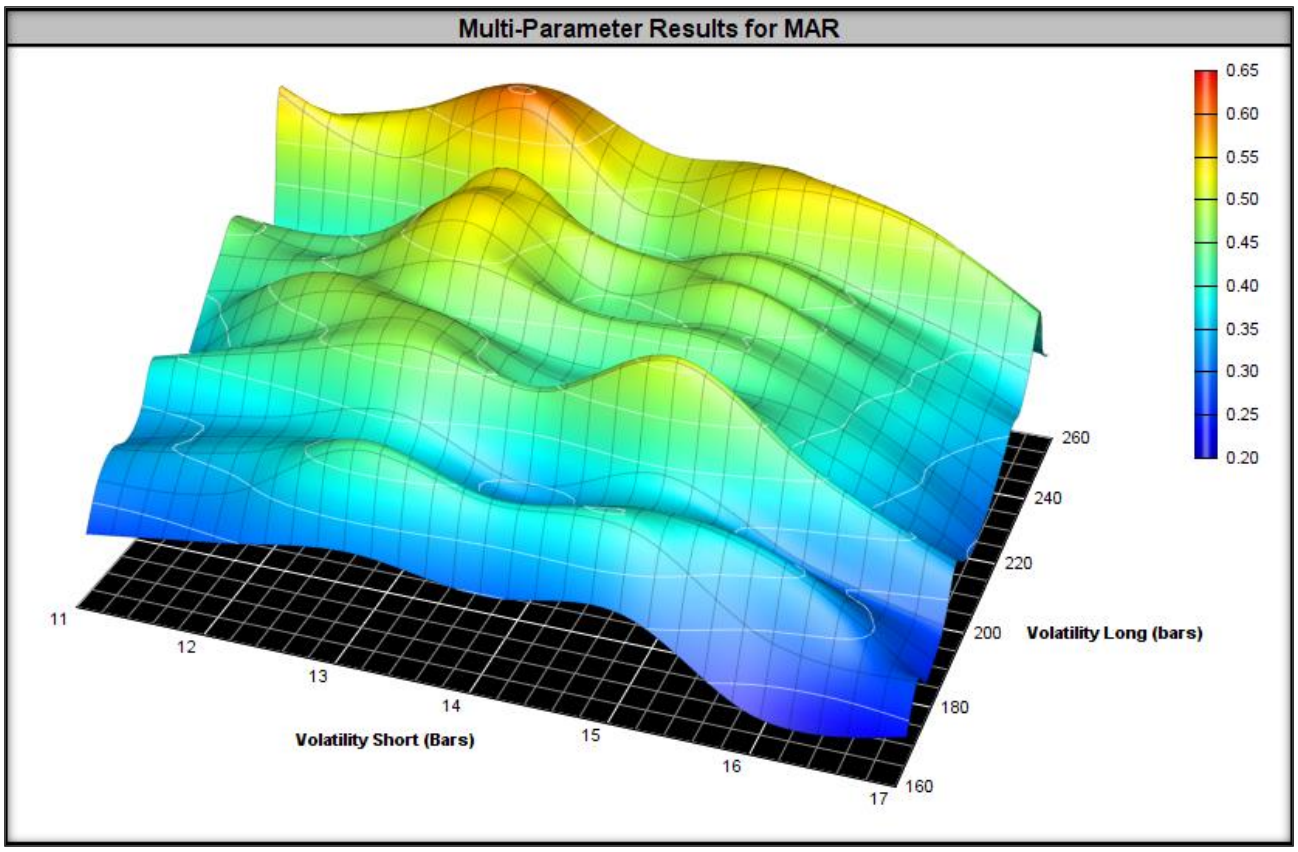
Test	Volatility Short (Bars)	Volatility Long (bars)	Volatility Threshold (Vol Short/Vol Long)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades
882	16	200	90.0%	$103,108,095.56	8.38%	0.35	0.75	0.90	24.0%	16.3	177
873	16	195	90.0%	$98,880,779.20	7.88%	0.33	0.71	0.91	23.9%	16.8	179
872	16	195	87.5%	$94,427,131.61	7.33%	0.31	0.67	0.82	23.9%	16.8	172
701	15	190	87.5%	$100,918,986.80	8.12%	0.34	0.76	0.89	23.8%	17.8	186
710	15	195	87.5%	$104,766,419.15	8.58%	0.36	0.79	0.89	23.6%	17.8	182
702	15	190	90.0%	$108,213,069.50	8.97%	0.38	0.83	0.95	23.5%	17.1	190
1116	17	240	90.0%	$93,125,775.78	7.16%	0.31	0.65	0.86	23.3%	16.6	163
1080	17	220	90.0%	$101,474,866.38	8.19%	0.35	0.74	0.85	23.3%	18.0	162
711	15	195	90.0%	$105,508,361.69	8.66%	0.37	0.79	0.88	23.2%	17.1	187
870	16	195	82.5%	$83,944,296.41	5.93%	0.26	0.57	0.72	23.2%	16.6	158
1107	17	235	90.0%	$89,802,642.82	6.73%	0.29	0.61	0.80	23.1%	16.8	164

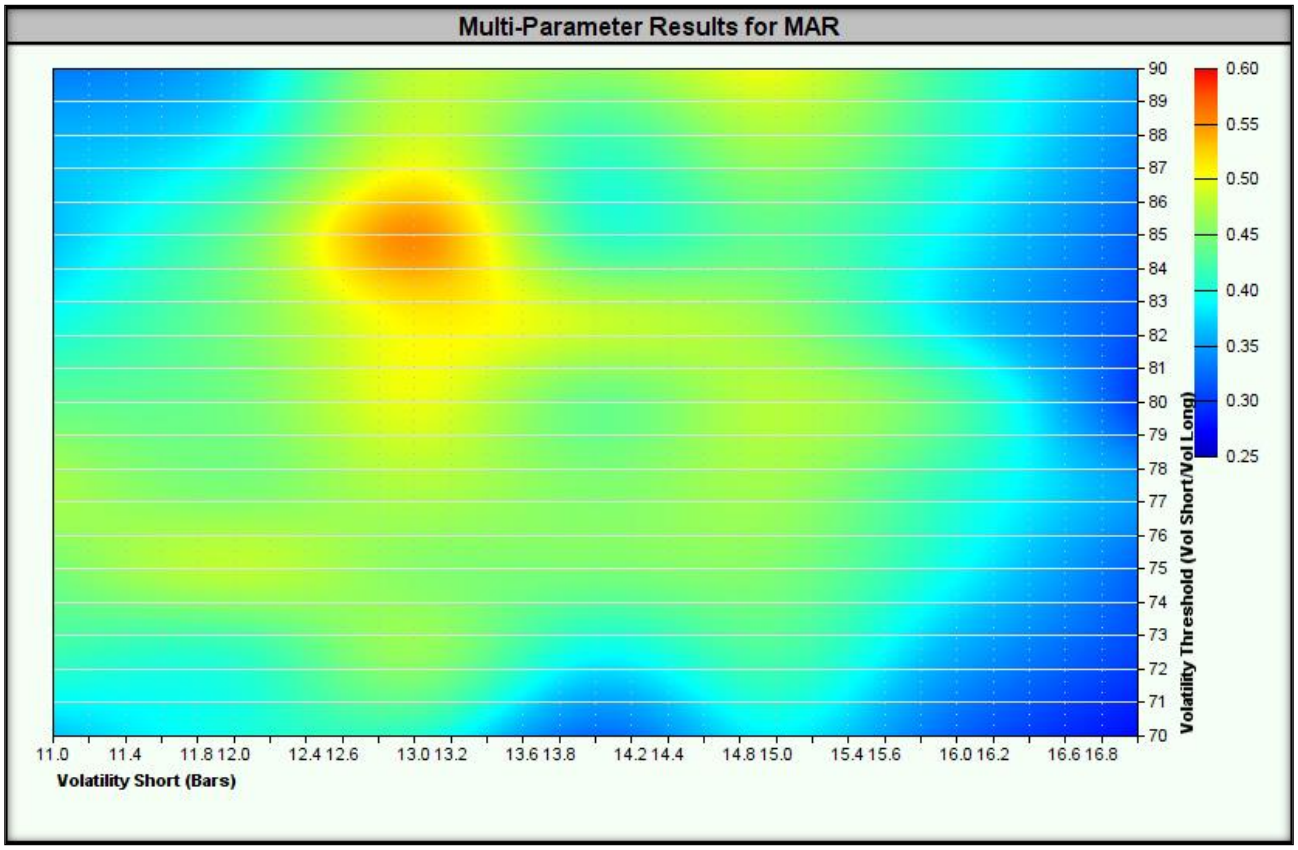
In summary, the strategy **passed the stability test** over a wide range of optimized parameters on out-of-sample data because:

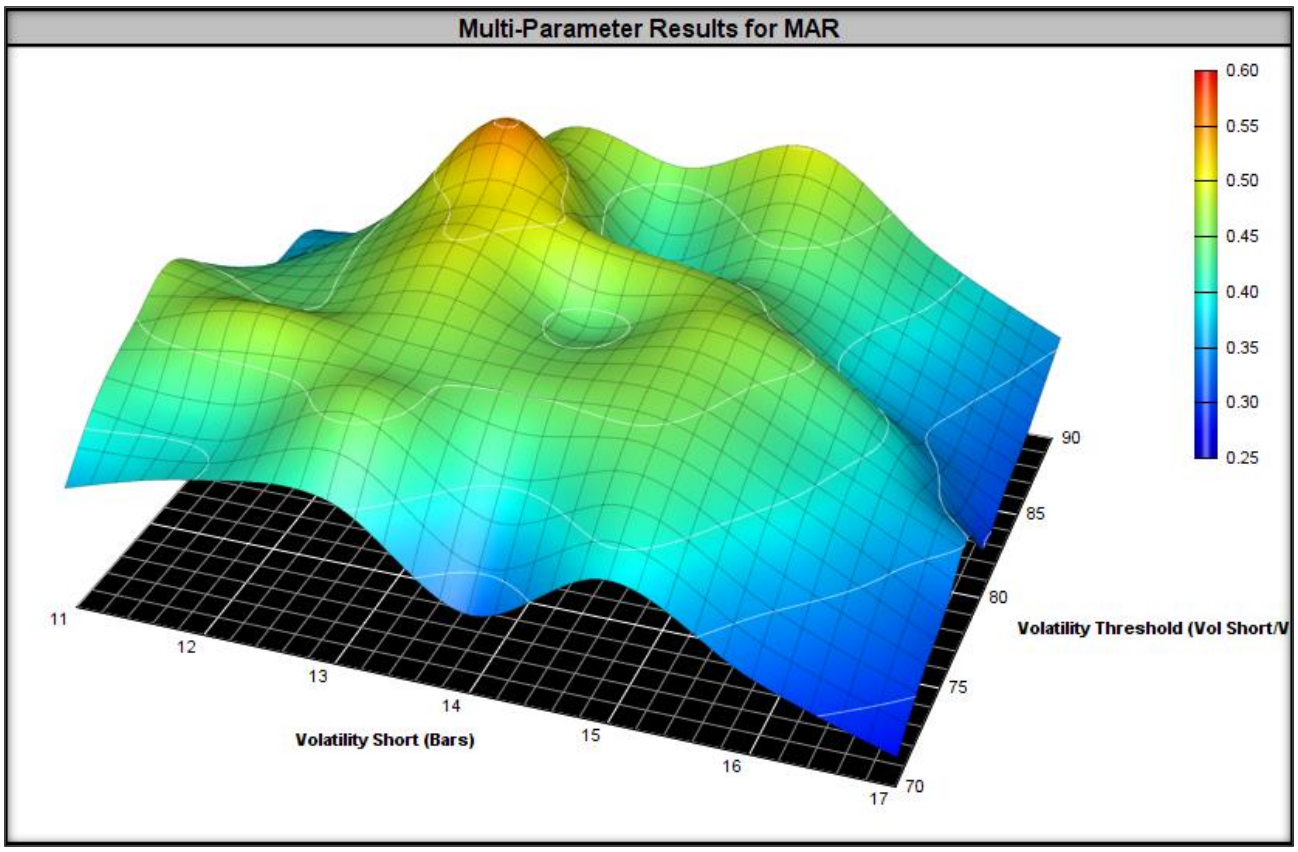
- **All test results showed a positive MAR value** – which indicates the stability of the strategy in various market conditions.
- **The maximum drawdown on out-of-sample data did not exceed 150% of the maximum drawdown value on in-sample data (24.0% vs. 29.4%)** – which means an acceptable risk of capital drawdown.
- **The decrease in the maximum MAR value on out-of-sample data was less than 50% compared to the in-sample test results (0.75 vs. 0.70) –** indicating that the strategy can achieve good results in a variety of market conditions.

Heatmaps for the tested ranges are shown below.


Multi-Parameter Results for MAR
Volatility Short (Bars)
11.0 11.4 11.8 12.0 12.4 12.6 13.0 13.2 13.6 13.8 14.2 14.4 14.8 15.0 15.4 15.6 16.0 16.2 16.6 16.8
Volatility Long (bars)
250 245 240 235 230 225 220 215 210 205 200 195 190 185 180 175 170 165
0.65 0.60 0.55 0.50 0.45 0.40 0.35 0.30 0.25 0.20


Multi-Parameter Results for MAR
Volatility Short (Bars)
11 12 13 14 15 16 17
Volatility Long (bars)
260 240 220 200 180 160
0.65 0.60 0.55 0.50 0.45 0.40 0.35 0.30 0.25 0.20





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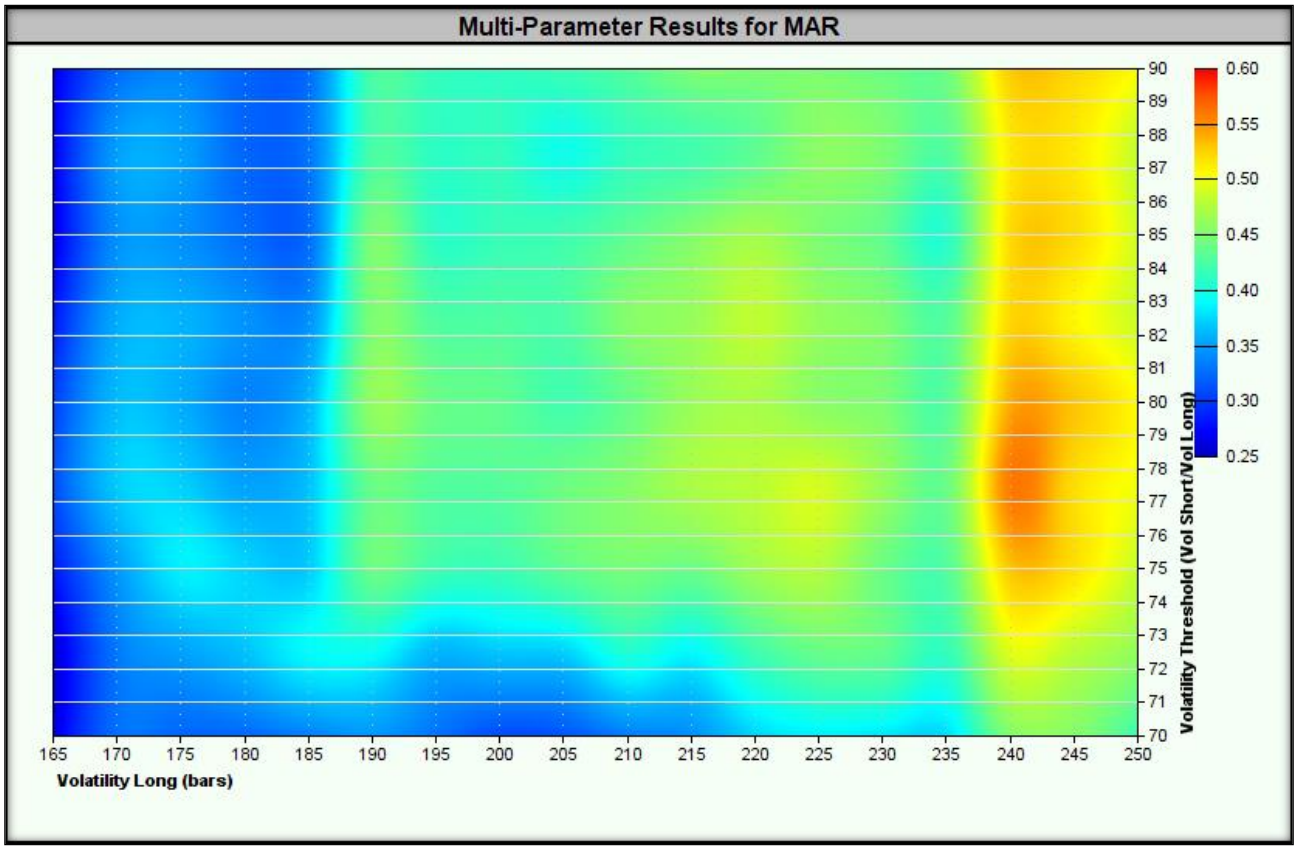
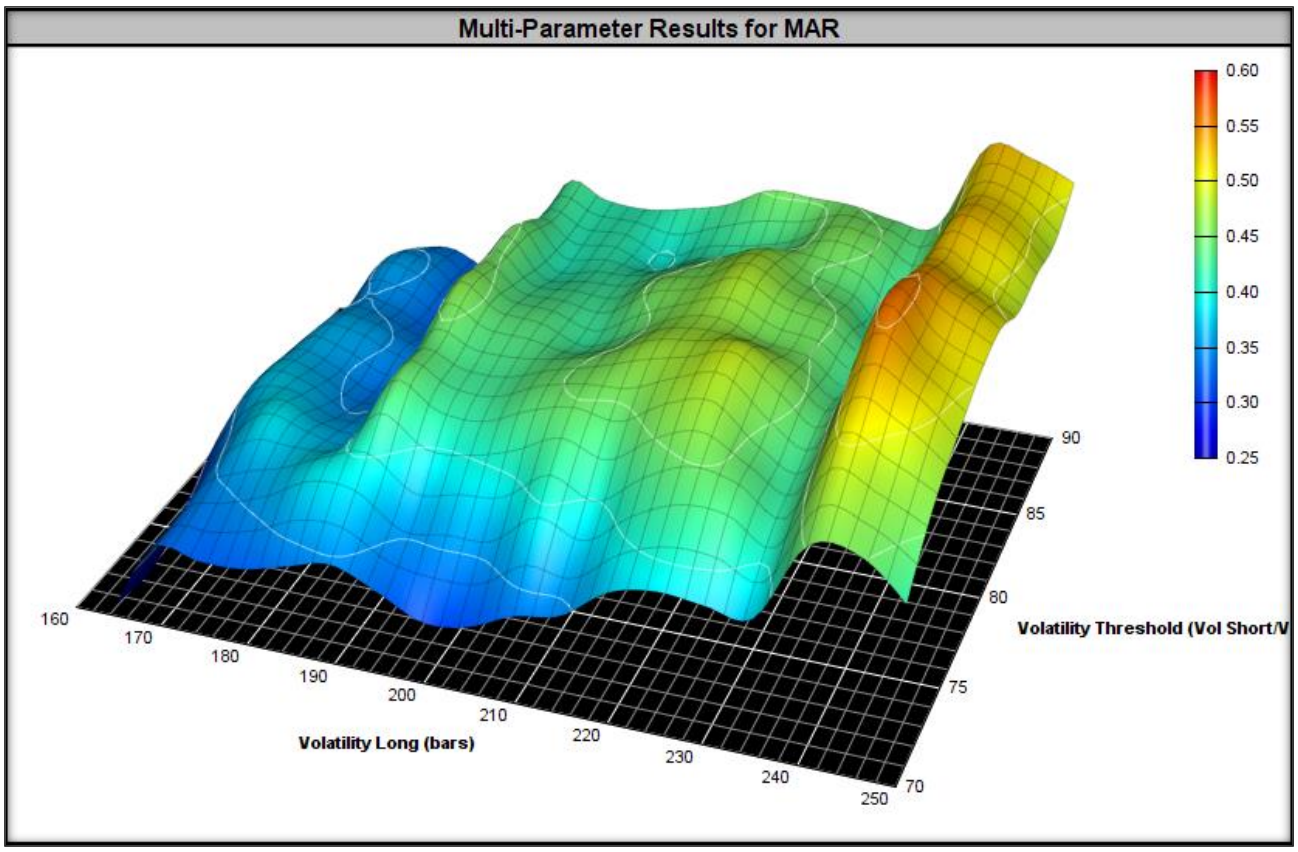
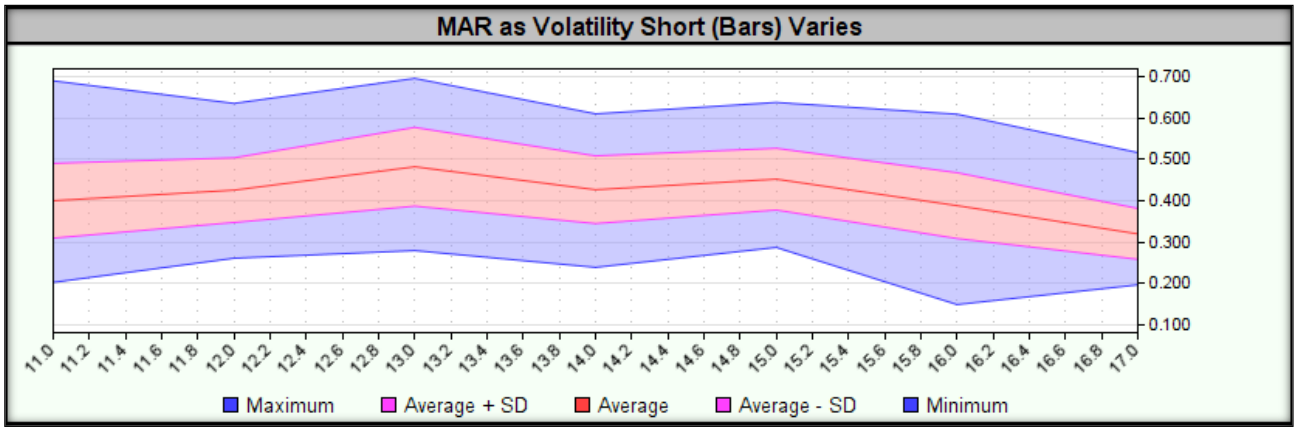
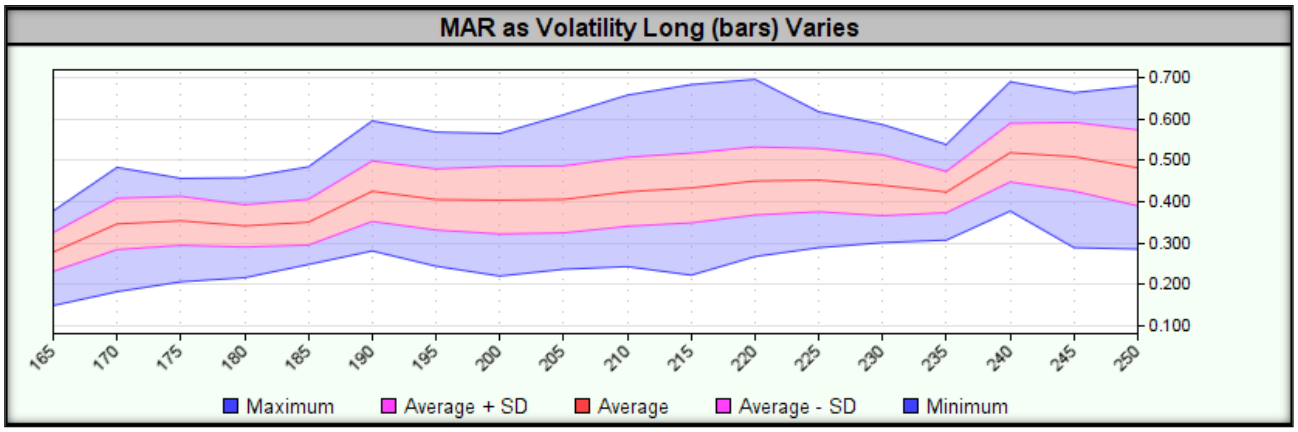
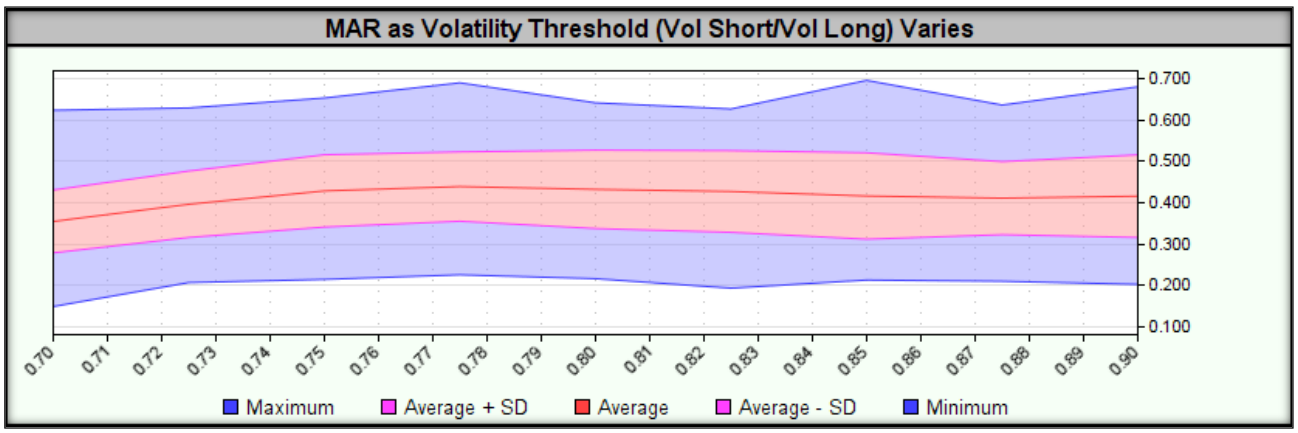

Multi-Parameter Results for MAR
Volatility Long (bars)
Volatility Threshold (Vol Short/Vol Long)


Multi-Parameter Results for MAR
Volatility Long (bars)
Volatility Threshold (Vol Short/V







Once **the stability test has passed across a wide range of optimized parameters,** we can proceed to **stability testing using Monte Carlo simulation.** The conditions for passing this test are similar to those required in the step above.

2. Monte Carlo simulation

Monte Carlo simulation involves running multiple simulations to examine how a strategy might perform under various market scenarios. A key goal of this method is to assess the potential **drawdown** of an optimized strategy. **Monte Carlo simulation** better reflects possible equity curve fluctuations and the depth of potential **drawdown,** allowing for a more realistic risk assessment. It also provides an ideal opportunity to

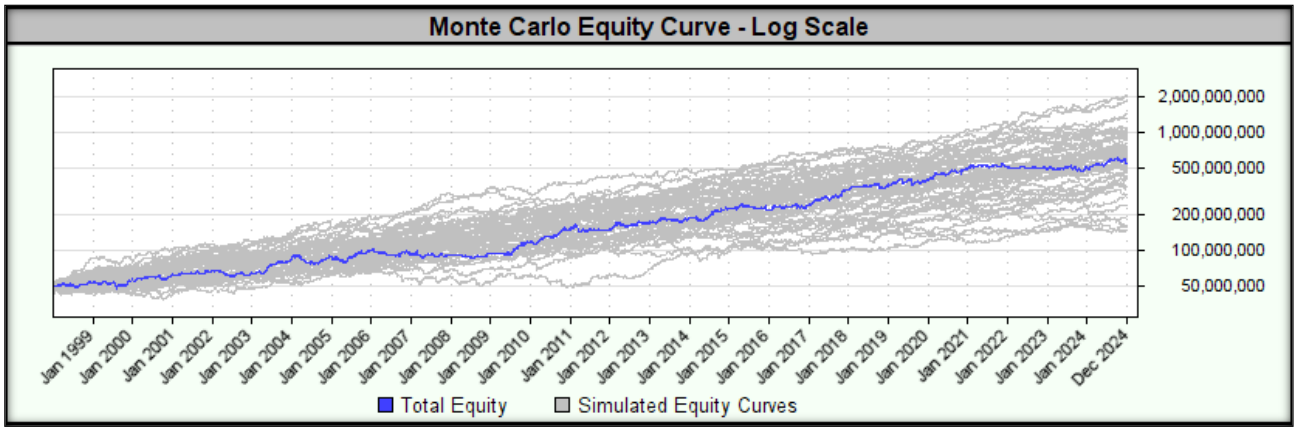
compare **the drawdown** obtained in tests on optimized parameter ranges with the results of **the Monte Carlo simulation,** using **a 99% confidence interval.**

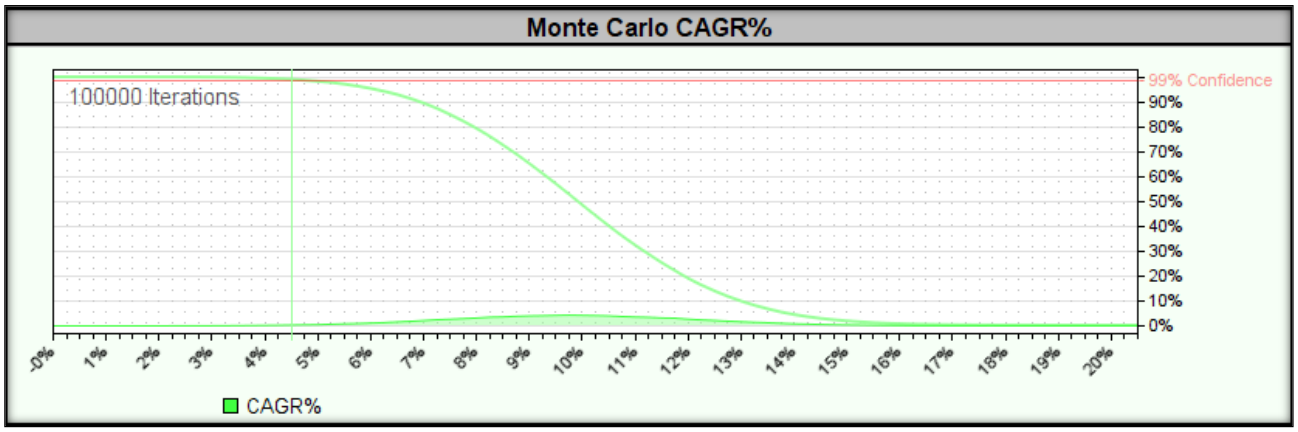
A strategy considered to be **stable (robust)** should achieve **a drawdown in a Monte Carlo simulation** that does not exceed **250% of the drawdown** size **from total tests in-sample and out-of-sample** (for parameters optimized on IS data). Furthermore, the **MAR indicator** should remain positive within the chosen confidence interval.

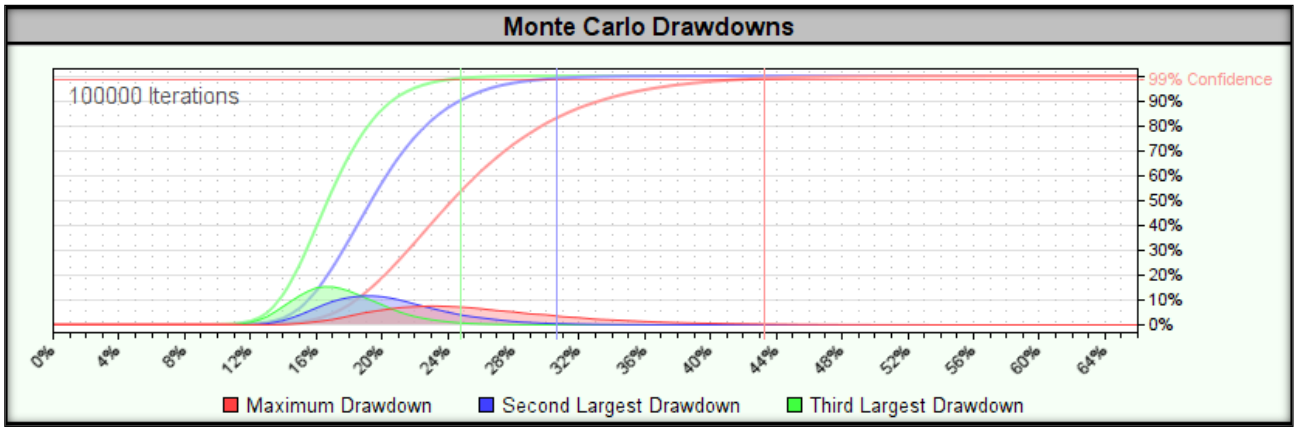
For data covering the period from **January 1, 1998 to December 31, 2024, a Monte Carlo simulation** was performed using **optimal strategy parameters.** The Monte Carlo simulation was performed **100,000 times,** testing **the variant with replacement (more conservative),** and **the confidence interval was set to 99%.**

The simulation with sample replacement are presented below.

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







- **CAGR%** – In 99% of simulations achieved **a rate of return equal to or higher than 4.5%.**
- **Drawdown** – 99% of simulations achieved **a drawdown of 43.2% or less.** For parameters optimized on in-sample data, the drawdown was 17.5%.

The strategy's stability criteria were met, as **the drawdown** in **the Monte Carlo simulation** did not exceed **250% of the drawdown** value from tests with **optimized parameters.** Furthermore, the **MAR indicator** remained positive in **99%** of tests, which was also a condition for the strategy's stability.

Now that we know that the strategy is **stable** across **wide ranges of data** and **a changing environment,** it is time to test its **stability** over **different time periods.**

3. Stability over a moving time window

Rolling window stability testing involves **evaluating one-year and three-year returns in time windows that move one year** apart (for both in-sample and out-of-sample data). This process involves **applying strategy parameters optimized for the in-sample data,** setting a one-year or three-year trading window, and then advancing it by one year.

We then analyze what proportion of these one- and three-year periods showed positive returns. **A strategy considered robust should achieve profitable results in at least 70% of the one- and three-year periods.**

For data covering the period from **01/01/1998 to 31/12/2024, testing of optimized parameters** was carried out on **a moving data window.**

Two variants of test windows were tested:

- **Annual testing window (365 days),** tested **every 365 days** – this means that **we measure the annual rate of return every year.**
- **Three-year testing window (1095 days),** tested **every 365 days** – this means **we measure the three-year rate of return every year.**

A one-year (365/365) test window are shown below.

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

	Test Start Date	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3	RAR [%]	%PF	Expectancy	Ruin
1	19980101	$53,523,386.04	7.05%	0.78	0.94	2.00	9.0%	7.5	23	7.91	5.19	1.52	0.00	0.0%
2	19990101	$53,855,019.43	7.74%	0.54	0.59	NA	14.2%	7.0	19	1.81	1.63	1.53	0.00	0.0%
3	20000101	$51,838,744.65	3.72%	0.34	0.43	NA	10.9%	3.8	18	2.84	2.26	1.27	0.00	0.0%
4	20010101	$52,967,145.22	5.94%	1.17	0.92	2.00	5.1%	4.6	18	11.56	7.51	2.85	0.00	0.0%
5	20020101	$47,969,951.49	-4.06%	-0.33	-0.29	-2.01	12.2%	10.8	23	-13.42	-8.19	0.86	0.00	0.0%
6	20030101	$66,574,379.52	33.17%	7.40	2.47	2.00	4.5%	2.7	23	100.64	37.59	7.74	0.00	0.0%
7	20040101	$51,109,373.73	2.22%	0.12	0.24	NA	17.9%	9.9	28	-3.98	-4.41	1.15	0.00	0.0%
8	20050101	$58,190,642.61	16.59%	1.22	1.22	NA	13.6%	4.9	34	27.03	24.19	2.00	0.00	0.0%
9	20060101	$46,326,520.74	-7.37%	-0.52	-0.83	-2.01	14.1%	11.5	31	-5.95	-3.57	0.74	0.00	0.0%
10	20070101	$46,972,117.20	-6.06%	-0.42	-0.51	-2.00	14.4%	10.2	28	-5.53	-4.47	0.74	0.00	0.0%
11	20080101	$51,993,855.63	3.99%	1.01	0.91	NA	3.9%	6.1	12	3.48	1.03	1.90	0.00	0.0%
12	20090101	$62,642,932.48	25.31%	4.56	2.03	2.00	5.5%	3.3	14	63.02	32.48	6.80	0.00	0.0%
13	20100101	$61,555,844.65	23.20%	1.75	1.38	NA	13.3%	2.6	31	56.94	38.43	2.45	0.00	0.0%
14	20110101	$49,366,895.73	-1.28%	-0.09	-0.01	NA	14.5%	10.3	21	-5.53	-4.31	0.92	0.00	0.0%
15	20120101	$58,309,900.99	16.68%	1.73	1.60	NA	9.6%	6.0	30	11.03	8.66	2.26	0.00	0.0%
16	20130101	$54,766,783.79	9.54%	0.96	1.18	2.00	9.9%	7.4	31	5.76	4.41	2.18	0.00	0.0%
17	20140101	$59,029,699.55	18.07%	2.08	1.28	2.00	8.7%	3.6	35	38.25	28.80	1.89	0.00	0.0%
18	20150101	$47,915,593.66	-4.17%	-0.36	-0.36	-2.00	11.5%	8.3	29	-4.95	-3.14	0.77	0.00	0.0%
19	20160101	$54,583,857.50	9.20%	1.20	1.00	NA	7.7%	3.8	30	5.38	3.86	1.46	0.00	0.0%
20	20170101	$68,400,271.46	36.95%	3.86	2.29	2.01	9.6%	2.7	33	52.80	31.45	4.14	0.00	0.0%
21	20180101	$54,431,435.21	8.87%	0.90	0.79	2.00	9.9%	3.6	25	2.78	2.14	2.18	0.00	0.0%
22	20190101	$53,198,619.18	6.40%	0.51	0.58	2.00	12.6%	8.0	35	5.49	3.68	1.34	0.00	0.0%
23	20200101	$65,125,783.22	30.28%	3.83	2.12	NA	7.9%	4.3	28	30.48	19.61	4.31	0.00	0.0%
24	20210101	$51,509,141.94	3.03%	0.44	0.45	NA	6.9%	6.5	25	1.70	1.56	1.19	0.00	0.0%
25	20220101	$47,772,625.12	-4.51%	-0.95	-0.80	NA	4.7%	6.8	9	-2.06	-0.63	0.34	0.00	0.0%
26	20230101	$51,098,192.90	2.20%	0.24	0.23	2.00	9.3%	5.4	22	-2.62	-1.98	1.21	0.00	0.0%
27	20240101	$54,826,857.91	9.66%	0.92	0.74	NA	10.5%	3.0	34	22.54	16.32	1.52	0.00	0.0%

A three-year testing window (1095/365) are shown below.

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

	Test Start Date	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3	RAR [%]	%PF	Expectancy	Ruin
1	19980101	$61,007,314.70	6.88%	0.50	0.69	45.70	13.7%	7.5	56	1.82	6.50	1.55	0.00	0.0%
2	19990101	$62,840,228.56	7.92%	0.56	0.76	5.27	14.2%	7.0	50	3.43	10.18	1.86	0.00	0.0%
3	20000101	$54,922,571.30	3.19%	0.26	0.38	0.58	12.2%	10.8	55	1.15	3.56	1.28	0.00	0.0%
4	20010101	$66,493,976.86	9.98%	0.82	0.92	0.76	12.2%	15.2	63	2.60	7.04	2.04	0.00	0.0%
5	20020101	$65,461,010.76	9.40%	0.54	0.78	0.65	17.5%	15.2	68	3.18	13.47	1.71	0.00	0.0%
6	20030101	$78,495,942.48	16.25%	0.93	1.25	1.36	17.5%	16.6	74	3.70	11.23	2.43	0.00	0.0%
7	20040101	$54,303,197.63	2.80%	0.16	0.30	0.38	17.9%	16.9	87	1.23	6.32	1.18	0.00	0.0%
8	20050101	$52,703,199.20	1.78%	0.12	0.21	0.20	15.3%	23.5	86	0.41	1.82	1.13	0.00	0.0%
9	20060101	$46,187,906.00	-2.61%	-0.18	-0.28	-0.55	14.9%	35.4	65	-1.33	-2.56	0.87	0.00	0.0%
10	20070101	$61,225,925.23	6.99%	0.48	0.74	0.53	14.5%	29.1	54	1.68	5.48	1.76	0.00	0.0%
11	20080101	$82,701,537.54	18.28%	2.41	1.78	1.75	7.6%	6.1	49	12.80	21.27	4.72	0.00	0.0%
12	20090101	$80,306,908.07	17.16%	1.28	1.35	1.45	13.4%	10.3	54	9.24	21.89	3.36	0.00	0.0%
13	20100101	$72,493,473.66	13.19%	0.98	0.98	1.42	13.4%	12.1	76	3.08	12.45	2.01	0.00	0.0%
14	20110101	$62,259,512.62	7.60%	0.52	0.71	1.04	14.5%	12.3	76	1.77	8.47	1.67	0.00	0.0%
15	20120101	$74,958,415.22	14.47%	1.46	1.34	3.14	9.9%	9.2	91	3.18	10.49	2.10	0.00	0.0%
16	20130101	$62,521,168.04	7.74%	0.67	0.74	0.88	11.5%	9.2	93	3.68	12.80	1.58	0.00	0.0%
17	20140101	$61,918,635.67	7.40%	0.64	0.70	0.82	11.5%	20.2	93	2.36	8.02	1.41	0.00	0.0%
18	20150101	$72,177,922.28	13.05%	1.14	1.11	0.74	11.5%	20.6	88	3.27	10.26	1.87	0.00	0.0%
19	20160101	$81,462,508.82	17.68%	1.79	1.46	1.28	9.9%	3.9	83	9.03	20.61	2.37	0.00	0.0%
20	20170101	$81,125,516.59	17.54%	1.39	1.35	1.27	12.6%	8.0	90	5.17	15.94	2.38	0.00	0.0%
21	20180101	$77,330,759.89	15.66%	1.24	1.27	1.63	12.6%	8.4	83	4.28	13.21	2.37	0.00	0.0%
22	20190101	$69,903,135.15	11.83%	0.94	1.09	0.96	12.6%	8.4	78	5.87	15.74	1.80	0.00	0.0%
23	20200101	$62,964,491.47	8.00%	0.82	0.84	0.53	9.7%	13.3	56	1.92	5.76	1.75	0.00	0.0%
24	20210101	$51,049,649.70	0.70%	0.06	0.12	0.21	12.5%	25.4	56	-0.56	-2.11	1.08	0.00	0.0%
25	20220101	$53,542,867.67	2.31%	0.22	0.26	0.45	10.5%	7.9	61	1.37	4.69	1.21	0.00	0.0%

In both cases, **success** is the completion of at least **70% of the periods** (both **365-day** and **1095-day) with positive returns.**

- **For the one-year test window (365/365): 21 out of 27 periods** ended with a positive rate of return (**78%**).
- **For the three-year test window (1095/365): 24 out of 25 periods** ended with a positive rate of return (**96%**).

Thus, **the test of the strategy's stability on a moving data window was passed.**

4. **Long/short stability**

For many instruments, markets **naturally tend** to move in an upward direction (so-called **long bias)**, which often makes investing in bullish scenarios easier than betting on bearish ones. **Optimizing a strategy** for a bullish scenario, typically dictated by the data used for optimization, can lead to **problems** when markets enter **a long-term downward trend.** Under such conditions, the strategy can generate **significant losses.**

To check for **a strategy's** tendency toward **long bias** or (less commonly) **short bias,** you should examine **the distribution of historical** buy and sell transactions. Ideally, this distribution should be approximately **50%/50%.** However, if one side is significantly favored (e.g., **70%/30%)**, the strategy may be **unstable** in a real market environment.

A strategy considered stable (robust) should show a maximum of **60% tendency (bias)** in one direction.

In the case of the Vol Trade v.2 strategy, testing **the long/short stability** does not make sense, because **the strategy** assumes opening **only long positions.**

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

In this step, we want to examine **how the strategy's performance is distributed across the various instruments in the portfolio.** Our goal is **to avoid a situation where the strategy's positive performance comes only from a small group of exceptionally well-performing instruments.**

To check this, for **the combined in-sample and out-of-sample data,** we analyze **what percentage of instruments achieved a profit factor value above 1** (which means a positive contribution to the strategy's result).

We expect that:

- **For the portfolio with the highest MAR** (obtained on IS data), the percentage of instruments with **profit factor > 1 will be at least 80%.**
- **For the portfolio with the lowest MAR** (obtained on IS data), the percentage of instruments with **profit factor > 1 will be at least 70%.**

If the above conditions are met, **we can consider that the strategy is stable on a wide basket of financial instruments.**

The profit factor for the instruments included in the portfolio using the highest MAR is presented below.

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

Instrument Performance Summary

Symbol	Wins	%	Losses	%	Trades	Win Months	%	Loss Months	%	Avg. Win %	Avg. Loss %	Avg. Trade %	% Profit Factor
DX	34	54.8%	28	45.2%	62	250	77.2%	74	22.8%	1.31%	1.68%	-0.04%	0.95
EBL	41	59.4%	28	40.6%	69	256	79.0%	68	21.0%	1.74%	1.10%	0.59%	2.32
ES	40	65.6%	21	34.4%	61	247	76.2%	77	23.8%	1.50%	1.21%	0.56%	2.35
FDX	30	50.0%	30	50.0%	60	243	75.0%	81	25.0%	1.94%	1.26%	0.34%	1.55
FLG	42	62.7%	25	37.3%	67	258	79.6%	66	20.4%	1.38%	1.08%	0.46%	2.14
GC	31	51.7%	29	48.3%	60	243	75.0%	81	25.0%	1.62%	1.20%	0.26%	1.44
HSI	25	49.0%	26	51.0%	51	249	76.9%	75	23.1%	2.89%	1.36%	0.73%	2.05
NIY	26	51.0%	25	49.0%	51	252	77.8%	72	22.2%	2.18%	1.51%	0.37%	1.51
NQ	41	51.2%	39	48.8%	80	230	71.0%	94	29.0%	1.48%	0.97%	0.28%	1.60
TY	38	61.3%	24	38.7%	62	257	79.3%	67	20.7%	1.70%	1.01%	0.65%	2.66

The profit factor for the instruments included in the portfolio **using the lowest MAR** is presented below.

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

Instrument Performance Summary													
Symbol	Wins	%	Losses	%	Trades	Win Months	%	Loss Months	%	Avg. Win %	Avg. Loss %	Avg. Trade %	% Profit Factor
DX	14	51.9%	13	48.1%	27	291	89.8%	33	10.2%	2.01%	1.77%	0.19%	1.22
EBL	25	69.4%	11	30.6%	36	282	87.0%	42	13.0%	1.66%	1.14%	0.80%	3.30
ES	23	52.3%	21	47.7%	44	255	78.7%	69	21.3%	2.16%	1.07%	0.62%	2.21
FDX	23	52.3%	21	47.7%	44	253	78.1%	71	21.9%	1.72%	1.68%	0.10%	1.12
FLG	18	54.5%	15	45.5%	33	279	86.1%	45	13.9%	1.16%	1.41%	-0.01%	0.99
GC	17	42.5%	23	57.5%	40	265	81.8%	59	18.2%	1.92%	1.23%	0.11%	1.15
HSI	18	62.1%	11	37.9%	29	267	82.4%	57	17.6%	3.01%	1.92%	1.14%	2.57
NIY	18	45.0%	22	55.0%	40	260	80.2%	64	19.8%	2.30%	2.00%	-0.07%	0.94
NQ	26	54.2%	22	45.8%	48	261	80.6%	63	19.4%	2.04%	1.09%	0.61%	2.21
TY	15	48.4%	16	51.6%	31	276	85.2%	48	14.8%	2.42%	1.55%	0.37%	1.47

For our tested strategy:

- **the portfolio with the highest MAR** (obtained on IS data) has a percentage of instruments with **profit factor > 1 at the level of 90%.**
- **the portfolio with the lowest MAR** (obtained on IS data) has a percentage of instruments with **profit factor > 1 at the level of 80%.**

Thus, **the test of the strategy stability on the portfolio of financial instruments was passed.**

6. Money Management (Position Sizing)

After completing **the stability tests,** we now know **what range of results we can expect from our strategy,** and even more importantly – **what amount of capital loss (drawdown).**

Previous tests show that:

- **The in-sample drawdown** for optimized parameters was **14.5%.**
- **in-sample and out-of-sample drawdown** for the optimized parameters was **17.5%.**
- **The highest in-sample drawdown** for the tested parameter range was **29.4%.**
- **The largest out-of-sample drawdown** for the tested parameter range was **24.0%.**
- **Drawdown in 99% of Monte Carlo simulations** was equal to or lower than **43.2%.**

Our investment strategy was tested assuming that **the risk of a single position is 1.0% of the total capital, with a hypothetical stop loss order placed 2 x ATR (40 days) away from the position opening point.**

With the above information in mind, you should consider **whether the risk of a single position is acceptable, taking into account the possible drawdown.**

At this stage, **this position size is slightly too low for me personally and I am increasing it from 1% to 1.25%, but I will make the final decision after conducting Walk-Forward Analysis tests.**

To summarize, at this point **the strategy has been optimized to the following parameters:**

- **VolShort & HighestHigh:** 16 days;
- **MALong & VolLong:** 165 days;
- **VolRatio:** 70%;
- **Stop loss:** none;
- **Position opening method:** at the opening price of the next day;

- **Position closing method:** all positions are closed at the opening of the next session when VolShort > VolLong;
- **Position size:** corresponding to a risk of 1.25% of total capital, with a hypothetical stop loss order located 2 x ATR (40 days) away from the position opening point;
- **Position direction:** long positions (buy) only.

7. Strategy Risk Management

In addition to specifying **a maximum position size,** we can implement additional mechanisms to **improve risk management** within your investment strategy. Key elements include:

- **Maximum number of open positions in highly correlated instruments,**
- **Maximum number of open positions in moderately correlated instruments,**
- **Maximum number of open positions in one direction,**
- **Maximum risk value of all positions,**
- **Drawdown – position reduction mechanism.**

Optimal values for these parameters can be determined by **maximizing the MAR objective function.** However, based on experience and **awareness of the risks** posed by **excessive portfolio concentration in one direction (long/short)** or **excessive exposure to correlated instruments,** I adopt **certain arbitrary concentration limits.**

These aren't the "best" optimal values for all market conditions – just like position size, sometimes **it's worth reducing it and sometimes increasing it.** However, the key goal is **to avoid drawdowns** that could force you **to terminate your strategy for financial or emotional** reasons.

Too much concentration in correlated instruments or in one market direction can weaken diversification, which is one of the key sources of the strategy's advantage.

Therefore, **I assume the following concentration limits without optimization:**

- **Maximum number of open positions in highly correlated instruments: 3 positions (units),**
- **Maximum number of open positions in moderately correlated instruments: 6 positions (units),**
- **Maximum number of open positions in one direction: 12 positions (units).**

After this step, we've **optimized all the elements of our investment strategy.** We can finally **analyze the results the strategy generates in more detail.**

We haven't done this before because our goal **was not to optimize the parameters themselves and look for the "best" set,** but **to build a stable strategy.**

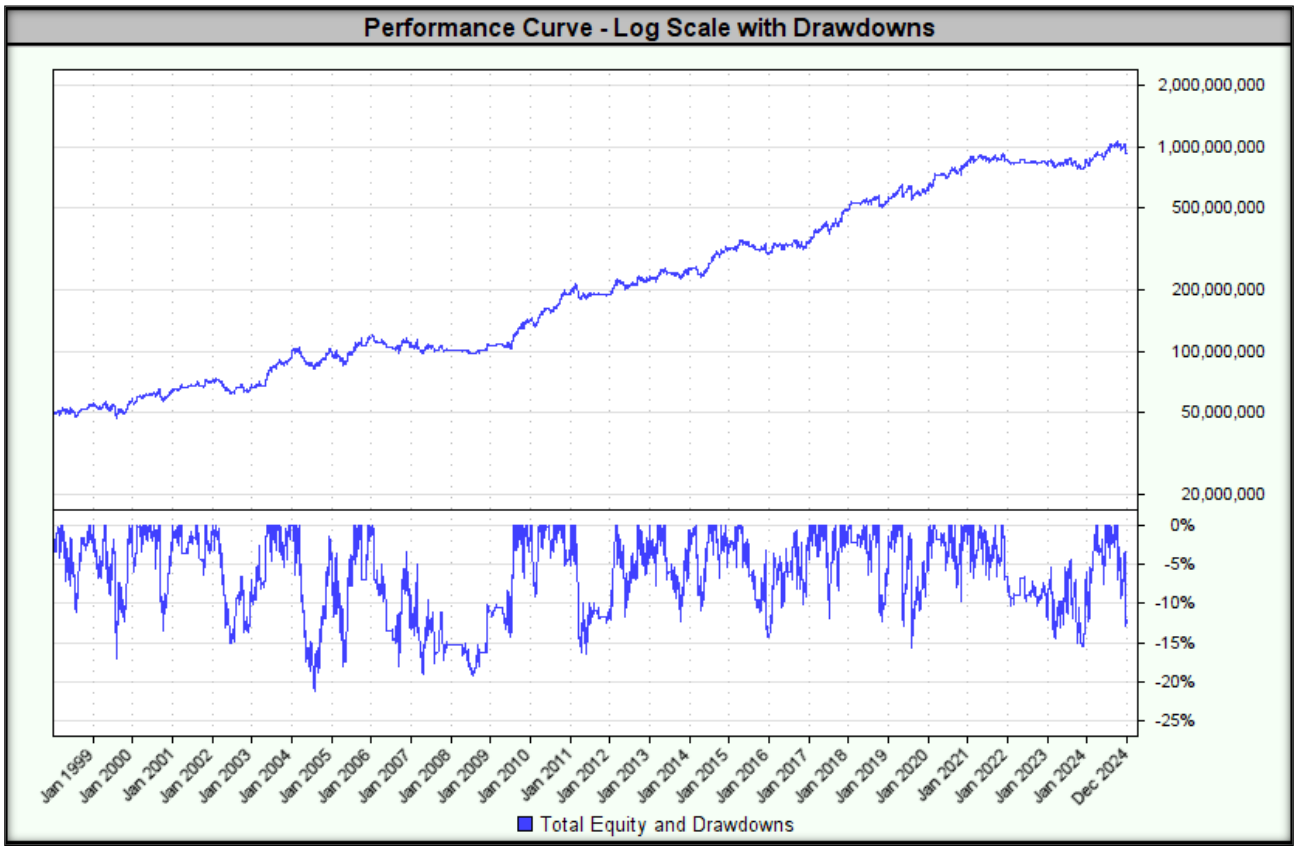
Importantly, **we will not ultimately use the parameters optimized in the backtests,** as **they serve only as a reference point. The parameters used in real transactions will be determined during the Walk-Forward Analysis.**

Before we move on to this step, **let us summarize the results on the in-sample data and on the combined in-sample and out-of-sample data.**

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

Indicators/Measures	In-sample	In-sample & Out-of-sample
CAGR%	12.6%	11.5%
MAR Ratio	0.70	0.54
RAR%	15.3%	12.9%
R-Cubed	0.58	0.35
Robust Sharpe Ratio	1.10	0.93
Max Drawdown	17.9%	21.2%
Wins	55.1%	55.9%
Losses	44.9%	44.1%
Average Win%	2.14%	2.14%
Average Loss%	1.42%	1.54%
Win/Loss Ratio	1.34	1.39
Average Trade Duration (days)	58	58
Percent Profit Factor	1.85	1.76
SQN	-	-
Number of transactions	432	623

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



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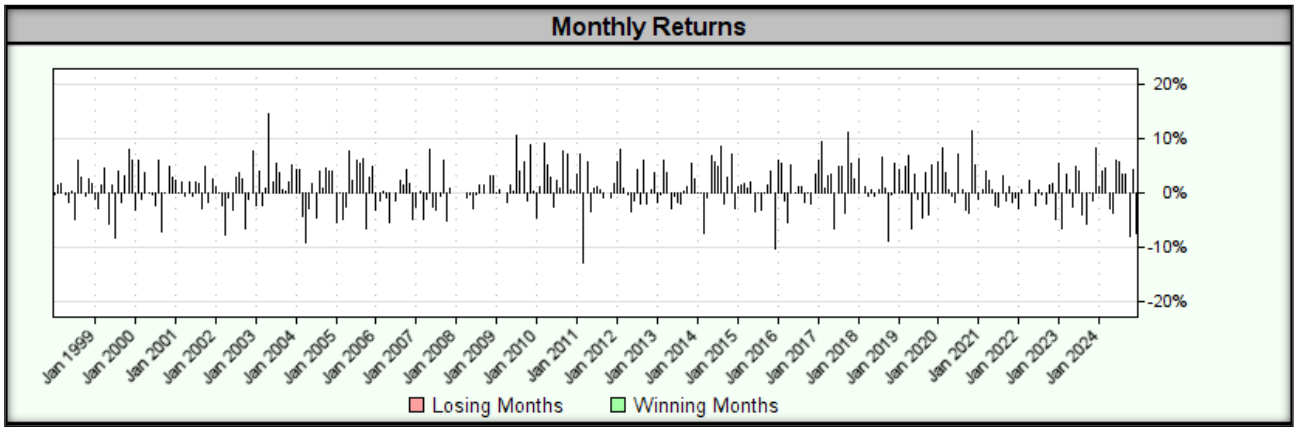

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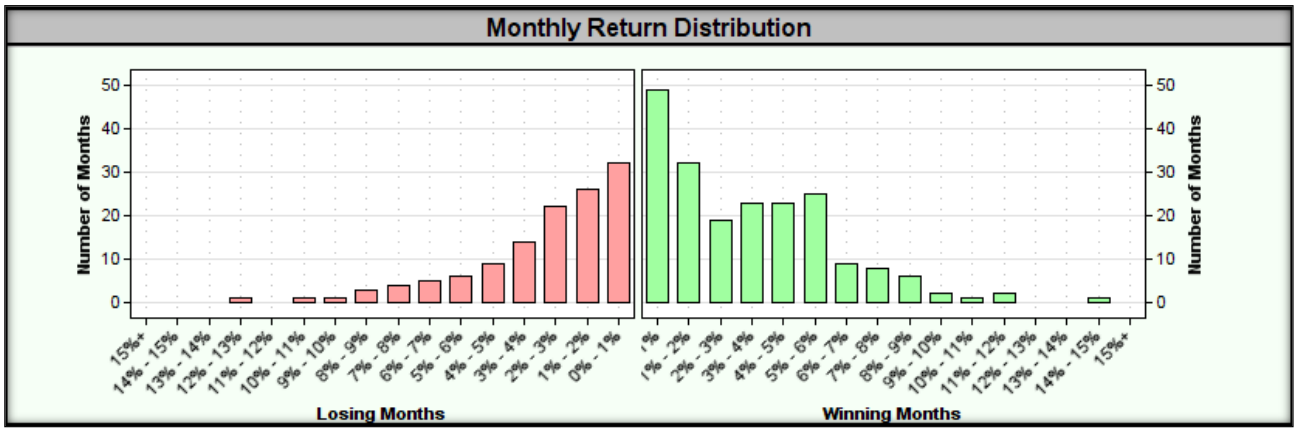


To summarize, at this point **the strategy has been optimized to the following parameters:**

- **VolShort & HighestHigh:** 16 days;
- **MALong & VolLong:** 165 days;
- **VolRatio:** 70%;
- **Stop loss:** none;
- **Position opening method:** at the opening price of the next day;
- **Position closing method:** all positions are closed at the opening of the next session when VolShort > VolLong;
- **Position size:** corresponding to a risk of 1.25% of total capital, with a hypothetical stop loss order located 2 x ATR (40 days) away from the position opening point;
- **Maximum number of open positions in different categories:**
  - **Highly correlated instruments:** 3 items (units);
  - **Moderately correlated instruments:** 6 items (units);
  - **Maximum number of positions in one direction:** 12 positions (units);
- **Position direction:** long positions (buy) only.

Step 5: Walk-Forward Analysis

Walk-Forward Analysis (WFA) is a key tool for assessing **a strategy's ability to perform in real-world market conditions.** It provides **reliable measures of reward and risk** after the optimization process and allows you to answer several key questions:

1. **What rate of return can you expect from the strategy?**
    - The optimization result often overestimates the expected rate of return, which can lead to unrealistic forecasts.
    - WFA provides more **reliable and realistic measures of return** by minimizing the impact of overfitting to historical data.
2. **What set of parameters should be used in the next period?**
    - Thanks to **WFA,** it is possible **to dynamically adjust the strategy parameters** to **the latest market changes,** increasing its adaptability.

WFA tests the strategy over multiple time periods, minimizing the risk of overfitting (overfitting the strategy to historical data). The WFA process consists of **two repeated steps:**

1. **Optimization (In-Sample):**
    - The strategy is optimized over a specific **training period** (**in-sample)**.
    - This step adjusts the parameters to obtain **the best results.**
2. **Testing (Out-of-Sample):**
    - The strategy, using **the parameters optimized in step 1,** is tested on **a test period** (**out-of-sample)**.
    - This stage verifies the effectiveness of the strategy in new market conditions that **were not used** during optimization.

Walk-Forward Efficiency (WFE) is a key metric that assesses a strategy's potential to perform under real-world market conditions. WFE compares:

- **The rate of return achieved in the in-sample window** (where parameters were optimized)
- **Rate of return in the out-of-sample window** (where the strategy was running on unknown data)

Similarly, **for the drawdown value,** WFE checks whether the strategy does not lose significant stability outside the optimization period.

A strategy considered **stable (robust) should meet the following conditions:**

- **WFE ≥ 50% for the rate of return** – means that the strategy retains at least half of its effectiveness beyond the optimization period.
- **WFE ≤ 150% for drawdown** – means that the drawdown outside the optimization period is not significantly higher than during the optimization period.

The WFA results and the assessment of the strategy's effectiveness according to the Walk-Forward Efficiency measure are presented below.

Walk-Forward Optimization (WFO) parameters:

- **Objective function:** MAR;
- **Position size:** corresponding to a risk of 1.25% of total capital, with a hypothetical stop loss order located 2 x ATR (40 days) away from the position opening point;
- **Range of optimized parameters:**
  - **VolShort & HighestHigh:** range 11-17 days (step: 1);
  - **MALong & VolLong:** range 165-250 days (step: 5);
  - **VolRatio:** range 70%-90% (step: 2.5 pp);
- **Position opening method:** at the opening price of the next day;
- **Stop loss:** none;
- **Position closing method:** all positions are closed at the opening of the next session when VolShort > VolLong;
- **Maximum number of open positions in different categories:**
  - **Highly correlated instruments:** 3 items (units);
  - **Moderately correlated instruments:** 6 items (units);
  - **Maximum number of positions in one direction:** 12 positions (units);
- **Position direction:** long positions only (buy);
- **Data period:** 01/01/1995 – 31/12/2024.

Below are the test results for various windows.

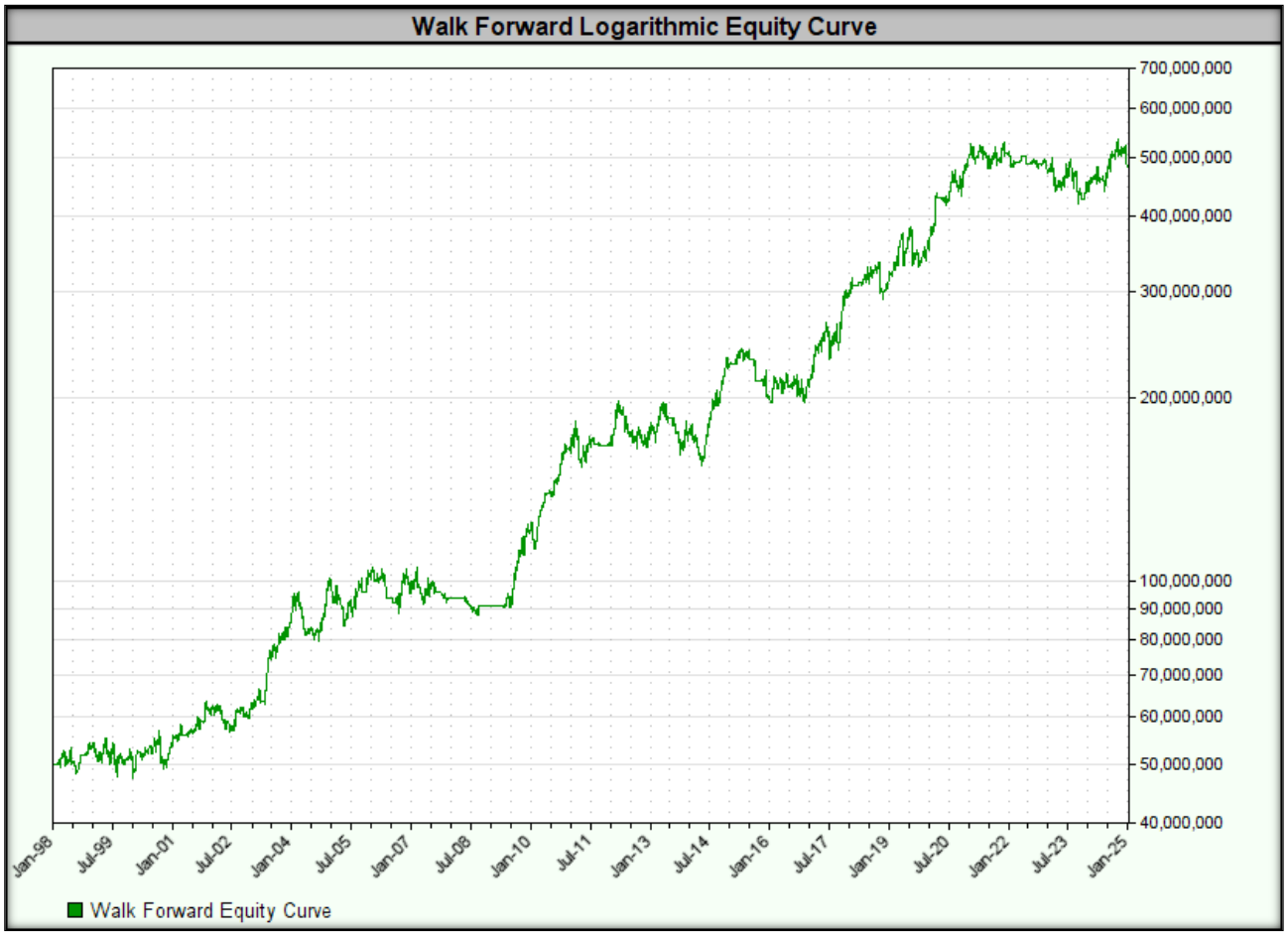
1. **Walk Forward Optimization: 1095 days; Walk Forward Out-of-sample: 365 days**

The results of the Walk-Forward Analysis (WFA) for the 1095/365 day combination are presented below.

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

Walk Forward Summary Performance						
Ending Balance	CAGR%	MAR	Annual Sharpe	Max Total Equity DD	Longest Drawdown	# Trades
469,919,856	8.64%	0.40	0.54	21.53%	34.14	595

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



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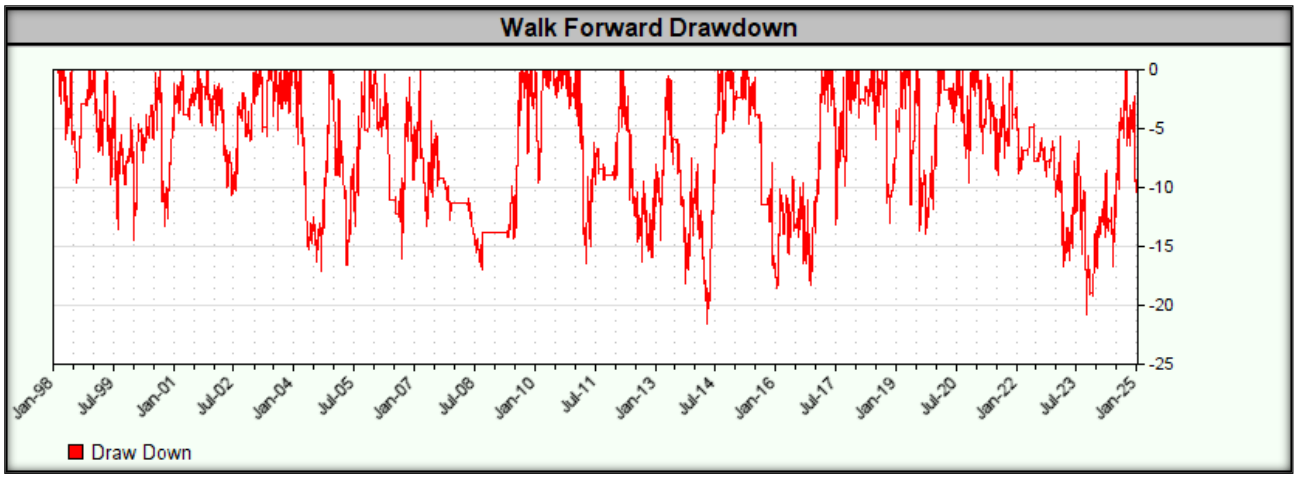


Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Optimization:	1095	CAGR%		Max DD		MAR	
WFA:	365	Projections	Real	Projections	Real	Projections	Real
19971231	19981230	19.7%	7.1%	9.7%	9.6%	2.03	0.74

19981231	19991230	16.9%	-4.1%	8.1%	13.5%	2.08	- 0.31
19991231	20001229	17.7%	5.4%	16.2%	13.3%	1.09	0.41
20010101	20011228	15.1%	14.3%	13.5%	4.7%	1.12	3.02
20011231	20021227	15.4%	2.2%	14.4%	9.7%	1.07	0.23
20021230	20031229	12.9%	38.9%	11.3%	5.7%	1.14	6.88
20031230	20041228	15.9%	15.0%	4.9%	17.1%	3.26	0.88
20041229	20051228	19.0%	1.8%	15.2%	16.2%	1.25	0.11
20051229	20061228	23.3%	-4.0%	15.9%	16.0%	1.46	- 0.25
20061229	20071228	12.4%	-4.8%	17.4%	13.3%	0.71	- 0.36
20071231	20081226	9.6%	-2.8%	10.6%	6.8%	0.91	- 0.41
20081229	20091225	5.1%	33.9%	10.6%	7.1%	0.49	4.76
20091228	20101227	10.6%	35.9%	12.5%	9.6%	0.85	3.73
20101228	20111227	26.2%	1.4%	7.0%	16.5%	3.72	0.08
20111228	20121226	22.7%	3.3%	9.2%	16.3%	2.46	0.20
20121227	20131226	17.8%	3.0%	12.6%	17.7%	1.42	0.17
20131227	20141226	10.6%	27.1%	13.3%	14.7%	0.80	1.84
20141229	20151225	16.7%	-11.2%	11.0%	16.9%	1.52	- 0.66
20151228	20161223	11.0%	6.3%	11.8%	10.1%	0.94	0.63
20161226	20171225	13.8%	37.6%	10.8%	13.2%	1.27	2.85
20171226	20181225	19.9%	5.8%	12.8%	13.0%	1.55	0.44
20181226	20191225	25.3%	16.3%	10.8%	14.0%	2.33	1.16
20191226	20201224	28.5%	34.1%	12.2%	9.6%	2.34	3.56
20201225	20211224	25.2%	5.3%	11.5%	8.9%	2.19	0.60
20211227	20221223	21.1%	-6.8%	11.5%	7.4%	1.83	- 0.92
20221226	20231222	13.2%	-4.8%	8.2%	16.0%	1.62	- 0.30
20231225	20241223	5.3%	6.8%	13.2%	10.1%	0.40	0.67
Mean		**16.7%**	**9.7%**	**11.7%**	**12.1%**	**0.96**	**0.55**
		WFE:	**58.3%**	**WFE:**	**103.3%**	**WFE:**	**57.2%**

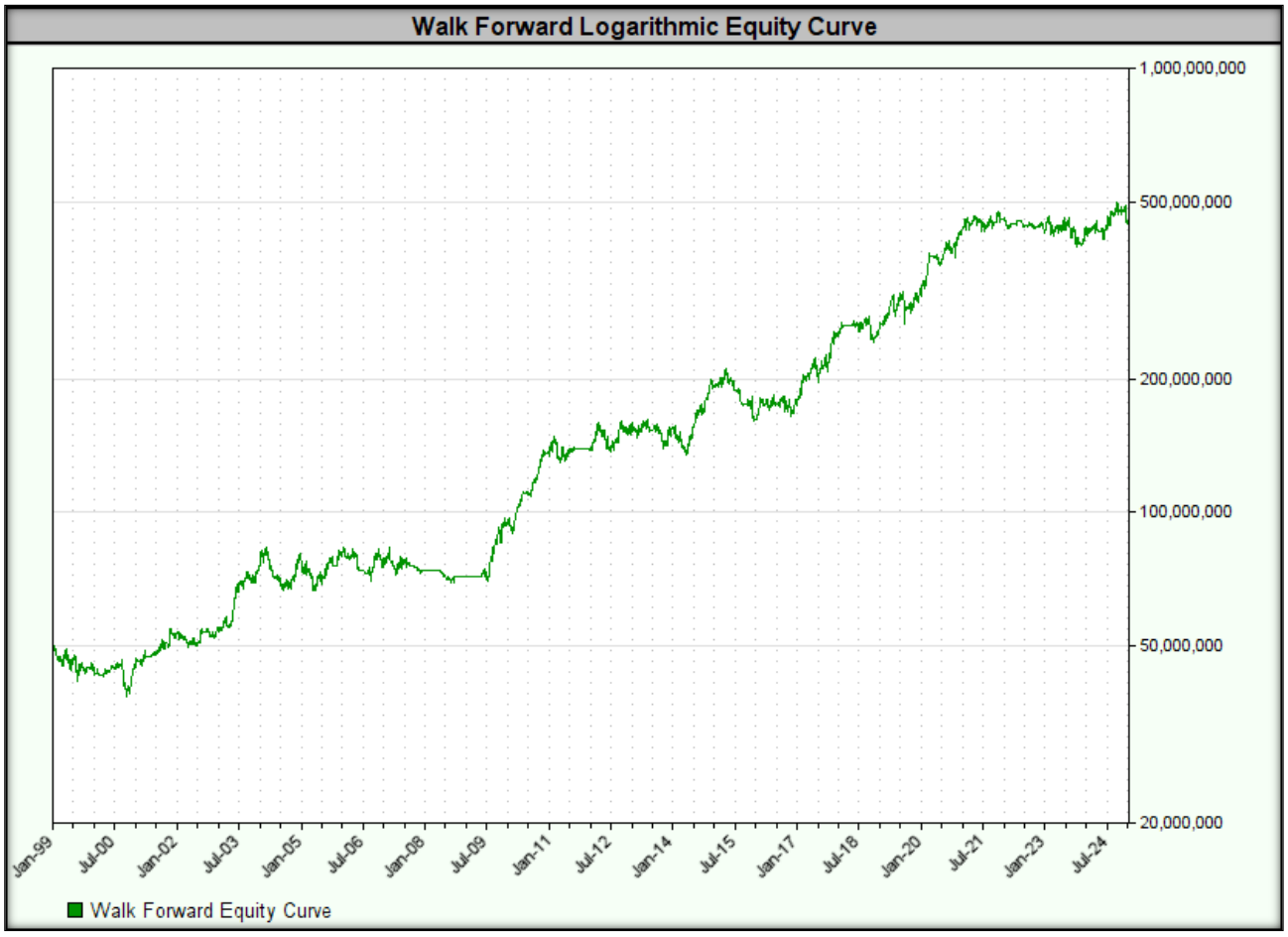
2. **Walk Forward Optimization: 1460 days; Walk Forward Out-of-sample: 365 days**

The results of the Walk-Forward Analysis (WFA) for the 1460/365 day combination are presented below.

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

Walk Forward Summary Performance						
Ending Balance	CAGR%	MAR	Annual Sharpe	Max Total Equity DD	Longest Drawdown	# Trades
440,014,236	8.71%	0.36	0.53	23.98%	35.55	596

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



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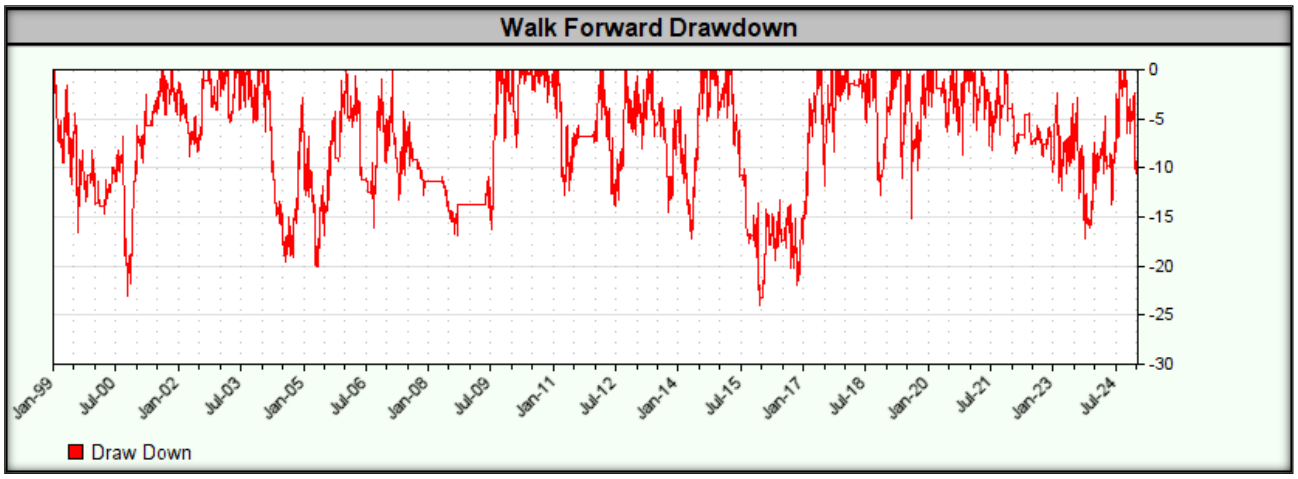


Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Optimization:	1460	CAGR%		Max DD		MAR	
WFA:	365	Projections	Real	Projections	Real	Projections	Real
19981231	19991230	16.7%	-10.6%	8.4%	16.5%	1.99	- 0.64

19991231	20001229	13.8%	1.1%	12.2%	17.4%	1.13	0.07
20010101	20011228	13.2%	18.1%	13.8%	4.6%	0.96	3.94
20011231	20021227	15.7%	3.7%	13.7%	7.7%	1.14	0.48
20021230	20031229	12.0%	36.6%	14.4%	5.4%	0.83	6.74
20031230	20041228	19.1%	7.4%	11.3%	19.6%	1.69	0.38
20041229	20051228	19.3%	-0.2%	15.2%	17.8%	1.27	- 0.01
20051229	20061228	16.9%	-4.0%	15.9%	16.0%	1.06	- 0.25
20061229	20071228	17.1%	-4.8%	15.4%	13.2%	1.11	- 0.36
20071231	20081226	8.9%	-2.8%	17.4%	6.8%	0.51	- 0.41
20081229	20091225	6.9%	31.9%	13.2%	7.2%	0.52	4.44
20091228	20101227	11.6%	43.8%	10.6%	7.9%	1.10	5.54
20101228	20111227	18.5%	1.5%	13.7%	12.8%	1.35	0.12
20111228	20121226	19.1%	10.8%	10.2%	13.9%	1.88	0.78
20121227	20131226	18.1%	2.2%	9.7%	14.6%	1.86	0.15
20131227	20141226	15.3%	22.4%	12.9%	13.9%	1.18	1.62
20141229	20151225	15.0%	-15.2%	14.1%	24.0%	1.06	- 0.63
20151228	20161223	11.9%	10.0%	12.5%	10.1%	0.95	1.00
20161226	20171225	10.8%	40.0%	11.8%	11.9%	0.91	3.37
20171226	20181225	19.0%	3.3%	10.7%	12.8%	1.77	0.26
20181226	20191225	16.8%	23.0%	13.0%	15.2%	1.29	1.51
20191226	20201224	23.8%	33.8%	12.2%	8.8%	1.94	3.87
20201225	20211224	29.2%	8.3%	11.6%	8.2%	2.51	1.01
20211227	20221223	19.8%	-6.3%	11.5%	6.8%	1.71	- 0.92
20221226	20231222	13.4%	1.4%	11.5%	15.2%	1.16	0.09
20231225	20241223	13.6%	3.7%	13.2%	10.1%	1.03	0.36
Mean		**16.0%**	**10.0%**	**12.7%**	**12.2%**	**0.92**	**0.42**
		WFE:	**62.5%**	**WFE:**	**96.4%**	**WFE:**	**45.3%**

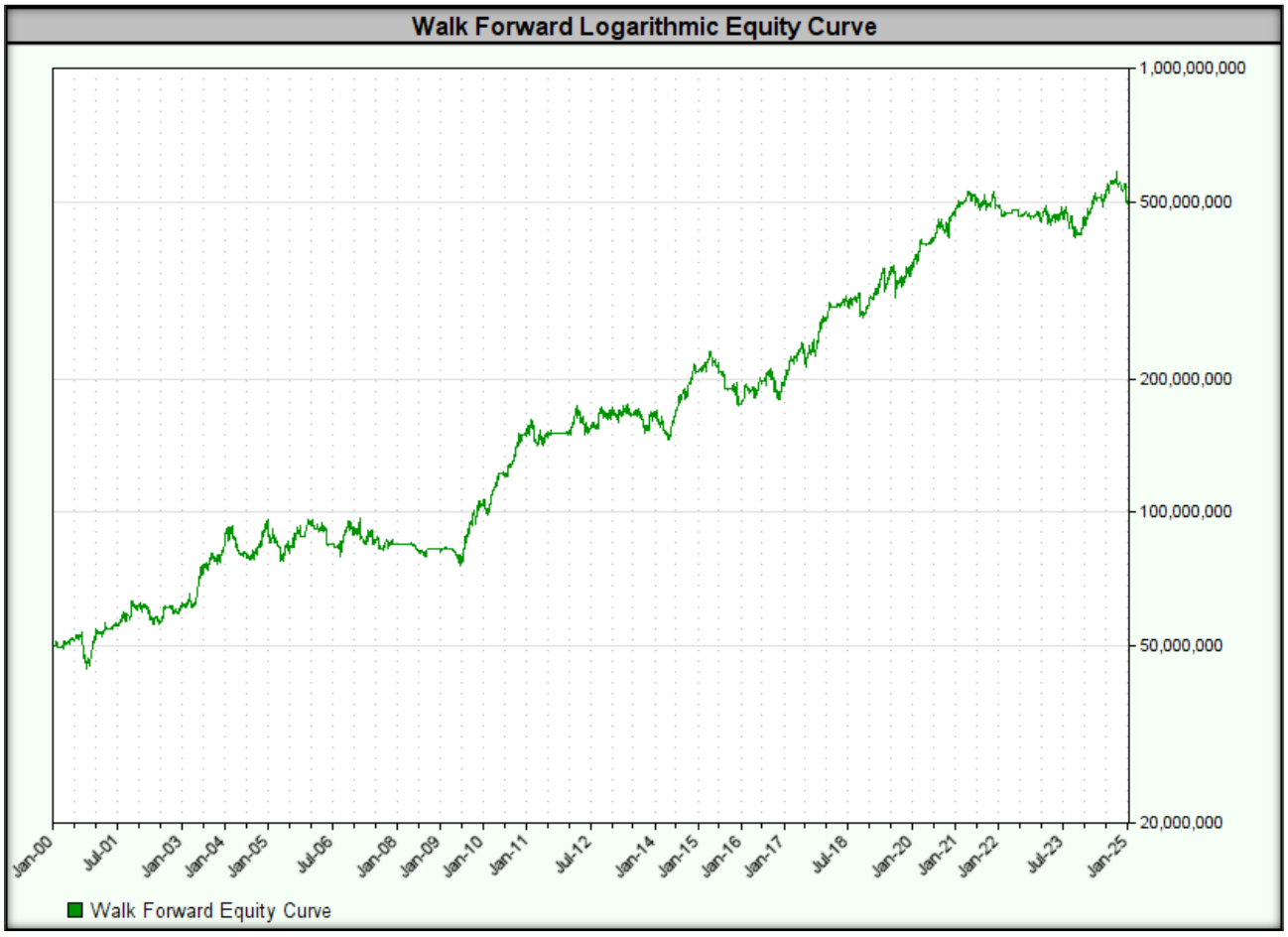
3. Walk Forward Optimization: 1825 days; Walk Forward Out-of-sample: 365 days

Below are **the results of the Walk-Forward Analysis (WFA) for the 1825/365 day combination.**

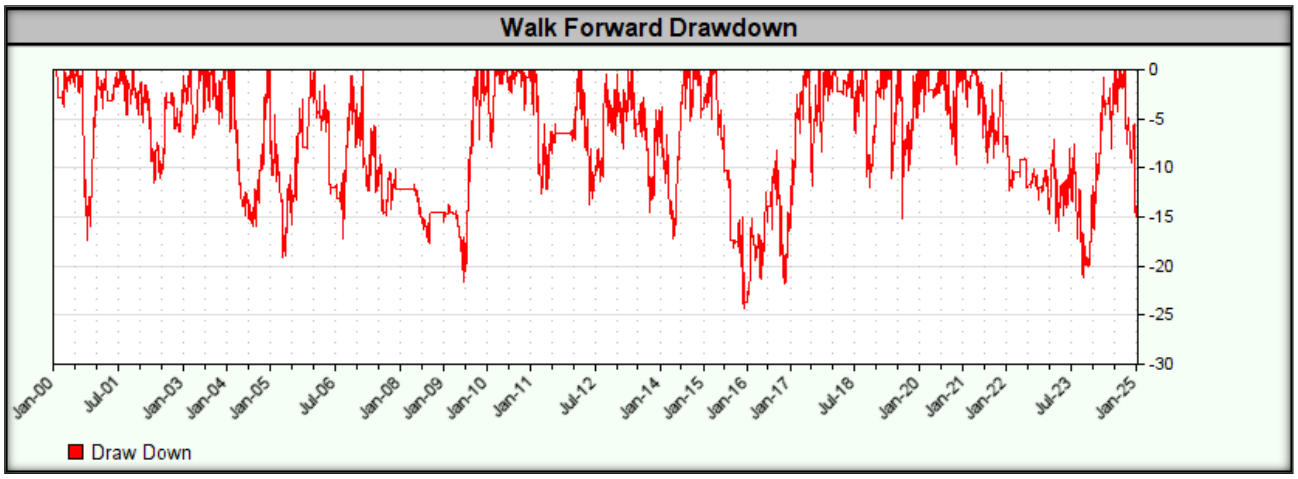
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Walk Forward Summary Performance						
Ending Balance	CAGR%	MAR	Annual Sharpe	Max Total Equity DD	Longest Drawdown	# Trades
480,580,744	9.46%	0.39	0.58	24.38%	38.54	606

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.



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

Optimization:	1825	CAGR%		Max DD		MAR	
WFA:	365	Projections	Real	Projections	Real	Projections	Real
19991231	20001229	14.8%	4.7%	12.2%	17.3%	1.22	0.27

20010101	20011228	13.0%	18.1%	13.8%	4.6%	0.95	3.94
20011231	20021227	15.6%	1.6%	15.0%	10.4%	1.04	0.16
20021230	20031229	13.2%	34.8%	13.7%	6.9%	0.96	5.06
20031230	20041228	16.9%	14.0%	14.7%	15.9%	1.15	0.88
20041229	20051228	18.0%	-1.7%	15.2%	19.0%	1.18	- 0.09
20051229	20061228	15.6%	-3.6%	15.3%	17.2%	1.02	- 0.21
20061229	20071228	14.7%	-6.8%	17.8%	14.9%	0.83	- 0.45
20071231	20081226	13.3%	-2.8%	15.4%	6.8%	0.86	- 0.41
20081229	20091225	8.5%	26.1%	18.9%	9.3%	0.45	2.81
20091228	20101227	11.3%	44.2%	12.9%	8.0%	0.87	5.56
20101228	20111227	17.3%	0.1%	10.6%	12.6%	1.64	0.01
20111228	20121226	15.2%	10.3%	14.0%	13.8%	1.09	0.75
20121227	20131226	14.7%	2.1%	9.7%	14.6%	1.51	0.14
20131227	20141226	17.9%	22.4%	12.7%	13.9%	1.41	1.62
20141229	20151225	19.8%	-15.1%	16.1%	24.4%	1.23	- 0.62
20151228	20161223	9.3%	10.9%	14.0%	14.7%	0.66	0.74
20161226	20171225	11.5%	38.6%	12.5%	11.8%	0.92	3.27
20171226	20181225	16.0%	9.3%	11.8%	12.0%	1.35	0.77
20181226	20191225	19.2%	23.0%	13.0%	15.2%	1.48	1.52
20191226	20201224	15.8%	29.1%	12.8%	9.6%	1.24	3.02
20201225	20211224	25.6%	5.5%	12.2%	9.5%	2.09	0.58
20211227	20221223	24.4%	-8.1%	11.9%	8.2%	2.05	- 0.98
20221226	20231222	13.9%	1.4%	11.5%	15.2%	1.21	0.09
20231225	20241223	11.2%	8.4%	11.9%	14.5%	0.94	0.58
Mean		**15.5%**	**10.7%**	**13.6%**	**12.8%**	**0.82**	**0.44**
		WFE:	**69.0%**	**WFE:**	**94.3%**	**WFE:**	**53.4%**

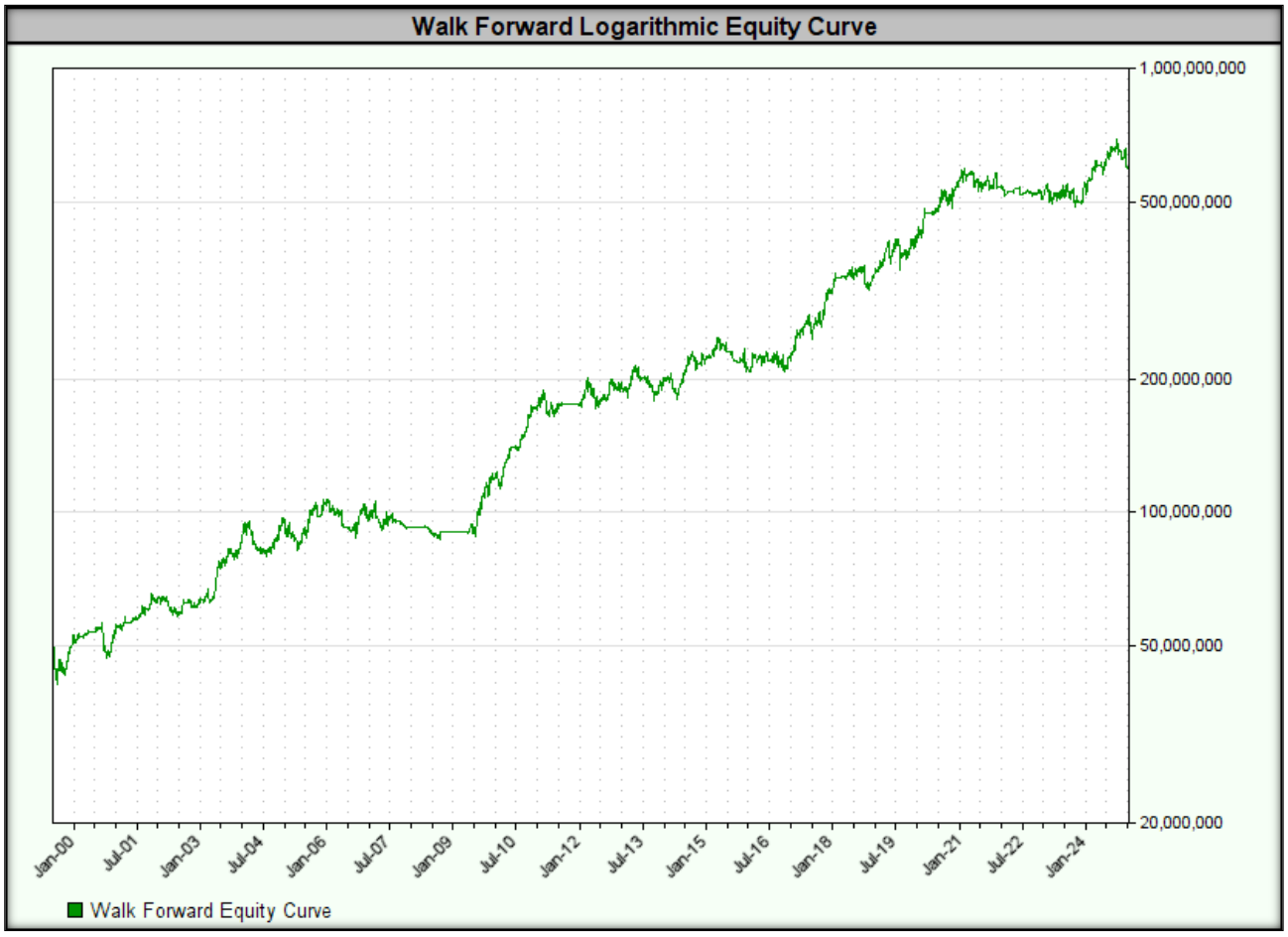
4. **Walk Forward Optimization: 1644 days; Walk Forward Out-of-sample: 548 days**

The results of the Walk-Forward Analysis (WFA) for the 1644/548 day combination are presented below.

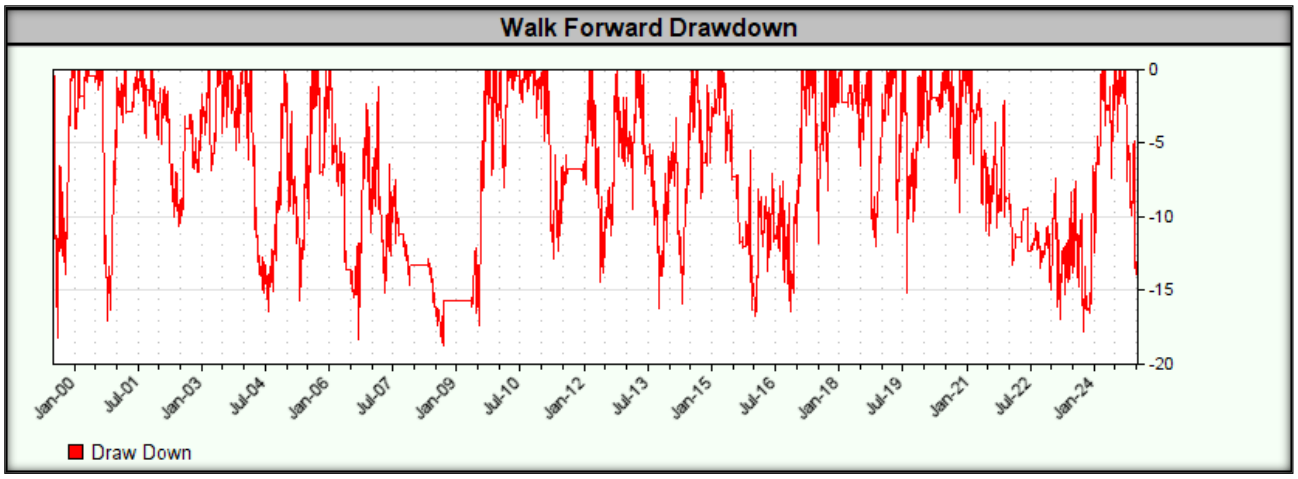
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Walk Forward Summary Performance						
Ending Balance	CAGR%	MAR	Annual Sharpe	Max Total Equity DD	Longest Drawdown	# Trades
585,869,645	10.12%	0.54	0.62	18.72%	43.73	558

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.



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

Optimization:	1644	CAGR%		Max DD		MAR	
WFA:	548	Projections	Real	Projections	Real	Projections	Real
19990705	20001229	16.7%	5.2%	9.5%	18.2%	1.76	0.29

20010101	20020702	15.7%	6.2%	14.5%	10.7%	1.08	0.59
20020703	20040101	12.6%	29.7%	13.7%	6.9%	0.92	4.32
20040102	20050701	14.1%	1.6%	13.3%	16.5%	1.06	0.10
20050704	20070101	13.9%	6.5%	16.0%	18.4%	0.87	0.35
20070102	20080702	16.1%	-5.8%	15.4%	15.3%	1.04	- 0.38
20080703	20100101	6.7%	20.9%	17.5%	7.2%	0.38	2.91
20100104	20110701	11.8%	27.8%	10.6%	12.8%	1.11	2.17
20110704	20130101	16.3%	9.3%	13.7%	14.4%	1.19	0.65
20130102	20140703	22.1%	4.6%	11.1%	16.2%	1.99	0.29
20140704	20160101	15.1%	0.3%	14.5%	16.3%	1.04	0.02
20160104	20170703	10.3%	12.2%	12.1%	10.2%	0.85	1.20
20170704	20190102	11.8%	24.9%	11.8%	12.0%	1.00	2.08
20190103	20200703	18.3%	24.1%	13.0%	15.2%	1.41	1.59
20200706	20211231	24.8%	8.1%	12.2%	11.2%	2.04	0.72
20220103	20230704	22.1%	-1.2%	11.5%	10.3%	1.91	- 0.11
20230705	20250102	13.4%	8.0%	11.9%	13.8%	1.13	0.58
Mean		**15.4%**	**10.7%**	**13.1%**	**13.3%**	**0.88**	**0.59**
		WFE:	**69.8%**	**WFE:**	**101.5%**	**WFE:**	**66.6%**

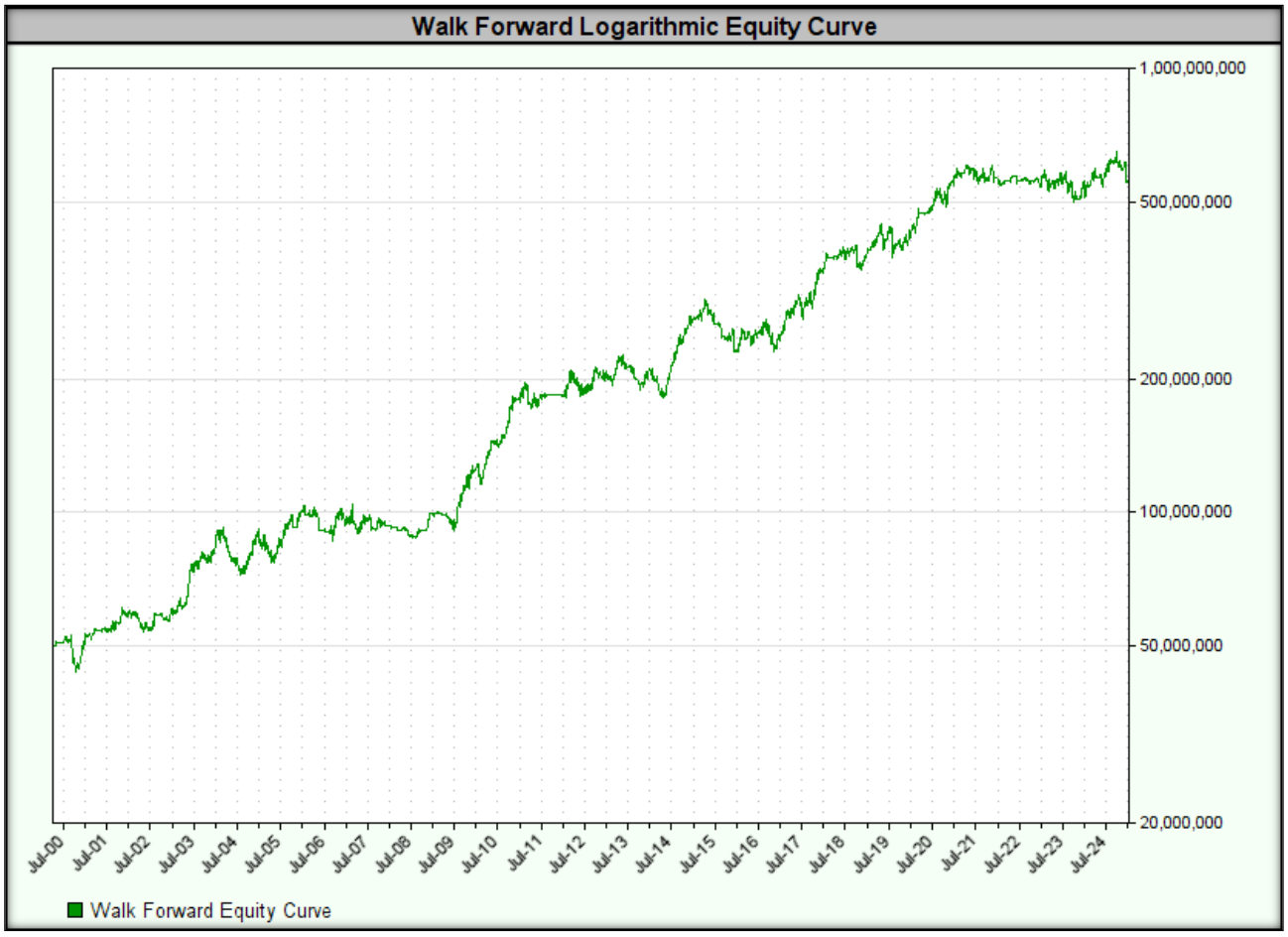
5. **Walk Forward Optimization: 1918 days; Walk Forward Out-of-sample: 548 days**

The results of the Walk-Forward Analysis (WFA) for the 1918/548 day combination are presented below.

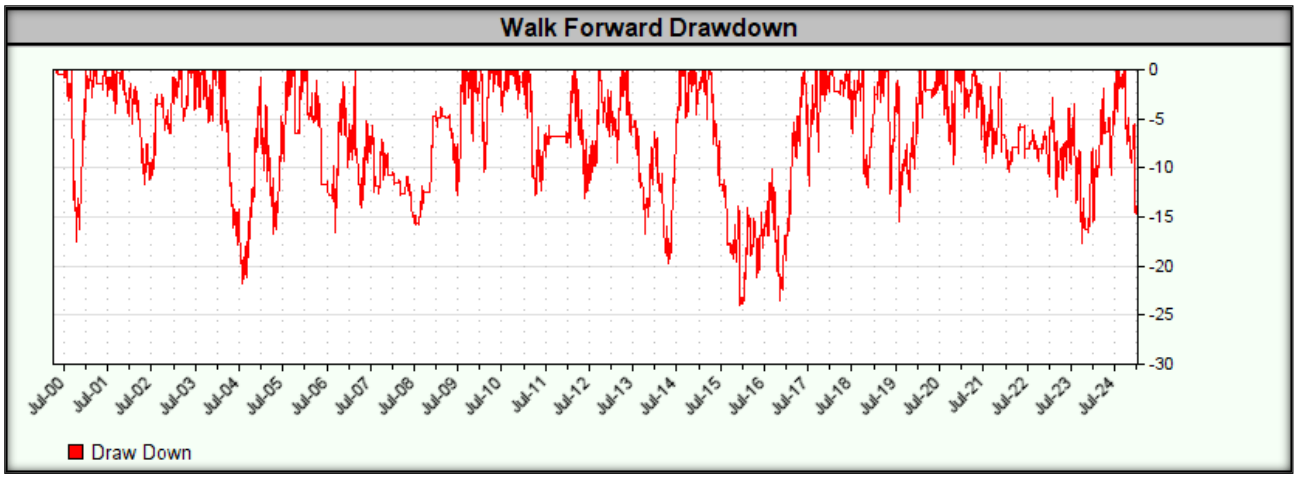
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Walk Forward Summary Performance						
Ending Balance	CAGR%	MAR	Annual Sharpe	Max Total Equity DD	Longest Drawdown	# Trades
545,318,350	10.13%	0.42	0.61	23.99%	38.77	618

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.



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

Optimization:	1918	CAGR%		Max DD		MAR	
WFA:	548	Projections	Real	Projections	Real	Projections	Real
20000403	20011001	14.9%	8.7%	12.2%	17.5%	1.23	0.50

20011002	20030402	16.9%	5.9%	15.0%	11.6%	1.13	0.51
20030403	20041001	12.2%	16.3%	13.7%	21.8%	0.89	0.75
20041004	20060331	13.7%	18.0%	16.2%	16.1%	0.84	1.12
20060403	20071002	14.8%	-1.5%	15.9%	15.6%	0.93	- 0.09
20071003	20090402	16.1%	1.7%	17.9%	9.4%	0.90	0.18
20090403	20101001	7.6%	37.9%	18.8%	10.4%	0.40	3.67
20101004	20120402	15.7%	17.2%	10.6%	12.8%	1.48	1.35
20120403	20131002	17.3%	-2.8%	14.3%	13.8%	1.21	- 0.20
20131003	20150403	18.2%	30.3%	12.2%	14.3%	1.49	2.12
20150406	20160930	16.8%	-8.2%	13.6%	24.0%	1.24	- 0.34
20161003	20180403	10.1%	30.0%	12.1%	11.8%	0.83	2.54
20180404	20191003	16.7%	3.4%	11.8%	15.5%	1.41	0.22
20191004	20210402	15.6%	30.0%	12.8%	9.6%	1.23	3.11
20210405	20221003	26.2%	-4.0%	12.2%	10.4%	2.14	- 0.39
20221004	20240403	17.4%	2.4%	11.5%	15.2%	1.51	0.16
20240404	20250110	12.9%	-6.4%	11.9%	16.0%	1.08	- 0.40
Mean		**15.5%**	**10.5%**	**13.7%**	**14.5%**	**0.82**	**0.44**
		WFE:	**68.0%**	**WFE:**	**105.6%**	**WFE:**	**53.4%**

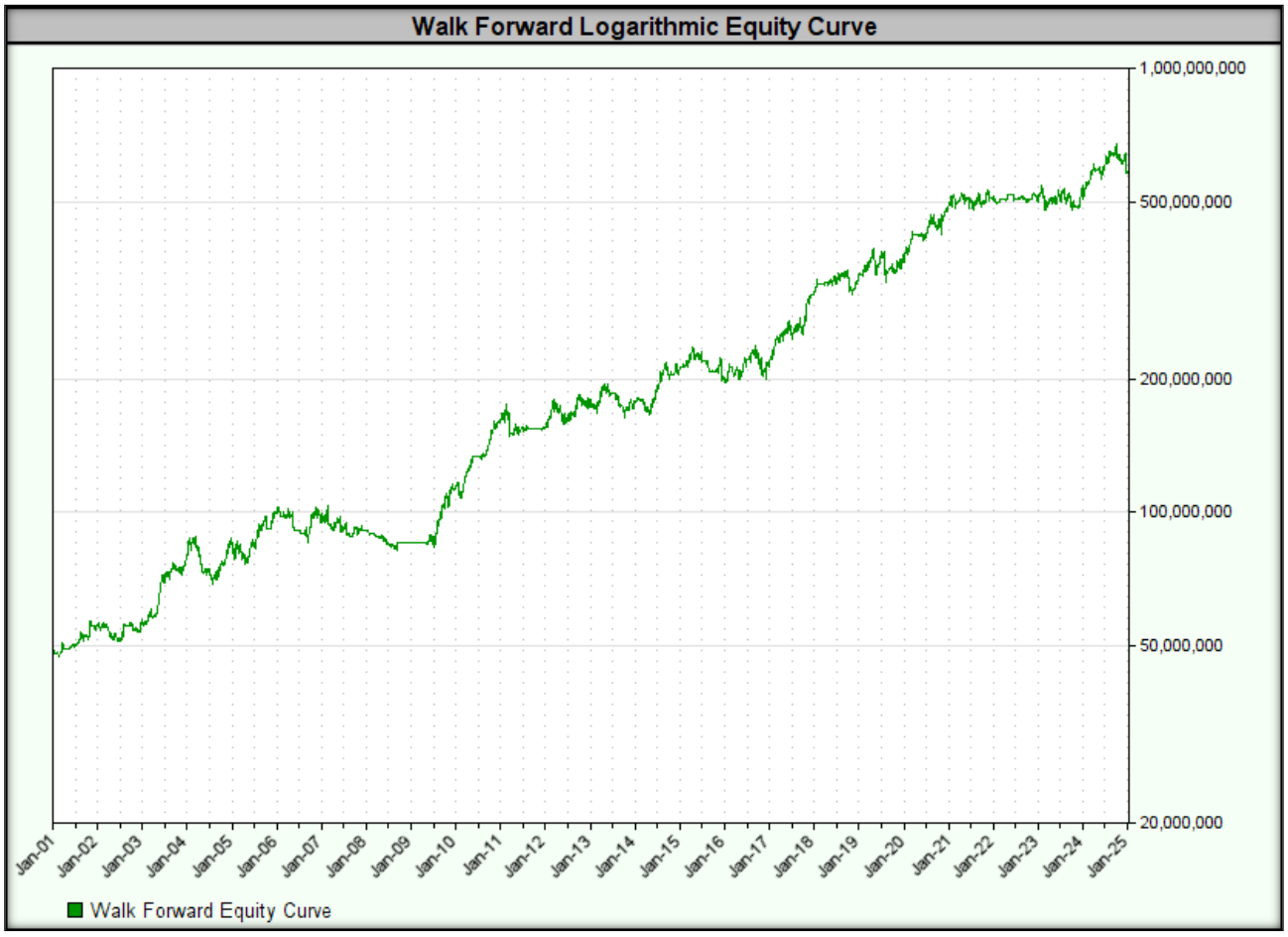
6. **Walk Forward Optimization: 2192 days; Walk Forward Out-of-sample: 548 days**

The results of the Walk-Forward Analysis (WFA) for the 2192/548 day combination are presented below.

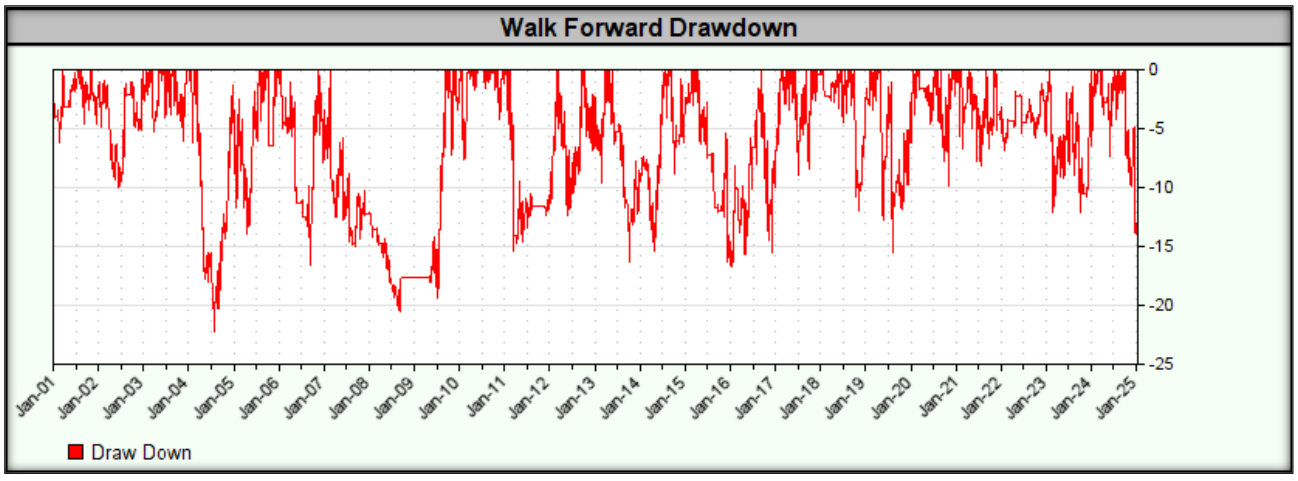
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Walk Forward Summary Performance						
Ending Balance	CAGR%	MAR	Annual Sharpe	Max Total Equity DD	Longest Drawdown	# Trades
572,627,574	10.68%	0.48	0.65	22.18%	30.62	550

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.



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

Optimization:	2192	CAGR%		Max DD		MAR	
WFA:	548	Projections	Real	Projections	Real	Projections	Real
20010101	20020702	13.7%	2.2%	13.8%	10.0%	1.00	0.22

20020703	20040101	14.0%	34.0%	15.0%	6.0%	0.93	5.63
20040102	20050701	16.6%	3.5%	13.7%	22.2%	1.21	0.16
20050704	20070101	13.4%	10.1%	16.2%	16.6%	0.83	0.61
20070102	20080702	14.2%	-8.7%	17.8%	18.4%	0.80	- 0.48
20080703	20100101	11.1%	21.0%	15.4%	7.2%	0.72	2.92
20100104	20110701	10.1%	21.9%	17.5%	15.4%	0.58	1.43
20110704	20130101	15.6%	12.3%	12.7%	12.3%	1.23	0.99
20130102	20140703	15.2%	4.6%	14.0%	16.4%	1.09	0.28
20140704	20160101	19.2%	2.7%	14.5%	16.3%	1.32	0.16
20160104	20170703	14.4%	15.7%	16.6%	15.6%	0.87	1.01
20170704	20190102	11.8%	23.3%	12.2%	11.9%	0.97	1.95
20190103	20200703	14.9%	15.2%	12.0%	15.5%	1.25	0.98
20200706	20211231	19.8%	14.2%	13.8%	9.8%	1.43	1.44
20220103	20230704	21.9%	0.9%	12.2%	12.1%	1.79	0.07
20230705	20250102	16.0%	8.1%	11.9%	13.8%	1.34	0.59
Mean		**15.1%**	**11.3%**	**14.3%**	**13.7%**	**0.85**	**0.51**
		WFE:	**74.7%**	**WFE:**	**95.7%**	**WFE:**	**59.8%**

7. Walk-Forward Analysis Summary

The above analysis shows that **regardless of the adopted combination of optimization and testing window lengths,** the **WFE results are very good:**

- **WFE for CAGR% remains around 60%-70%,** which indicates good performance of the strategy in real-world conditions.
- **The WFE for drawdown remains around 90%-105%,** which means that the strategy does not lose significant stability outside the optimization period.

Considering both **MAR** and **WFE,** the best results were achieved for **the combination of 2192/548 days** (2192 days of optimization, 548 days of testing).

Below is **a comparison of the WFA test results for the 2192/548 combination with the results of the strategy using the optimized parameters from step 4:**

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

	WFA	Optimized
CAGR%	10.7%	11.5%
MAR Ratio	0.48	0.54
Max Drawdown	22.2%	21.2%

The results are similar, which is a positive sign – it means that the strategy remains **stable** and **independent of overfitting to historical data.**

Step 6: Using the strategy in real time

After **extensive testing, implementing a real-time** investment strategy becomes **relatively simple. Buy/sell signals and stop loss orders are automatically generated** by the computer based on pre-established rules and formulas.

The most important element **of strategy execution** is **consistent execution of all signals, without exception. As Larry Williams noted:** *"Trading strategies work. Traders do not."*

Before making **a final decision to implement a strategy,** it's important to verify **whether it actually adds value** to the overall portfolio performance. It doesn't make sense to implement a strategy that **generates similar signals** or **has a similar equity curve.**

Key criteria for evaluating strategies before implementation:

1. **Daily return correlation**
   - The **lower the correlation** with other strategies, the better.
   - **Optimal values:** Correlation **close to zero or negative.**
2. **Reducing maximum drawdown**
   - If adding a strategy to a portfolio results in **a lower maximum drawdown,** this is **a strong positive signal.**
3. **Objective Function Improvement (MAR)**
   - If adding a strategy causes **the MAR to increase,** this indicates that **it has added value** to the portfolio.
4. **Better results in Monte Carlo simulation**
   - Monte Carlo simulation determines the potential **maximum drawdown.**
   - If Monte Carlo results **improve** after adding a strategy, this is **a strong positive signal.**

The above elements are often interrelated – usually **all** or **none of them are met.**

Once you decide to add a strategy to your portfolio, **the question arises:** *Should you implement the strategy immediately or is it better to wait?*

Some studies suggest **an incubation period** of **3-6 months,** during which:

- The strategy is **monitored** but **does not execute real transactions.**
- **Generated signals, positions and results** are observed to detect **potential anomalies.**

In our case, **the incubation period** lasts from the moment **the strategy is launched in a live environment** until **a drawdown occurs at approximately half the maximum drawdown** observed in historical data. **Only after this threshold is reached does the strategy begin to be used with real funds.**

Thanks to this:

- **We avoid investing real money in an untested environment.**
- **We wait for a drawdown to occur** before launching the strategy, which **reduces the risk of starting at an unfavorable moment.**

The final decision on its full implementation should be based on **thorough testing and analysis of the value added to the portfolio,** so that the strategy actually supports long-term investment goals and does not increase unnecessary risk.