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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.

ATR Ignition v.4

Investment Strategy Testing Summary

The ATR Ignition strategy is a **trend following trading technique** developed by Larry Connors that is based on **price breakouts above historical volatility as measured by the ATR** (Average True Range) indicator. The strategy aims to capture strong market moves that occur after key volatility levels are broken – situations where **the market emerges from a low volatility phase and initiates a new directional impulse.**

Compared to ATR Ignition v.2, this strategy has been expanded to include the **Inside Day candlestick pattern,** described by Toby Crabel, which **requires that the price range of the candle preceding the breakout be within the price range of the previous day**. The addition of this element should strengthen the strategy's effectiveness, as periods **of low volatility** statistically often **precede dynamic price movements.**

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

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

The ATR Ignition strategy is a trend following investment technique developed by Larry Connors, based on **price breakouts above historical volatility measured by the ATR** (Average True Range) indicator. In the analyzed version, the strategy was expanded to include the **Inside Day candlestick formation,** described by Toby Crabel, which requires that **the price range of the candle preceding the breakout be within the price range of the previous day.** Adding this element should enhance the strategy's effectiveness, as periods **of low volatility** statistically often **precede dynamic price movements.**

The strategy aims to capture strong market moves that occur after key volatility levels are breached – situations where **the market emerges from a phase of low volatility and initiates a new directional impulse.**

For the purposes of the test, the daily volatility of financial instruments was used, analyzing moments in which **the price breaks above or below the last close by a value equal to a multiple of the ATR (e.g. 150%). However, this** breakout must occur in **the direction of the long-term trend** (measured by the moving average) and must be preceded by an **Inside Day candle.**

The strategy uses:

- **Average volatility (ATR)** to determine the level of order activation (breakout);
- **Buy stop and sell stop orders** activated above/below the previous day's close;
- **Stop loss order** set one tick below (for a long position) or above (for a short position) the last candle;
- **Following the dominant trend** defined by the long-term moving average;
- **Mechanism of closing positions** when the trend changes.

Why can a volatility breakout be effective? A breakout above a certain volatility level means that the market is breaking through a barrier of "natural price noise." In situations where prices move too quickly by historical standards, a strong trend is often initiated—investors and algorithms respond to increased activity, volume, and breaks of psychological support and resistance levels. Relative volatility strategies like ATR Ignition don't try to predict market direction, but rather respond to market dynamics—making them immune to forecast bias and well-suited to momentum environments.

Characteristics of the strategy and its strengths and weaknesses:

- **Directional neutrality** – allows you to react to movements in both directions without predetermining the direction of the breakout.
- **Volatility-based** – adapts better to current market conditions than strategies with fixed price thresholds.
- **Defined risk level** – strict stop loss limits potential losses.
- **Lack of directional prediction** – strategy is based on reaction to movement, not prediction.
- **Potential false breakouts** – losses may occur in the event of short-term movements without continuation (so-called false breakouts).
- **Playing with the trend** – transactions are opened only in the direction of the dominant trend.
- **Sensitivity to the ATR parameter** – the threshold value (e.g. 150%) should be adjusted to the instrument and the market environment.

ATR Ignition is a strategy that, despite its simplicity, provides access to an effective breakout trading mechanism. **Its strength lies in its reactivity to market behavior and its ability to adapt to current volatility conditions.** However, it requires careful calibration and conscious risk management, especially in the environment of false price signals.

Step 2: Define investment principles

Below is **the pseudocode** for the **ATR Ignition v.4 strategy** on daily data:

1. **Calculating Indicators:**
   a. **ATR-N-day –** used to determine order activation levels.
   b. **The previous day's closing price** – reference base for setting stop orders.
   c. **X-day moving average (SMA)** – determines the dominant trend in a given instrument.

2. **Generating Entry Signals (at the start of the day):**
   a. **Each day, designate:**
      i. Buy stop = Previous day's closing price + K * ATR
      ii. Sell stop = Previous day's closing price - K * ATR
      where K is the ATR multiplier (e.g. 1.5, i.e. 150% ATR).
   b. **Trend direction condition:**
      i. We set a buy stop only if the previous day's low > SMA-X (uptrend).
      ii. We set a sell stop only if the previous day's high < SMA-X (downtrend).
   c. **Condition (Inside Day):**
      i. We only set a buy stop if the price range of yesterday's candle was within the price range of the day before yesterday.
      ii. a sell stop if the price range of yesterday's candle was within the price range of the day before yesterday.
   d. **Set an appropriate pending order (buy stop or sell stop).**

3. **Position Opening Rules:**
   a. **Long position:**
      i. If the market price rises to the buy stop level, a long position will be opened.
      ii. Set your stop loss one tick below the low of the previous day's candle.
   b. **Short position:**
      i. If the market price falls to the sell stop level, a short position will be opened.
      ii. Set your stop loss one tick above the high of the previous day's candle.

4. **Generating Exit Signals –** the position is closed when any of the following conditions is met:
   - Activation of stop loss order (original),
   - Price violates SMA-X:
      i. for long position: if low < SMA-X;
      ii. for short position: if high > SMA-X.

5. **Daily Monitoring –** every day:
   - Calculate ATR and update order activation levels based on last close.
   - Calculate SMA and update defense order.
   - Verify if a breakout up or down has occurred.
   - Set new orders, cancel outdated ones.

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 performed assuming that **the risk of one position corresponds to 0.5% of the total capital.**

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 cocoa futures contract. At the beginning of August 2010 (the first candle in the left-hand rectangle), **the ATR(10) volatility was $74.89, the closing price that day was $807, and we set the ATR multiplier at 150%.** Furthermore, this candle is **an Inside Day** (it is within the previous day's price range). Since the quotes are in a downtrend (below the 200-day moving average), we set a **sell stop order the next day at $694** ($807 - 150% x 74.89; rounded). **The order was filled** (the second candle in the left-hand rectangle) and a short position was opened (taking into account slippage, the execution price was $692).

Stop loss (red steps) **was set tick above the high of the candle from the day preceding the opening of the position.** However, it should be noted that after a few days, our **stop loss starts to follow the market,** because **its level is set at the lower of two values:** 1) the high of the candle from the day preceding the opening of the position; 2) the level of the moving average. At the beginning of December 2010, the moving stop loss was activated (candle in the rectangle on the right) and **the position was closed. The system worked correctly.**

The second transaction was made on a futures contract for the DAX index. In mid-June 2019 (the first candle in the rectangle on the left), **the ATR(10) volatility was 132 points, the closing price that day was 13777, and**

we set the ATR multiplier at 150%. In addition, this candle is **Inside Day** (it is within the price range of the previous day). Since the quotes are in an upward trend (above the 200-day moving average), the next day we set a **buy stop order at 13975** (13777 + 150% x 132; rounded). **The order was executed** (second candle in the rectangle on the left) and a long position was opened (taking into account slippage, the execution price was 13980).

Stop loss (red steps) **was set tick below the low of the candle from the day before the position was opened.** After a dozen or so days, our original stop loss order was activated (candle in the rectangle on the right) and **the position was closed. 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 base parameters,** which in my opinion 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:

- **Distance of buy/sell order from last closing price:** 150% ATR;
- **ATR lengths:** 10 days;
- **Moving average:** 200 days;
- **Inside Day:** 1 day;
- **Stop loss:** for long position, tick below the minimum of the candle preceding the day the position was opened; for a short position, tick above the maximum of the candle preceding the day the position was opened;
- **Trailing stop loss:** moving average;
- **How to open a position:** buy stop/sell stop order;
- **Position size:** corresponding to a risk of 0.5% of total capital;
- **Position direction:** long (buy) and short (sell) positions.

The test result is shown below.

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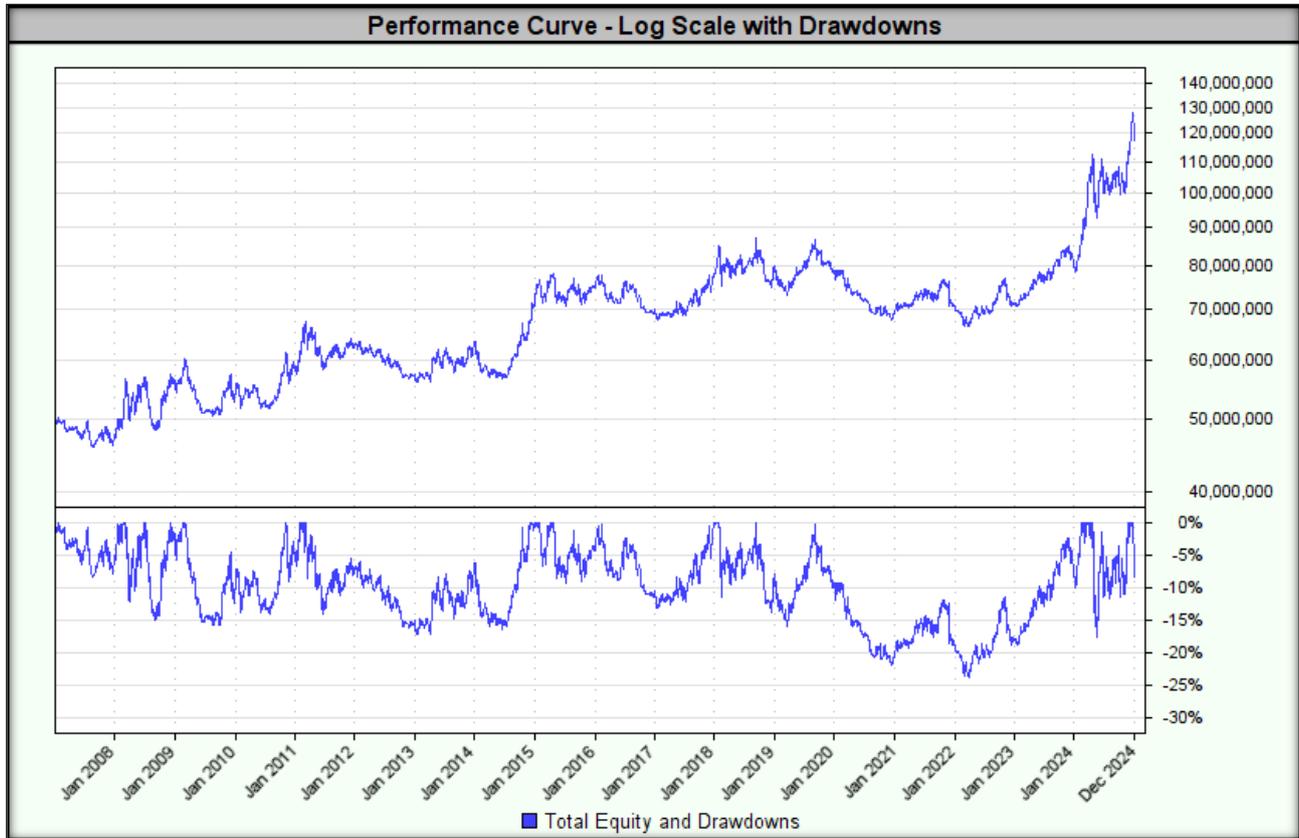
Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.

Indicators/Measures	Concluding a transaction at the opening price
CAGR%	5.1%
MAR Ratio	0.22
RAR%	3.1%
R-Cubed	0.08
Robust Sharpe Ratio	0.27
Max Drawdown	23.7%
Wins	17.8%
Losses	82.2%
Average Win%	3.83%
Average Loss%	0.51%
Win/Loss Ratio	7.52
Average Trade Duration (days)	80
Percent Profit Factor	1.63
SQN	0.37
Number of transactions	427

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 consideration 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**

Ignition v.4 Strategy in this version it assumes **optimizing the parameters proposed by the creator of the strategy, Larry Connors, and optimizing the parameter for the moving average** that filters out transactions that are not in line with the dominant trend. **Inside Day,** which requires that the price range of the candle preceding the breakout be within the price range of the previous day, is not optimized.

The Grid Search method, which involves **full optimization of all specified 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 parameters on **in-sample data.** For this purpose, we determine **the ranges of parameter values** so that **the quotient of the highest and lowest value of the range is at least 150%.**

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

- **ATR lengths:** range **15-25 days (step: 1);**
- **Distance of buy/sell order from last closing price:** range **120%-180% ATR (step: 5 pp.);**
- **Moving average:** range **190-280 days (step: 5).**

The lowest MAR value of 0.15 was achieved for the following parameters:
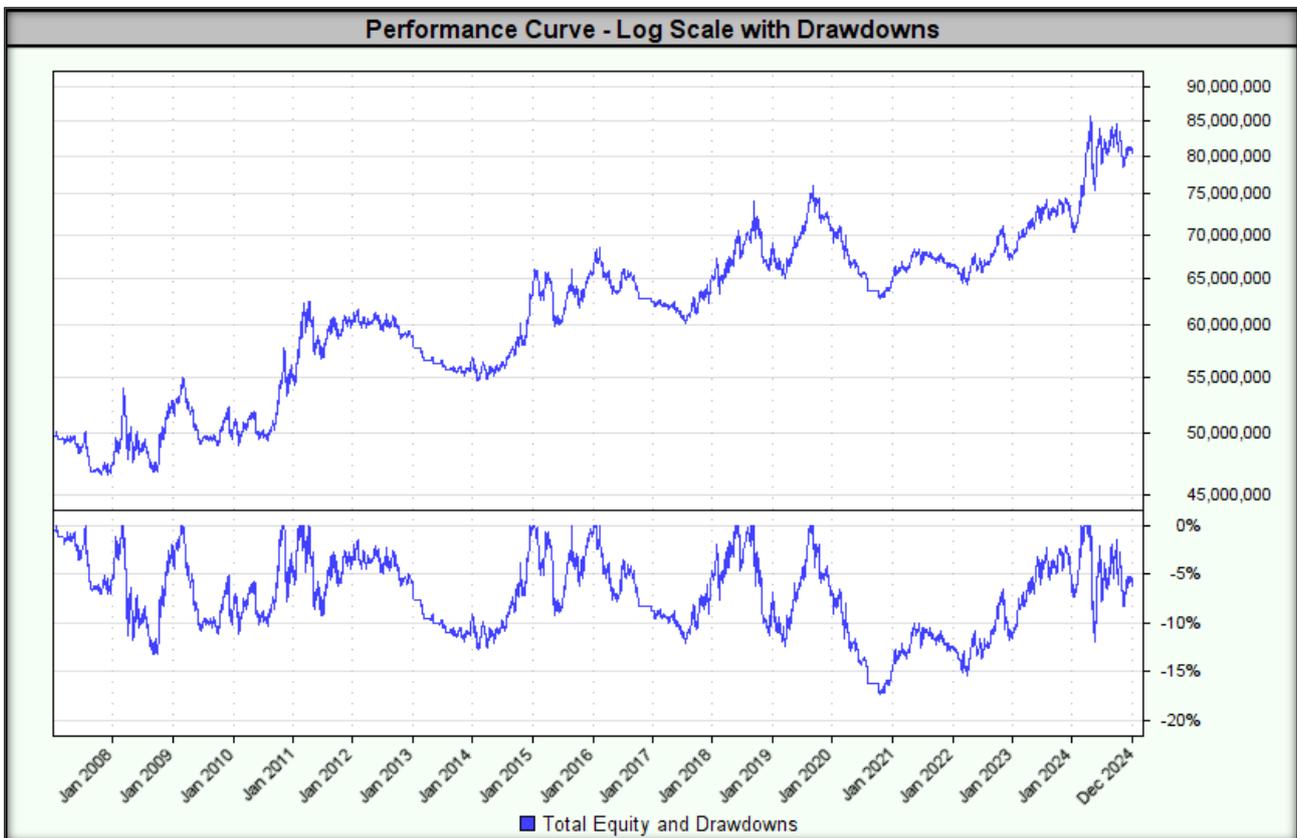
- **ATR lengths:** 24 days;
- **Distance of buy/sell order from last closing price:** 170% ATR;
- **Moving average:** 195 days.

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

Test	ATR Bars	ATR Multiplier (%)	Moving Average (bars)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3	RAR [%]
2415	24	170%	195	$80,333,824.97	2.67%	0.15	0.38	0.42	17.3%	53.7	260	0.08	2.43
1427	20	170%	195	$80,724,238.48	2.70%	0.16	0.39	0.41	17.4%	54.3	262	0.07	2.39
2168	23	170%	195	$80,722,717.00	2.70%	0.16	0.39	0.42	17.3%	53.7	259	0.08	2.46
2662	25	170%	195	$80,847,378.62	2.71%	0.16	0.39	0.43	17.3%	53.7	258	0.08	2.51
1921	22	170%	195	$81,190,582.77	2.73%	0.16	0.39	0.43	17.3%	53.7	258	0.08	2.46
1674	21	170%	195	$81,243,392.94	2.73%	0.16	0.39	0.43	17.3%	54.3	257	0.08	2.50
686	17	170%	195	$81,362,149.29	2.74%	0.17	0.39	0.45	16.5%	54.3	262	0.08	2.41
933	18	170%	195	$82,641,891.57	2.83%	0.17	0.40	0.48	16.9%	54.3	263	0.08	2.50
1845	22	150%	195	$100,564,625.24	3.96%	0.17	0.40	0.41	23.5%	61.2	417	0.08	3.02
2092	23	150%	195	$100,565,894.33	3.96%	0.17	0.40	0.41	23.4%	62.2	416	0.08	3.08

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 0.46 was achieved for the following parameters:

- **ATR lengths:** 25 days;
- **Distance of buy/sell order from last closing price:** 120% ATR;
- **Moving average:** 225 days.

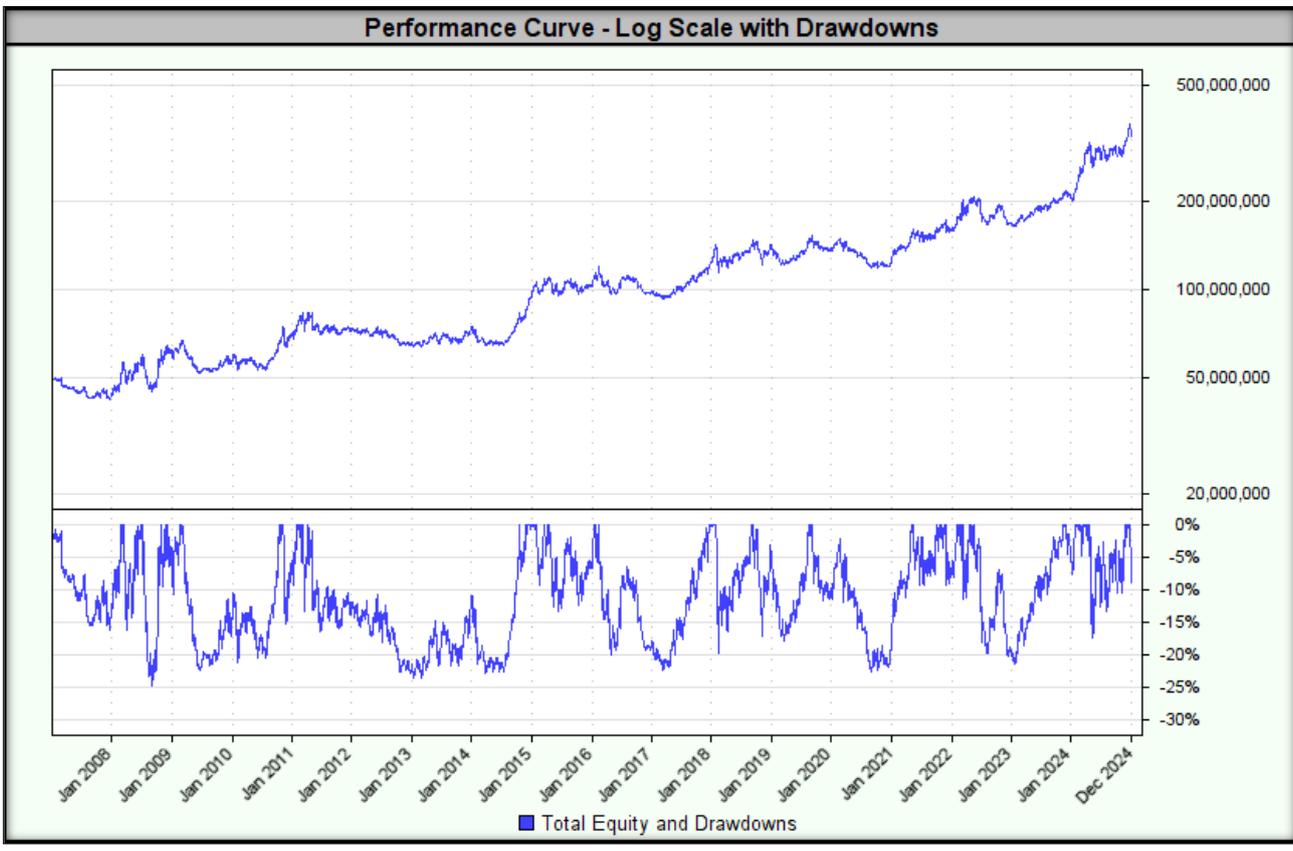**The highest MAR value** was accompanied by **a drawdown of 24.8%.**

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

Test	ATR Bars	ATR Multiplier (%)	Moving Average (bars)	End Balance	CAGR%	MAR ▽	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3	RAR [%]
2478	25	120%	225	$346,927,758.88	11.36%	0.46	0.69	0.57	24.8%	42.2	695	0.24	9.56
996	19	120%	225	$345,614,652.49	11.34%	0.46	0.68	0.56	24.7%	42.2	705	0.22	9.50
502	17	120%	225	$336,670,613.47	11.18%	0.46	0.68	0.55	24.4%	42.2	712	0.22	9.48
2231	24	120%	225	$345,161,925.45	11.33%	0.46	0.69	0.57	24.8%	42.2	696	0.23	9.55
1984	23	120%	225	$341,170,635.36	11.26%	0.45	0.68	0.57	24.9%	42.2	694	0.24	9.56
1737	22	120%	225	$340,643,216.40	11.25%	0.45	0.68	0.57	24.9%	42.2	695	0.24	9.55
8	15	120%	225	$334,147,944.08	11.13%	0.45	0.67	0.54	24.8%	42.2	718	0.23	9.36
1490	21	120%	225	$335,968,573.89	11.16%	0.45	0.68	0.57	24.9%	43.6	698	0.23	9.41
749	18	120%	225	$335,102,480.67	11.15%	0.45	0.67	0.55	24.8%	42.2	712	0.22	9.29
255	16	120%	225	$329,117,278.49	11.04%	0.45	0.67	0.54	24.8%	42.2	717	0.22	9.28

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.

Performance Curve - Log Scale with Drawdowns

For all combinations of tested parameter ranges, **the highest drawdown was 33.5%.**

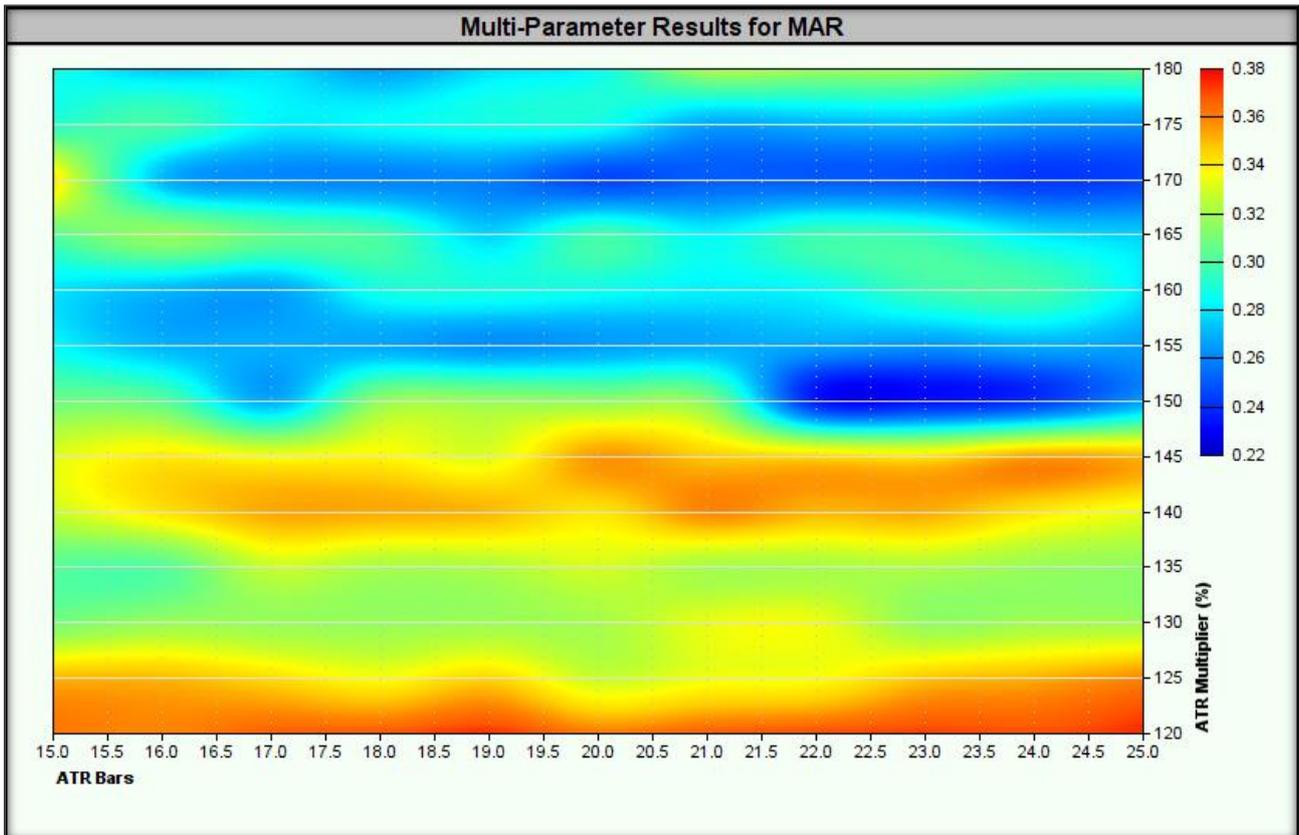*Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.*

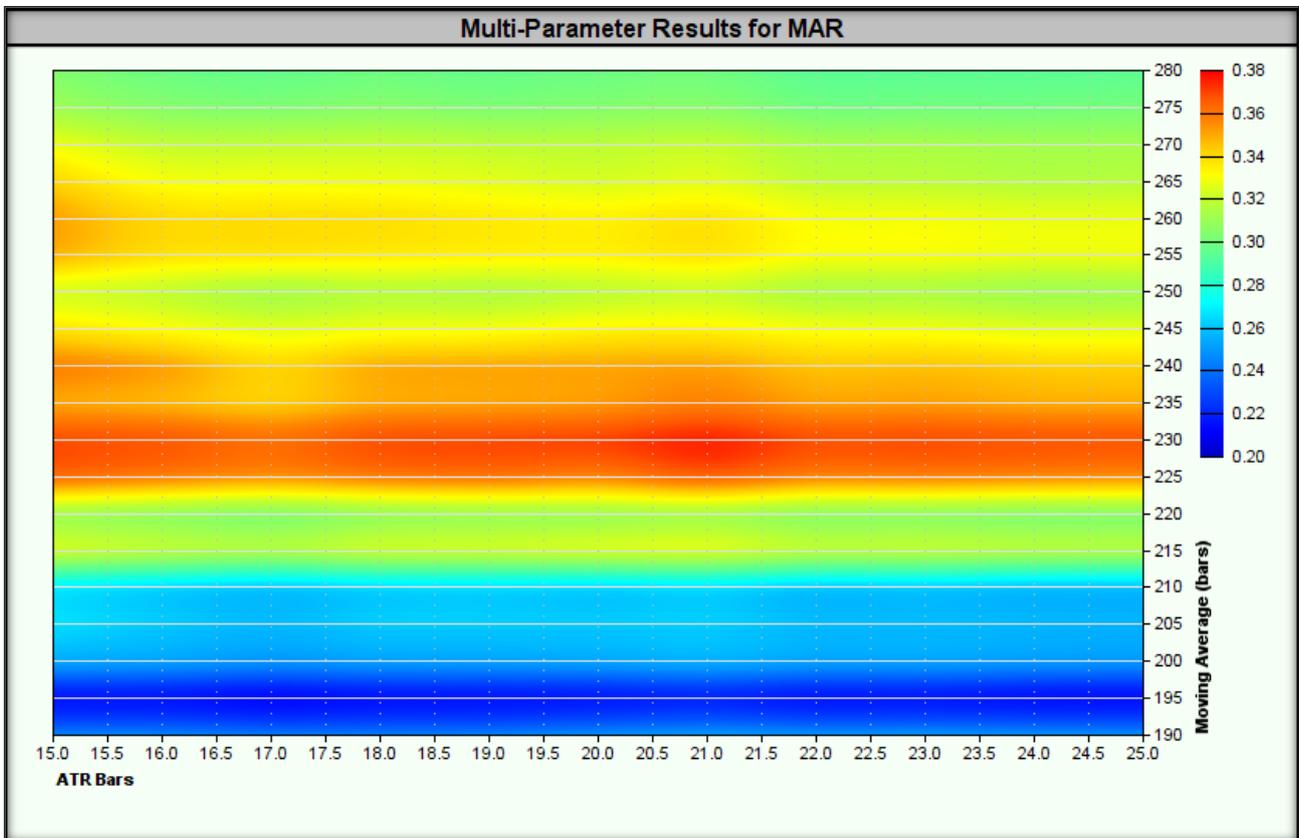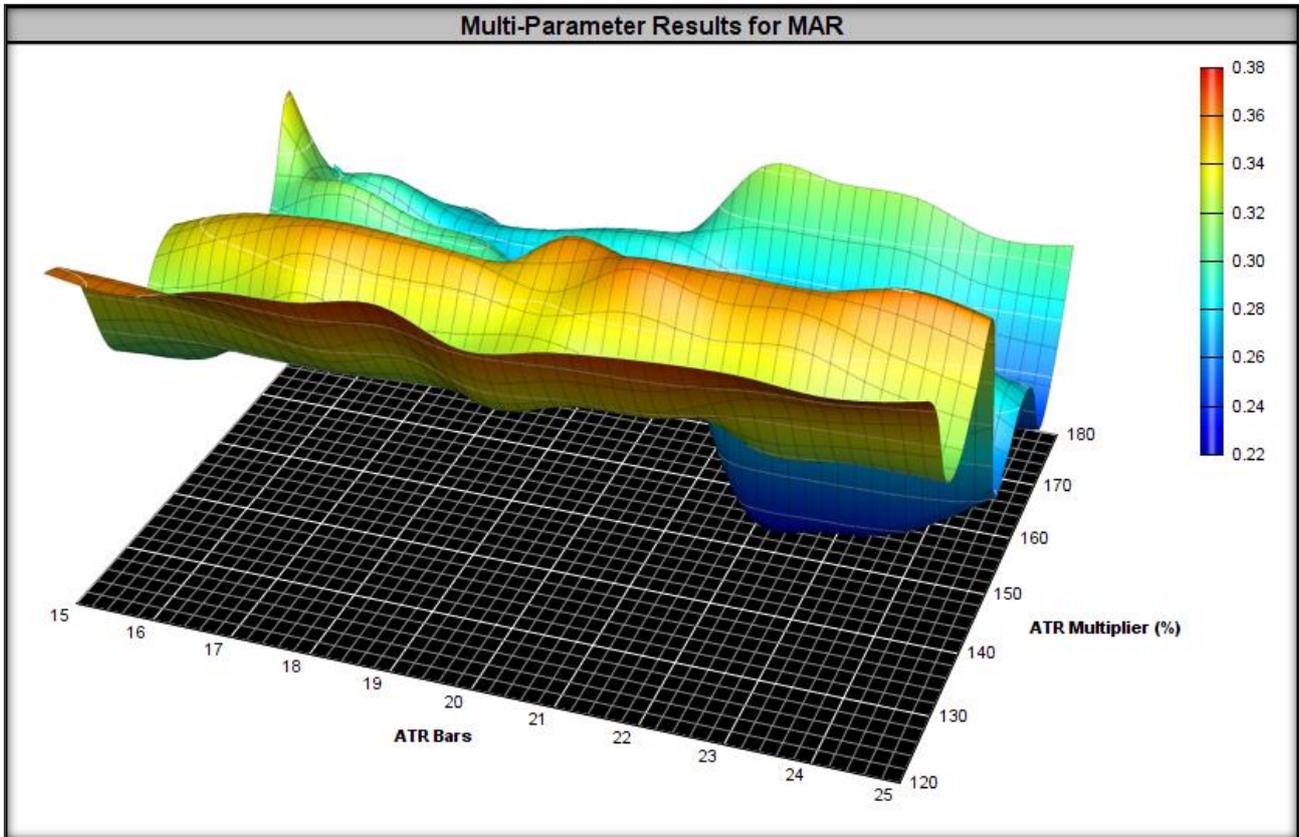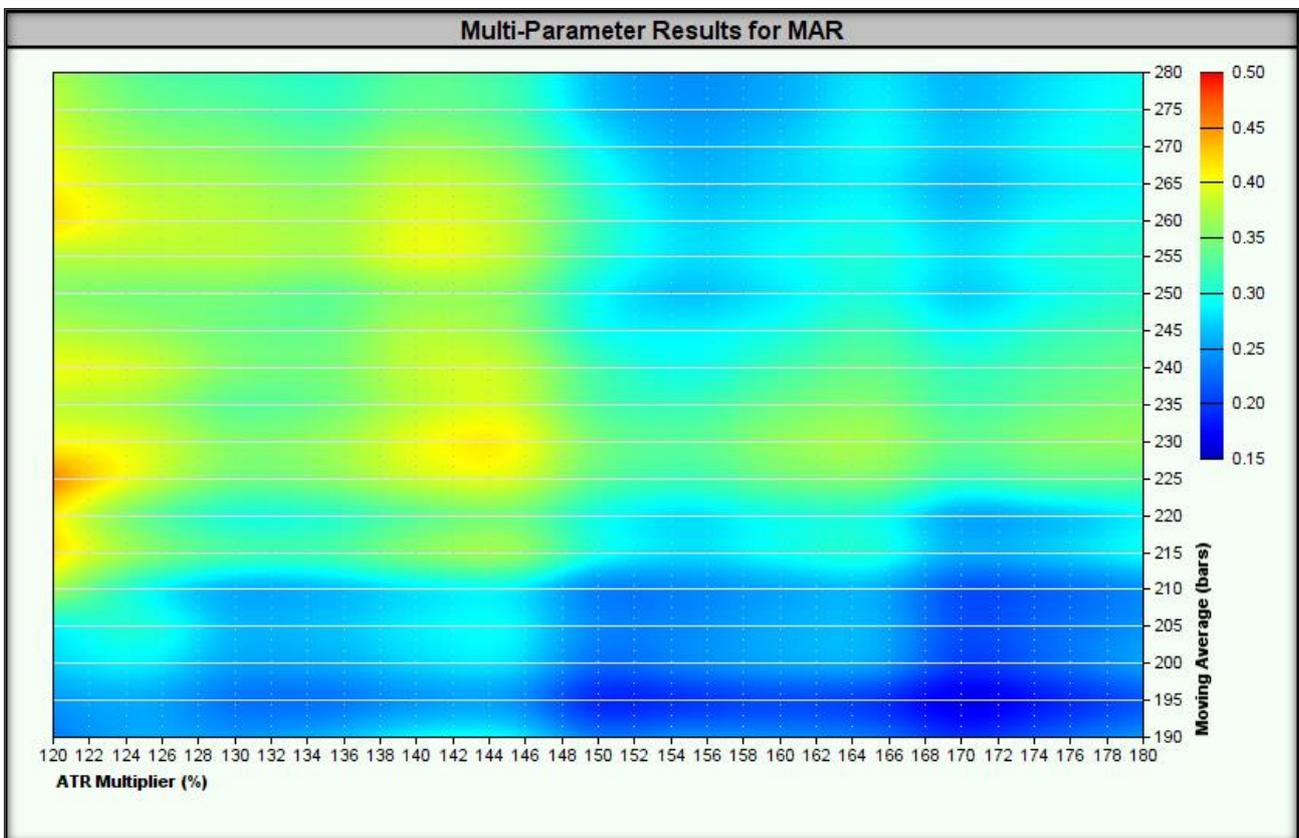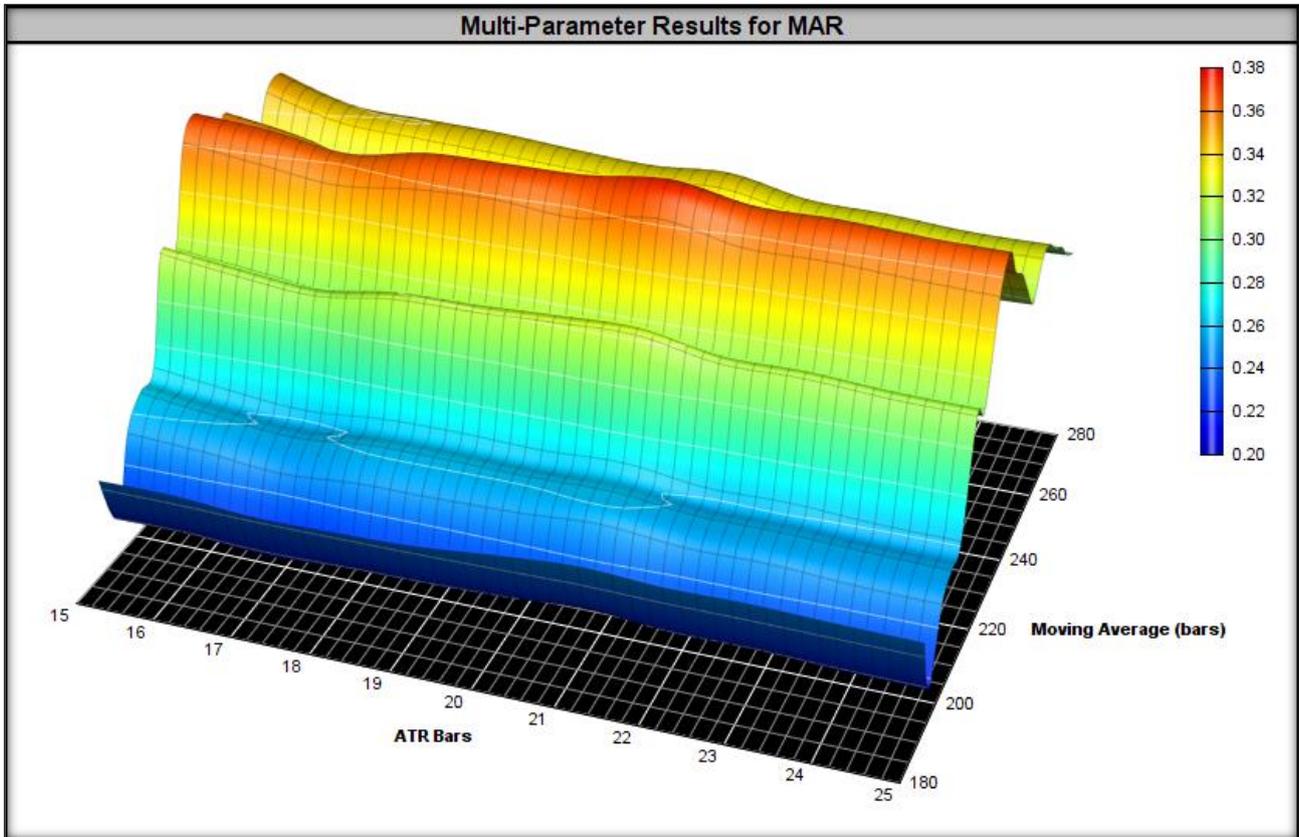| Test	ATR Bars	ATR Multiplier (%)	Moving Average (bars)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD ▽	Longest DD	Trades	R3	RAR [%]
779	18	125%	280	$312,472,345.53	10.72%	0.32	0.66	0.51	33.5%	43.6	631	0.19	8.95
742	18	120%	190	$187,273,020.70	7.61%	0.23	0.51	0.51	33.4%	45.3	743	0.16	7.25
38	15	125%	280	$322,309,111.94	10.91%	0.33	0.67	0.52	33.2%	43.6	631	0.19	8.96
778	18	125%	275	$326,997,656.89	11.00%	0.33	0.68	0.53	33.2%	43.6	628	0.20	9.32
248	16	120%	190	$183,663,573.74	7.50%	0.23	0.51	0.49	33.2%	45.2	749	0.15	7.23
495	17	120%	190	$188,114,868.71	7.64%	0.23	0.52	0.50	33.1%	45.1	743	0.16	7.43
285	16	125%	280	$319,899,023.46	10.86%	0.33	0.67	0.52	33.1%	43.6	630	0.19	8.95
532	17	125%	280	$314,397,564.10	10.76%	0.32	0.66	0.51	33.1%	43.6	631	0.19	8.98
989	19	120%	190	$191,562,529.22	7.75%	0.23	0.52	0.52	33.0%	45.2	737	0.16	7.40
1026	19	125%	280	$315,046,853.72	10.77%	0.33	0.66	0.51	33.0%	43.6	629	0.19	9.01

In summary, the strategy **passed the stability test** over a wide range of optimized parameters on in-sample data because:
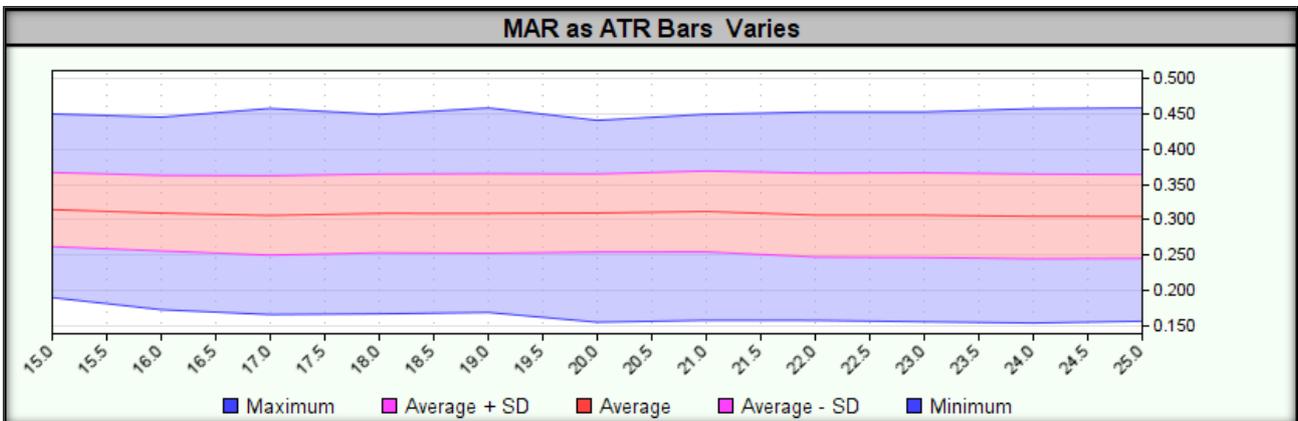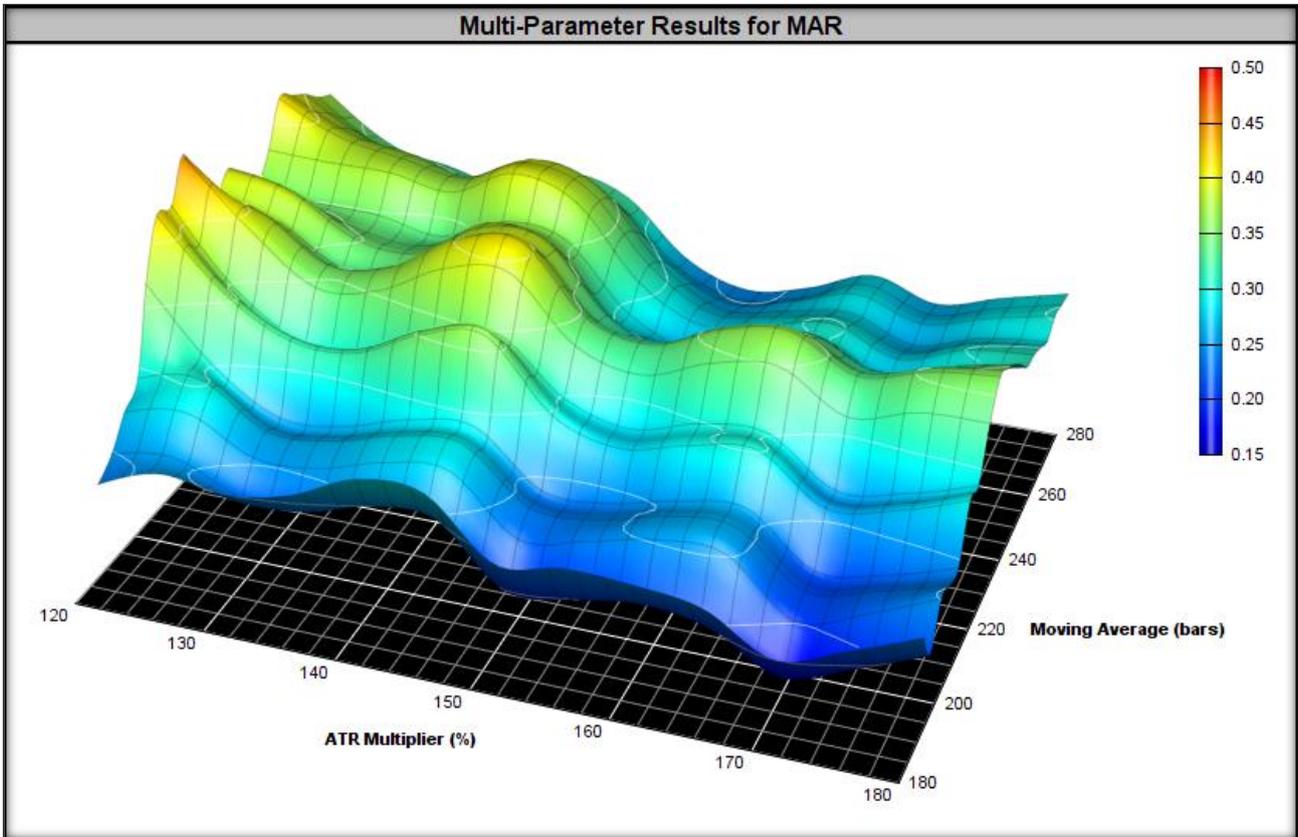
- **All test results showed a positive MAR value** – which indicates the stability of the strategy in various market conditions.
- **The maximum drawdown did not exceed 250% of the drawdown value** for the result with the highest MAR (**33.5 % vs. 24.8 %**) – which means an acceptable risk of deep capital drawdowns.
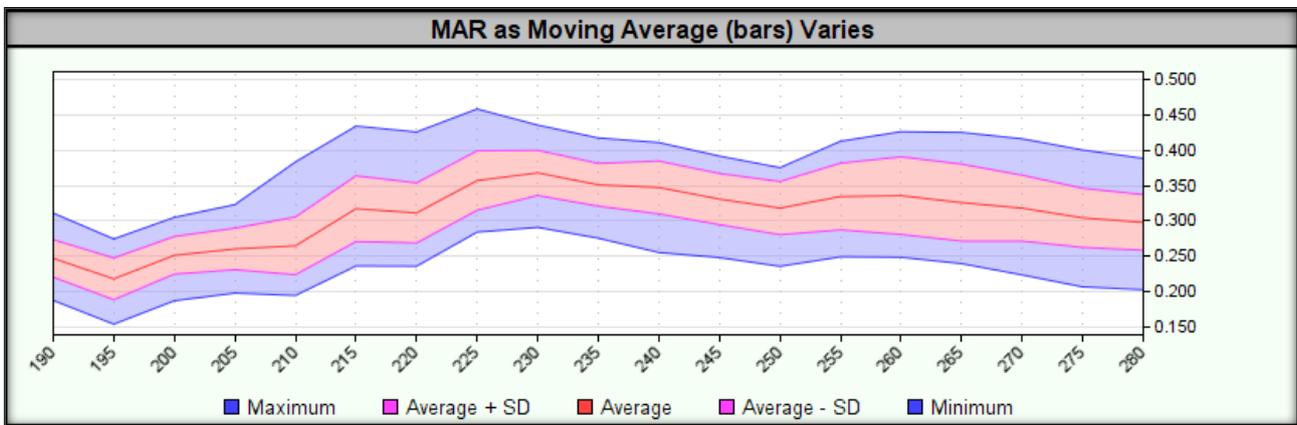
Heatmaps for the tested ranges are presented below.

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

MAR as ATR Bars Varies

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

MAR as ATR Multiplier (%) Varies

Legend: Maximum, Average + SD, Average, Average - SD, Minimum

MAR as Moving Average (bars) Varies

Legend: Maximum, Average + SD, Average, Average - SD, Minimum

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:

- **ATR lengths:** range **15-25 days (step: 1);**
- **Distance of buy/sell order from last closing price:** range **120%-180% ATR (step: 5 pp.);**
- **Moving average:** range **190-280 days (step: 5).**

The lowest MAR value of -0.05 was achieved for the following parameters:

- **ATR lengths:** 25 days;
- **Distance of buy/sell order from last closing price:** 175% ATR;
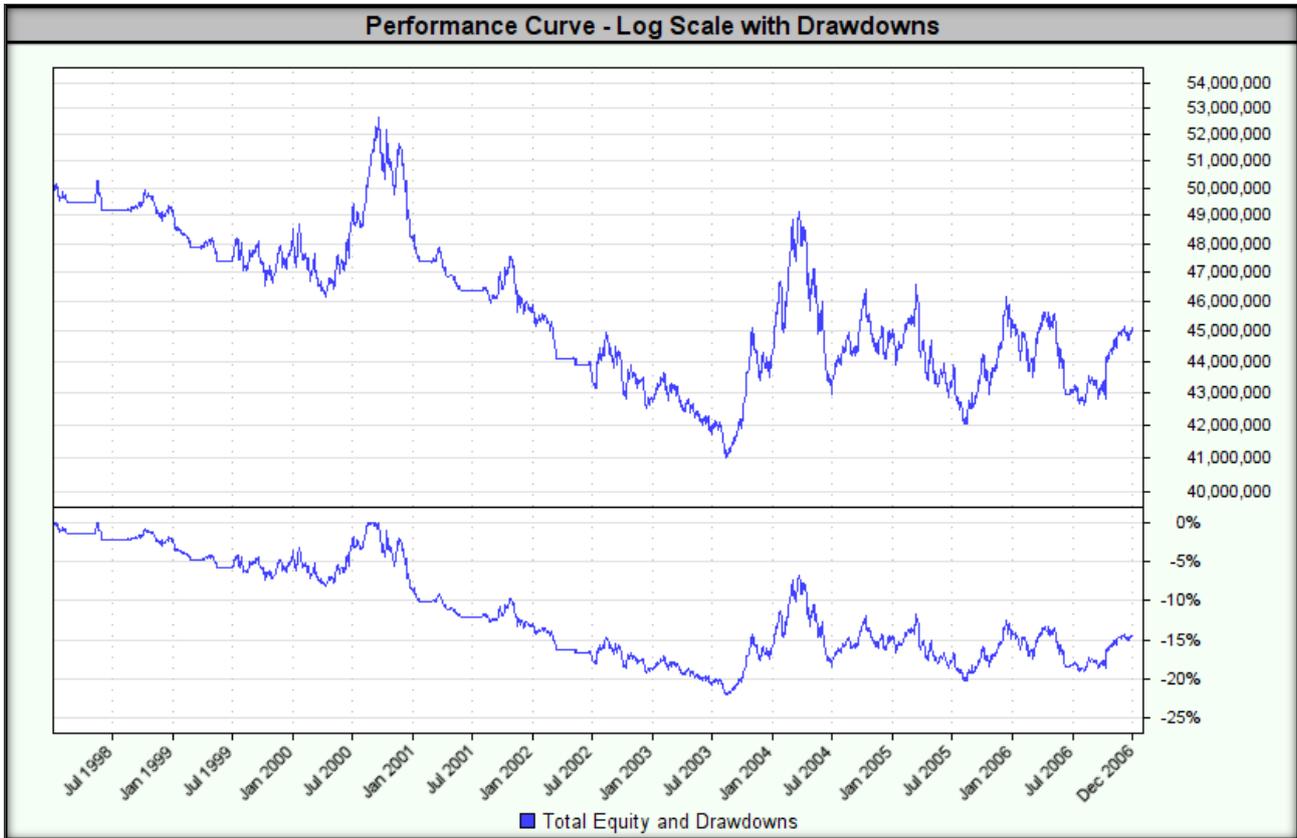- **Moving average:** 205 days.

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

Test	ATR Bars	ATR Multiplier (%)	Moving Average (bars)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3	RAR [%]
2683	25	175%	205	$45,099,601.01	-1.14%	-0.05	-0.14	-0.40	22.1%	75.3	115	-0.17	-1.68
726	17	180%	205	$44,990,007.35	-1.17%	-0.05	-0.15	-0.37	22.7%	75.3	112	-0.18	-1.75
725	17	180%	200	$45,257,939.20	-1.10%	-0.05	-0.14	-0.35	22.6%	75.3	112	-0.17	-1.68
2684	25	175%	210	$45,615,635.85	-1.02%	-0.05	-0.12	-0.37	21.2%	75.3	113	-0.16	-1.52
727	17	180%	210	$45,541,837.63	-1.03%	-0.05	-0.13	-0.34	21.7%	75.3	110	-0.16	-1.59
723	17	180%	190	$45,260,839.31	-1.10%	-0.05	-0.15	-0.32	23.2%	75.3	112	-0.18	-1.82
973	18	180%	205	$45,507,037.95	-1.04%	-0.05	-0.13	-0.33	22.3%	75.3	110	-0.16	-1.58
2436	24	175%	205	$45,917,322.33	-0.94%	-0.05	-0.11	-0.35	20.6%	75.3	115	-0.14	-1.38
2433	24	175%	190	$45,738,111.95	-0.99%	-0.04	-0.12	-0.31	22.0%	75.3	116	-0.16	-1.62
2435	24	175%	200	$45,917,934.28	-0.94%	-0.04	-0.11	-0.33	21.1%	75.3	115	-0.14	-1.40
972	18	180%	200	$45,766,643.67	-0.98%	-0.04	-0.12	-0.31	22.2%	75.3	110	-0.15	-1.51

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.

Performance Curve - Log Scale with Drawdowns

Total Equity and Drawdowns

The highest MAR value of 0.43 was achieved for the following parameters:

- **ATR lengths:** 16 days;
- **Distance of buy/sell order from last closing price:** 120% ATR;
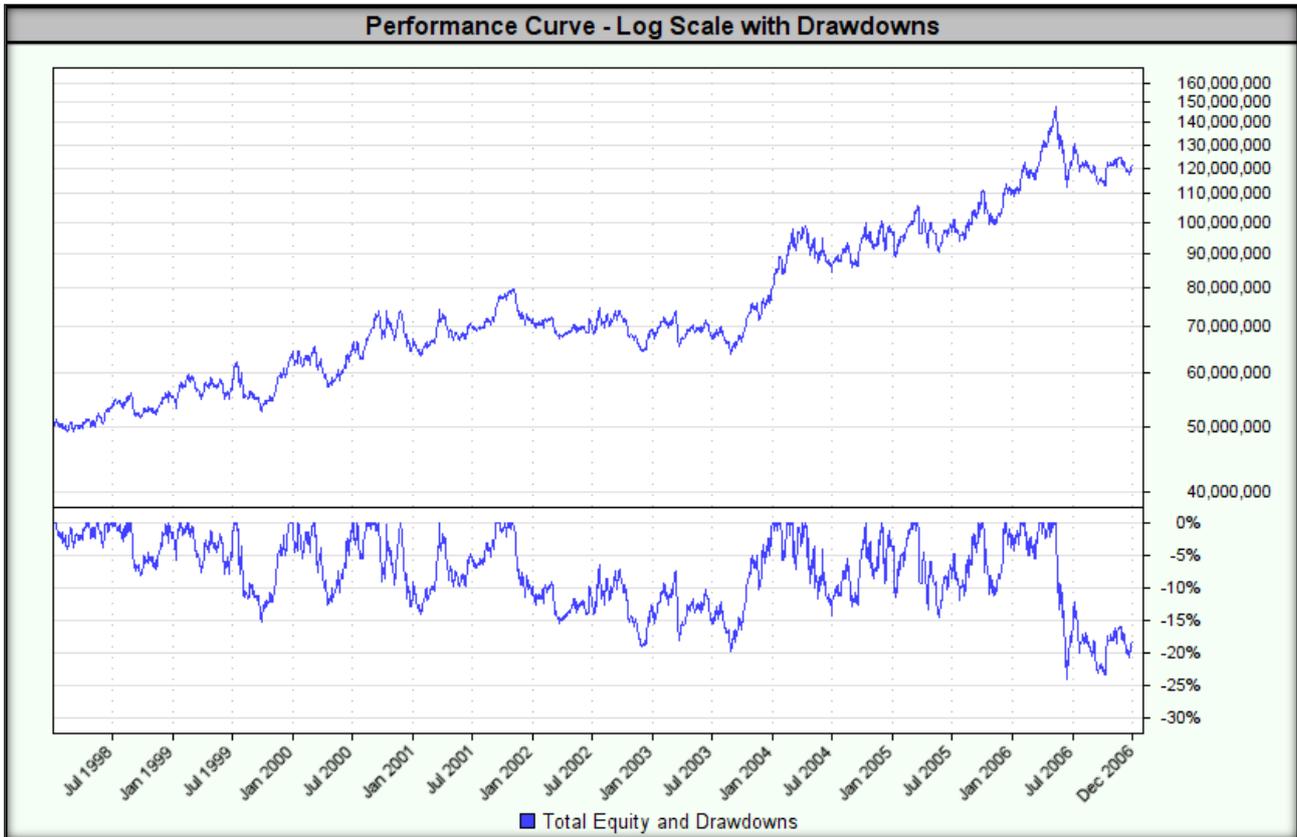- **Moving average:** 230 days.

The highest MAR value was accompanied by **a drawdown of 24.1%.**

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

Test	ATR Bars	ATR Multiplier (%)	Moving Average (bars)	End Balance	CAGR%	MAR ▽	Sharpe	Ann. Sharpe	Max TE DD	Longest DD	Trades	R3	RAR [%]
256	16	120%	230	$120,949,019.55	10.32%	0.43	0.67	1.48	24.1%	25.9	355	0.75	9.73
9	15	120%	230	$120,583,432.37	10.29%	0.43	0.67	1.49	24.1%	25.9	356	0.76	9.73
255	16	120%	225	$118,669,830.30	10.09%	0.42	0.66	1.26	23.9%	26.1	358	0.67	9.25
253	16	120%	215	$115,066,385.53	9.71%	0.42	0.65	1.20	23.1%	26.1	360	0.55	8.59
8	15	120%	225	$118,255,685.29	10.05%	0.42	0.66	1.26	24.0%	26.1	359	0.70	9.24
6	15	120%	215	$114,705,657.85	9.68%	0.42	0.64	1.20	23.1%	26.1	361	0.57	8.58
257	16	120%	235	$118,112,405.89	10.03%	0.41	0.65	1.48	24.3%	25.9	354	0.67	9.48
254	16	120%	220	$115,736,724.34	9.78%	0.41	0.64	1.23	23.8%	26.1	361	0.63	8.85
10	15	120%	235	$117,739,288.09	9.99%	0.41	0.65	1.49	24.3%	25.9	355	0.68	9.48
7	15	120%	220	$115,337,983.99	9.74%	0.41	0.64	1.24	23.8%	26.1	362	0.64	8.84
14	15	120%	255	$124,055,723.42	10.64%	0.41	0.67	1.77	26.1%	23.9	344	0.88	11.01

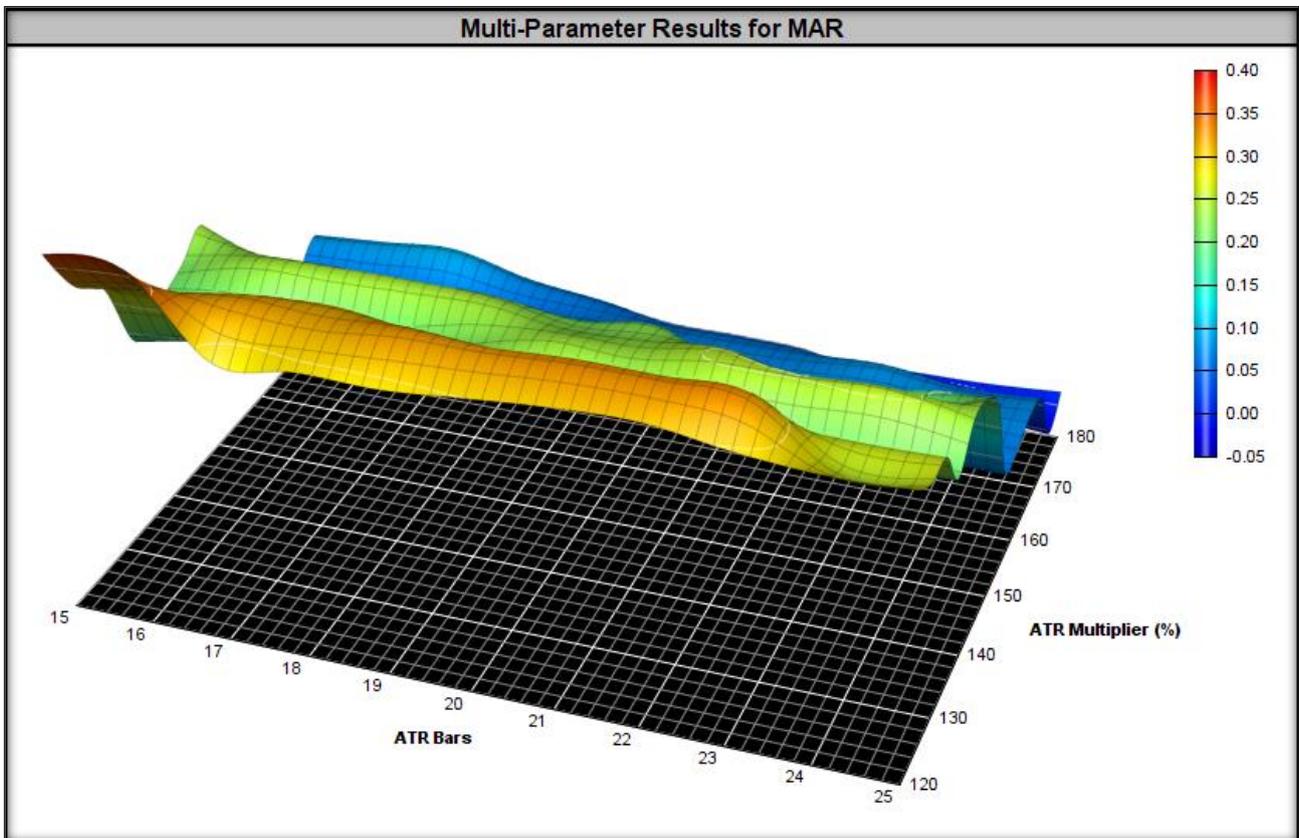Below is a graph of the equity curve for **the strategy with the highest MAR.**

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

Performance Curve - Log Scale with Drawdowns

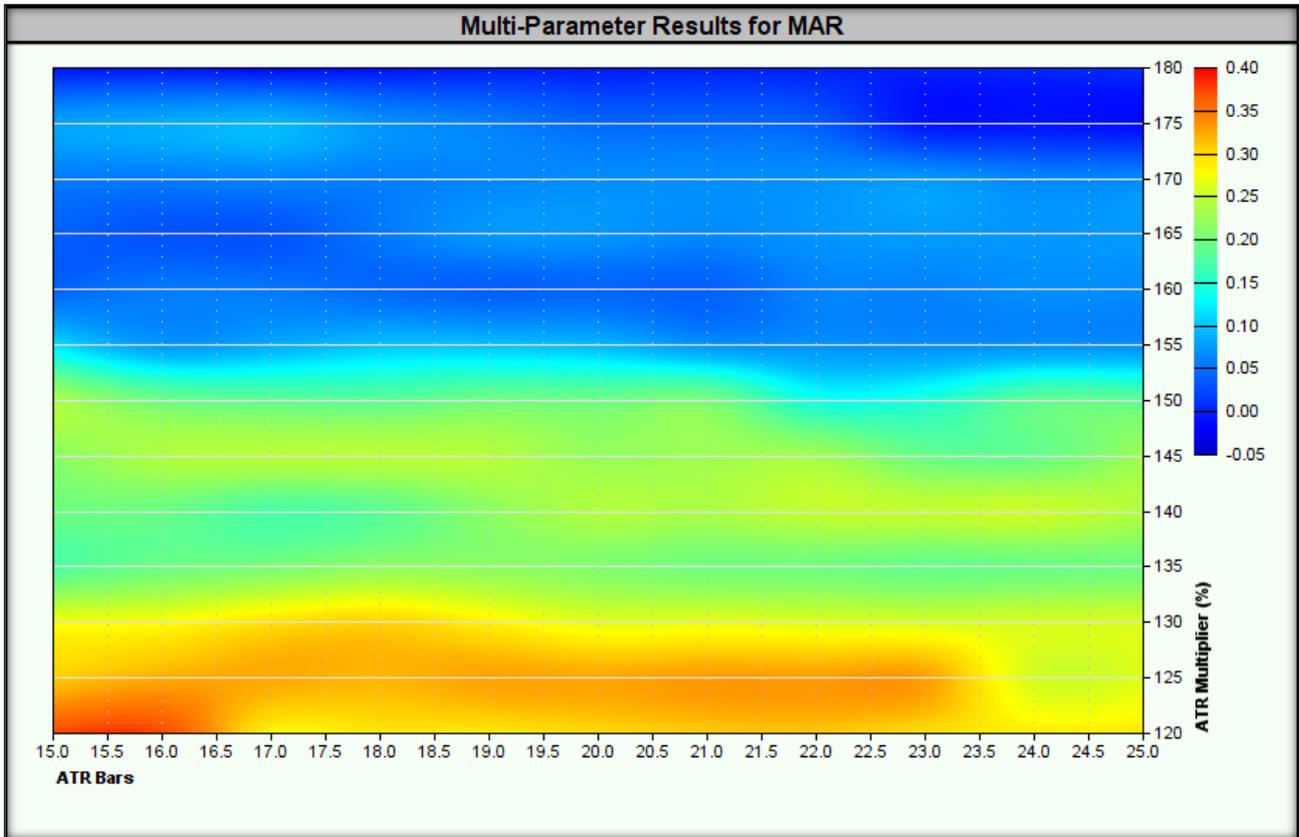For all combinations of tested parameter ranges, **the highest drawdown was 28.3%.**

Historical or simulated results do not guarantee that similar outcomes will be achieved in the future.
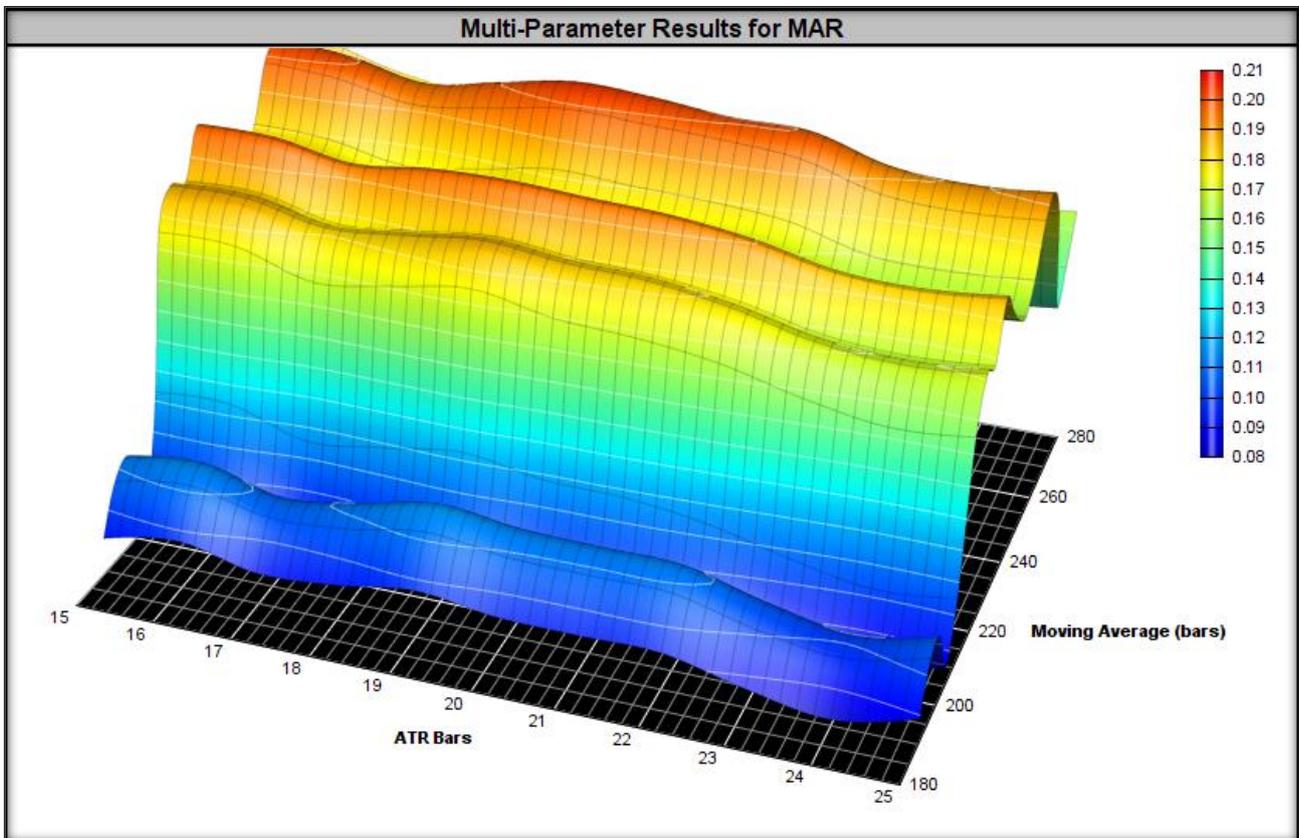
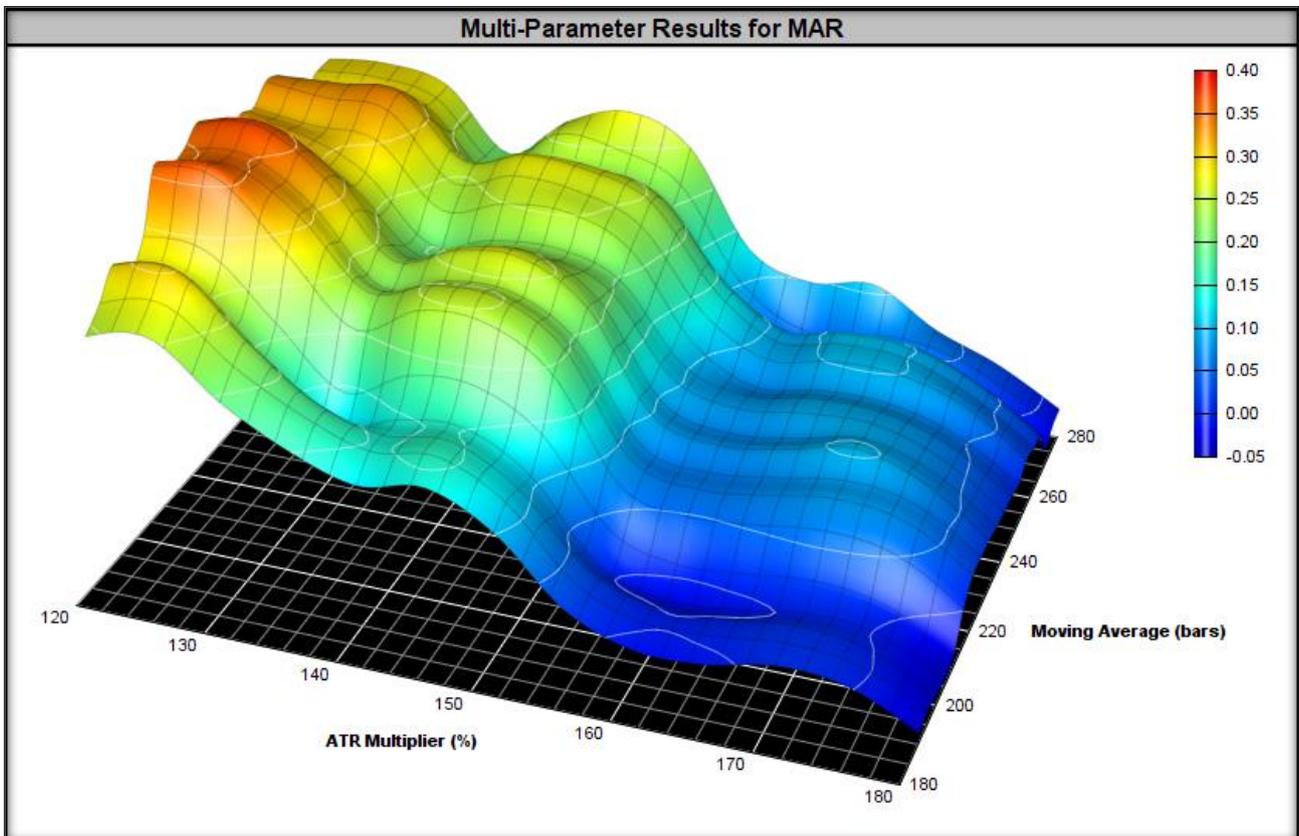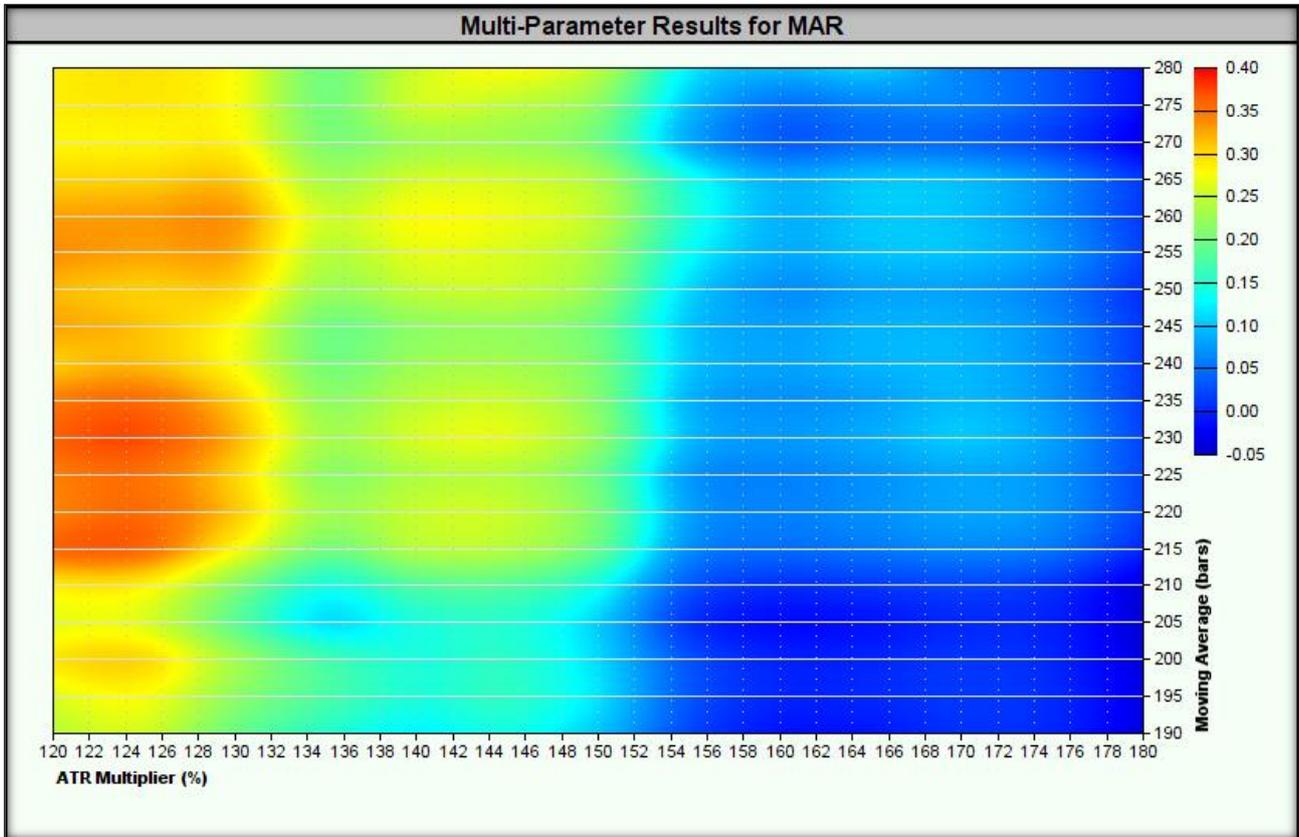| Test	ATR Bars	ATR Multiplier (%)	Moving Average (bars)	End Balance	CAGR%	MAR	Sharpe	Ann. Sharpe	Max TE ... ▽	Longest DD	Trades	R3	RAR [%]
506	17	120%	245	$105,472,241.63	8.66%	0.31	0.56	1.20	28.3%	23.9	356	0.53	9.23
419	16	165%	190	$46,358,395.17	-0.84%	-0.03	-0.05	-0.16	28.3%	75.3	167	-0.14	-2.09
666	17	165%	190	$46,322,832.39	-0.85%	-0.03	-0.06	-0.16	28.3%	75.3	167	-0.14	-2.10
1000	19	120%	245	$105,946,951.95	8.71%	0.31	0.57	1.08	28.3%	23.9	356	0.59	9.28
753	18	120%	245	$106,370,101.78	8.76%	0.31	0.57	1.08	28.3%	24.4	353	0.59	9.30
505	17	120%	240	$99,041,421.24	7.90%	0.28	0.52	1.10	27.9%	25.8	360	0.51	8.17
999	19	120%	240	$99,576,196.37	7.96%	0.29	0.53	1.07	27.9%	25.8	360	0.54	8.25
752	18	120%	240	$99,954,487.96	8.01%	0.29	0.53	1.07	27.9%	25.8	357	0.54	8.26
1247	20	120%	245	$107,009,582.51	8.83%	0.32	0.57	1.10	27.9%	23.9	354	0.60	9.31
1494	21	120%	245	$108,941,198.37	9.05%	0.33	0.59	1.12	27.8%	24.4	350	0.63	9.44
1741	22	120%	245	$109,184,532.66	9.07%	0.33	0.59	1.10	27.8%	23.9	348	0.61	9.52

In summary, the strategy **failed the stability test** in a wide range of optimized parameters on out-of-sample data, because **only part of** results showed a positive **MAR value** – which indicates the instability of the strategy in various market conditions.
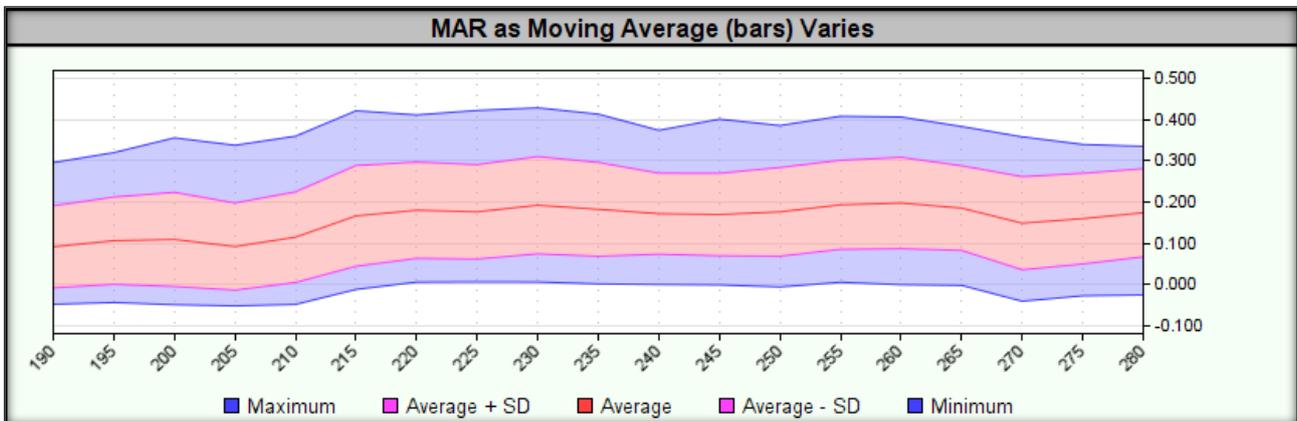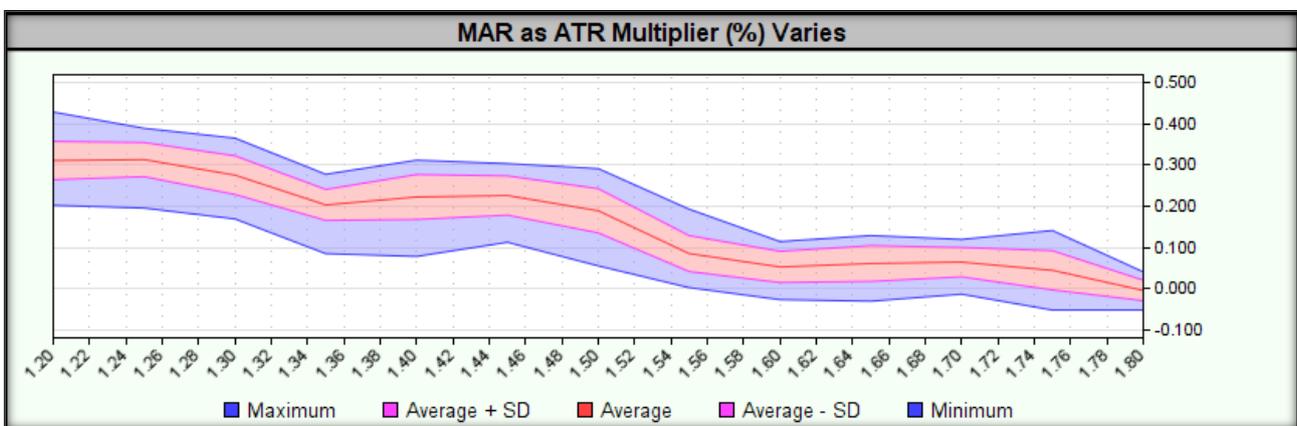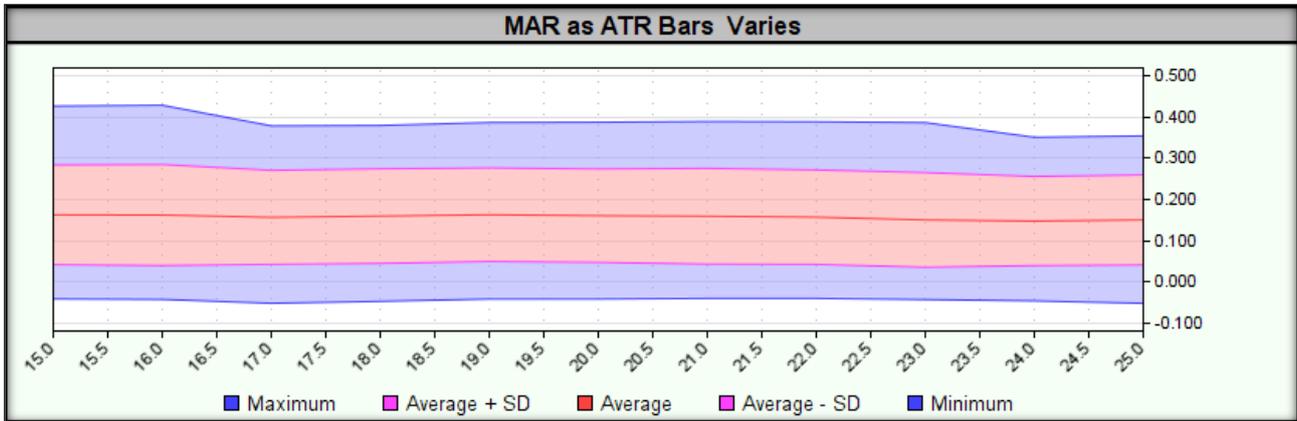
Therefore, **further testing of the strategy is not justified,** as its use in real transactions **is highly questionable.**

Heatmaps for the tested ranges are presented below.

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

Multi-Parameter Results for MAR

MAR as ATR Bars Varies

MAR as ATR Multiplier (%) Varies

MAR as Moving Average (bars) Varies
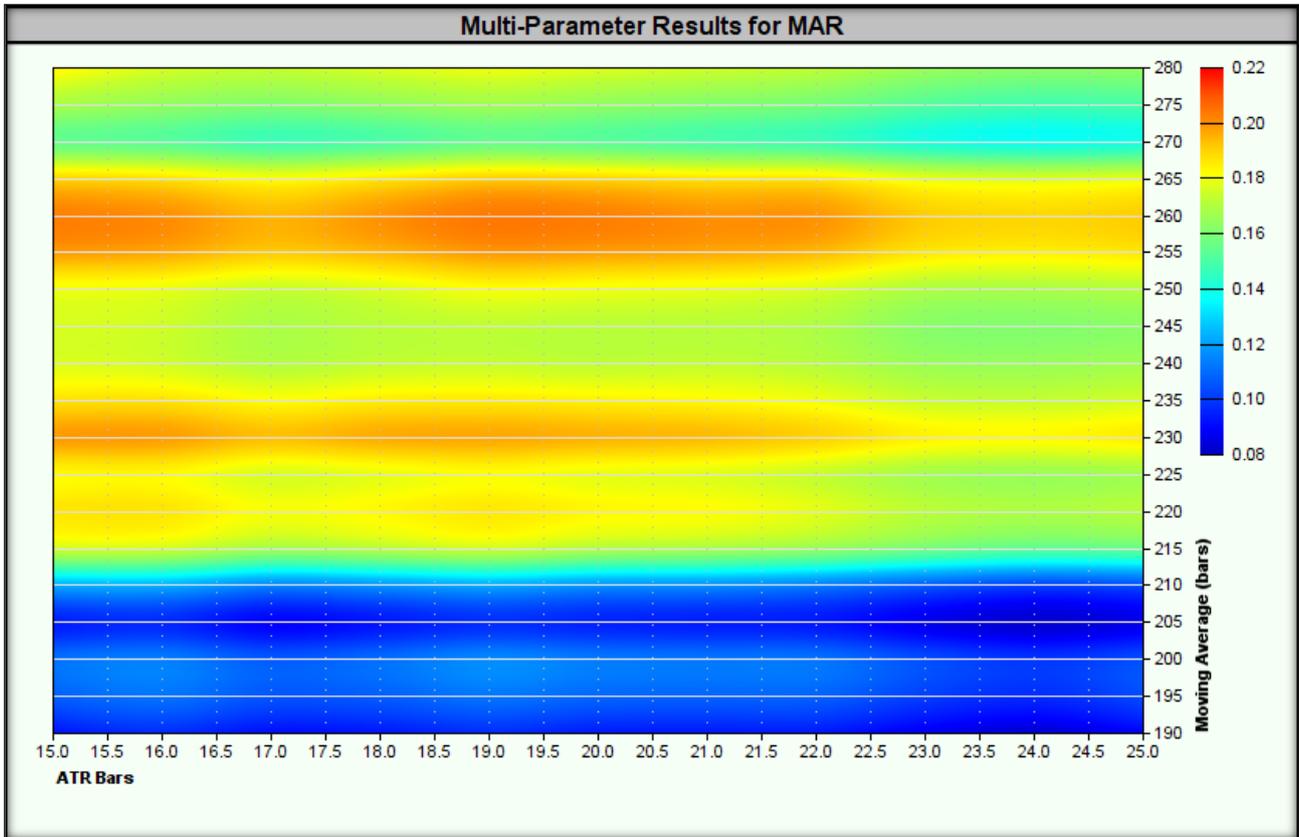
2. **Monte Carlo simulation**

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

The step was skipped due to **failure of previous tests.**

Step 6: Using the strategy in real time

The step was skipped due to **failure of previous tests.**