



Terror Gaps v.1

Investment Strategy Testing Summary

The **Terror Gaps strategy** is a **swing trading** investment technique that uses the **ConnorsRSI (Relative Strength Index)** and a **downward correction (taking into account price gaps)** of an instrument in an **upward trend** (quotes above the 100-day average). The key assumption of the strategy is **to open long positions during a correction and then close them after the price increases.**

The strategy was tested on **parameters suggested by the strategy creator, Larry Connors:**

- **Length of the moving average (SMA):** 100 days;
- **ConnorsRSI (CRSI):** RSI Bars (3), Streak Bars (2); Rank Bars (100);
- **Entries ConnorsRSI (CRSI):** 20;
- **Exit ConnorsRSI (CRSI):** 70;
- **Price formation:**
 - The opening price of the day must be lower than the low price of the previous day (downward gap).
 - The closing price of the day must be below the opening price of the day (bearing candle).
- **Method of opening a position:** at the opening price of the next day;
- **Stop loss:** none;
- **Position sizes:** corresponding to a risk of 2.0% of total capital, with a hypothetical stop loss order placed 2 x ATR (40 days) away from the position opening position;
- **Position direction:** long positions (buy) only.

It should be noted that the strategy failed the stability test in a wide range of optimized parameters. This means that the strategy loses its profitability and generates a significantly larger drawdown when tests are performed on suboptimal parameters. Therefore, **it is not recommended to use it in real transactions.**

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

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

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

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



Even though the strategy **failed the parameter stability test**, based on the conclusions from the tests conducted so far, **version v.2 of the strategy will include elements whose lack was identified in the tests below.**



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Step 1: Formulate an investment strategy

Terror Gaps is a **short-term investment strategy** created by **Larry Connors**. It is based on **market psychology**, and in particular on **the emotions of fear and greed** that are inherent in financial markets. The strategy focuses on **identifying and exploiting extreme states of fear**, especially during **sharp intraday sell-offs**.

The strategy involves **buying ETFs (exchange-traded funds) at times when other investors are selling their positions in panic**, often after a series of price declines.

Key elements of the strategy:

- **multi-day sell -off:** When an ETF experiences declines for several days in a row, **investors begin to feel uncomfortable and anxious**;
- **Gap down:** After a series of declines, the ETF **opens at a lower price the next day**, increasing fear among long position holders;
- **Further Intraday Decline:** **The ETF continues to decline** throughout the day, often leading investors to panic and irrationally sell off their holdings.

The strategy involves **entering a long position at the peak of fear**, taking advantage of a potential **price rebound** when the market calms down.

Characteristics of the strategy and its strengths and weaknesses:

- **Leveraging market psychology:** The strategy is based on understanding investor emotions, such as fear and panic, which often lead to irrational decisions.
- **Clearly defined rules:** Precise entry and exit criteria make it easy to implement and maintain trading discipline.
- **High Profit Potential:** Buying during extreme declines can yield significant gains in the short term when prices rebound.
- **Continuation Downside Risk:** There is no guarantee that once you enter a position, the price will stop falling, which could lead to further losses.
- **Requires a lot of mental toughness:** Trading against dominant market emotions can be difficult and stressful.
- **Simple implementation:** The strategy is easy to understand and implement, even for less experienced traders.
- **Flexibility:** Can be used on various markets and financial instruments.
- **No defined Stop Loss:** May lead to uncontrolled losses in case of sudden price movements.
- **Potential Difficulty Executing Orders:** During sharp declines, market liquidity may be limited.

To test the above strategy, we will make the following **changes and extensions**:

- **Instead of ETFs**, tests were performed on **stock indices, bonds, gold and the dollar index**;
- **The candle forming a gap must close below the opening** (for long positions), while **positions are opened the next day at the opening**;
- **We will add a trend filter** in the form of a **100-day moving average** to **open positions in line with the dominant trend**.



Terror Gaps is a strategy that, while simple to implement, requires caution due to its susceptibility to false signals and lack of stop losses. Its application requires careful optimization and risk management, especially in volatile market conditions.



Step 2: Define investment principles

Below is the pseudocode for the **Terror Gaps strategy** on daily data:

1. Calculation of Indicators and Criteria:

- a. **ConnorsRSI (CRSI):** Calculate ConnorsRSI indicator for the instrument (RSI Bars (3), Streak Bars (2); Rank Bars (100));
- b. **100-day SMA:** Calculate the 100-day moving average of the instrument's closing price;

2. Generating Entry Signals - Long Position:

- a. **Entry conditions:**
 - i. The instrument's price is above the 100-day SMA (uptrend);
 - ii. CRSI at closing must be less than 20; **Comment:** the creator of the strategy suggests a value of 5. However, for such a level the number of transactions is a dozen or so, which does not allow drawing any conclusions;
 - iii. The daily opening price must be lower than the previous day's low price;
 - iv. The closing price of the day must be below the opening price of the day (bearing candle);
- b. **Entry into position:** Open a long position the following day at open;

3. Generating Exit Signals: Close the entire position the next day on opening when CRSI closes above 70;

4. Loss Management: No Stop Loss orders defined.

5. Daily Monitoring:

- a. **Calculation of indicators** – every day:
 - i. Calculate ConnorsRSI at the close of the day;
 - ii. Calculate 100-day SMA;
 - iii. Check if there is a downward price gap at the open (if the opening price is lower than the previous day's low);
- b. **Checking entry conditions:** If conditions are met, open a long position the next day at open;
- c. **position monitoring** – if position is open:
 - i. Follow ConnorsRSI.
 - ii. Once ConnorsRSI closes above 70, close your position for the next day's open.

6. Additional Notes:

- a. **No Short Positions:** The strategy focuses only on long positions in an uptrend.
- b. **Financial Instruments:** For the purposes of this test, **long positions on stock indices, bonds, gold and the dollar index were used.**

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

The tests are carried out assuming that the risk of one position is **2.0% of the total capital**, with a **hypothetical stop loss order located 2 x ATR (40 days)** away from the position opening point.



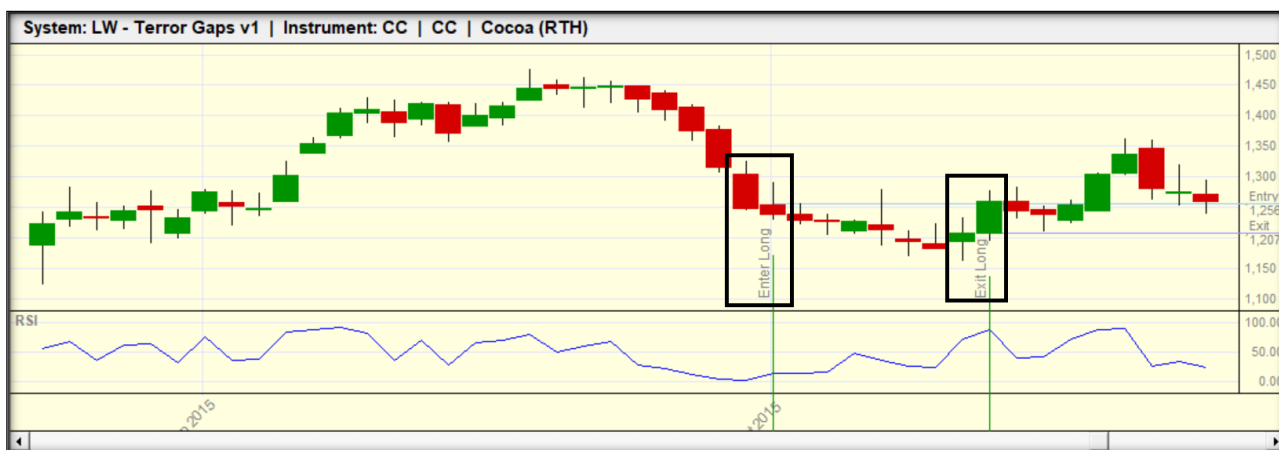
Step 3: Conduct a preliminary test of the investment strategy

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

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

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

The first transaction is on a **cocoa futures contract**. In September 2015, cocoa was in an **upward trend** (price above the 100-day moving average). Therefore, we were only interested in long positions. To open a long position, **CRSI must be below 20**, while the candle preceding the opening of the position must open **with a downward gap**, and its **closing price must fall below the opening price**. This situation was created by **the first candle in the marked rectangle on the left**. So **the next day we open a long position on the opening** (the second candle in the marked rectangle on the left). **The system worked correctly.**

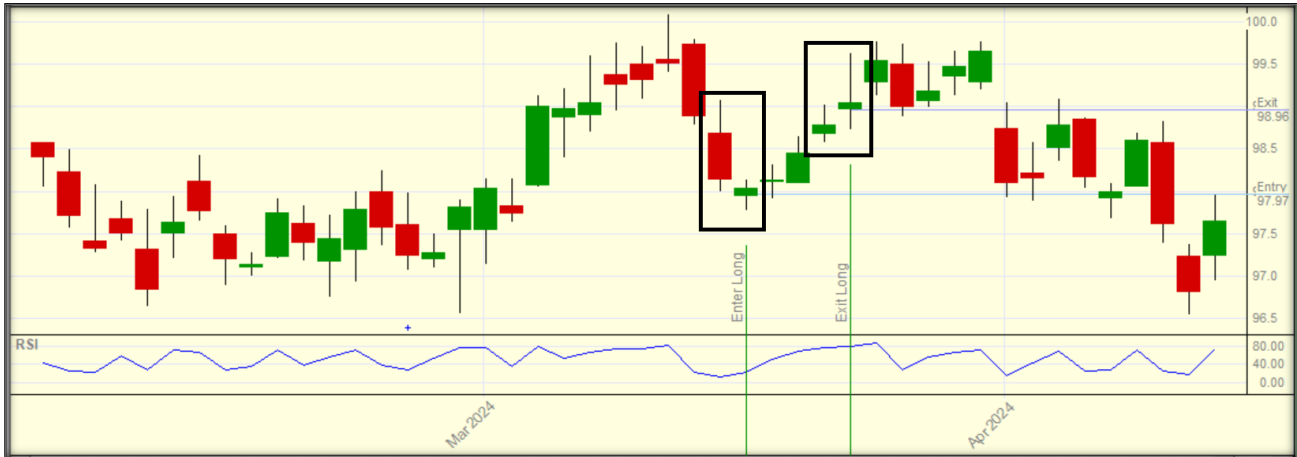


The price continued to fall slightly for a few days, then rebounded slightly, which resulted in **the CRSI indicator rising above 70** (the first candle in the marked rectangle on the right). Therefore, **the next day we close the position at the opening** (the second candle in the marked rectangle on the right). **The system worked correctly.**

The second transaction is on a **futures contract for British bonds**. In March 2024, the bonds were in an **upward trend** (price above the 100-day moving average). Therefore, we were only interested in long positions. To open a long position, **the CRSI must be below 20**, while the candle preceding the opening of the position must open with a **downward gap**, and its **closing price must fall below the opening price**. This



situation was created by **the first candle in the marked rectangle on the left**. So **the next day we open a long position for the opening** (the second candle in the marked rectangle on the left). **The system worked correctly.**



The price bounced back very quickly, which resulted in **the CRSI indicator rising above 70** (the first candle in the marked rectangle on the right). Therefore, **the next day we close the position at the opening** (the second candle in the marked rectangle on the right). **The system worked correctly.**

Once we are sure that the transactions are generated correctly, we can proceed to the first test of the strategy on the full **in-sample data set**. These tests are conducted on **the basic parameters** that were **proposed by the creator, Larry Connors**.

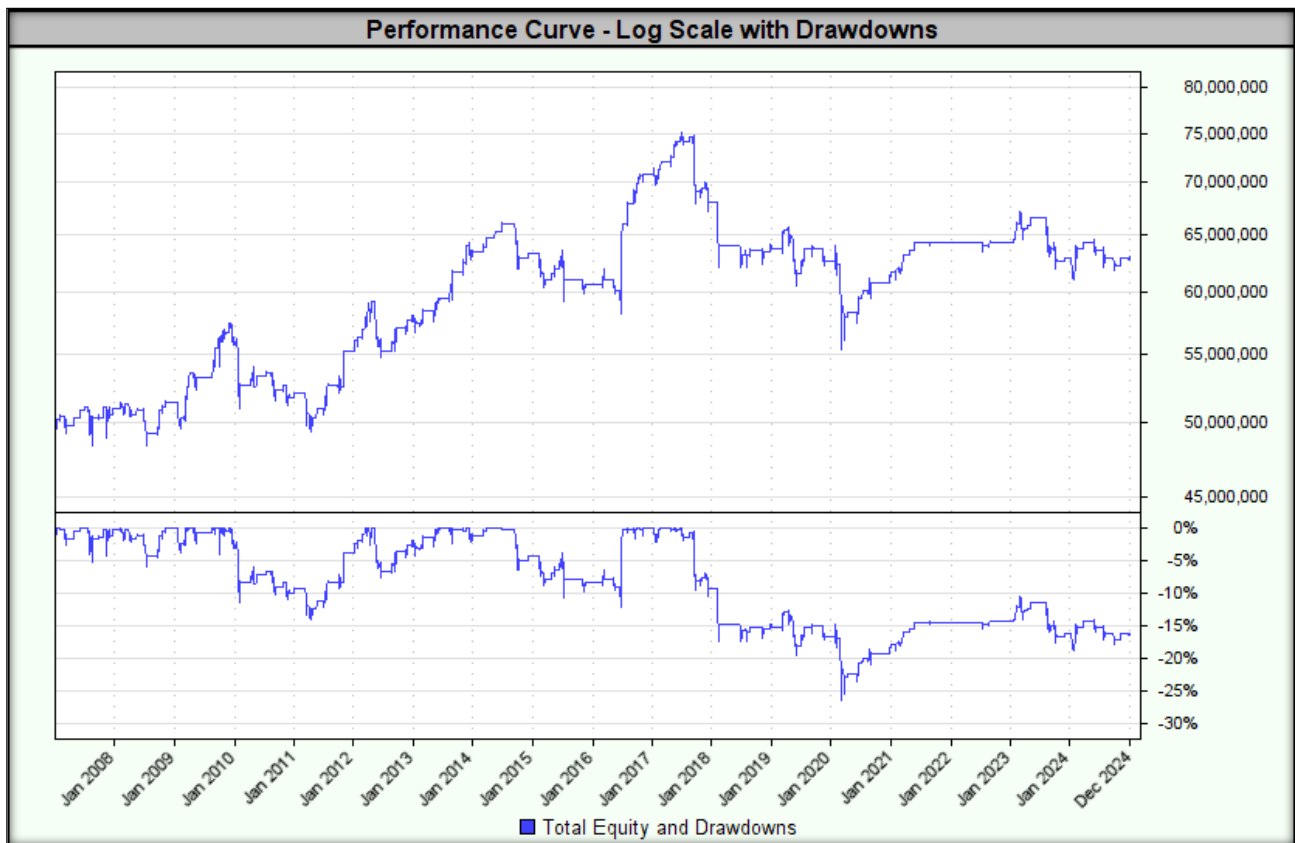
First of all, **we reject strategies that linearly lose capital**. If a strategy exhibits such a pattern, it is a clear signal that any parameter optimization does not make sense.

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

Tested base parameters:

- **Length of the moving average (SMA):** 100 days;
- **ConnorsRSI (CRSI):** RSI Bars (3), Streak Bars (2); Rank Bars (100);
- **Entries ConnorsRSI (CRSI):** 20;
- **Exit ConnorsRSI (CRSI):** 70;
- **Price formation:**
 - The opening price of the day must be lower than the low price of the previous day (downward gap).
 - The closing price of the day must be below the opening price of the day (bearing candle).
- **Method of opening a position:** at the opening price of the next day;
- **Stop loss:** none;
- **Position sizes:** corresponding to a risk of 2.0% of total capital, with a hypothetical stop loss order placed 2 x ATR (40 days) away from the position opening position;
- **Position direction:** long positions (buy) only.

The test result is shown below.



Indicators/Measures	Concluding a transaction at the opening price
CAGR%	1.3%
MAR Ratio	0.05
RAR%	1.5%
R-Cubed	0.05
Robust Sharpe Ratio	0.22
Max Drawdown	26.4%
Wins	65.5%
Losses	34.5%
Average Win%	0.97%
Average Loss %	1.51%
Win/ Loss Ratio	0.64
Average Trade Duration (days)	7
Percent Profit Factor	1.22
SQN	-
Number of transactions	232

In summary, the system works properly and generates signals as expected. **Tests on basic parameters yielded average results.** Despite everything, we can move on to the most interesting stage of creating an investment strategy – **optimization and stability.**



Step 4: Optimization and assessment of investment strategy stability

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

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

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

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

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

1. Stability across a wide range of optimized parameters

Gaps v.1 Strategy in this version it assumes **optimization of parameters using The Grid method Search**. It consists of **full optimization of all indicated parameters by creating a wide range of possible combinations**. Our goal is to find such **parameter ranges** that **the strategy remains stable (robust)**, which will allow us to assess its usefulness in real market conditions.

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

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

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

- **Moving average lengths (SMA):** range **60-120 days (step: 5)**;
- **Entries ConnorsRSI (CRSI):** range **15-25 (step: 1)**;
- **Exit ConnorsRSI (CRSI):** range **54-80 (step: 2)**.

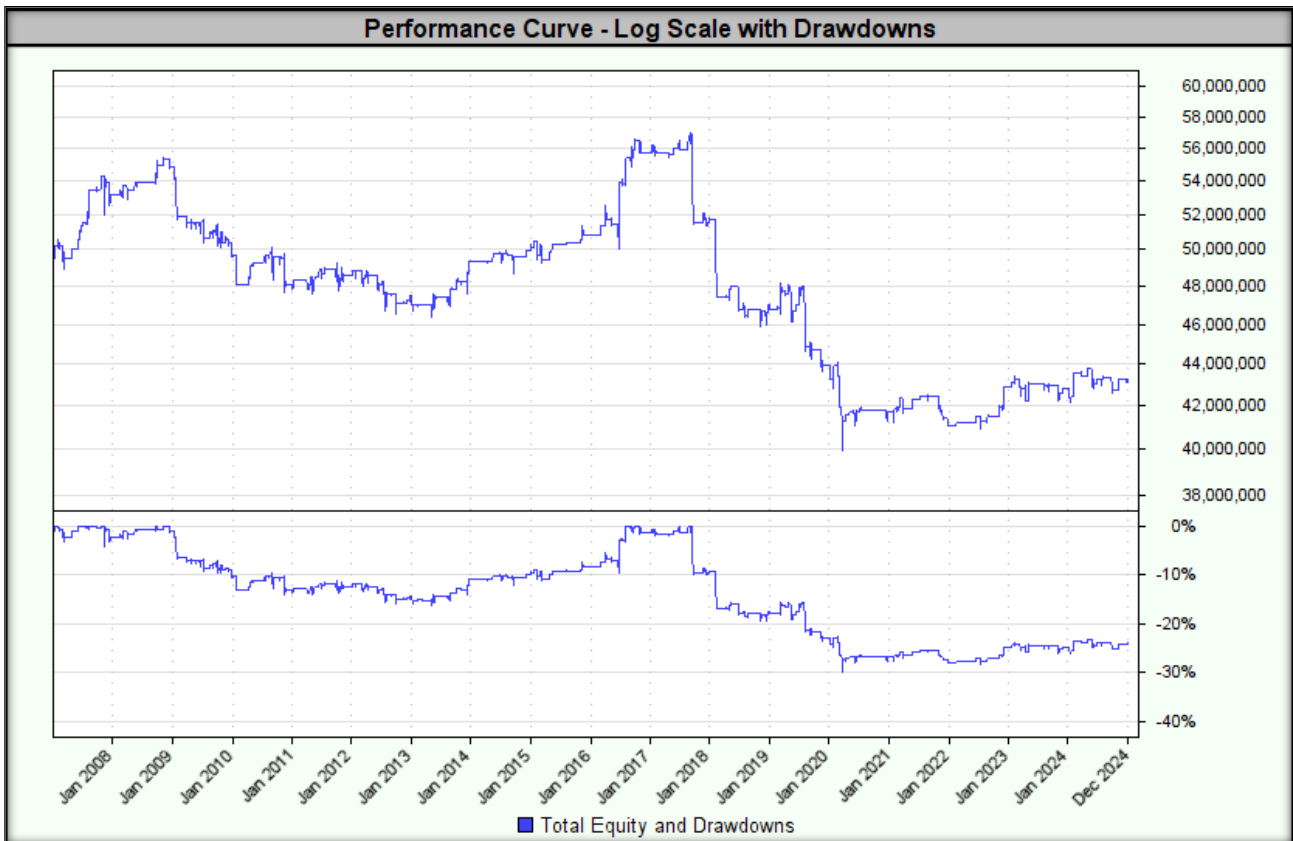
The lowest MAR value of -0.03 was achieved for the following parameters:

- **Length of the moving average (SMA):** 60;
- **Entries ConnorsRSI (CRSI):** 25;
- **Exit ConnorsRSI (CRSI):** 54.



Test	Moving Average (Bars)	RSIOpen	RSIClose	End Balance	CAGR%	MAR	Sharpe	Ann. Sh...	Max TE DD	Longest DD	Trades	R3	RAR [%]	%PF
141	60	25	54	\$43,263,197.14	-0.80%	-0.03	-0.14	-0.15	29.8%	94.3	306	-0.04	-1.24	0.90
127	60	24	54	\$43,245,083.16	-0.80%	-0.03	-0.14	-0.15	30.0%	93.1	293	-0.04	-1.17	0.90
1702	115	15	68	\$44,922,326.06	-0.59%	-0.02	-0.06	-0.15	24.9%	182.4	122	-0.03	-0.59	0.89
281	65	24	54	\$44,193,310.37	-0.68%	-0.02	-0.11	-0.13	29.5%	93.1	297	-0.03	-1.05	0.92
295	65	25	54	\$44,332,398.64	-0.67%	-0.02	-0.11	-0.13	29.3%	93.1	310	-0.03	-1.09	0.92
604	75	25	56	\$43,739,048.39	-0.74%	-0.02	-0.10	-0.13	33.2%	90.2	322	-0.04	-1.32	0.92
1695	115	15	54	\$46,388,307.13	-0.42%	-0.02	-0.05	-0.11	19.4%	90.9	123	-0.03	-0.68	0.90
1394	105	15	68	\$46,130,200.91	-0.45%	-0.02	-0.06	-0.12	20.9%	182.4	117	-0.02	-0.39	0.91
113	60	23	54	\$44,815,671.91	-0.61%	-0.02	-0.10	-0.12	28.7%	93.1	271	-0.03	-0.97	0.92
142	60	25	56	\$44,477,326.46	-0.65%	-0.02	-0.10	-0.12	30.8%	90.2	306	-0.03	-1.03	0.93

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



The highest MAR value of 0.28 was achieved for the following parameters:

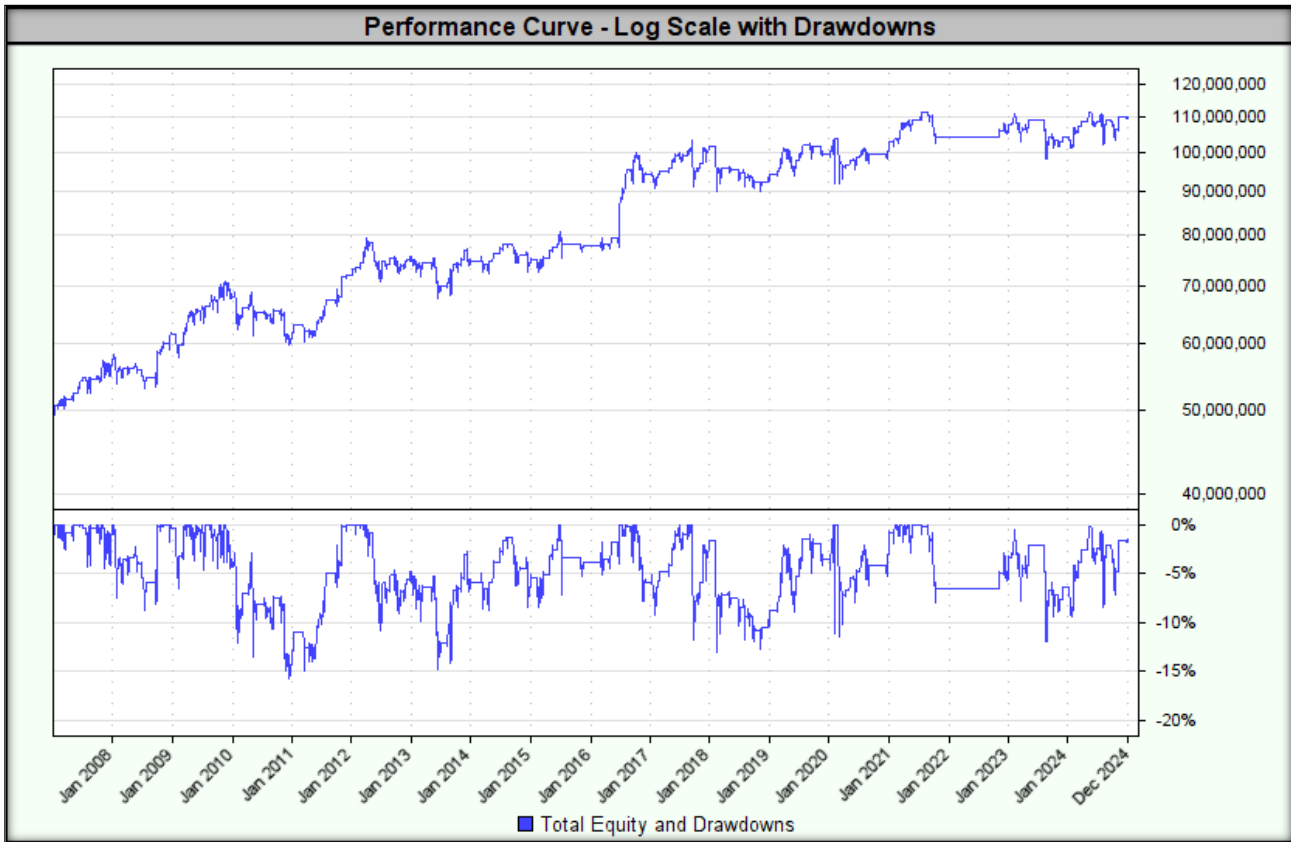
- Length of the moving average (SMA): 110;
- Entries ConnorsRSI (CRSI): 24;
- Exit ConnorsRSI (CRSI): 78.

The highest MAR value was accompanied by a drawdown of 15.8%.

Test	Moving Average (Bars)	RSIOpen	RSIClose	End Balance	CAGR%	MAR	Sharpe	Ann. Sh...	Max TE DD	Longest DD	Trades	R3	RAR [%]	%PF
1679	110	24	78	\$109,669,776.57	4.46%	0.28	0.55	0.57	15.8%	40.2	291	0.19	4.31	1.49
1371	100	24	78	\$109,773,842.62	4.47%	0.28	0.54	0.48	16.1%	41.7	288	0.18	4.59	1.50
909	85	24	78	\$113,673,818.59	4.67%	0.26	0.58	0.51	17.7%	40.2	283	0.26	4.99	1.54
881	85	22	78	\$113,558,718.07	4.66%	0.26	0.57	0.48	18.0%	41.7	252	0.21	4.80	1.60
1636	110	21	76	\$98,630,175.77	3.85%	0.26	0.52	0.52	14.9%	42.0	249	0.15	3.47	1.54
755	80	24	78	\$110,874,236.56	4.52%	0.26	0.57	0.51	17.7%	40.2	276	0.25	4.84	1.54
1651	110	22	78	\$107,751,769.54	4.36%	0.26	0.53	0.51	17.1%	41.9	263	0.16	3.98	1.53
1343	100	22	78	\$107,883,812.09	4.37%	0.26	0.52	0.43	17.1%	42.0	260	0.16	4.25	1.54
391	70	20	78	\$89,631,780.57	3.30%	0.25	0.46	0.46	13.1%	40.2	198	0.17	3.79	1.53
1063	90	24	78	\$109,396,330.64	4.45%	0.25	0.54	0.49	17.7%	40.2	286	0.21	4.64	1.50



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



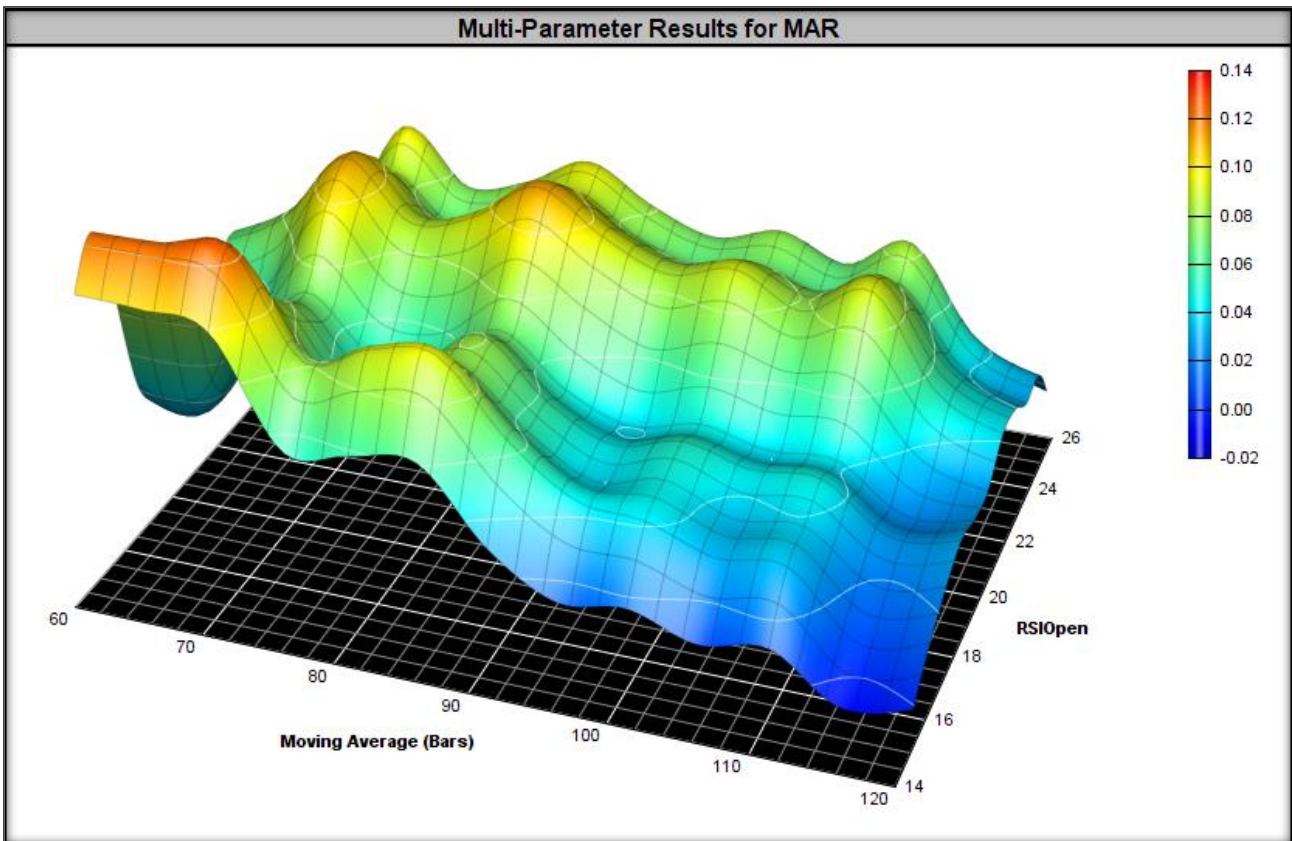
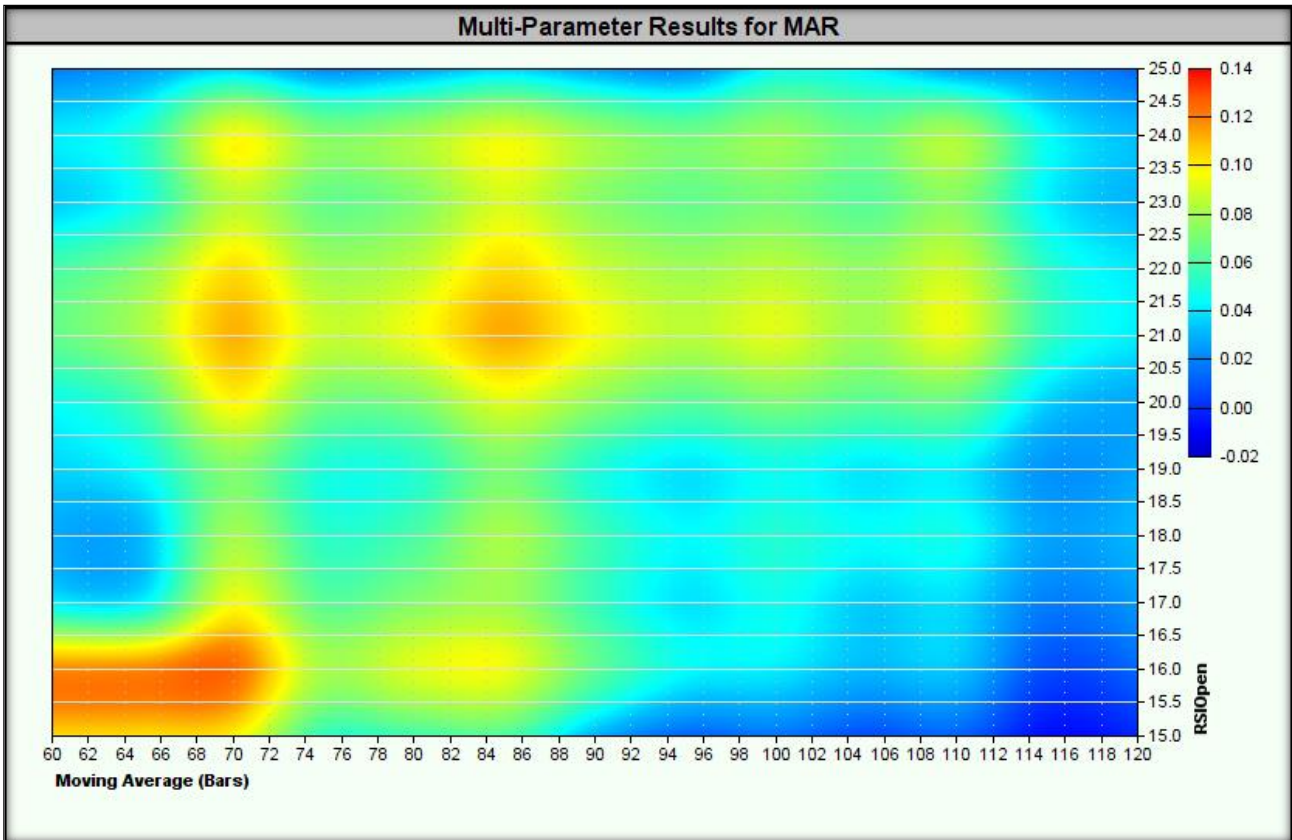
For all combinations of tested parameter ranges, the highest drawdown was 72.6%.

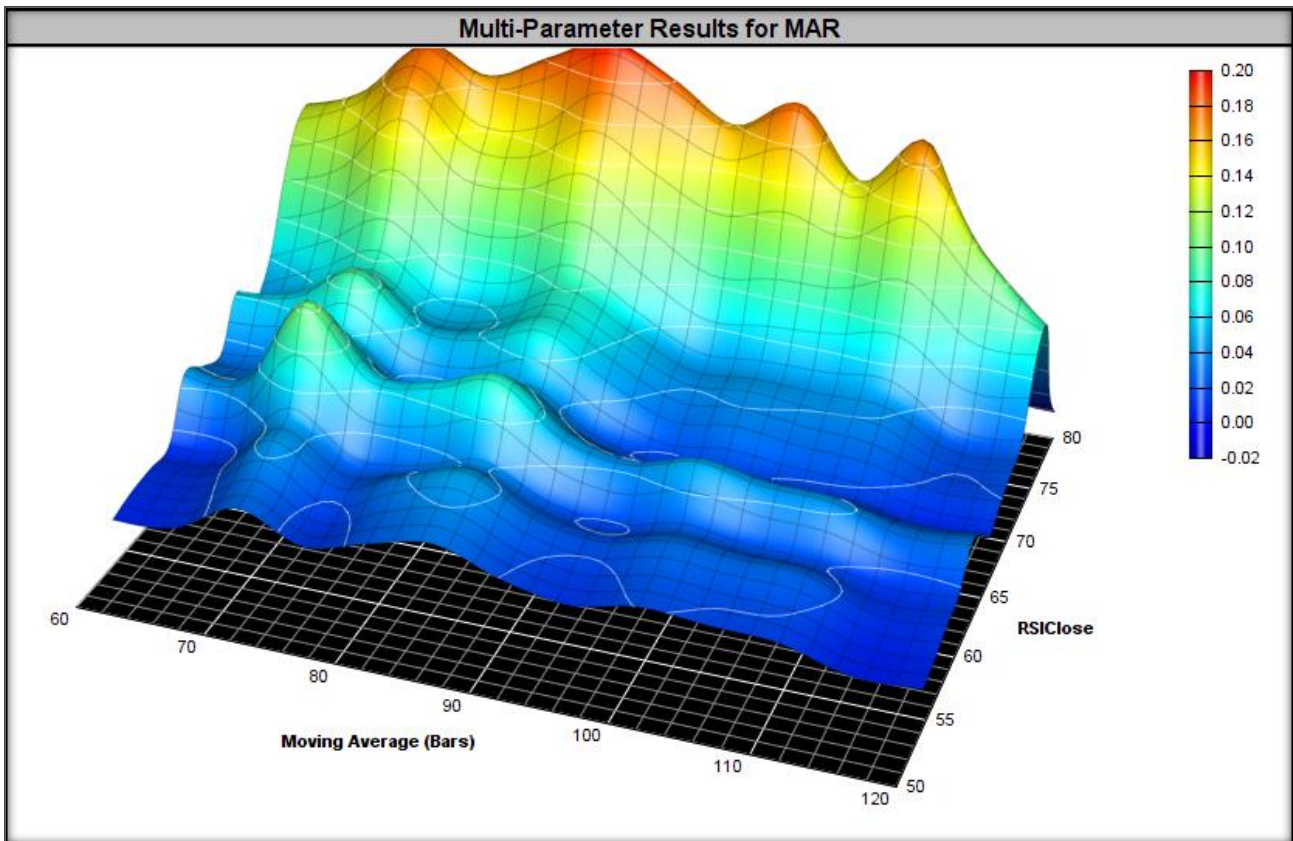
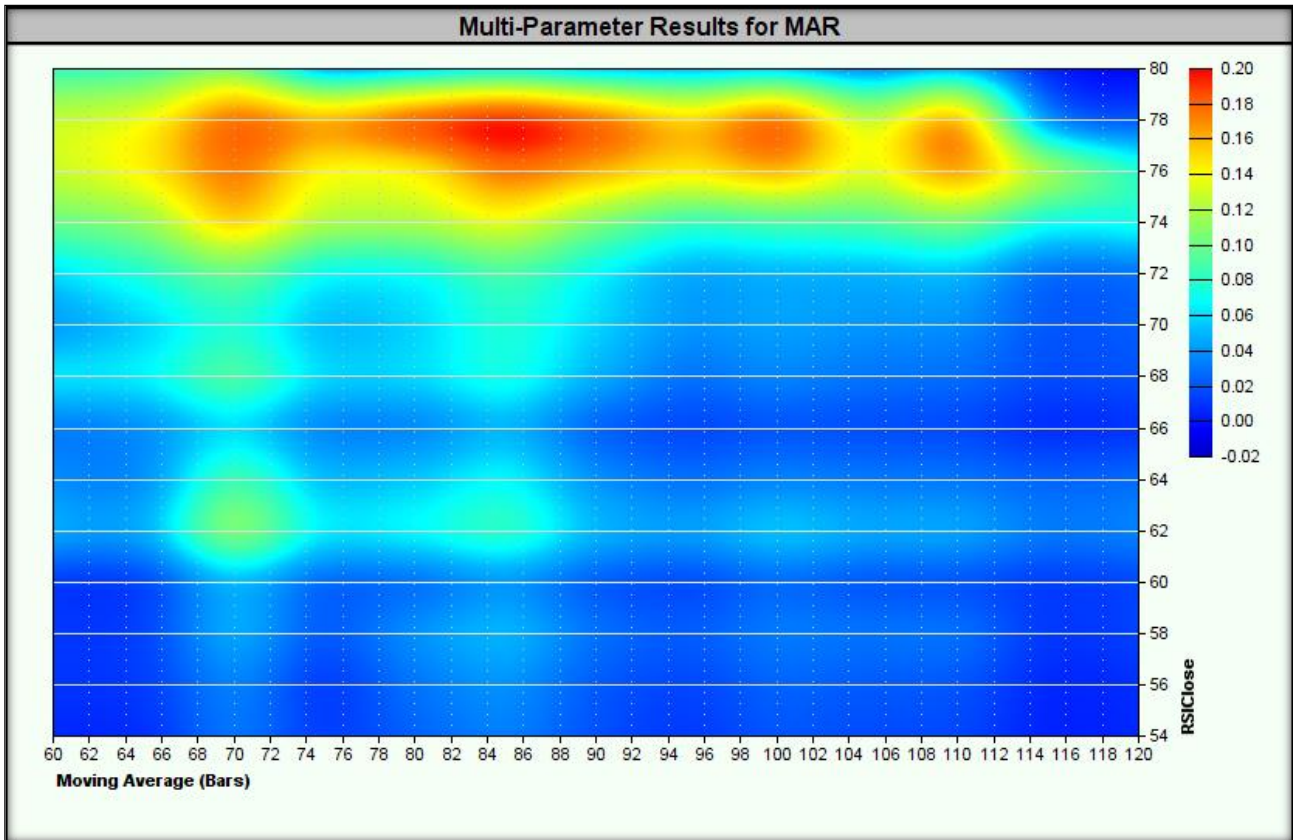
Test	Moving Average (Bars)	RSIOpen	RSIClose	End Balance	CAGR%	MAR	Sharpe	Ann. Sh.	Max TE...	LongestDD	Trades	R3	RAR [%]	%PF
2002	120	25	80	\$47,933,341.78	-0.23%	-0.00	0.07	-0.02	72.6%	65.3	292	-0.01	-0.90	1.12
1960	120	22	80	\$53,307,232.14	0.36%	0.01	0.10	0.03	65.0%	87.7	254	-0.00	-0.12	1.15
1932	120	20	80	\$45,365,114.16	-0.54%	-0.01	0.03	-0.04	64.9%	87.7	217	-0.02	-0.99	1.07
1974	120	23	80	\$50,023,542.67	0.00%	0.00	0.08	0.00	64.8%	58.8	264	-0.01	-0.42	1.11
1988	120	24	80	\$57,539,048.46	0.78%	0.01	0.14	0.06	64.8%	58.8	281	0.01	0.56	1.18
1946	120	21	80	\$51,901,600.67	0.21%	0.00	0.09	0.02	64.7%	58.8	234	-0.01	-0.30	1.15
924	85	25	80	\$57,609,826.31	0.79%	0.01	0.13	0.06	59.9%	65.3	282	0.02	1.12	1.17
1694	110	25	80	\$53,515,240.41	0.38%	0.01	0.10	0.03	59.7%	87.7	285	0.00	0.15	1.13
1078	90	25	80	\$54,250,320.39	0.45%	0.01	0.11	0.03	59.5%	65.3	283	0.01	0.65	1.14
1232	95	25	80	\$53,523,866.00	0.38%	0.01	0.10	0.03	59.4%	65.3	286	0.01	0.57	1.13

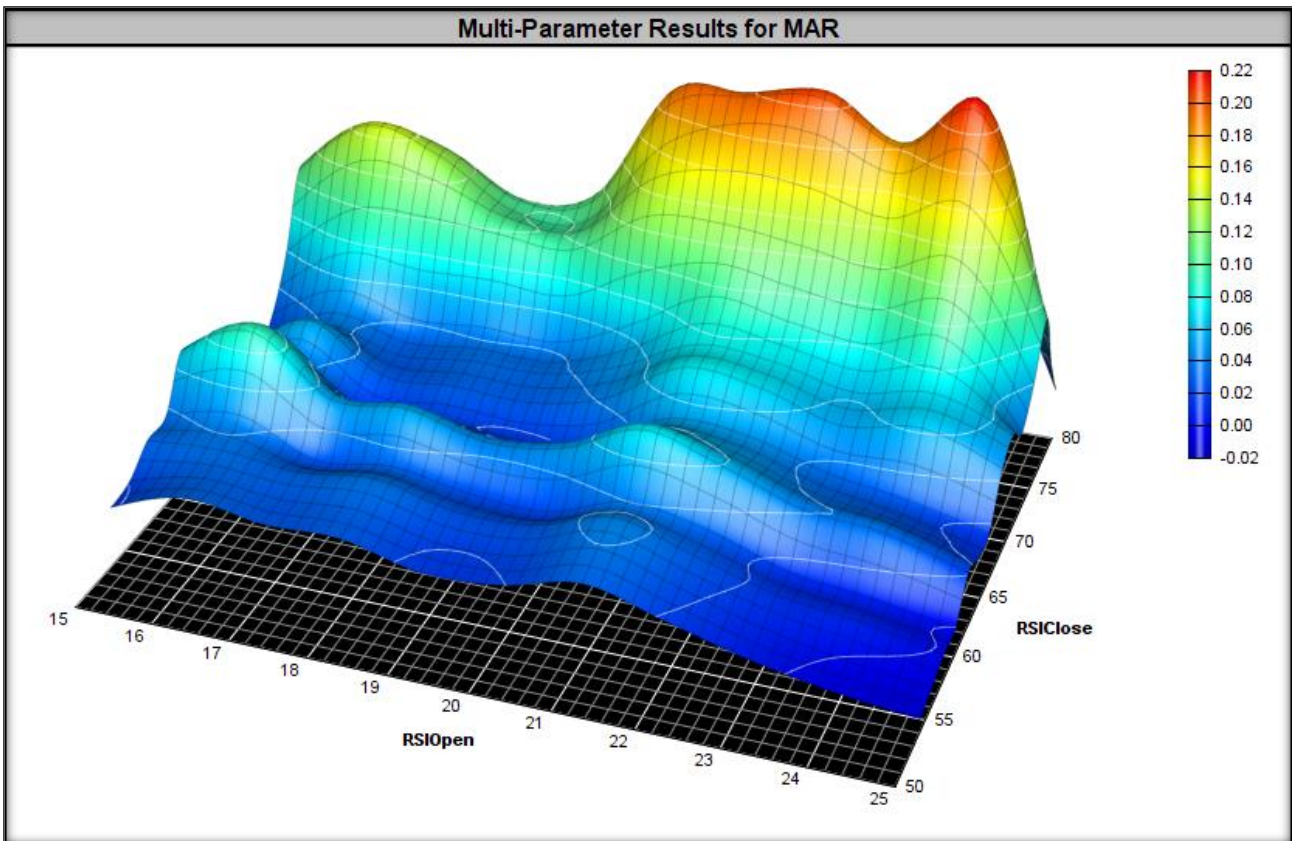
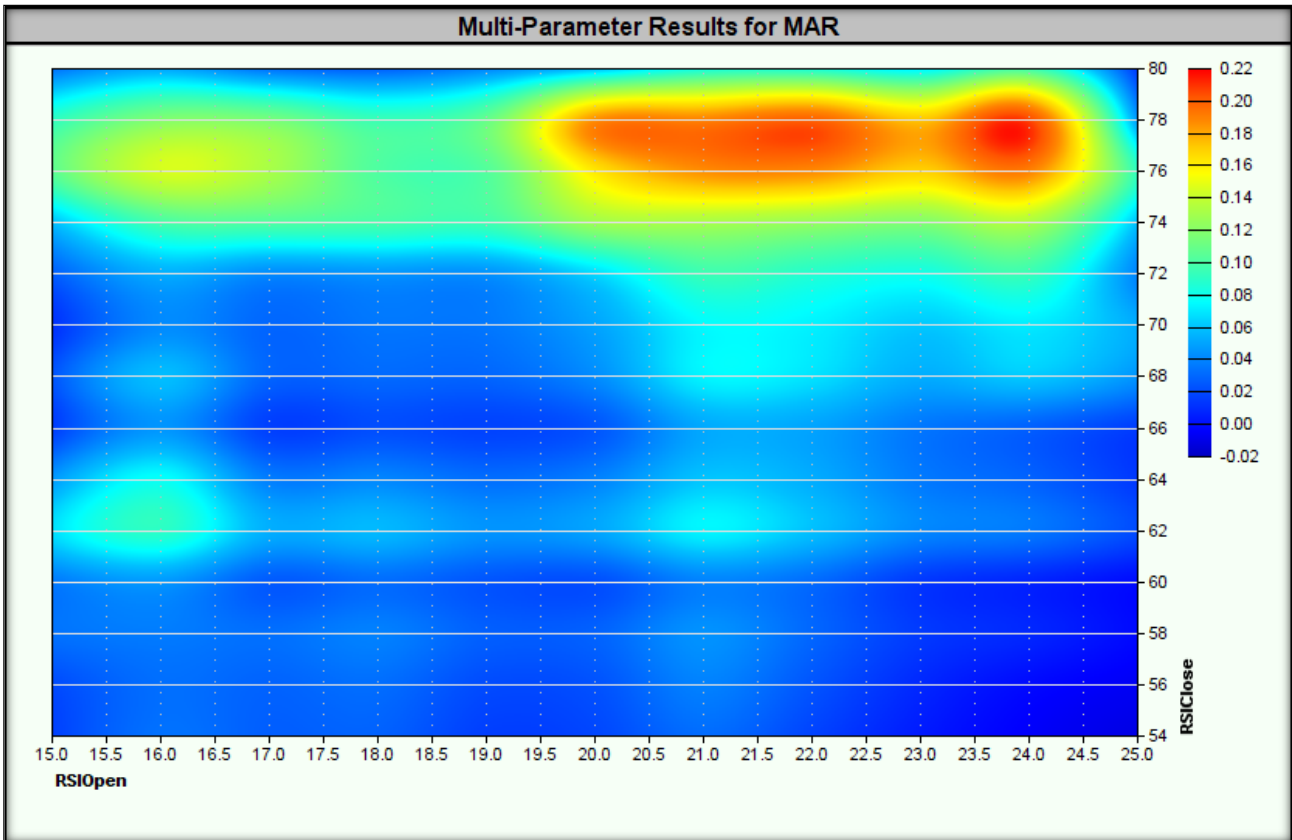
In summary, the strategy failed the stability test in a wide range of optimized parameters on the in-sample data because:

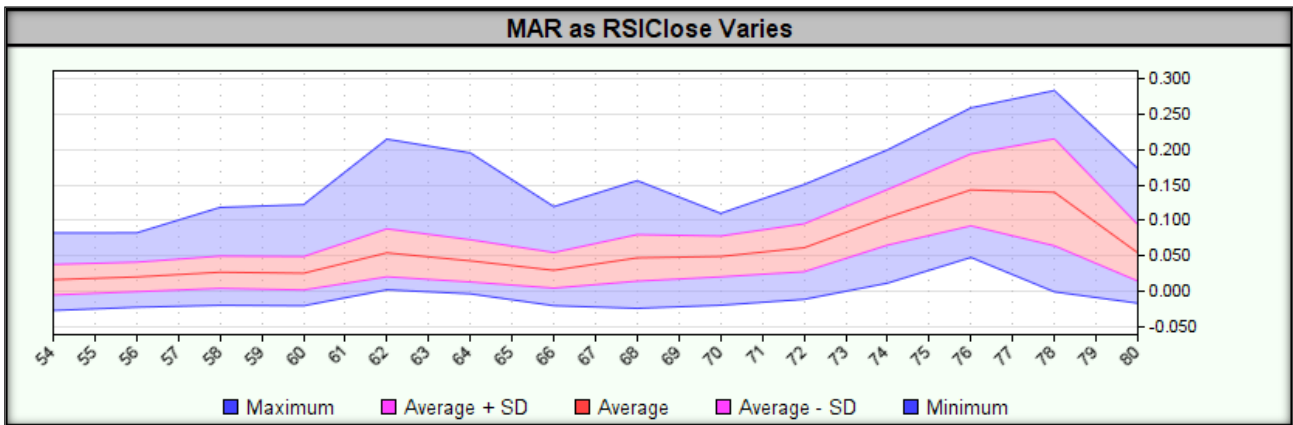
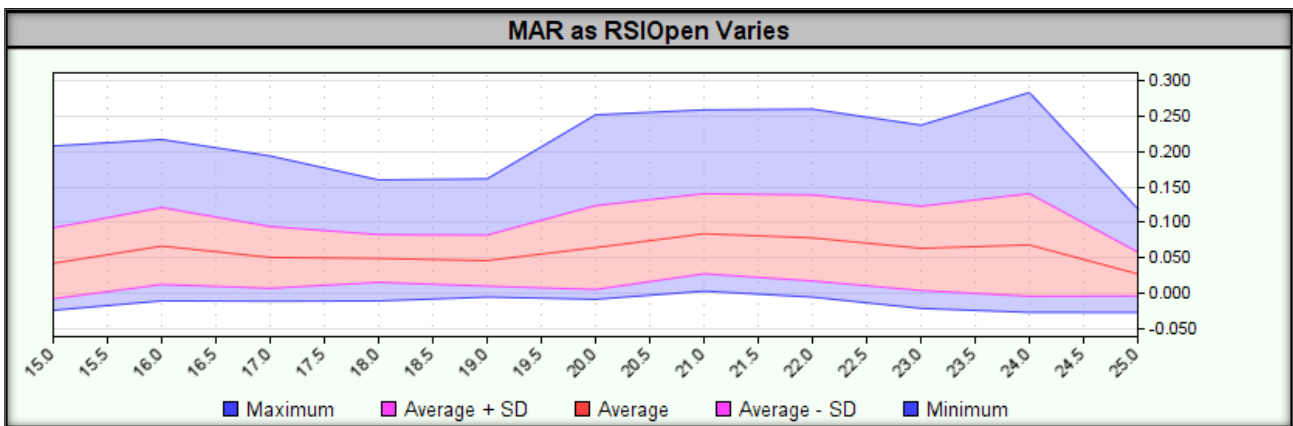
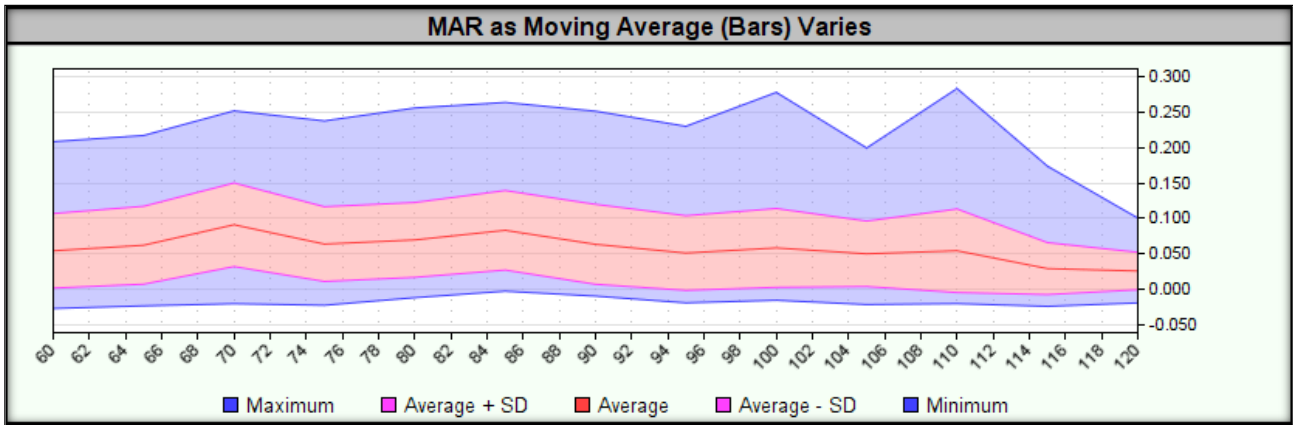
- **MAR value** – which indicates the instability of the strategy in different market conditions.
- **The maximum drawdown exceeded 250% of the drawdown value** for the result with the highest MAR (**72.6% vs. 15.8%**) – which means a high risk of deep capital drawdowns.

Therefore, **further testing of the strategy on these ranges is not justified**, because its use in real transactions is **highly doubtful**. Nevertheless, based on the results obtained (**heatmaps for tested ranges**) we can create another version of the strategy, in which we will include: i) a defensive order protecting against large losses, ii) changing ConnorsRSI to classic RSI, iii) pyramiding positions.









2. Monte Carlo simulation

The step was skipped due to failure of previous tests.

3. Stability over a moving time window

The step was skipped due to failure of previous tests.

4. Stability long/short

The step was skipped due to failure of previous tests.



5. Stability in the portfolio of financial instruments

The step was skipped due to failure of previous tests.

6. Money Management (Position Sizing)

The step was skipped due to failure of previous tests.

7. Strategy Risk Management

The step was skipped due to failure of previous tests.



Step 5: Walk Forward Analysis

Walk Forward Analysis (WFA) is a key tool for assessing a **strategy's ability to perform under real market conditions**. It provides **reliable measures of profit and risk** after the optimization process and allows for answering 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 a more **reliable and realistic measure 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, which helps **minimize 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)**.
 - In this step, parameters are adjusted 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 measure that assesses whether a strategy has the potential to perform under real market conditions. WFE compares:

- **The rate of return achieved in the in-sample window** (where parameters were optimized)
- **The rate of return in the out-of-sample window** (where the strategy was operating 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 \geq 50% for the rate of return** – means that the strategy retains at least half of its effectiveness outside the optimization period.
- **WFE \leq 150% for drawdown** – means that the drawdown outside the optimization period is not significantly higher than during the optimization period.

The step was skipped due to failure of previous tests.



Step 6: Using the strategy in real time

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

The most important element of **strategy implementation** is **consistent enforcement of all signals, without exceptions**. **How Larry Williams noted:** *"Trading strategies work. Traders do not."*

Before making a **final decision to implement a strategy**, it is necessary to check **whether it really adds value** to the results of the entire portfolio. It does not make sense to implement a strategy that **generates similar signals** or is **characterized by a similar course of the equity curve**.

Key criteria for evaluating the strategy 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 of them are met** or **none of them are met**.

Once you decide to add a strategy to your portfolio, **the question arises:** *Should you implement your strategy right away 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 identify **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 a level of about half of the maximum drawdown** observed in historical data. **Only after reaching this threshold 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 to fully implement it 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.