Design Report Presentation

Outline

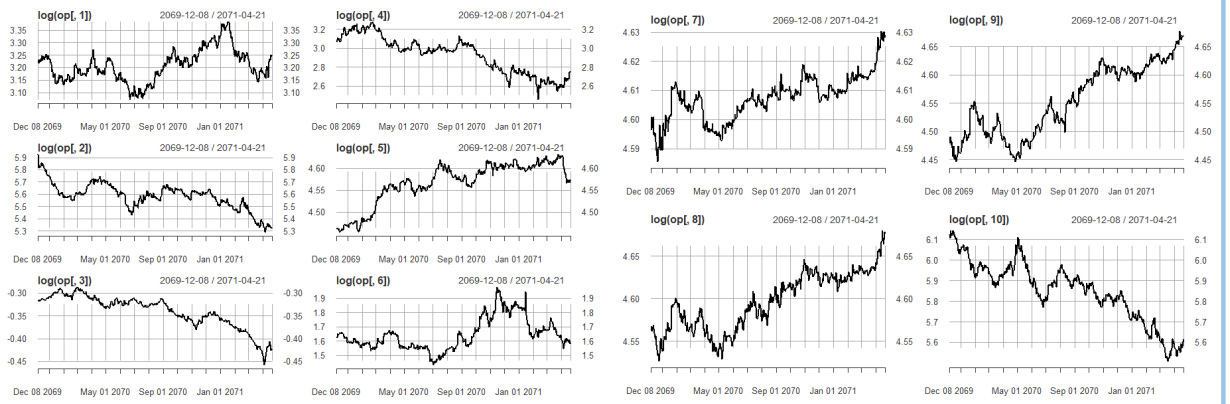
- **Analysis of Time Series**
- **Trading Strategies**
- **Risk Management**
- **Plan**

Analysis of Time Series

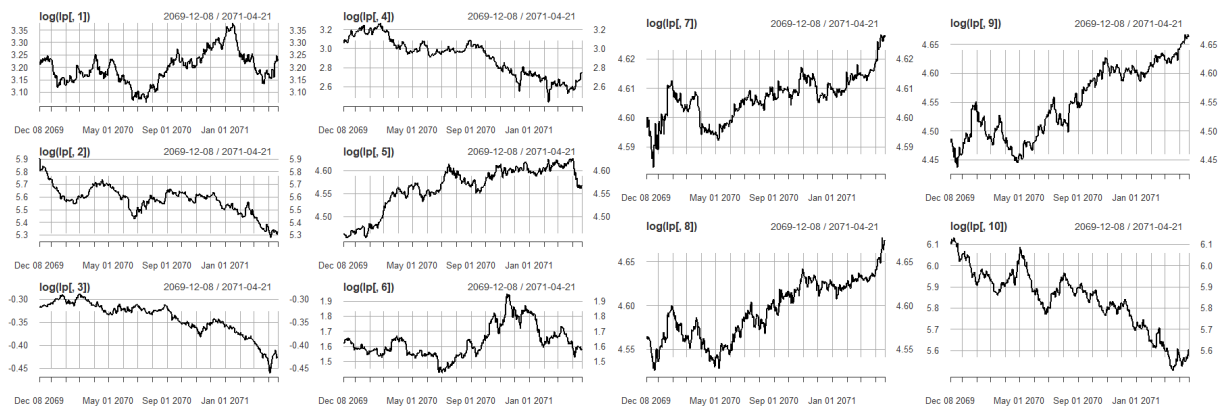
- Basics Exploration
- Basics Statistical Test
- Technical Indicator Data Analysis

Log open/high/low/close price plot

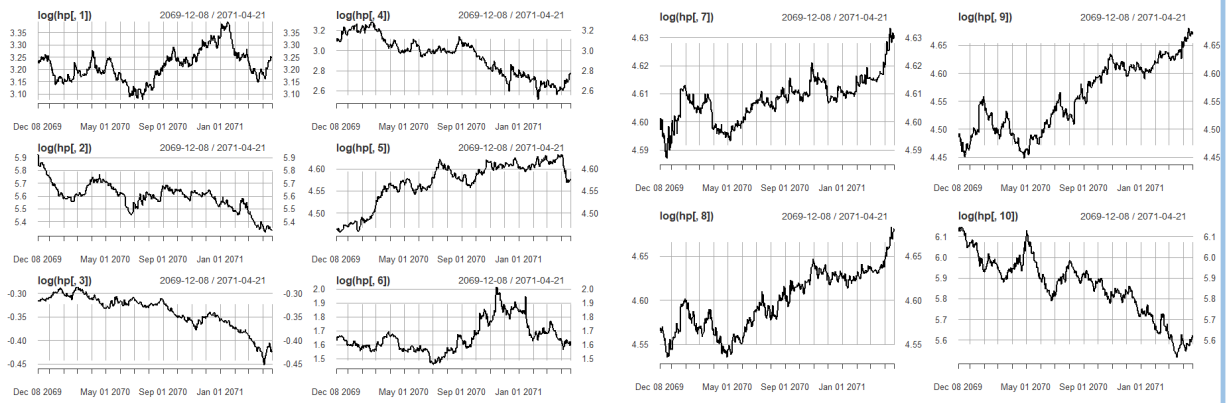
Open



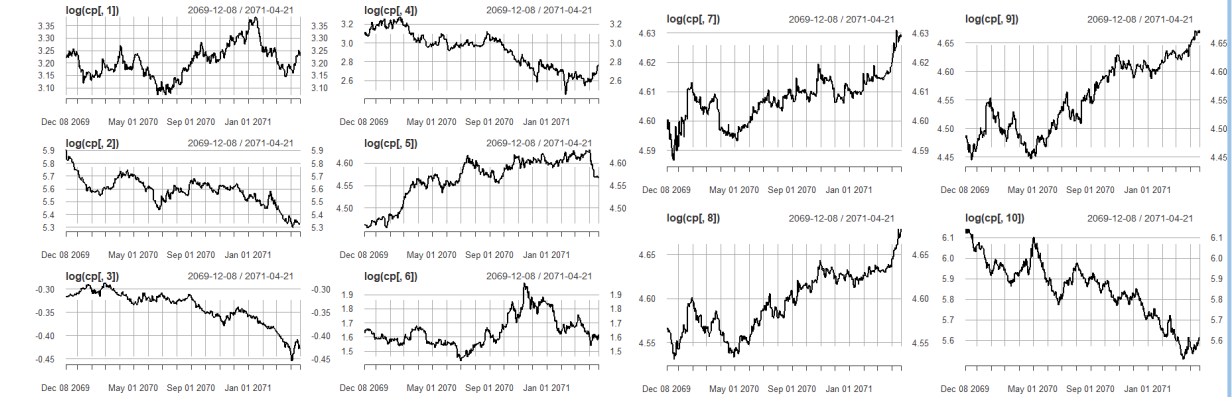
Low



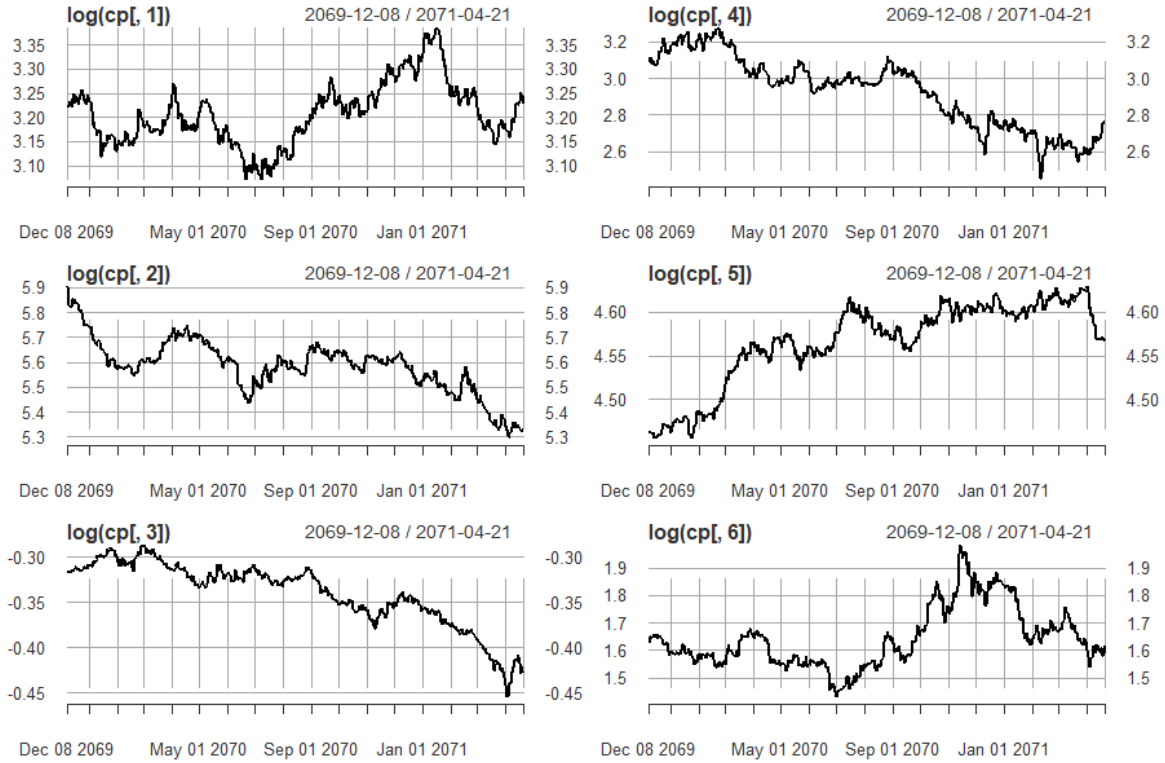
High

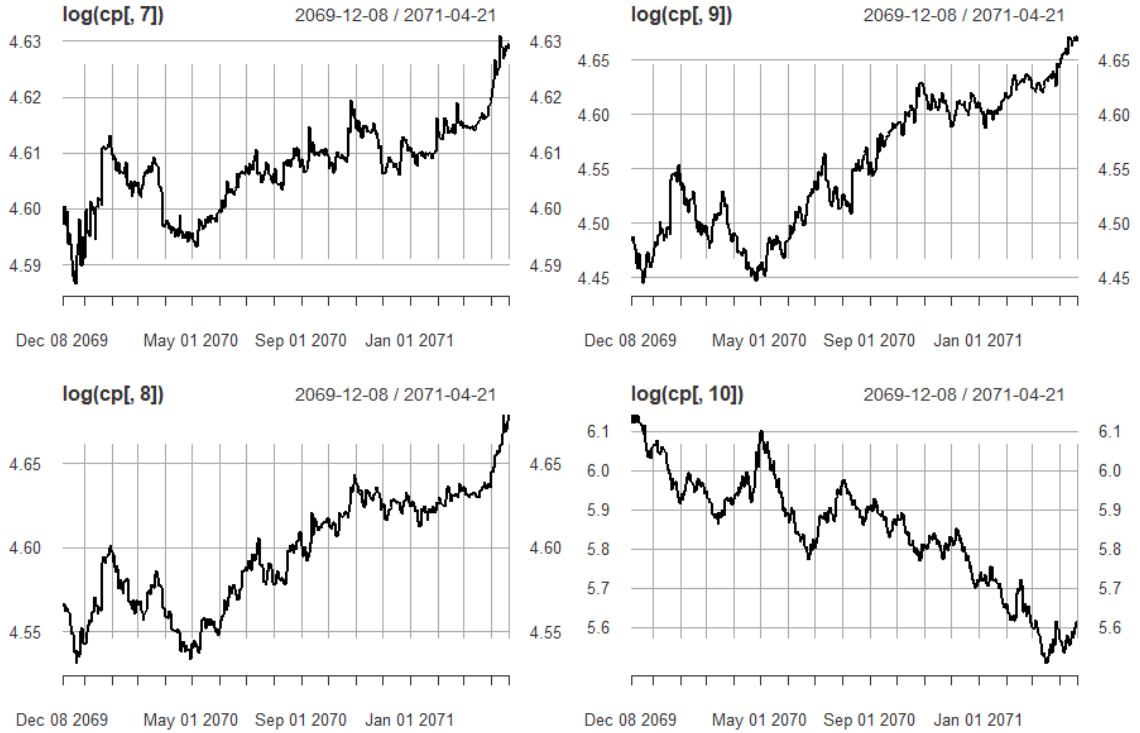


Close



Log Close Price

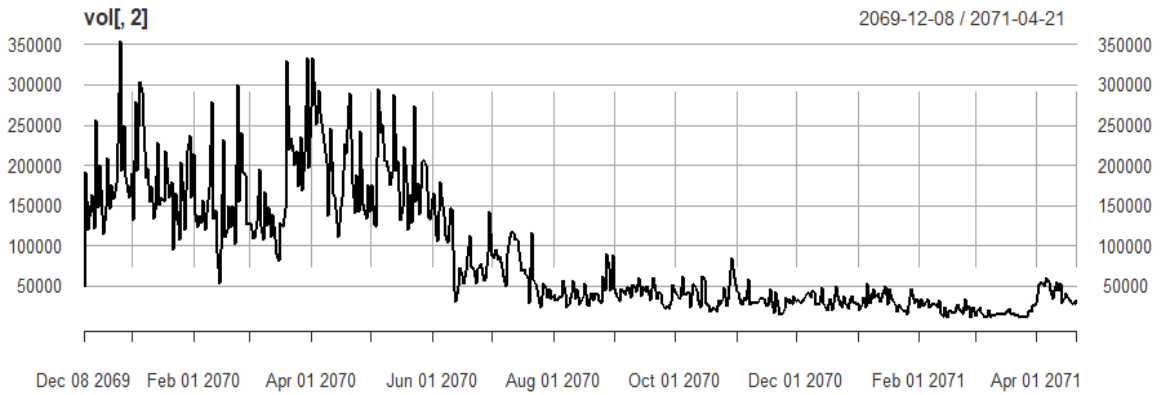


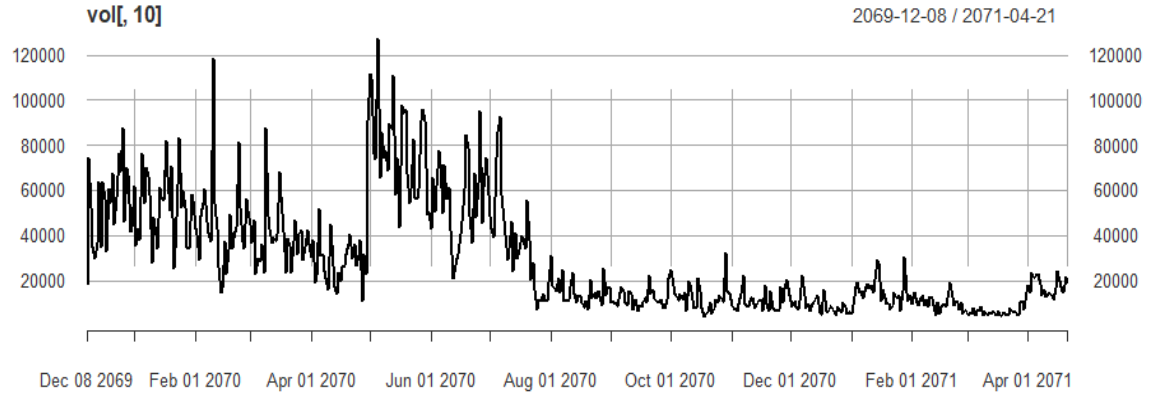


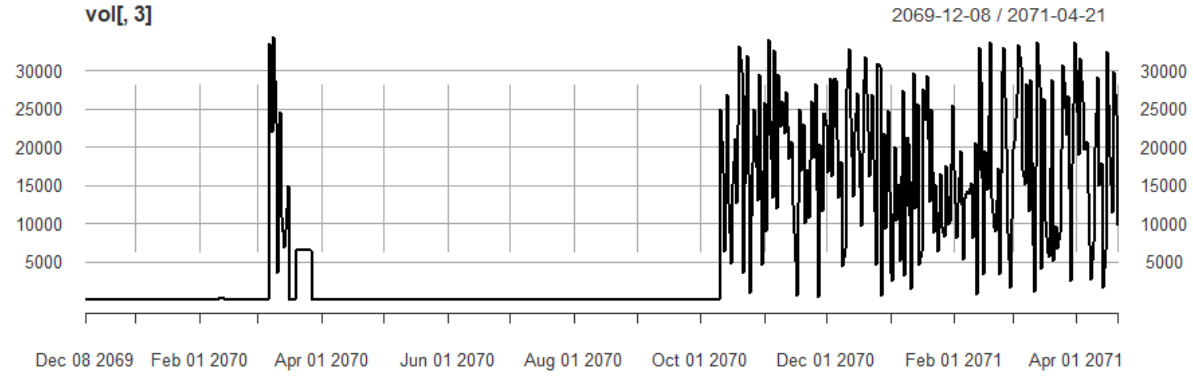
According to the log close price graph it can be concluded:

- series2, 3, 4 and 10 are downtrend.
- series7, 8 and 9 are in an uptrend and the three series have very similar trends.
- series1, 5 and 6 do not have a clear trend and have a strong overall volatility.

Volume



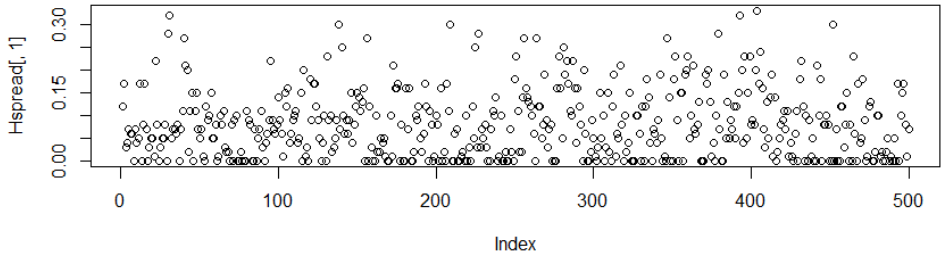


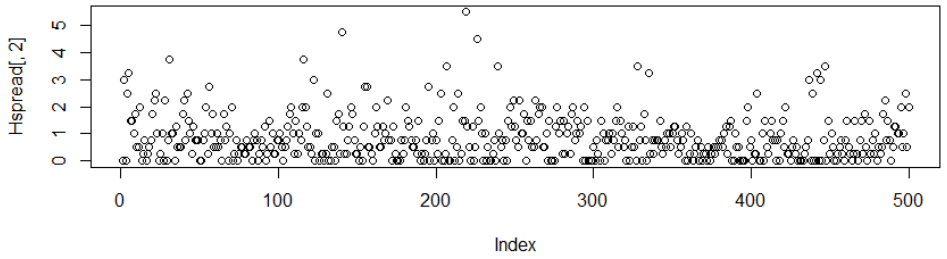


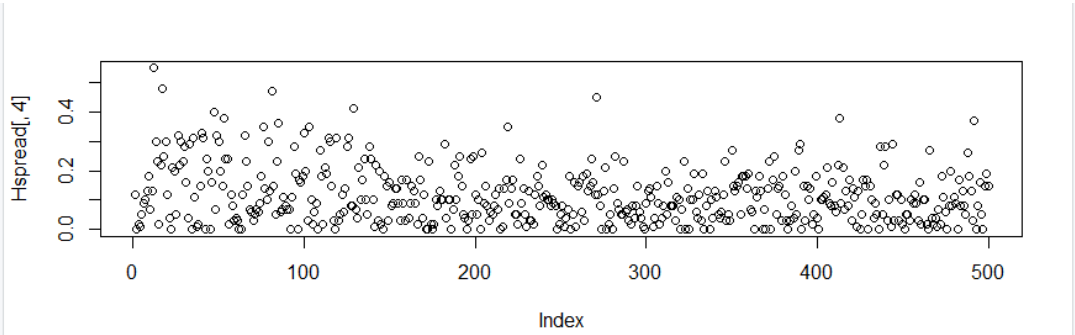
Series 2, 3 and 9 have at various times had very unusual volume.

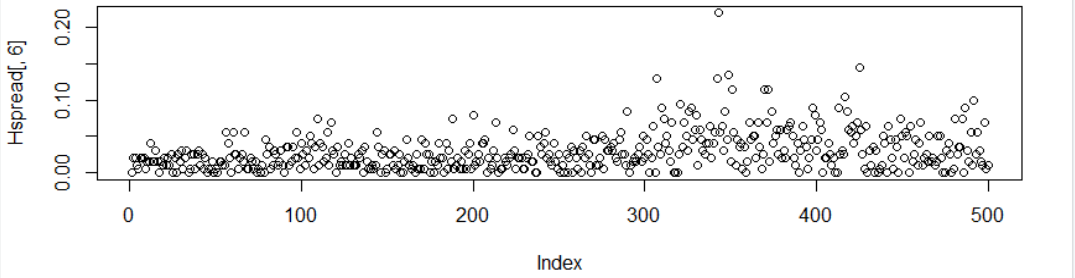
Signal screening is required at a later stage to prevent trading strategies from falling into false signal traps or suffering extreme risks.

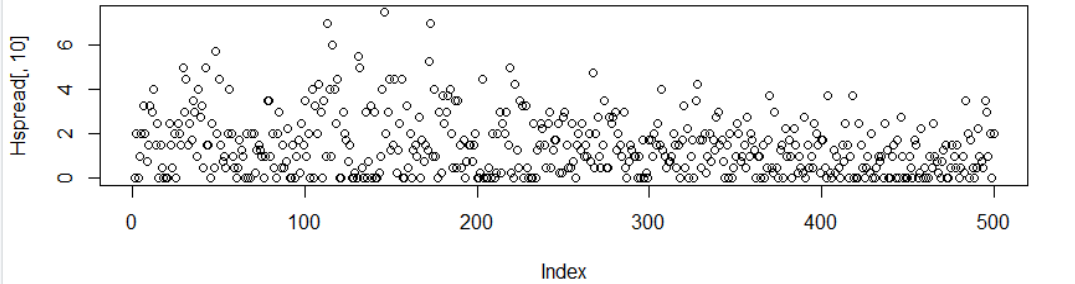
Daily Spread







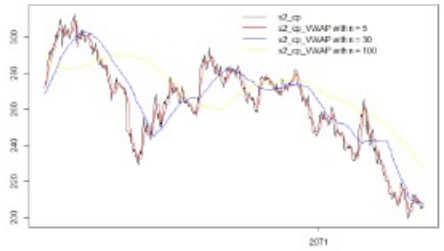


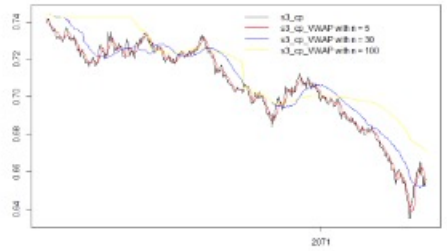


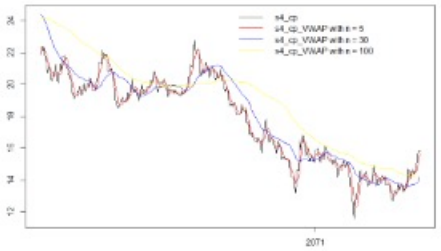
Series 1, 2, 4, 6 and10 can try to do spread trading or market marking strategy to arbitrage, using bilateral limit order. However, the volatility and frequency of volatility of Series 2 and 10 are both greater and more profitable.

VWAP


s1_cp
s1_cp_VWAP with n = 5
s1_cp_VWAP with n = 30
s1_cp_VWAP with n = 100
2071

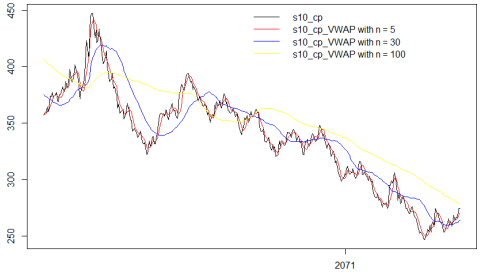

s2_cp
s2_cp_VWAP with n = 5
s2_cp_VWAP with n = 30
s2_cp_VWAP with n = 100
2071


s3_cp
s3_cp_VWAP with n = 5
s3_cp_VWAP with n = 30
s3_cp_VWAP with n = 100
2071


s4_cp
s4_cp_VWAP with n = 5
s4_cp_VWAP with n = 30
s4_cp_VWAP with n = 100
2071


s5_cp
s5_cp_VWAP with n = 5
s5_cp_VWAP with n = 30
s5_cp_VWAP with n = 100
2071


s6_cp
s6_cp_VWAP with n = 5
s6_cp_VWAP with n = 30
s6_cp_VWAP with n = 100
2071

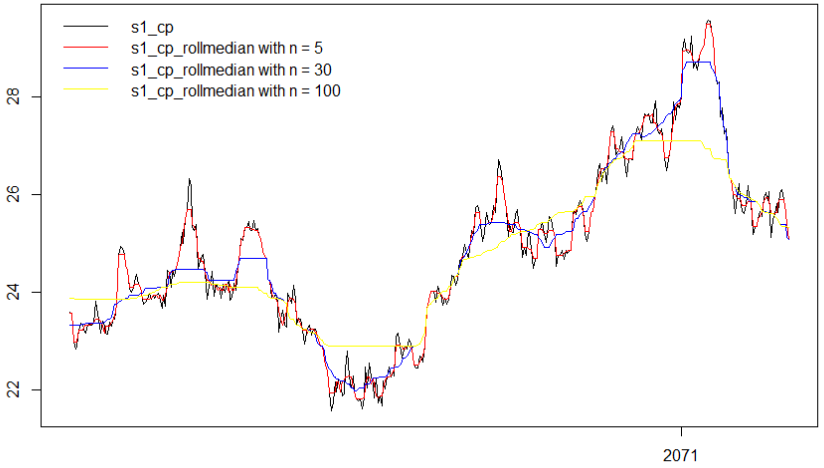

s10_cp
s10_cp_VWAP with n = 5
s10_cp_VWAP with n = 30
s10_cp_VWAP with n = 100
2071

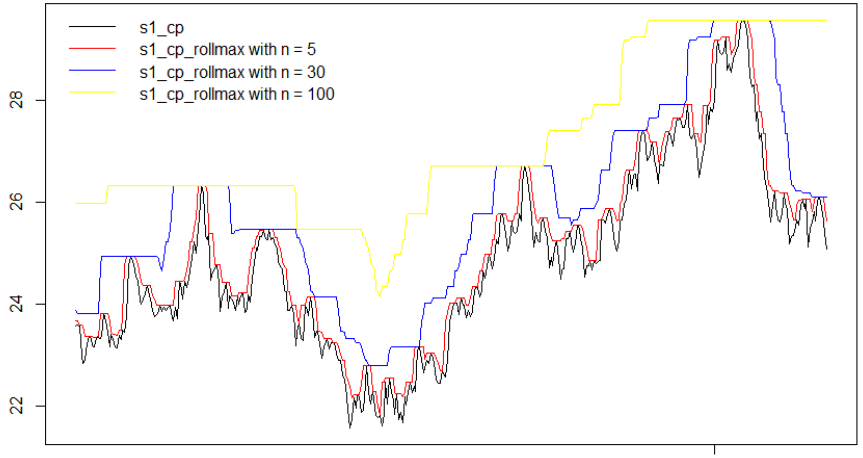

s7_cp
s7_cp_VWAP with n = 5
s7_cp_VWAP with n = 30
s7_cp_VWAP with n = 100
2071

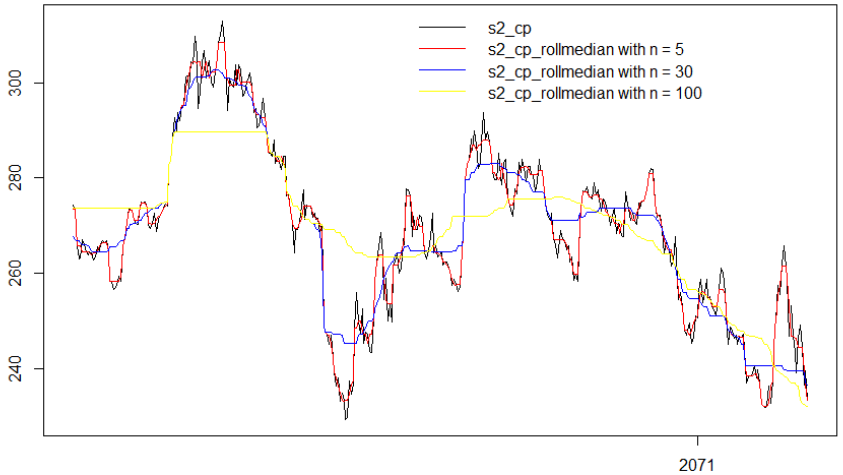

s8_cp
s8_cp_VWAP with n = 5
s8_cp_VWAP with n = 30
s8_cp_VWAP with n = 100
2071

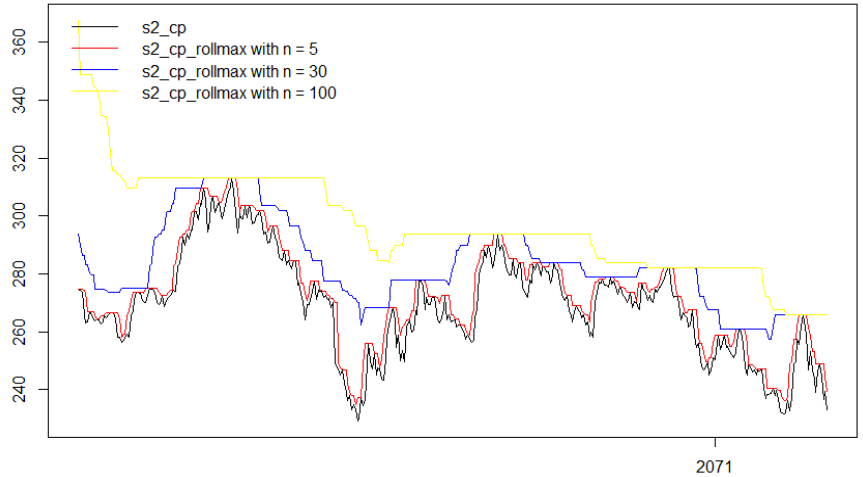

s9_cp
s9_cp_VWAP with n = 5
s9_cp_VWAP with n = 30
s9_cp_VWAP with n = 100
2071

Rolling medians & Rolling max









Trading Strategies

- Hierarchical Design
- Trading Ideas and Preliminary Strategy Performance

Hierarchical Design

Some investment philosophy will be obeyed in our strategy:

1. Never put eggs in one basket

2. Using leverage can bring more profit

3. Never risk losing all in one bet

4. All strategies are wrong, but some are useful

Triple Moving Average Strategy

In a nutshell, following trading rules will be implemented: Long enter signal: short > medium > long
Short enter signal: short < medium < long

Performance:

Part 1 day 1-500 with 0.2 slippage

Indicator/Slippage	PD ratio	PnL	Activeness
SMA	-29037.53	-29037.53	77%
VWAP	-41863.15	-41863.15	78%
EMA	-86263.66	-86263.66	79%
Rolling Median	-62488.88	-62488.88	76%

Part 1 day 1-500 without slippage

Indicator/Slippage	PD ratio	PnL	Activeness
SMA	1.23	53237.92	77%
VWAP	0.97	40088.46	78%
EMA	0.09	7343.56	79%
Rolling Median	-15972.56	-15972.56	76%

Relative Strength Strategy

Performance:

Part 1 day 1-500 with 0.2 slippage

Indicator/Slippage	PD ratio	PnL	Activeness
Stochastic Oscillator	-83609.15	-83609.15	27%
SMI30	0.71	51440.48	27%
SMI100	1.1	97236.07	27%
ADX30	-42865.13	-42865.13	27%
ADX100	-63516.43	-63516.43	27%
Momentum	-36916.8	-36916.8	27%
Triple Exponential Moving Average30	0.37	51218.15	27%
Triple Exponential Moving Average40	0.66	83840.37	27%
RSI30	-64204.87	-64204.87	27%
RSI100	0.69	107325.94	27%

Part 1 day 1-500 without slippage

Indicator/Slippage	PD ratio	PnL	Activeness
Stochastic Oscillator	-79471.09	-79471.09	27%
SMI30	0.76	54815.03	27%
SMI100	1.13	99733.56	27%
ADX30	-39503.96	-39503.96	27%
ADX100	-60810.48	-60810.48	27%
Momentum	-34969.65	-34969.65	27%
Triple Exponential Moving Average30	0.39	54139.48	27%
Triple Exponential Moving Average40	0.68	86620.41	27%
RSI30	-60814.67	-60814.67	27%
RSI100	0.7	109539.99	27%

Market Making Strategy

set the limit price to be daily (high-low)/2 +/- (spread in percentage) *close

Performance: No alternative indicators for this strategy yet.

Part 1 day 1-500 with 0.2 slippage

Indicator/Slippage	PD ratio	PnL	Activeness
-	1.93	14743.26	4%

Part 1 day 1-500 without slippage

Indicator/Slippage	PD ratio	PnL	Activeness
-	2.44	17729.67	4%

Lawrence Macmillan Volatility Trading System

Trading rules are as follow:
1. Historical volatility is short aligned.
2. Calculate historical volatility at 5, 10, 20, 30 and 100 days and find its standard deviation.
3. AC and AO indicators fall for 5 consecutive days.

Performance:

Part 1 day 1-500 with 0.2 slippage

Indicator/Slippage	PD ratio	PnL	Activeness
EMA	-33842.05	-33842.05	28%

Part 1 day 1-500 without slippage

Indicator/Slippage	PD ratio	PnL	Activeness
EMA	-18528.73	-18528.73	28%

BBands based Strategy (Mean-reversion)

Performance:

Part 1 day 1-500 with 0.2 slippage

Indicator/Slippage	PD ratio	PnL	Activeness
SMA	-58218.8	-58218.8	28%
VWAP	-45318.14	-45318.14	51%
EMA	-58218.8	-58218.8	28%
Rolling Median	-18312.19	-18312.19	89%

Part 1 day 1-500 without slippage

Indicator/Slippage	PD ratio	PnL	Activeness
SMA	-43300.78	-43300.78	28%
VWAP	-30351.83	-30351.83	51%
EMA	-43300.78	-43300.78	28%
Rolling Median	-9254.32	-9254.32	89%

BBands based Strategy (Trend-following)

Performance:

Part 1 day 1-500 with 0.2 slippage

Indicator/Slippage	PD ratio	PnL	Activeness
BBands	1.73	21792.12	34%

Part 1 day 1-500 without slippage

Indicator/Slippage	PD ratio	PnL	Activeness
BBands	3.4	36779.83	34%

Risk Management

- Position sizing
- Risk Control
- Strategy Exit Mechanism

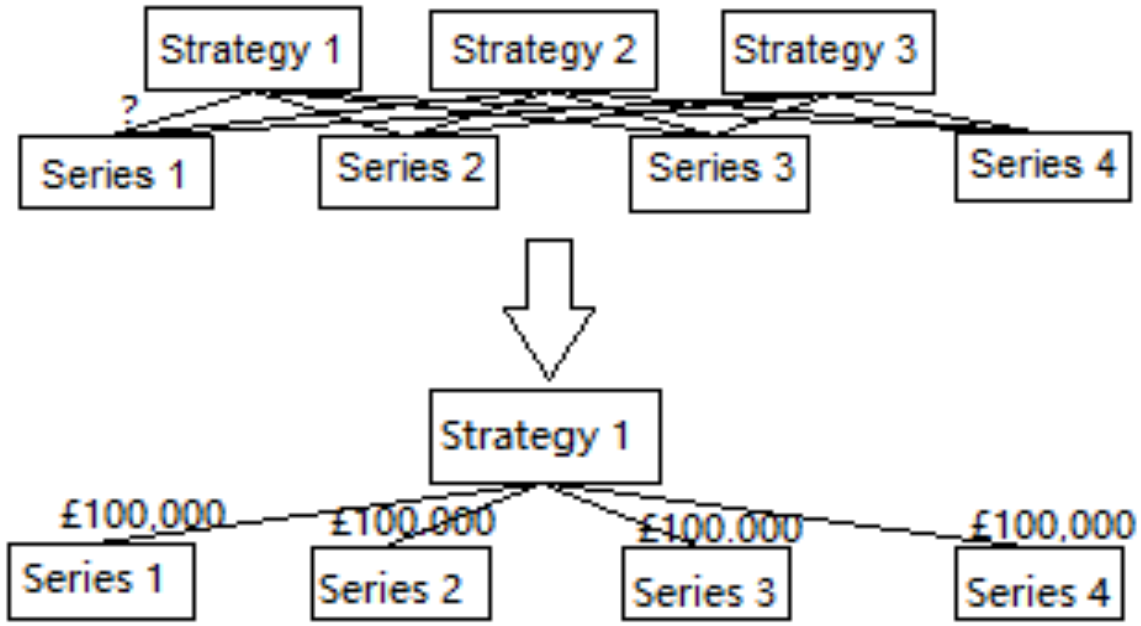
Fixed Size wager (benchmark)

For example, if we have Three strategies

Four series

£1,000,000 in total

Problem



Day1 triggered

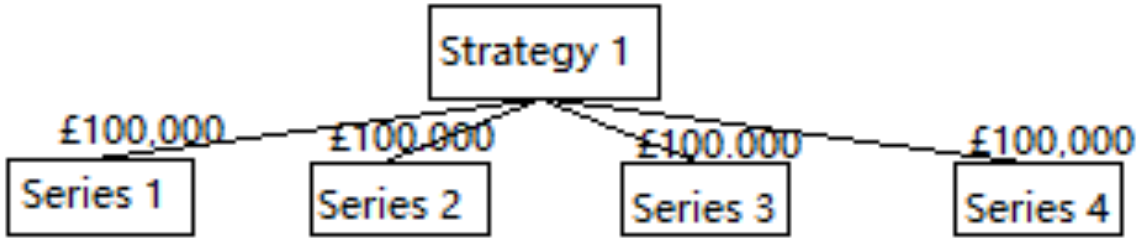
Performance based weighted average size wager (benchmark)

For example, if we have Three strategies

Four series

£1,000,000 in total

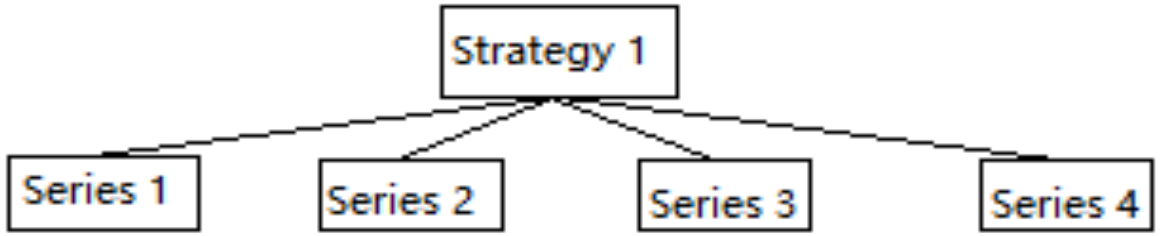
Five hundred days ago



Profit £50,000 Profit £10,000 Profit £10,000 Profit £10,000

50,000 / (50,000+10,000+10,000+10,000) = 62.5%

Five hundred days later



re-allocate 62.5% of balance 12.5% of balance 12.5% of balance 12.5% of balance

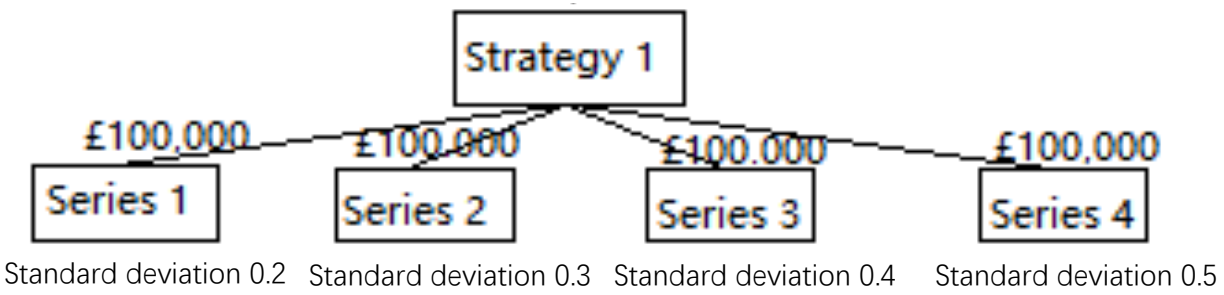
Volatility based weighted average size wager (benchmark)

For example, if we have Three strategies

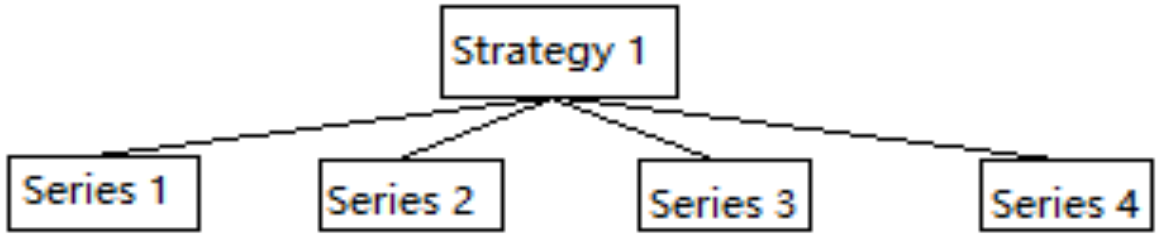
Four series

£1,000,000 in total

Thirty days ago



Thirty days later



S1 0.2 / (0.2+0.3+0.4+0.5) = 14%
S2 0.3 / (0.2+0.3+0.4+0.5) = 21%
S3 0.4 / (0.2+0.3+0.4+0.5) = 29%
S4 0.5 / (0.2+0.3+0.4+0.5) = 36%

re-allocate

14% of balance 21% of balance 29% of balance 36% of balance

Kelly formula (Optimal Position)

For example, if we have Three strategies

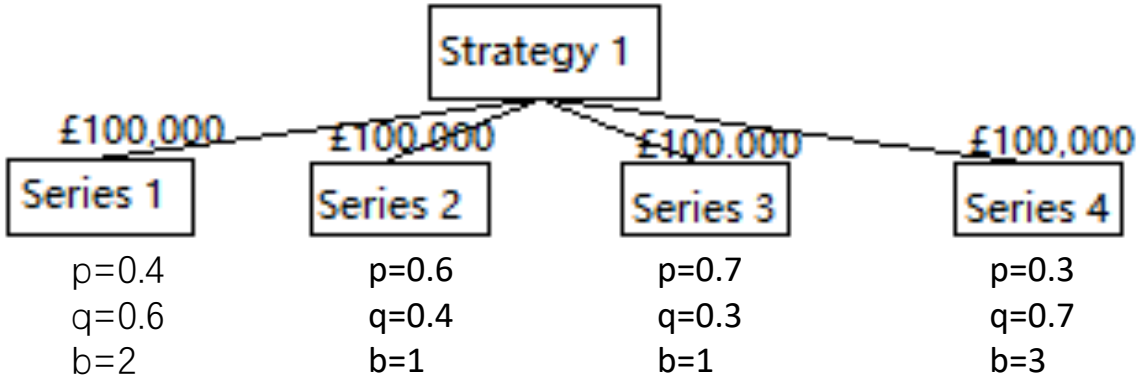
Four series

£1,000,000 in total

$$f^* = p - \frac{q}{b} = p + \frac{p-1}{b}$$

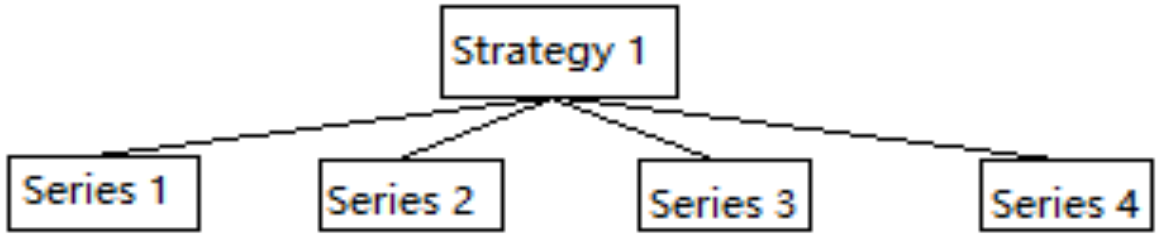
f^* is the fraction of the current bankroll to wager.
p is the probability of a win.
q is the probability of a loss ($q = 1 - p$).
b is the amount gained with a win.

Five hundred days ago



S1 0.4-0.6/2 = 10%
S2 0.6-0.4/1 = 20%
S3 0.7-0.3/1 = 40%
S4 0.3-0.7/3 = 7%

Five hundred days later



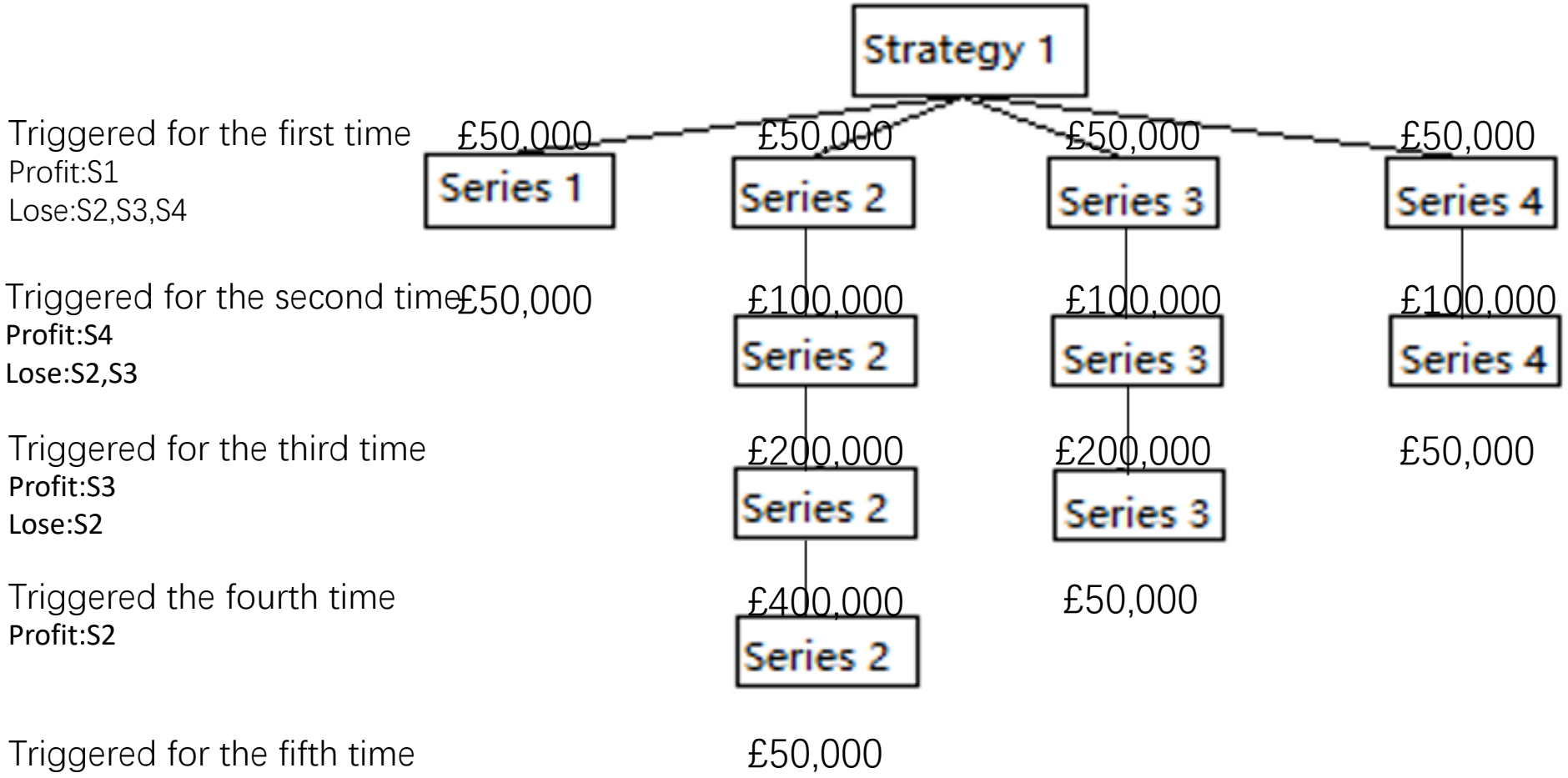
re-allocate 10% of balance 20% of balance 40% of balance 7% of balance

Martingale

For example, if we have Three strategies

Four series

£1,000,000 in total

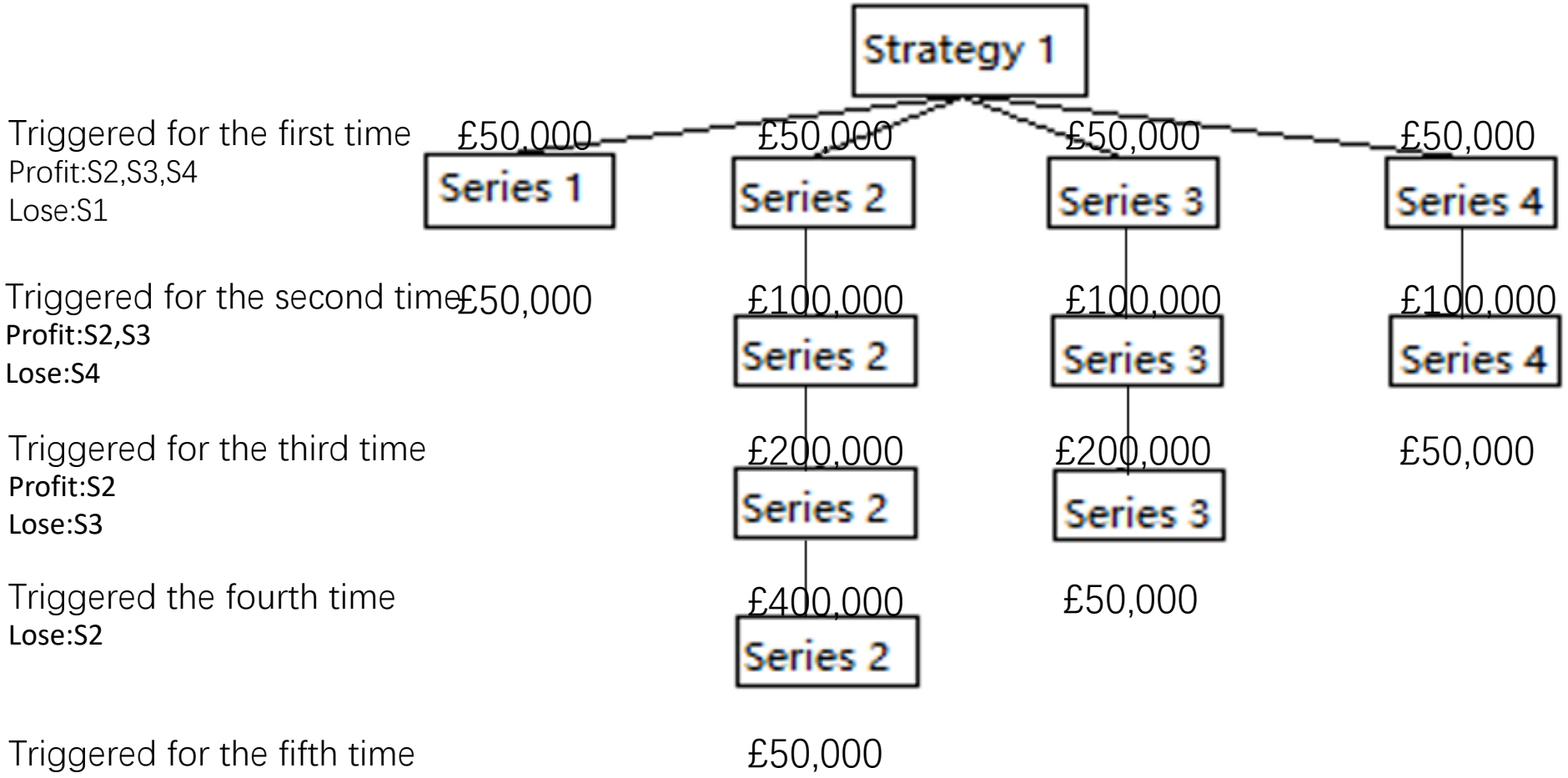


Reversed Martingale

For example, if we have Three strategies

Four series

£1,000,000 in total



Capital Utilization Rate

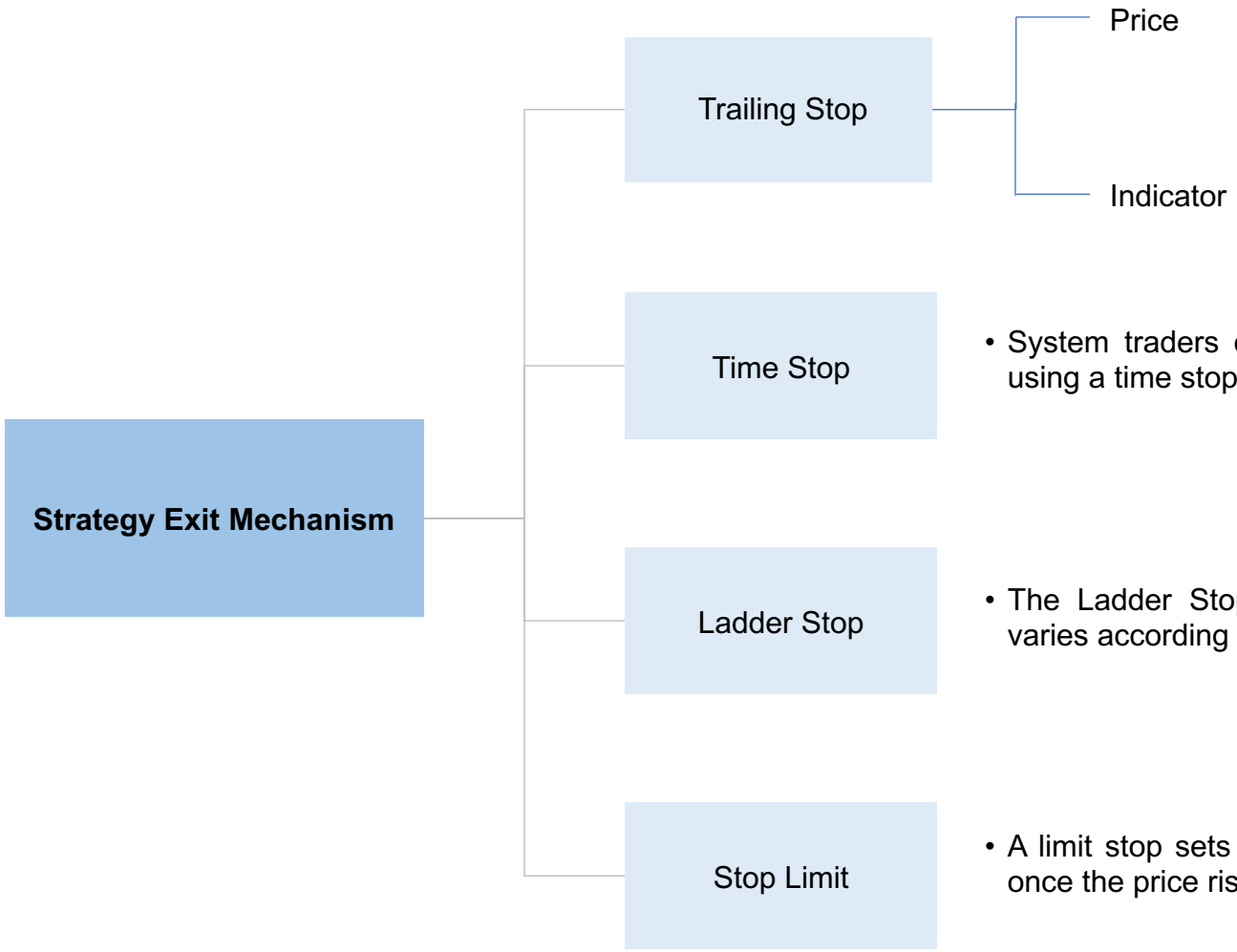
Problem: If the capital utilization rate is too low, it will result in failure to maximize profits.

If the capital utilization rate is too high, it will cause high risk exposure.

Leverage rate

Problem: The greater the leverage used, the greater the percentage of position, and the greater the probability that the portfolio will experience losses and bankruptcy if judgment is faulty.

Strategy Exit Mechanism

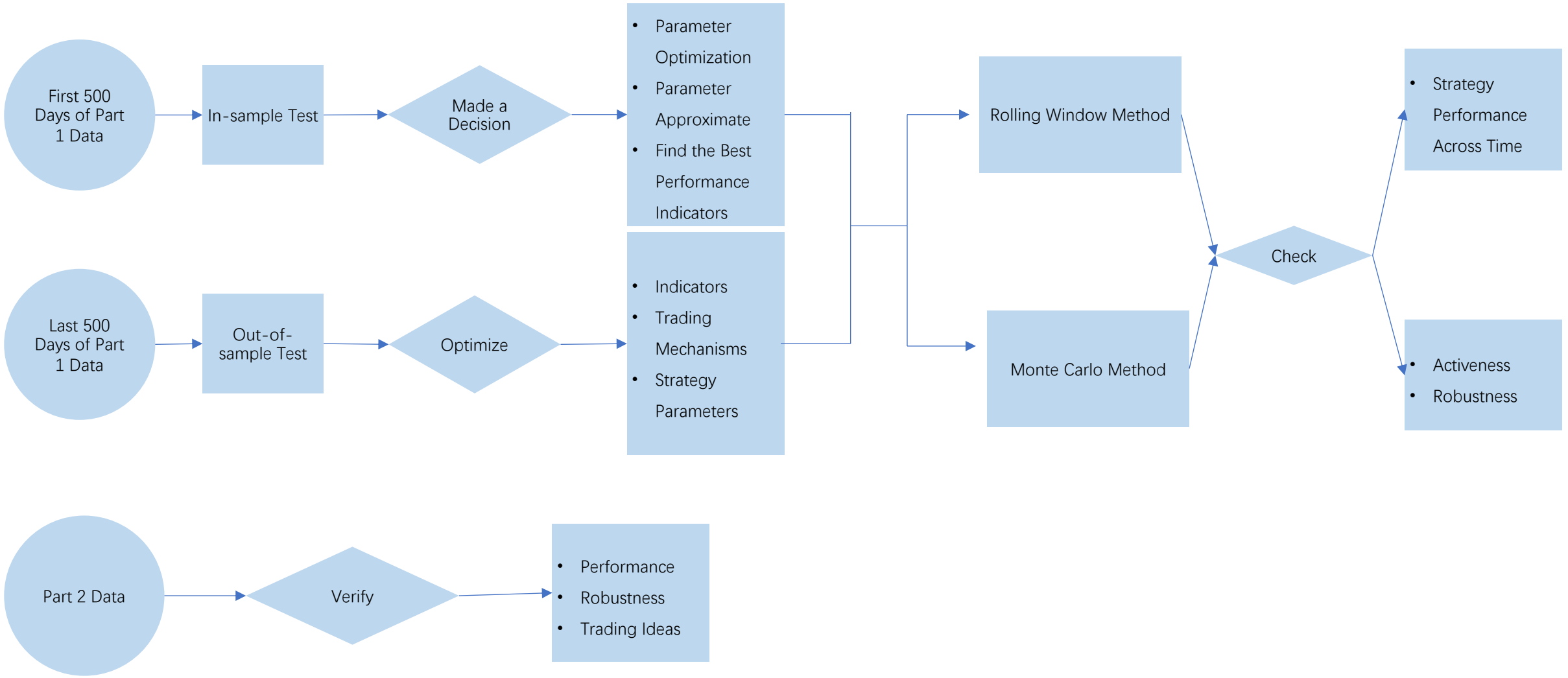


- System traders often test the strength of various entry techniques using a time stop. i.e. Exit after X number of bars from entry.
- The Ladder Stop is a dynamic stop-loss strategy. The stop price varies according to the highest price in the holding period.
- A limit stop sets the buy price as the base price and sells the stock once the price rises more than X% or falls more than Y%.

Plan

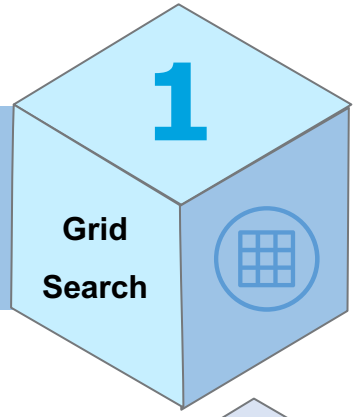
- Parameter Optimization
- Parameter Approximation
- Market Condition Identification and Signal Filtering
- Robustness Testing

Planning Process

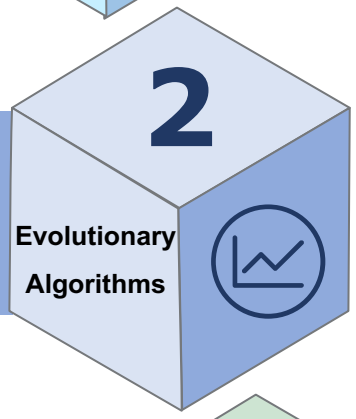


Parameter Optimization and Approximation

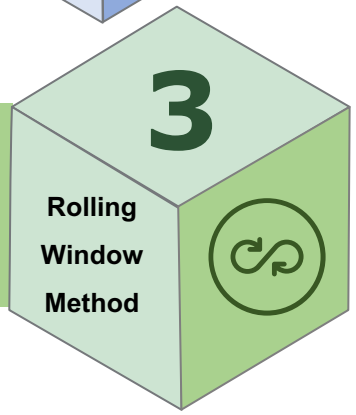
The parameters marked for tuning are:
- the number of hidden units,
- the number of fitting epochs/iterations in model training
- the amount of weight decay penalization.



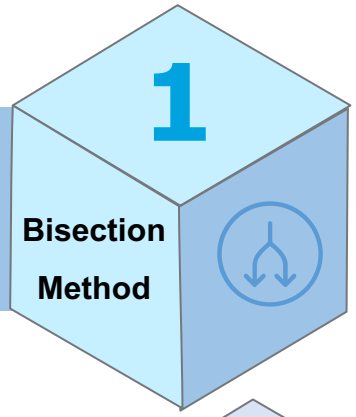
Higher robustness and wider applicability of EA compared to grid search



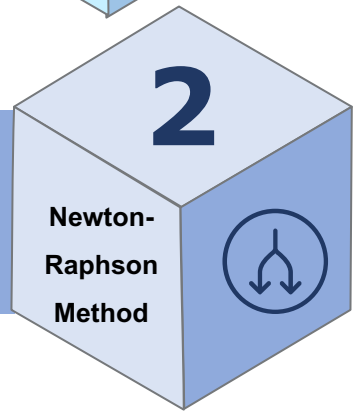
Rolling windows is more efficient than grid search



Continuously narrowing down the parameters to a reasonable range to assist the grid search



This method is faster than the bisection method



Market Condition Identification and Signal Filtering

1.Price Response

- Are there any sudden changes in trading volume
- Whether there is a new break in price

2.Expected Moves / ATR

- The focus is not on range but on trend e.g. how far is already moved which relative to how far it normally moves

3.Time of Days

- the price change from Monday to Friday is different from the end of each quarter, etc.
- not use any range bound trade until we've known that increased volatility we expect to come in

4. Length of Current Condition

Robustness Testing

Robustness Testing

Method 1	Method 2	Method 3
In-Sample and Out-of-Sample	Monte-Carlo method	Rolling-Window Matrix
The 1000-day dataset is divided into two equal parts, the first 500 days are in-sample for evolve strategy and the last 500 days are out-of-sample, similar to the unknown data, for testing the performance of the strategy.	verify how well the strategy performs when there are small changes in inputs, history data or other components of the strategy.	if the strategy passes this test it means that with the help of parameter re-optimization it is adaptable to a wide range of market conditions.