Crash v.1

Investment Strategy Testing Summary

Crash strategy is a **trend reversal investment technique** that uses the **ConnorsRSI** (Relative Strength Index) and **historical volatility** to identify situations in the market where **prices are rising very strongly in a short period of time, causing a run on the money of many market participants.** Despite the prevailing bullish trend in the market, this strategy aims to **identify moments when the price is driven by irrational investor enthusiasm,** which often leads to rapid price declines.

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

- **Historical Volatility Period:** 100 days;
- **Historical Volatility Value:** 100%;
- **ConnorsRSI (CRSI):** RSI Bars (3), Streak Bars (2); Rank Bars (100);
- **Entries ConnorsRSI (CRSI):** 90;
- **Exit ConnorsRSI (CRSI):** 30;
- **Stop loss:** none;
- **Position opening method:** sell limit 1 x ATR(40) away from the previous day's closing price;
- **Position sizes:** corresponding to a risk of 1.0% of total capital, with a hypothetical stop loss order placed 2 x ATR (40 days) away from the position opening position;
- **Position direction:** short positions (sell) only.

Although the strategy is based on **rational assumptions** and tries to use **the sheep-mover effect,** its **effectiveness in real transactions remains questionable.** It has not even passed **preliminary tests,** which means that **it is not recommended for use in real trading.**

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.

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Step 1: Formulate an investment strategy

Crash Strategy is a **short -selling strategy** invented by Larry Connors that aims **to take advantage of extreme states of greed in the market.** It involves identifying instruments that are **overbought and are likely to reverse their uptrend soon.** Despite the prevailing uptrend in the market, this strategy aims to **identify the moment when the price is driven by irrational investor enthusiasm,** which often leads to rapid price declines.

For the purposes of this test, **short positions** on **stock indices, bonds, gold** and **the US dollar index were used,** which allows us to assess the strategy's effectiveness across a broad spectrum of asset classes.

The basic version of the strategy uses:

- **Historical Volatility –** The stock must have a 100-day historical volatility of at least 100%. We focus on the most volatile instruments that are prone to sharp price movements.
- **ConnorsRSI (CRSI) Indicator** – CRSI must be 90 or above at closing, indicating extreme overbought. The parameters for CRSI are: RSI Bars (3), Streak Bars (2); Rank Bars (100).
- **Entering a short position** – we place a sell order with a price limit higher by 3% or 5% than the previous day's closing price. This means that we are waiting for an even greater price increase before entering a short position. **Comment:** since we will be testing the strategy on futures contracts, the price of which may be negative as a result of adjustment for the rollover value, the price limit will be set at a distance of 1 x ATR(40).
- **Exiting a position** – we close the position when the CRSI at closing falls below 30. This indicates a trend reversal and the potential beginning of declines.

The strategy is simple and is based on specific, defined rules. However, it requires **a lot of discipline and mental toughness,** because it involves selling instruments that are in a strong upward trend and often enjoy great interest from the media and individual investors.

Characteristics of the strategy and its strengths and weaknesses:

- **Leveraging Market Psychology** – the strategy relies on investor behaviors such as greed and fear, which can create a market advantage.
- **Clearly Defined Rules** – Specific entry and exit criteria make it easier to implement and automate strategies.
- **High Profit Potential** – short positions in extremely overbought instruments can yield significant profits in a short period of time.
- **High Risk** – Short selling a stock that is rising parabolic carries the risk of potentially unlimited losses if the price continues to rise.
- **Psychological Difficulties –** trading against a strong upward trend and dominant market sentiment requires a lot of mental resilience.
- **Volatility and Liquidity** – high volatility can lead to price slippage and difficulties in executing orders at expected prices.
- **No Unlimited Loss Protection** – potential losses are theoretically unlimited if the price of the instrument continues to rise.

Crash Strategy is a tool for traders **wanting to take advantage of irrational market behavior** and extreme states of investor greed. Although it is **simple in concept, it requires a lot of discipline, experience and effective risk management.** Due to the high risk and potentially unlimited losses, **this strategy is recommended mainly for advanced investors** who are aware of its specifics and ready for the psychological challenges associated with trading against the dominant trend.

Step 2: Define investment principles

Below is **the pseudocode** for the **Crash strategy** on daily charts:

1. **Calculation of Indicators and Criteria:**
    a. **Historical Volatility:** 100-day historical volatility must be at least 100%.
    b. **ConnorsRSI (CRSI):** CRSI must close at 90 or above, indicating extreme overbought.
2. **Generating Short Entry Signals:**
    a. If all of the above conditions are met, get ready to enter a short position.
    b. The day after the conditions are met, set a short sell order (Sell limit) with a price limit higher by 1 x ATR(40) than the previous day's closing price.
3. **Generating Output Signals:**
    a. The position is closed when the closing CRSI indicator falls below 30.
    b. The position is closed at the opening price of the next day.
4. **Loss Management:** The strategy does not specify a specific Stop Loss level.
    a. **Daily Position Monitoring:** If a position is open, monitor the CRSI indicator daily to see if the exit condition is met. If the exit condition is met, close the position the next day at the open.
5. **Additional Notes:**
    a. **No Long Positions:** The strategy focuses only on short positions in an uptrend.
    b. **Financial Instruments:** For the purposes of this test, **short 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.

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

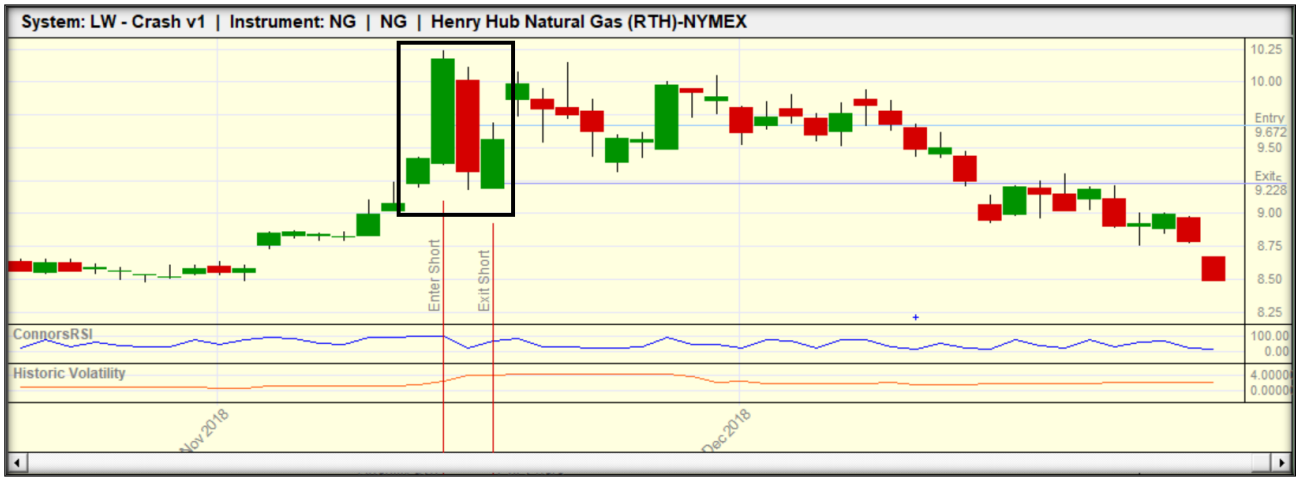
Step 3: Conduct a preliminary test of the investment strategy

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

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

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

The first transaction is on a **natural gas futures contract.** In mid-November 2018, **gas prices rose significantly,** meeting the conditions for opening a position (first candle in the rectangle; **CRSI > 90; Historical volatility > 100%). The next day (second candle in the rectangle), a sell limit order** was set at a distance of **1 x ATR from the previous day's closing price.** The order was activated and the candle that day makes a very big impression. **The next day** (third candle in the rectangle), **we have a strong drop in price,** which translates into **a drop in the CRSI indicator below 30.** This is therefore **a signal to close the position,** so we close it the next day at the opening (fourth candle in the rectangle). **The system worked correctly.**



Another example, this time closed with a large loss. At the end of June 2017, **wheat prices rose significantly, meeting the conditions for opening a position** (first candle in the rectangle; **CRSI > 90; Historical volatility > 100%). The next day (second candle in the rectangle), a sell limit order** was set, distant from the previous day's closing price by **1 x ATR.** The order was activated, **but prices rose for the next two days.** It was not until the next day (fifth candle in the rectangle) that we see a drop in price, which translates into **a drop in the CRSI below 30.** This is therefore a signal to close the position, so we close it the next day at the opening (sixth candle in the 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 **the basic parameters** that were **proposed by the creator, Larry Connors.**

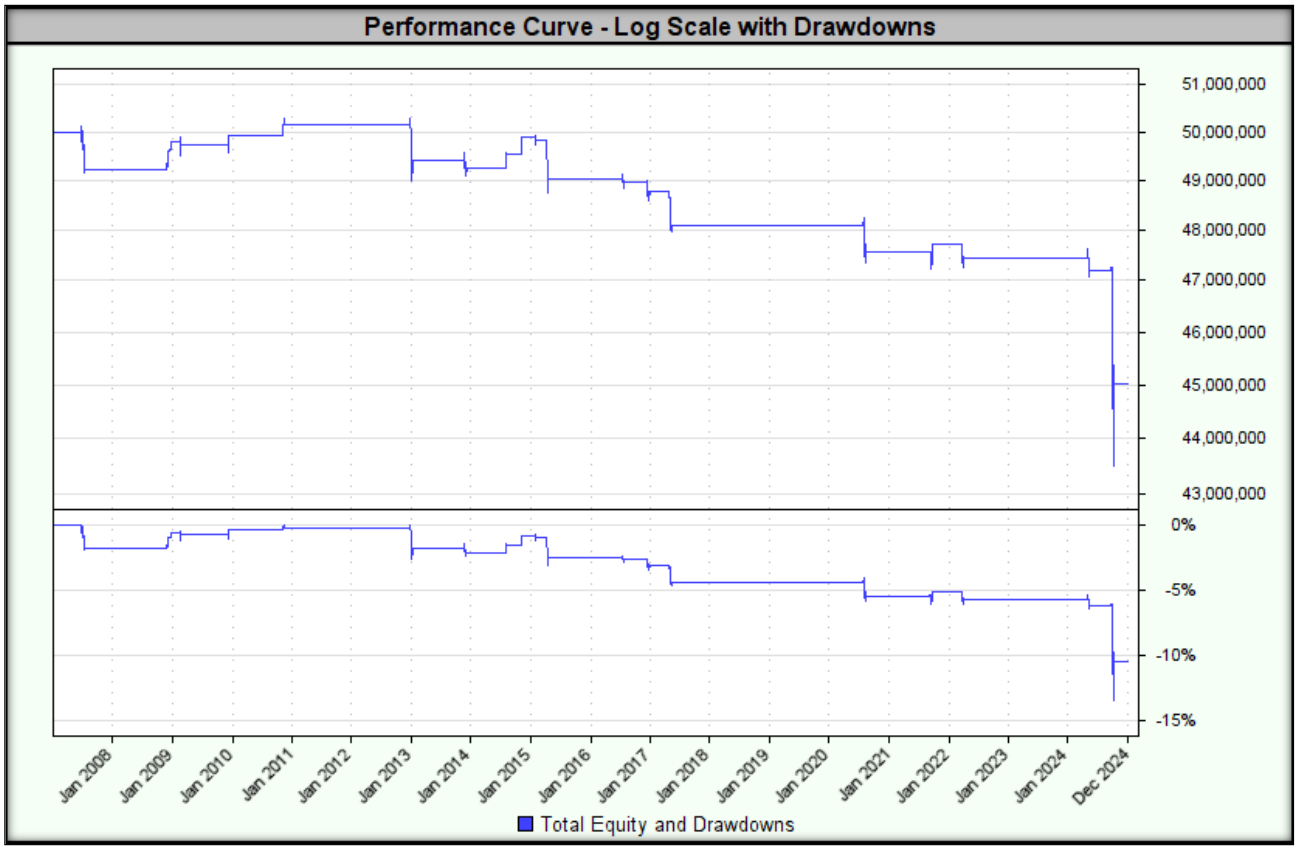
First of all, **we reject strategies that linearly lose capital.** If a strategy exhibits such a pattern, it is a clear signal that any parameter optimization does not make sense.

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

Tested base parameters:

- **Historical Volatility Period:** 100 days;
- **Historical Volatility Value:** 100%;
- **ConnorsRSI (CRSI):** RSI Bars (3), Streak Bars (2); Rank Bars (100);
- **Entries ConnorsRSI (CRSI):** 90;
- **Exit ConnorsRSI (CRSI):** 30;
- **Stop loss:** none;
- **Position opening method:** sell limit 1 x ATR(40) away from the previous day's closing price;
- **Position sizes:** corresponding to a risk of 1.0% of total capital, with a hypothetical stop loss order placed 2 x ATR (40 days) away from the position opening position;
- **Position direction:** short positions (sell) only.

The test result is shown below.



Indicators/Measures	Concluding a transaction at the opening price
CAGR%	-0.58%
MAR Ratio	-0.04
RAR%	-0.38%
R- Cubed	-0.04
Robust Sharpe Ratio	-0.27
Max Drawdown	13.5%
Wins	35.0%
Losses	65.0%
Average Win%	0.52%
Average Loss %	1.07%
Win/ Loss Ratio	0.49
Average Trade Duration (days)	12
Percent Profit Factor	0.26
SQN	-
Number of transactions	20

In summary, the system works properly and generates signals as expected. However, **tests on basic parameters have yielded poor results.** Therefore, **<u>further testing of the strategy is not justified,</u>** because its use in real transactions **is highly questionable.**

Step 4: Optimization and assessment of investment strategy stability

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

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

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 ≥ 50% for the rate of return** – means that the strategy retains at least half of its effectiveness outside 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 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.