When Backtests Meet Reality

Johann Christian Lotter / oP group Germany GmbH

www.Zorro-Project.com

www.Financial-Hacker.com

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When Backtests Meet Reality

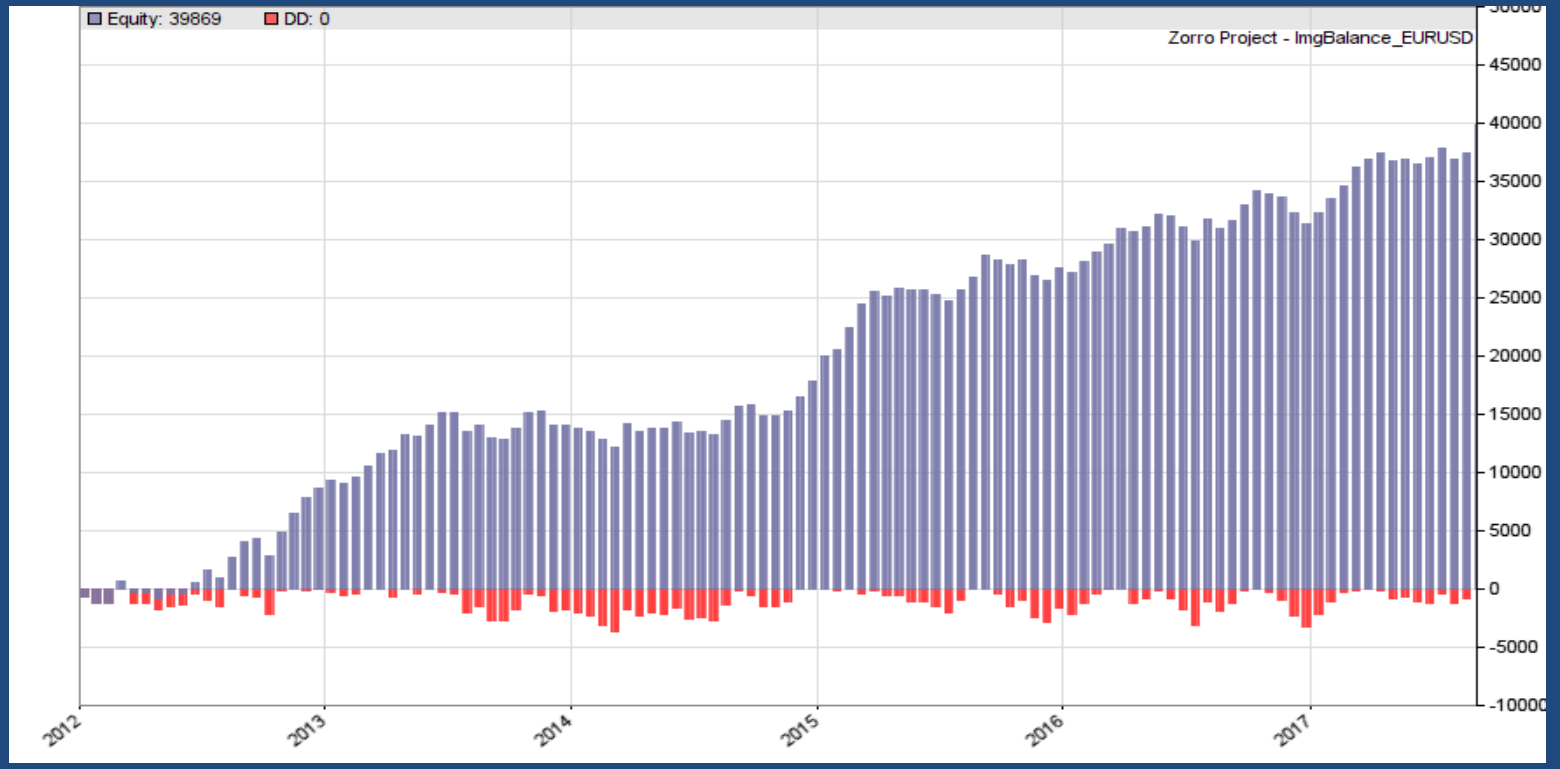
Agenda

- Backtest performance vs live performance
- Which deviation is tolerable?
- The „Cold Blood Index“

When backtests meet reality

Hypothetical trading strategy

- Profit factor: 1.5
- Out-of-sample backtest:

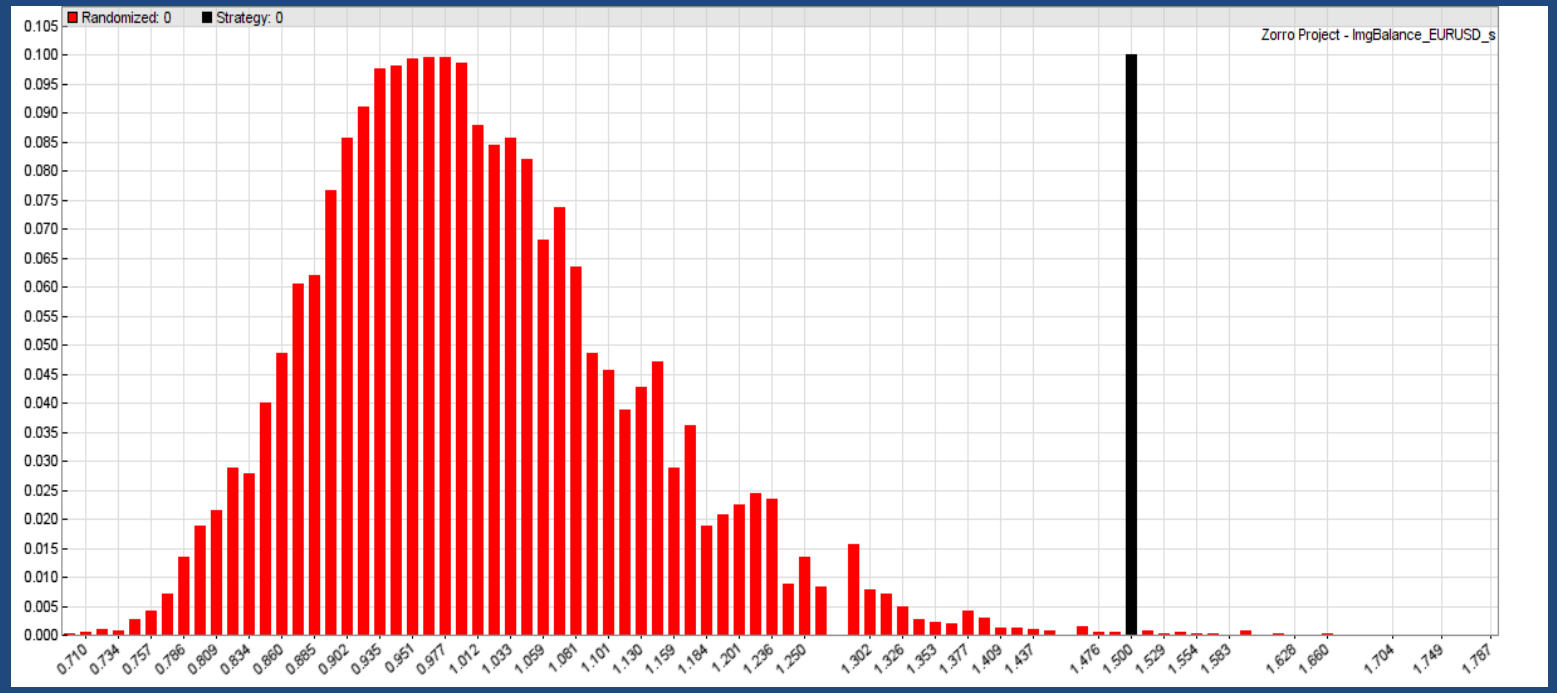


When backtests meet reality

Hypothetical trading strategy

Proft factor reality check

(with shuffled price curves):



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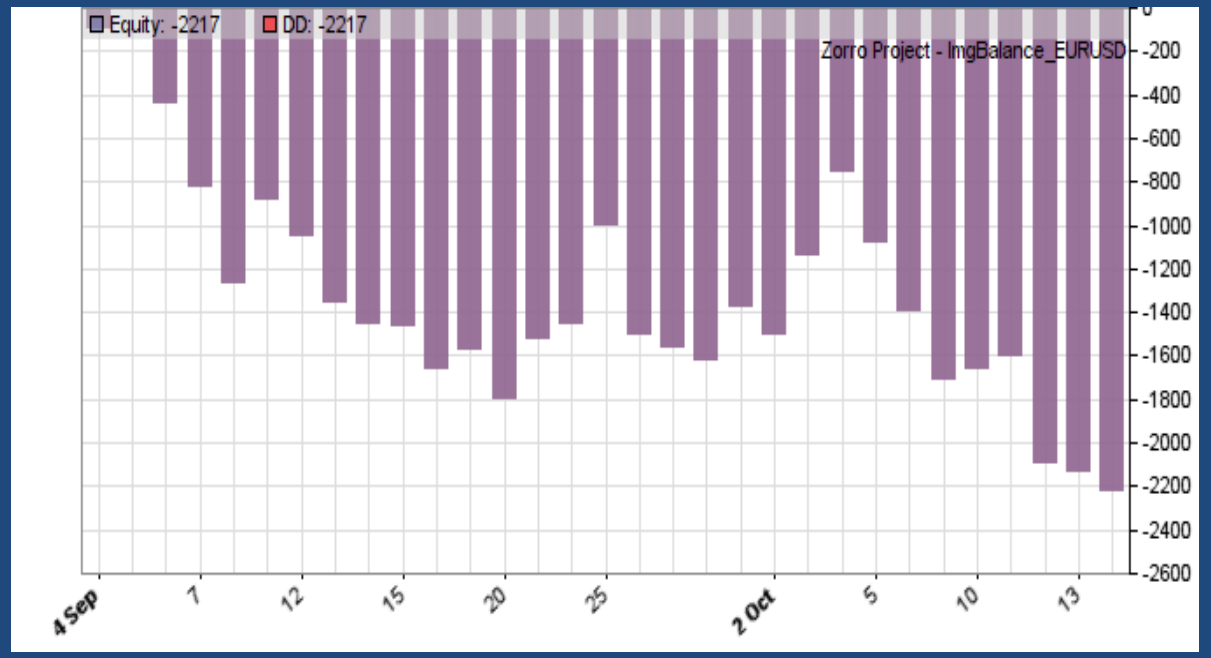
Trading it live

- $5000 initial capital
- Result after 6 weeks: $2200 loss



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Half capital gone - what now?

Pull out in panic?

Or go on in cold blood?

When backtests meet reality

Reasons for bad live results

- Bad luck => Go on
- Too short trade period => Go on
- Market change => Pull out
- Backtest was biased => Pull out
- Backtest was overfitted => Pull out
- Backtest Profitfactor was random => Pull out

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Determining market changes

- Lower trade volume
- Lower or higher volatility
- Higher mean reversion halflife
- Flatter frequency spectrum
- More randomness (Shannon entropy)
- etc. etc.

Problem: The nature of a market change is normally unknown.

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Determining backtest bias

- Put data aside for final test
  Problem: Data is rare and valuable
- Do not optimize
  Problem: Won't do for most strategies
- White's Reality Check
  Problem: Impractical for most strategies

When backtests meet reality

Determining bad luck

- Compare live drawdown with backtest
- Establish a drawdown tolerance limit
- If limit exceeded: pull out

When backtests meet reality

Limit = Worst drawdown

$$E_{(t)} < C + G\,\frac{t}{y} - D$$

E = Current account equity = $2800
C = Initial account capital = $5000
G = Backtest profit = $38000
t = Live trading period = 6 weeks
y = Backtest period = 300 weeks
D = Backtest max drawdown = $4000

(5000 + 38000*0.02 – 4000 = 1760)

The problem: Drawdown depth increases with time…

When backtests meet reality

Limit = Time-adjusted drawdown

$$E_{(t)} < C + G\,\frac{t}{y} - D\sqrt{\frac{t+l}{y}}$$

E = Current account equity = $2800
C = Initial account capital = $5000
G = Backtest profit = $38000
t = Live trading period = 6 weeks
y = Backtest period = 300 weeks
D = Backtest max DD depth = $4000
l = Backtest max DD length = 15 weeks

(5000 + 38000*0.02 – 4000*0.26 = 4720)

The problem: Uses only G and D from the whole backtest; gives a limit, but no quantitative parameter

When backtests meet reality

A more precise pull-out indicator:

- Calculates the drawdown probability
- Analyzes the complete backtest curve
- Considers drawdown duration

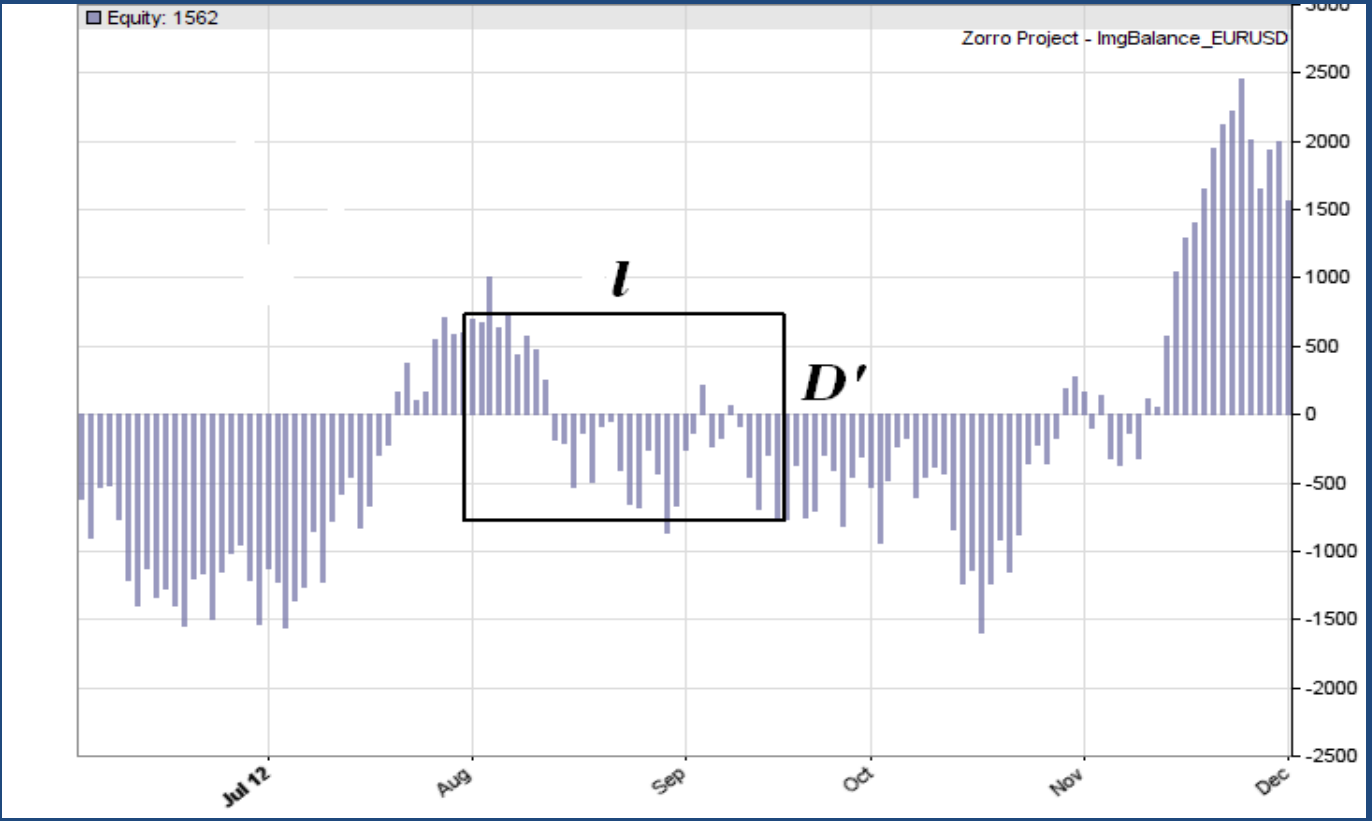
Cold Blood Index

„Cold Blood Index“ Algorithm
(from www.Financial-Hacker.com)

1. Determine length ***l*** and depth ***D*** of the currently worst drawdown.
2. Place a window of size ***l*** at the start of the first equity curve.
3. Determine the equity difference ***D'*** from end to start of the window. Increase a counter ***C*** when ***D' > D***.
4. Move the window forward by 1 day.
5. Repeat steps 3 and 4 until the window arrived at the end of the equity curve. Count the steps with a counter ***S***.
6. Repeat steps 3-5 with a set of shuffled curves. Calculate the mean ***N*** of all ***C***-values.

Cold Blood Index

Sampling window



Cold Blood Index

Algorithm, part 2

We now got the following numbers:

- ***N*** – number of all sections of length ***l*** in all backtest curves with a drawdown similar or worse than ***D***.
- ***S*** – number of all sections of length ***l*** in all backtest curves.
- ***T*** - number of all sections of length ***l*** in the live trading curve.

When pulling ***T*** balls from a basket of ***S*** balls of which ***N*** are red, how likely is it to NOT get at least one red ball?

Cold Blood Index

Ways of picking T balls:

$$\binom{S}{T} = \frac{S!}{T!\,(S-T)!}$$

Ways of picking no reds:

$$\binom{S-N}{T} = \frac{(S-N)!}{T!(S-N-T)!}$$

Probability of no reds in T balls:

$$P = \frac{(S-N)!\,(S-T)!}{S!\,(S-N-T)!}$$

Cold Blood Index

Drawdown Probability

$$1 - P = \frac{(S - N)!\,(S - T)!}{S!\,(S - N - T)!}$$

- ***P*** – Probability of the current drawdown
- ***N*** – number of all sections of length ***l*** in all backtest curves with a drawdown similar or worse than ***D***.
- ***S*** – number of all sections of length ***l*** in all backtest curves.
- ***T*** - number of all sections of length ***l*** in the live trading curve

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Drawdown right at start (***T = 1***):

$$P = 1 - \frac{(S-N)!\,(S-1)!}{S!\,(S-N-1)!} = \frac{N}{S}$$

Our hypothetical strategy:

N = 135, S = 1500 => ***P = 9%***

Cold Blood Index

When CBI fails

- Too short backtests (S < T)
- Reinvesting in backtest
- Drawdown already encountered
- Drawdown not normalized

Cold Blood Index

CBI Practical Use Example

- When the system is in a drawdown:
- Calculate CBI every day
- System stops automatically when CBI < 5%

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CBI source code on: www.Financial-Hacker.com