Down, Down, Deeper and Down

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Algo Trading Summit (Online)

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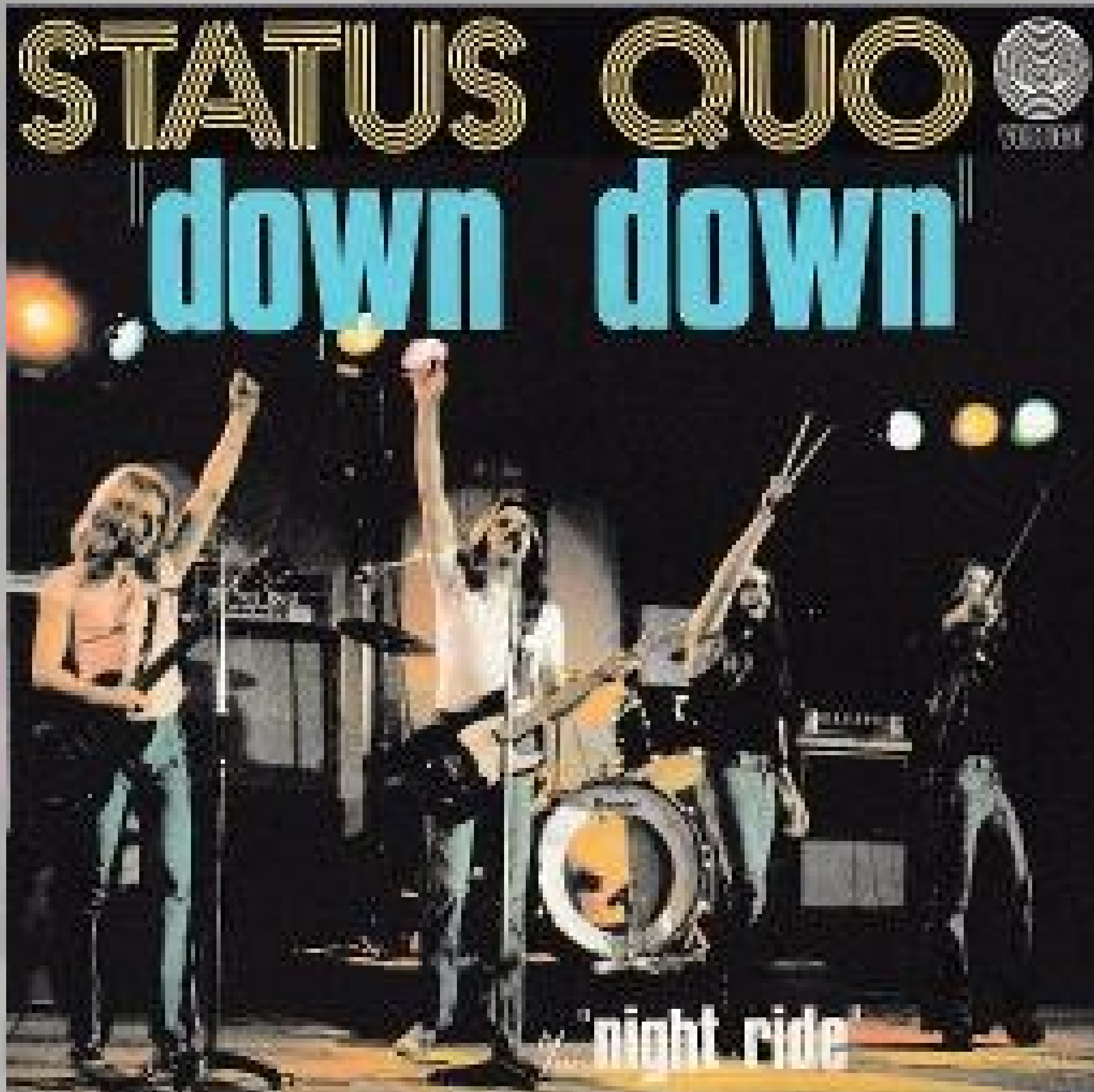
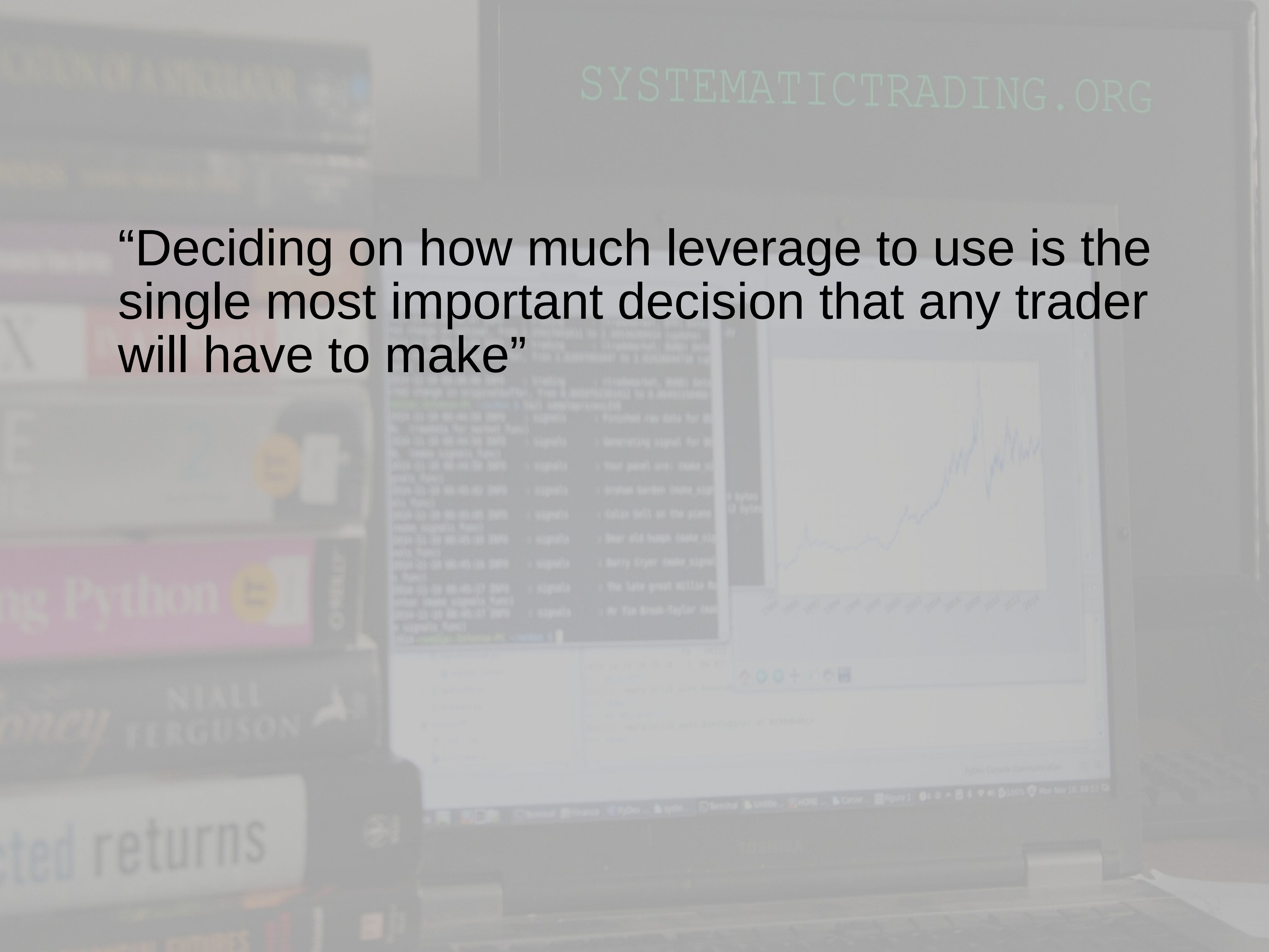

STATUS QUO
'down down'
'night ride'

“Deciding on how much leverage to use is the single most important decision that any trader will have to make”



“Deciding on how much leverage to use is the single most important decision that any trader will have to make”

‘Leveraged Trading’, 2019

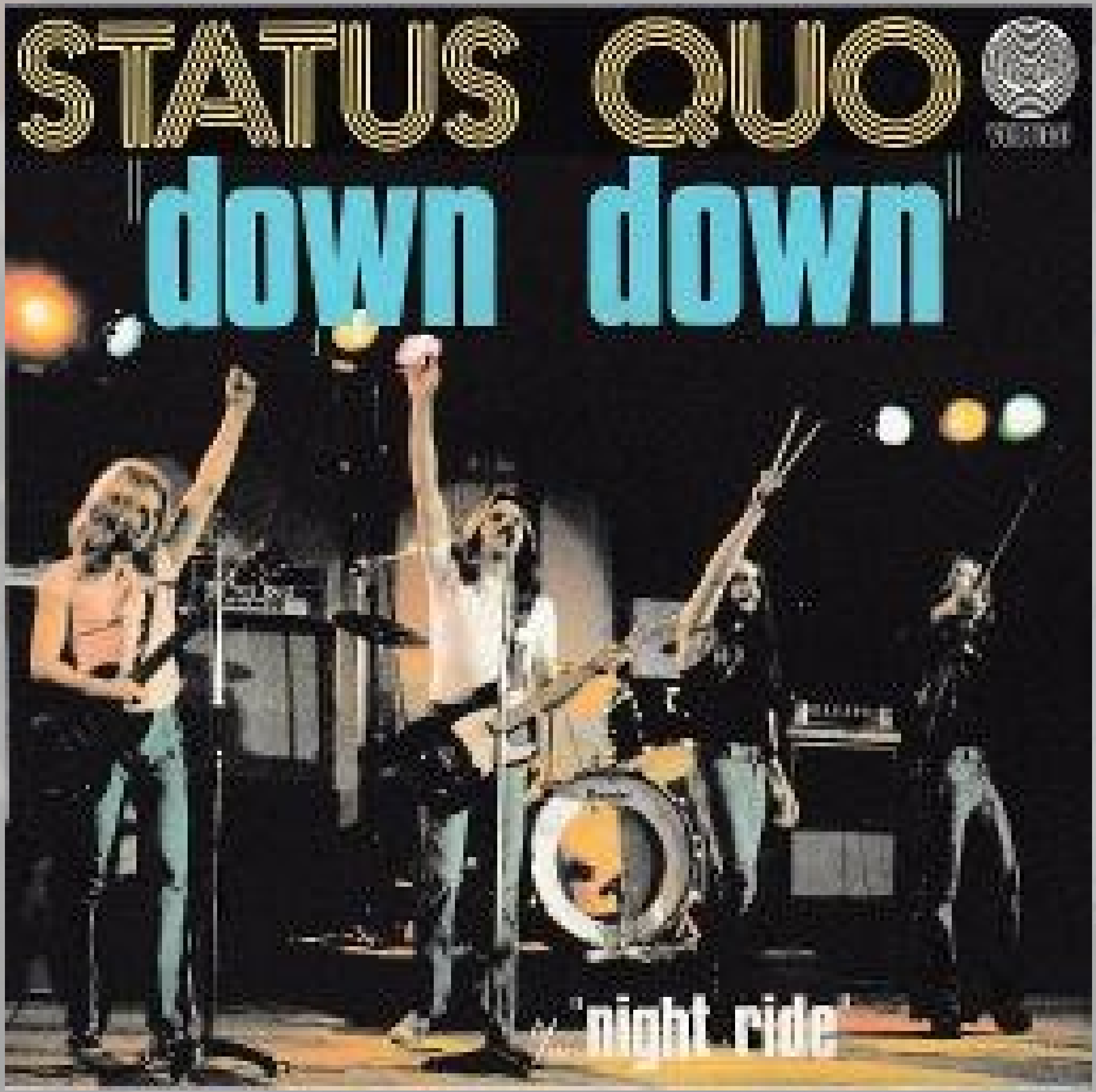
Robert Carver

“Deciding on how much leverage to use is the single most important decision that any trader will have to make”

But how do we make that decision? And what are targeting?

Method A: ‘Fancy’ Annualised standard deviation using Kelly Criteria

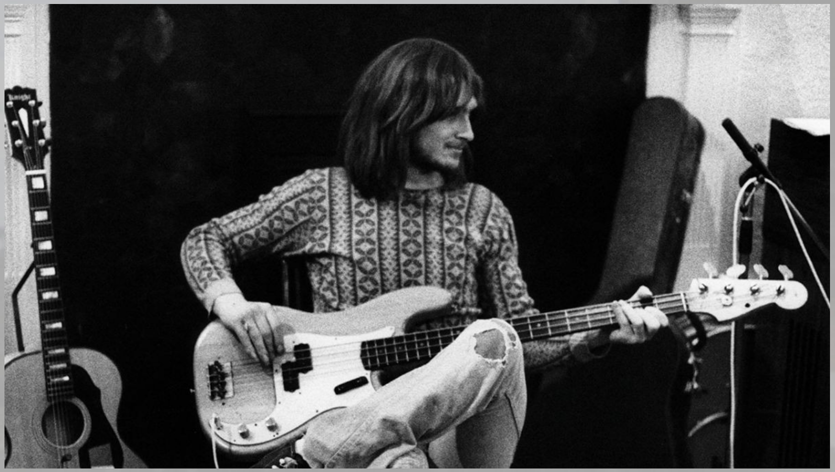
Method B: ‘Crude’ Scaling based on maximum drawdown



Method A: ‘Fancy’ Annualised standard deviation using Kelly Criteria

“I care about the ex-post distribution of returns. I know about the Kelly Criteria. I understand statistics.“

“There are 10 instruments in my record, 8 of which I played myself”

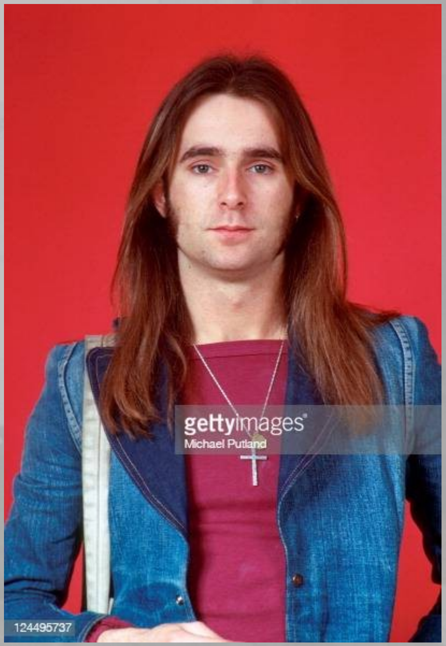


Method B: ‘Crude’ Scaling based on maximum drawdown

“I care about losing all my money. Who’s this Kelly guy?“

“There are three instruments in the record. And three* chords”

** not true. There are eight.*



Method A

- We scale our positions to achieve a specific risk target.
- The risk target is measured as an annualised standard deviation of returns.
- The risk target may be achieved daily, or over longer time period (which is better: see https://qoppac.blogspot.com/2020/10/should-i-run-my-trading-system-at-fixed.html)

Method A

- The risk target should be the most conservative of:
  - Risk possible given leverage available
  - Risk possible given prudent leverage limits
  - Risk possible given personal appetite
  - Risk possible given expected profitability of your trading system

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  - **Risk possible given expected profitability of your trading system**

Method A

- The optimal level of leverage is known as the Kelly optimum (and other names).
- We maximise log (final wealth)
- This is equivalent to maximising geometric mean

Method A

- Optimal Kelly leverage factor f:

$$f = (\mu - r_f) / \sigma^2 = \text{Sharpe Ratio} / \sigma$$

- Rearranging we get:

$$f\sigma = (\mu - r_f) / \sigma$$

- Optimal risk σ = Sharpe Ratio

Method A

Caveats:

- Full Kelly is very aggressive. Half is more common.
- Assumes Gaussian returns. Assumes no time dependence.
- Can we trust backtests? Overfitting, survivorship bias, costs…
- Can we measure Sharpe Ratio with precision?

Method A

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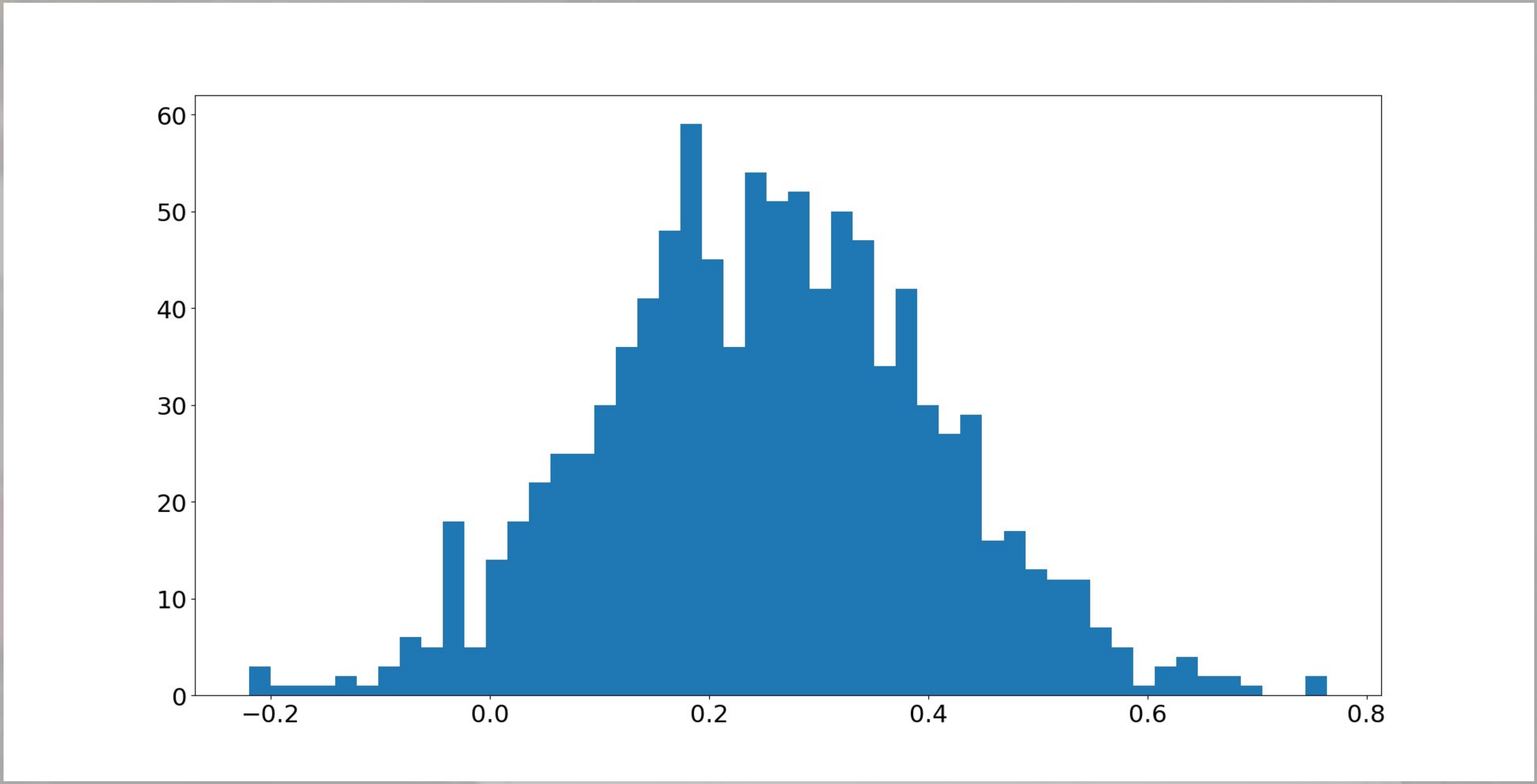
- **Can we measure Sharpe Ratio with precision?**

Method A

Can we measure Sharpe Ratio with precision?

- Sharpe ratios, like other statistics, have sampling error.
- Thus the optimal risk target also has a sampling error.



Bootstraps of 10 year backtests, True Sharpe Ratio of 0.5, Optimal annualised risk target using half Kelly criteria (half SR in backtest)

Method B: 3 ~~chords~~ steps

Run backtest on some arbitrary capital

Measure maximum drawdown

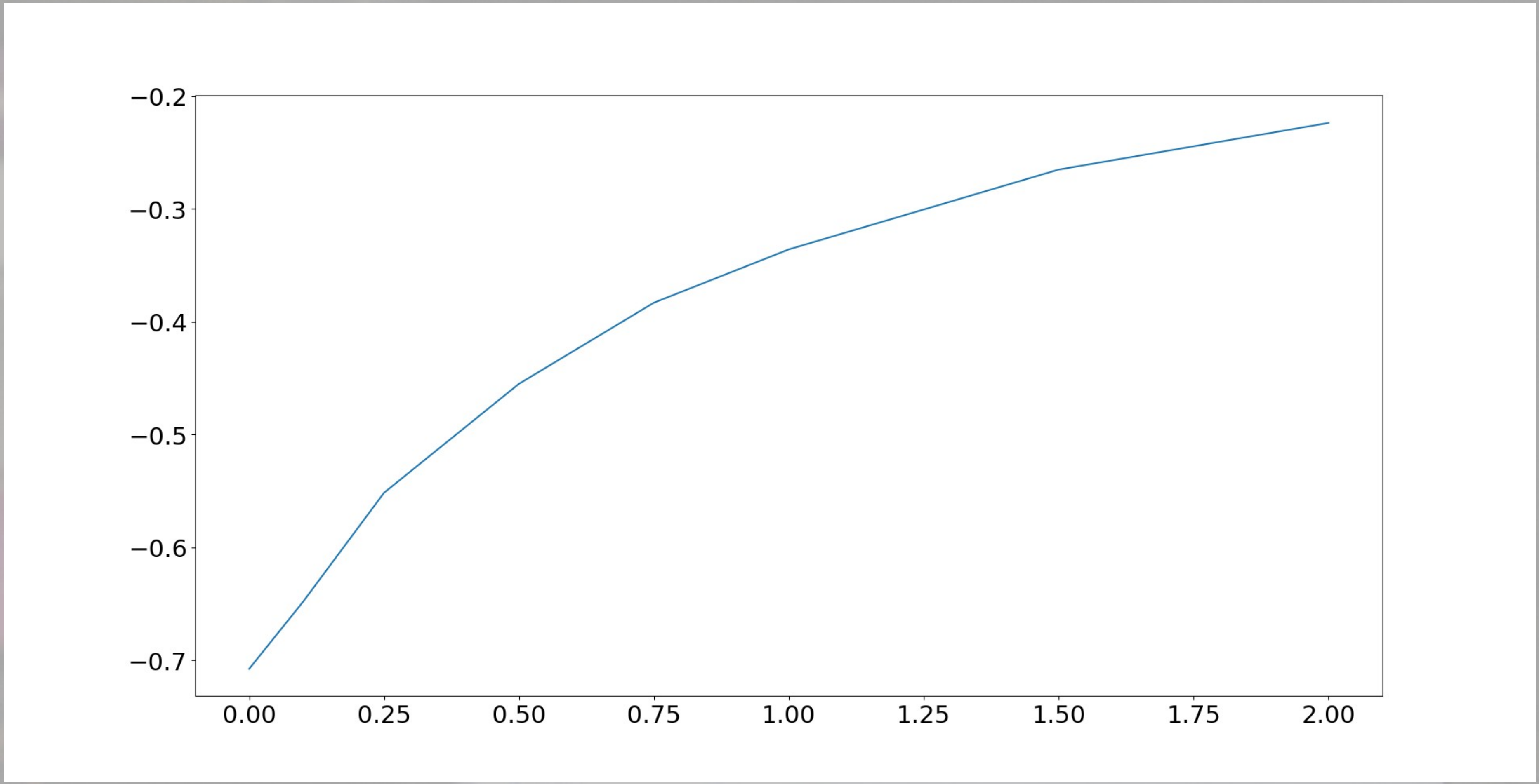
Set required capital so we never lose more than x% of our capital (I use 50%)

Method B

Simple!

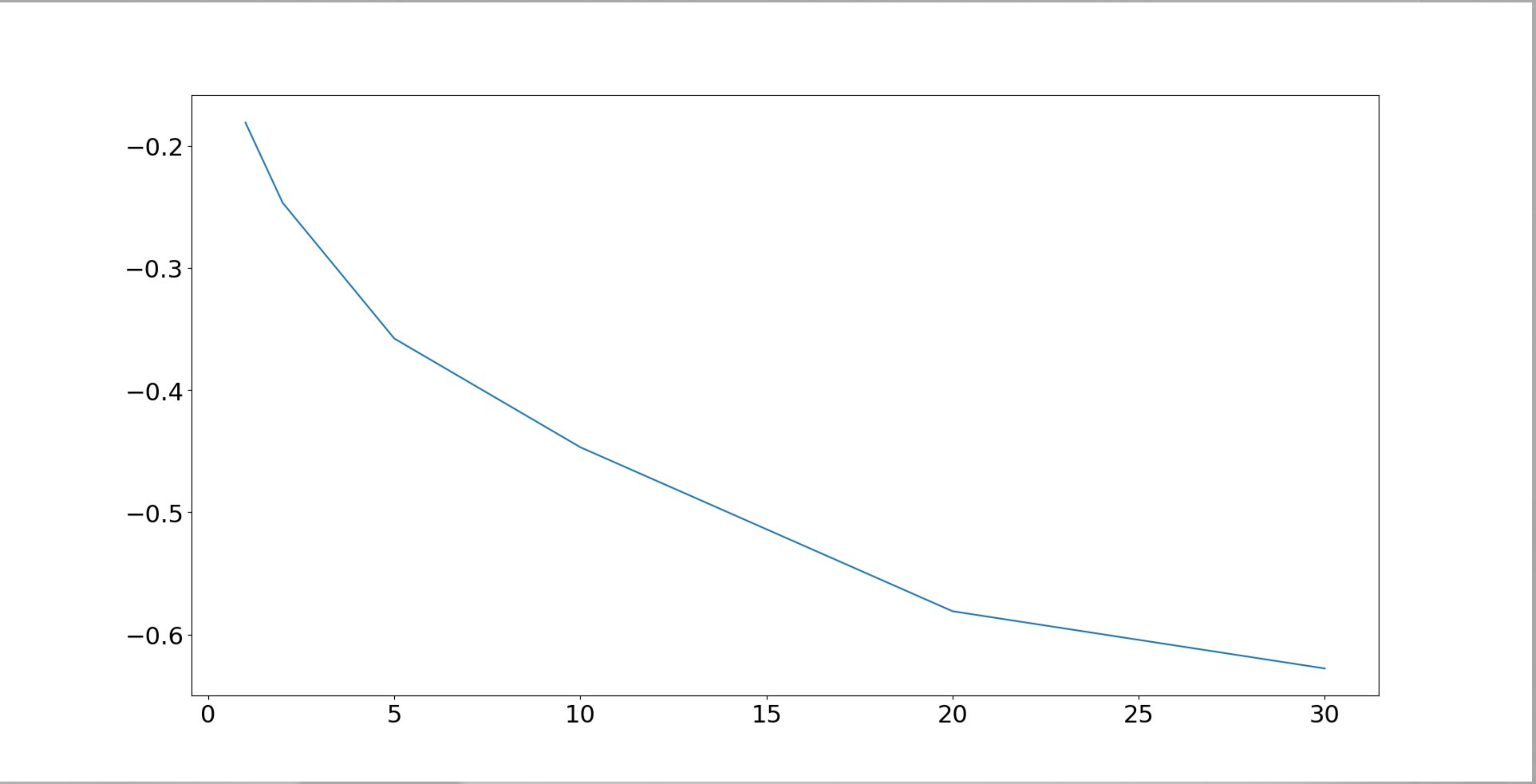
We can map this to a target standard deviation (for comparison purposes)

Properties of Max Drawdown



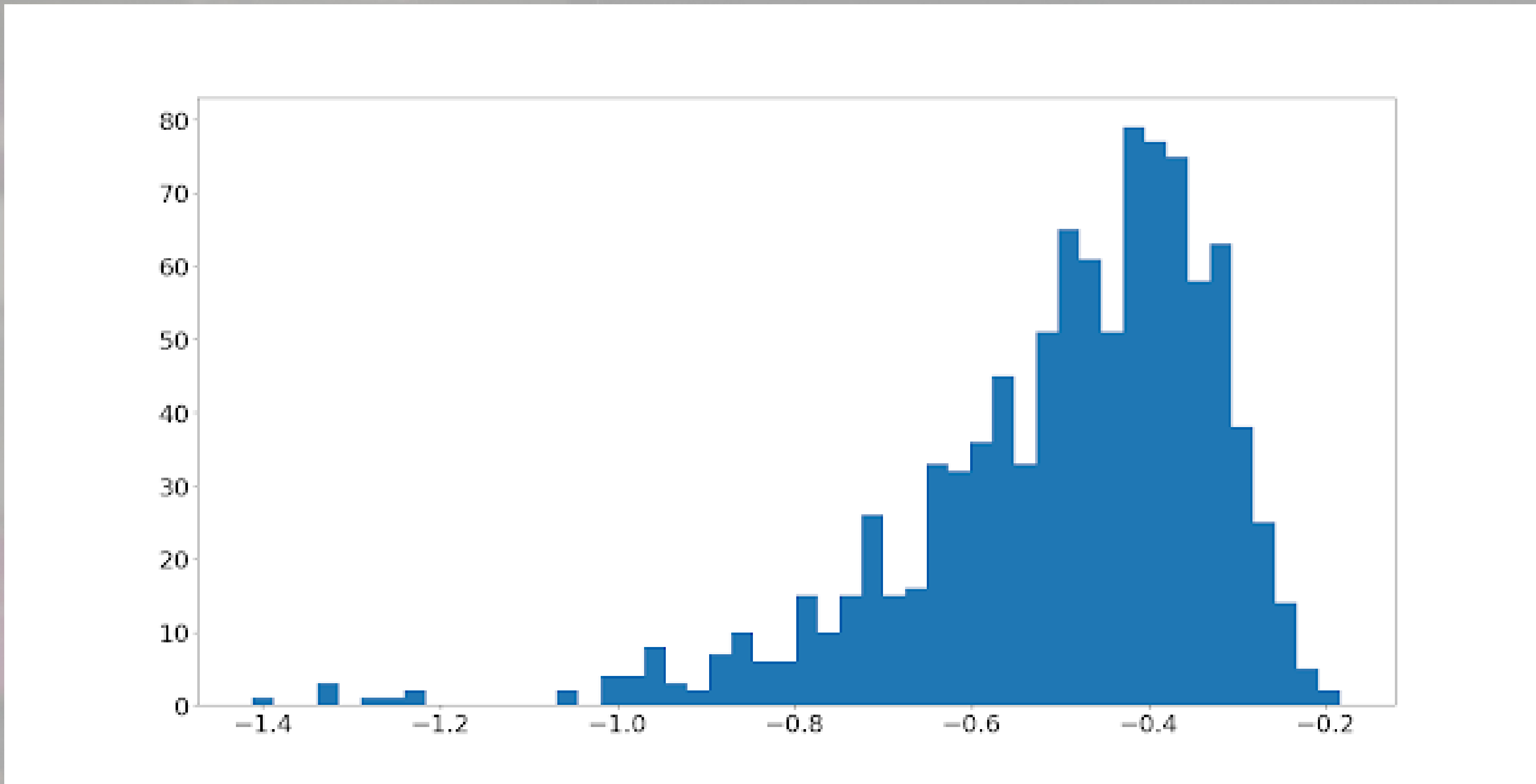
X-axis:annual Sharpe Ratio of returns. Y-axis: Median worst 10 year drawdown as a percentage using fixed capital. Period: 10 years. Standard deviation: 20% per year. Skew 0.0

Properties of Max Drawdown



X-axis: Length of backtest in years. Y-axis: Median worst 10 year drawdown as a percentage using fixed capital. SR 0.5, Standard deviation: 20% per year. Skew 0.0

Properties of Max Drawdown



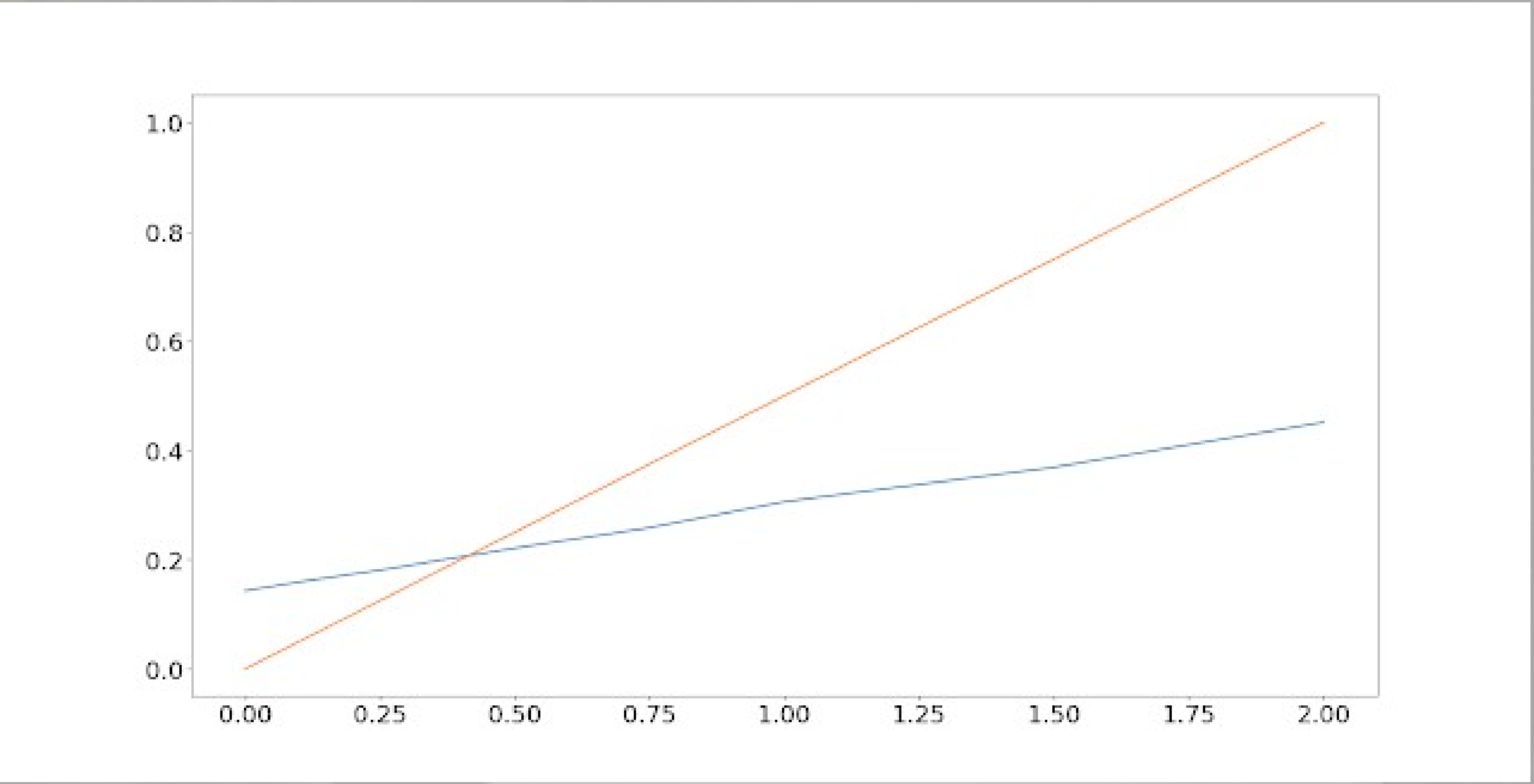
Distribution of maximum drawdown estimate. 10 year backtests. SR 0.5, Standard deviation: 20% per year. Skew 0.0

Comparing methods A and B

Method A: Set risk target at half Kelly (half SR)

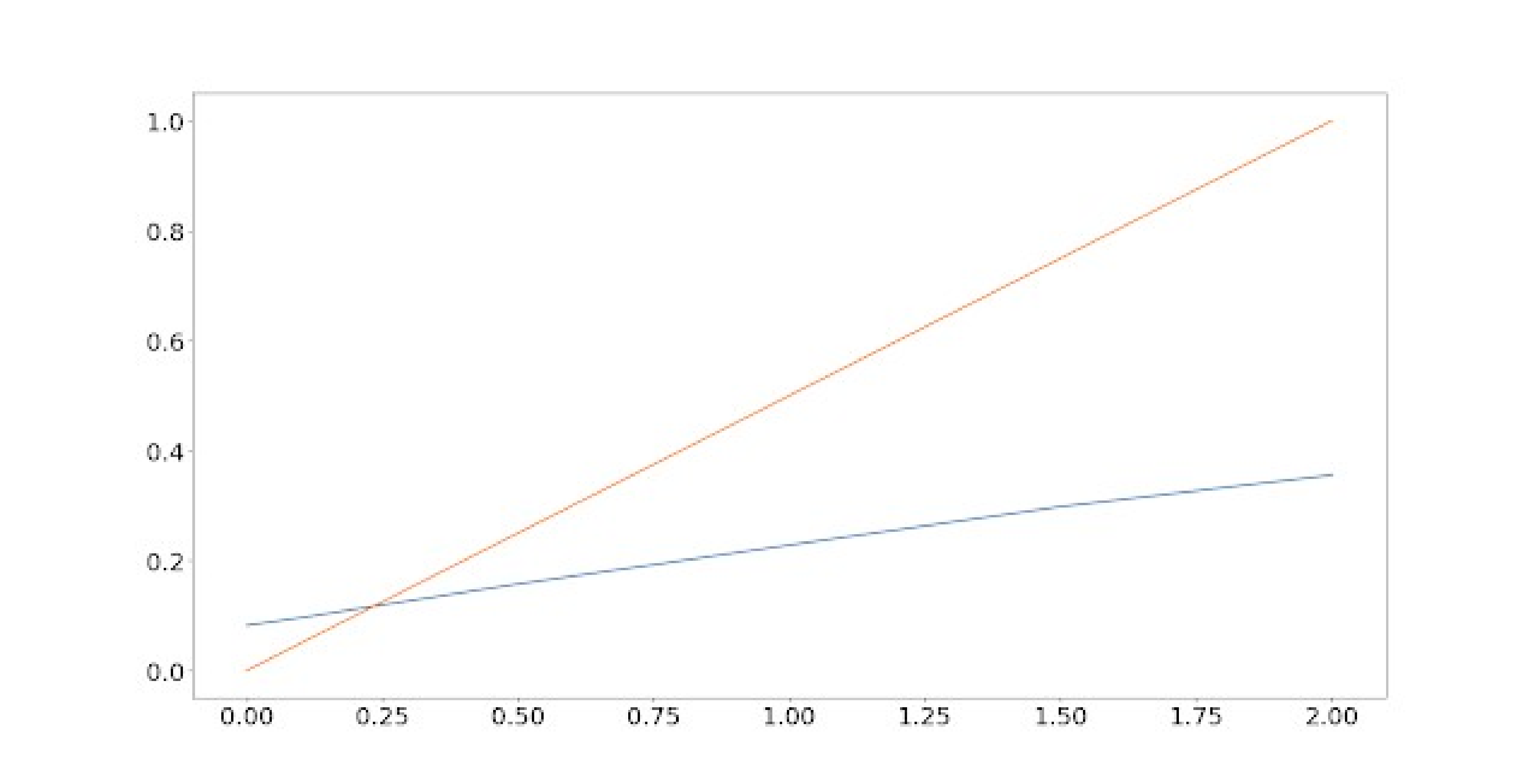
Method B: Set risk target such that our maximum drawdown over 10 years is half our capital

Comparing methods A and B

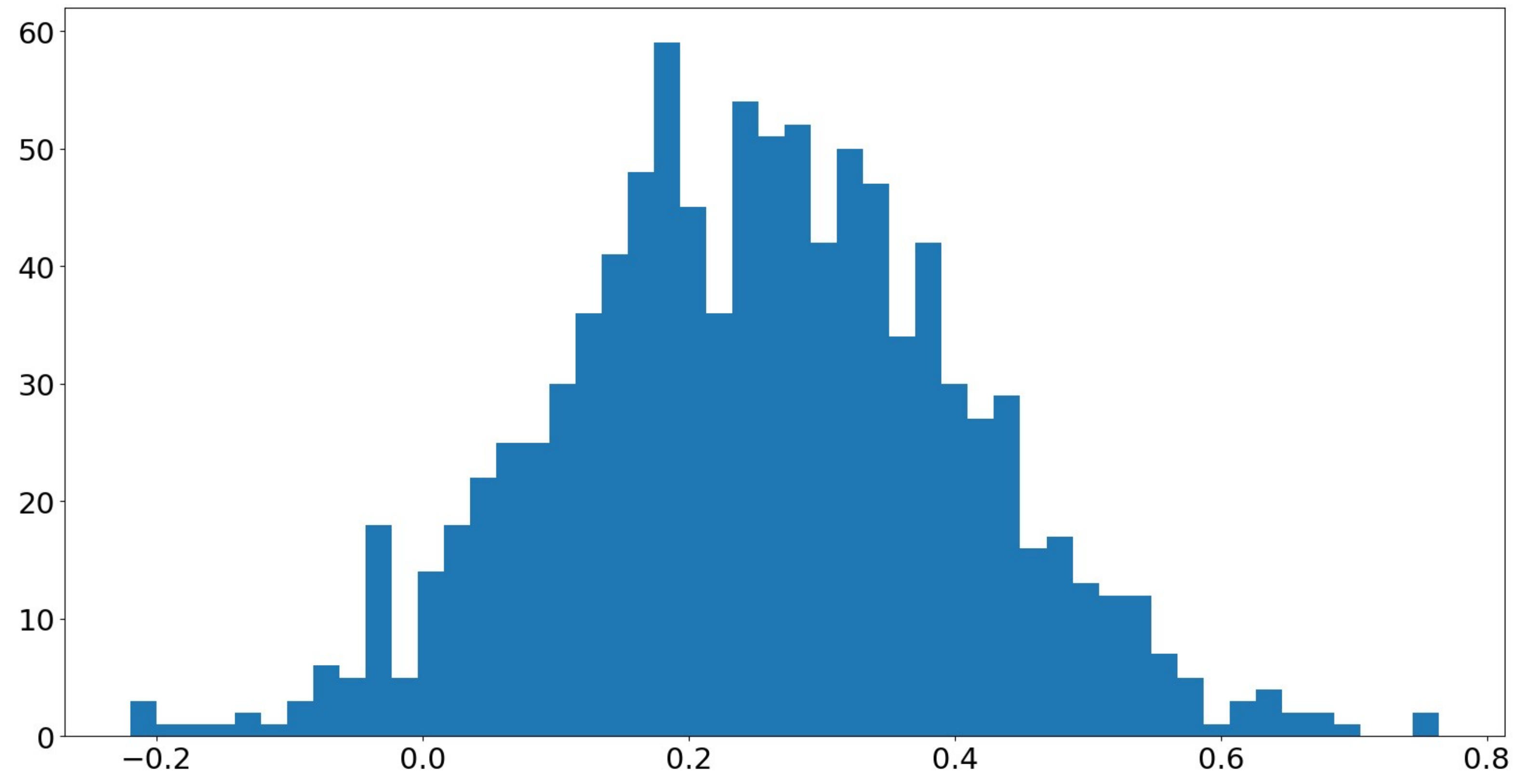


X-axis expected annualised Sharpe Ratio. Y-axis: appropriate risk target, annual standard deviation of returns. Blue line: Risk targeting based on Max DD. Orange line: risk targeting based on Kelly. Skew 0, 10 year backtest

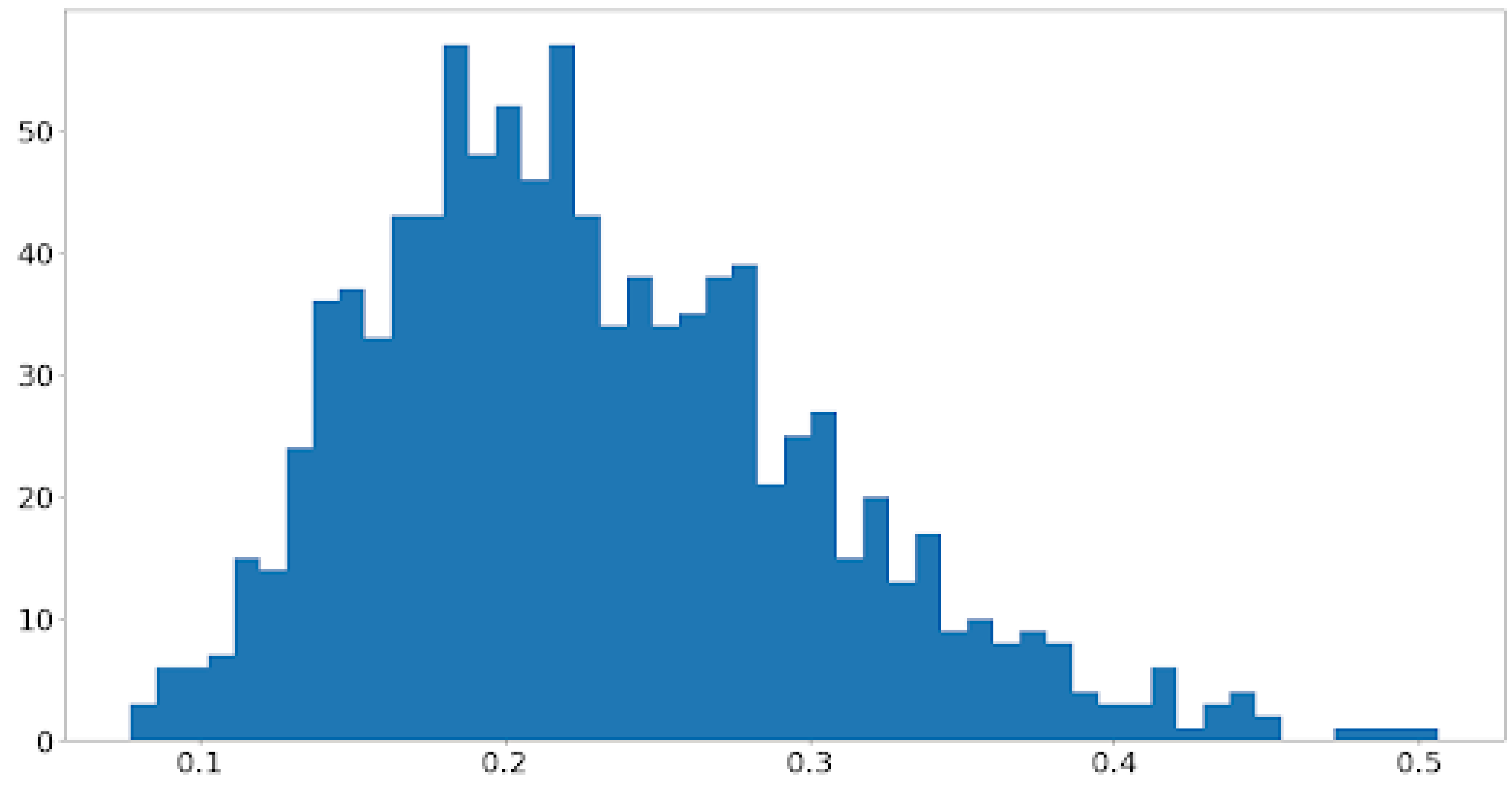
Comparing methods A and B



X-axis expected annualised Sharpe Ratio. Y-axis: appropriate risk target, annual standard deviation of returns. Blue line: Risk targeting based on Max DD. Orange line: risk targeting based on Kelly. Skew 0, 30 year backtest



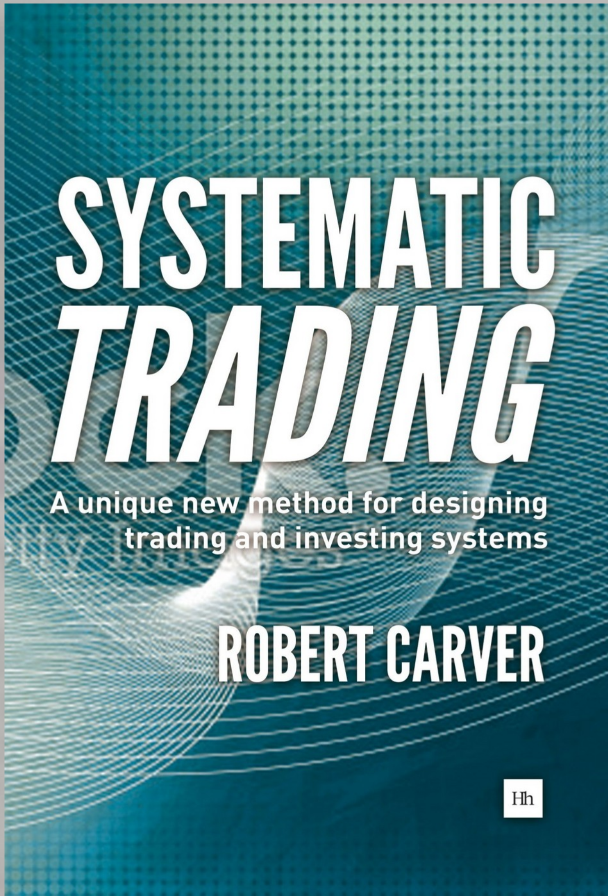
Bootstraps of 10 year backtests, True Sharpe Ratio of 0.5, Optimal annualised risk target using half Kelly criteria (half SR in backtest)

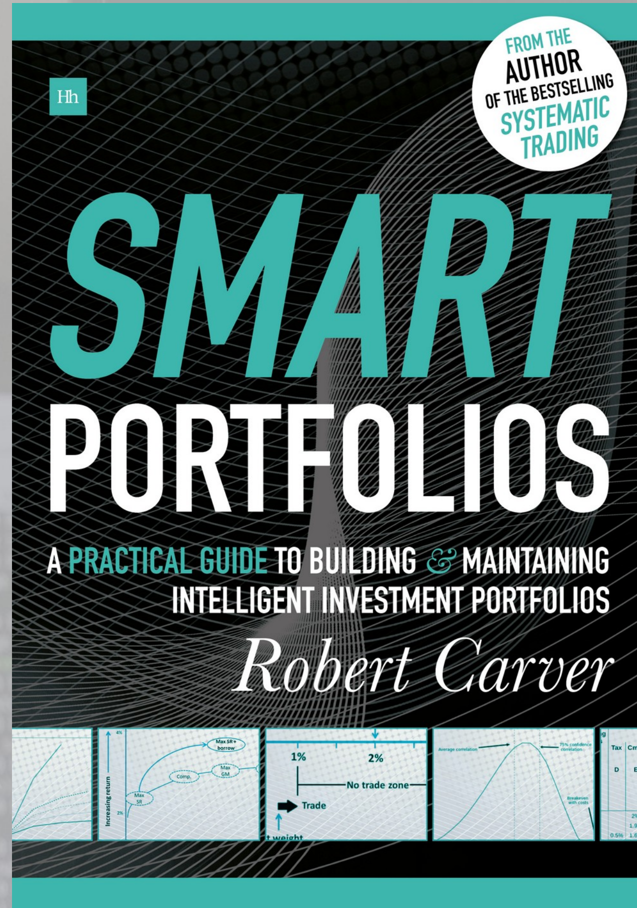


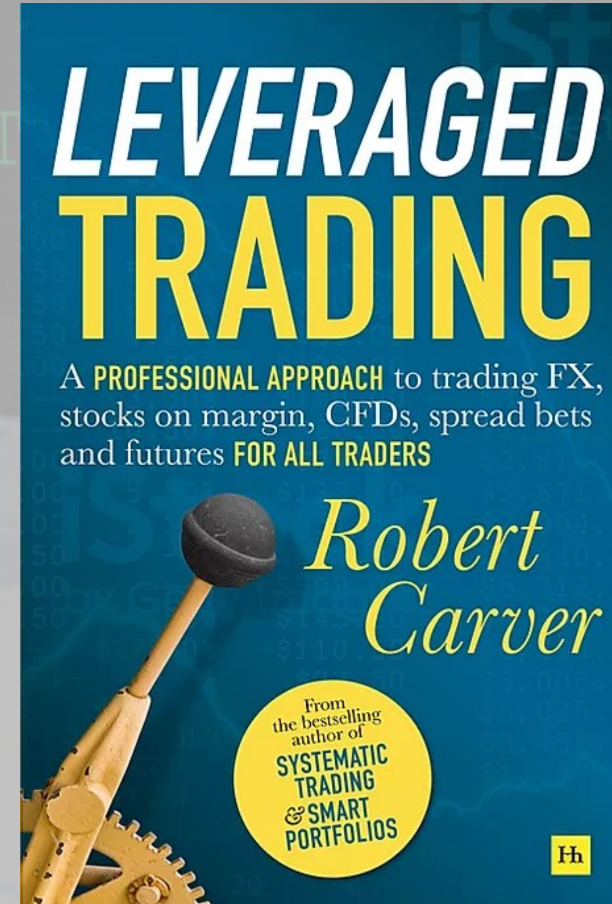
Distribution of optimal vol targets calculated as 0.2*0.5/Max_dd where Max_dd is the worst drawdown over 10 years on a random series of data calculated using a 20% annual standard deviation of returns

Conclusions

- Max drawdown is related to time series length.
- It’s a single data point: noisy statistic
- Both methods suffer from similar levels of sampling error
- On a ‘like for like’ basis, drawdown is more (too?) conservative for higher performing systems.
- Used carefully, max drawdown isn’t that bad.
- Tubular Bells is a masterpiece, but you can’t dance to it.







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