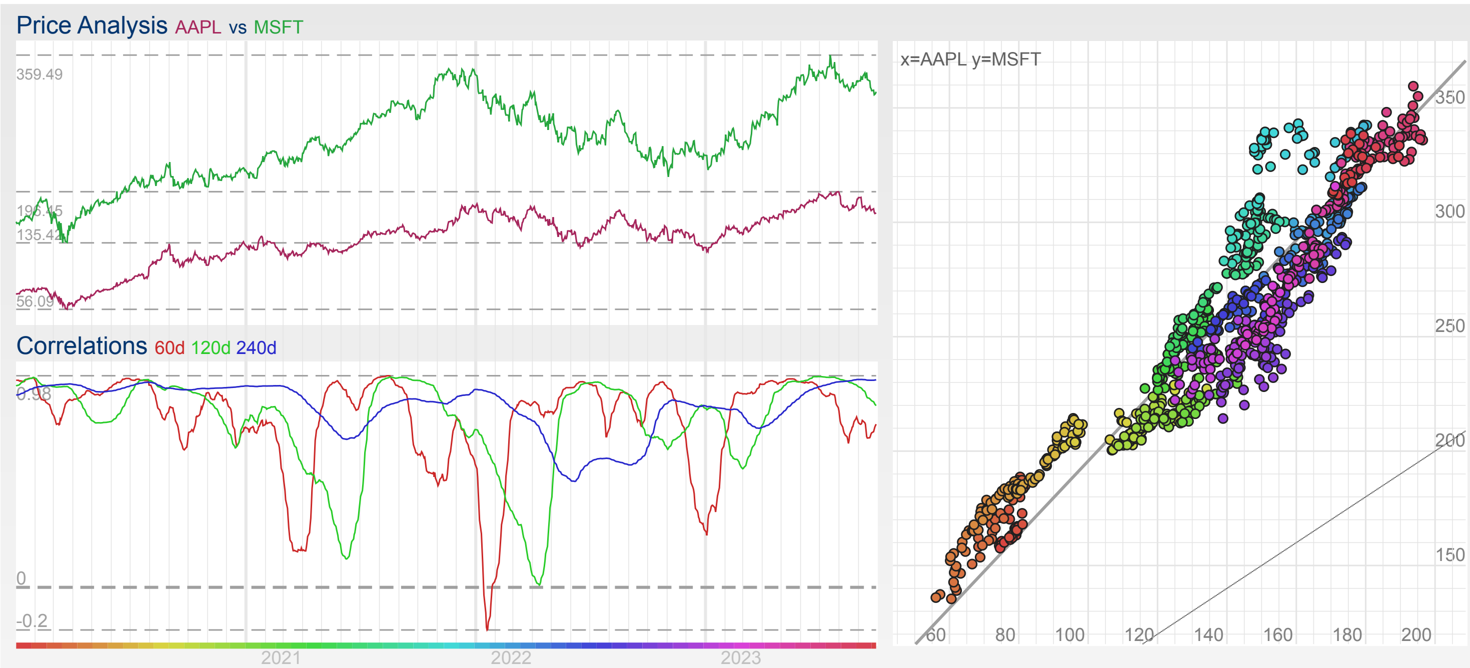
HQ Analysis of AAPL / MSFT

From: 2020-01-02 To: 2023-10-01

Symbol	Title	Sector	Industry	M.Cap.[M]	Div Yield	Last Close	AvgVol 200d
AAPL	Apple Inc	Technology	Consumer Electronics	2629985	0.0057	168.22	59873569
MSFT	Microsoft Corporation	Technology	Software - Infrastructure	2451234	0.0091	329.81	27740707



Orthogonal Spread Analysis

Here we apply an orthogonal regression (also known as total least squares (http://en.wikipedia.org/wiki/Total_least_squares)) to both price series. We are interested in some key statistical properties (like β, ...) and in analysing orthogonal residuals:

TLS: $AAPL^{*}(t) = \beta * MSFT^{*}(t) + \alpha$

Regression coefficient α:

-21.684137

Regression coefficient β:

0.621914

Standard Deviation (σ):

10.068907

ADF test of residuals (p-value):

0.0844

⊗ 95% confidence: residuals seem to contain a unit root

⊗ 99% confidence: residuals seem to contain a unit root

Mean Reversion Coefficient (MRC):

-0.015609

Half-life:

44.41

Skewness:

-0.3206

Kurtosis:

0.2162

Doornik-Hansen normality test (p-value):

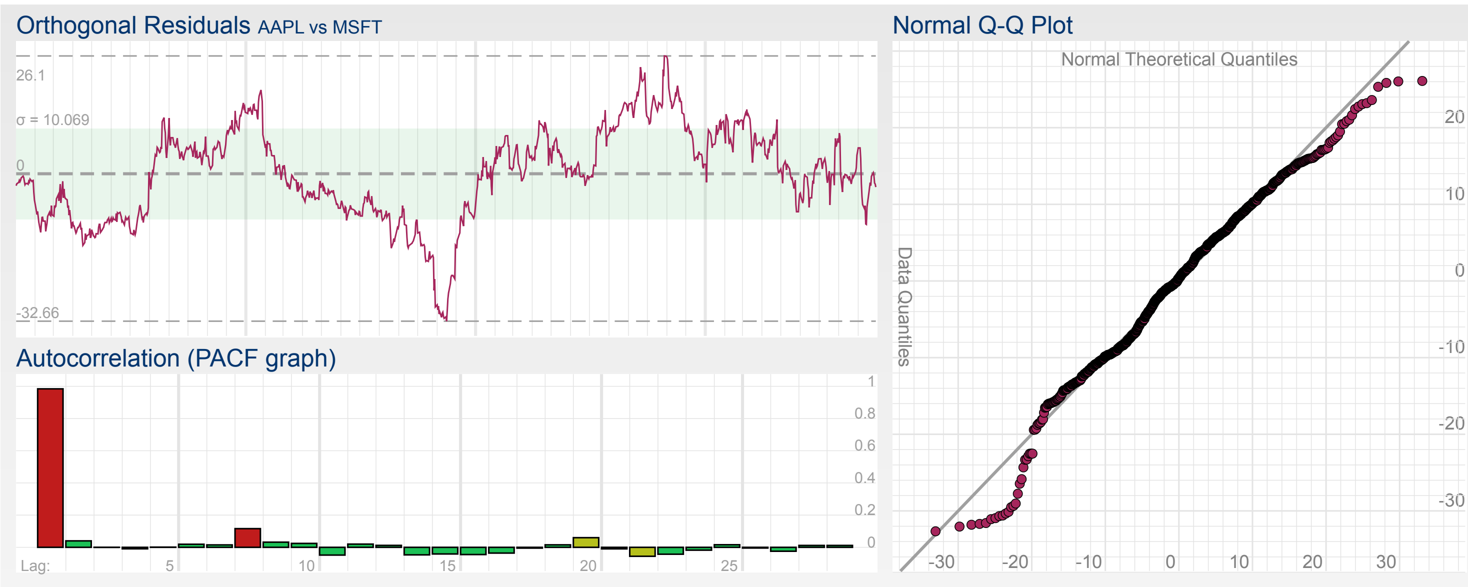
0.0003

⊗ Normality test failed at 95% confidence

[Shapiro-Wilk normality test (http://en.wikipedia.org/wiki/Shapiro%E2%80%93Wilk_test)](http://en.wikipedia.org/wiki/Shapiro%E2%80%93Wilk_test) (p-value):

(<< 0.0001)

⊗ Normality test failed at 95% confidence



Cointegration Analysis

In this section, [Engle-Granger cointegration test (http://en.wikipedia.org/wiki/Cointegration#Engle.E2.80.93Granger_two-step_method)](http://en.wikipedia.org/wiki/Cointegration#Engle.E2.80.93Granger_two-step_method) is performed using OLS regression method in both directions. Residuals of the regression are plotted and analyzed further:

AAPL / MSFT MSFT / AAPL

Engle-Granger test: *AAPL(t) = β * MSFT(t) + α + r(t)*

ADF p-value (AAPL):

0.3788

☑ H_0 not rejected => AAPL is probably I(1) process

ADF p-value (MSFT):

0.3806

☑ H_0 not rejected => MSFT is probably I(1) process

Cointegration p-value:

0.2314

⊗ 95% confidence: H_0 not rejected => cointegration test not passed

⊗ 99% confidence: H_0 not rejected => cointegration test not passed

Regression coefficient α:

-15.295200

Regression coefficient β:

0.597021

Regression R^2:

0.8666

Regression Adjusted R^2:

0.8664

Analysis of Residuals r(t)

Standard Deviation (σ):

11.790924

Mean Reversion Coefficient (MRC):

-0.015045

Half-life:

46.07

Half-life (ratio):

66.95

Skewness:

-0.2974

Kurtosis:

-0.0819

Doornik-Hansen normality test (p-value):

0.0001

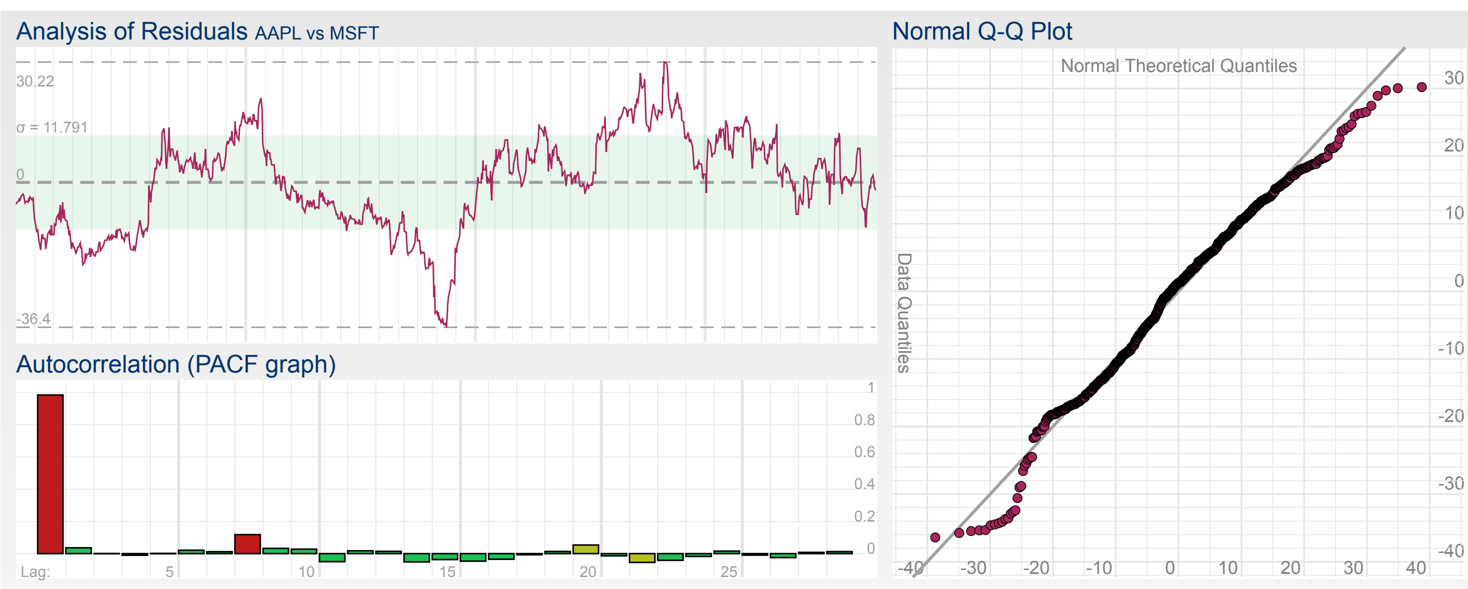
⊗ Normality test failed at 95% confidence

Shapiro-Wilk normality test (http://en.wikipedia.org/wiki/Shapiro%E2%80%93Wilk_test) (p-value):

(<< 0.0001)

⊗ Normality test failed at 95% confidence

Toggle Details



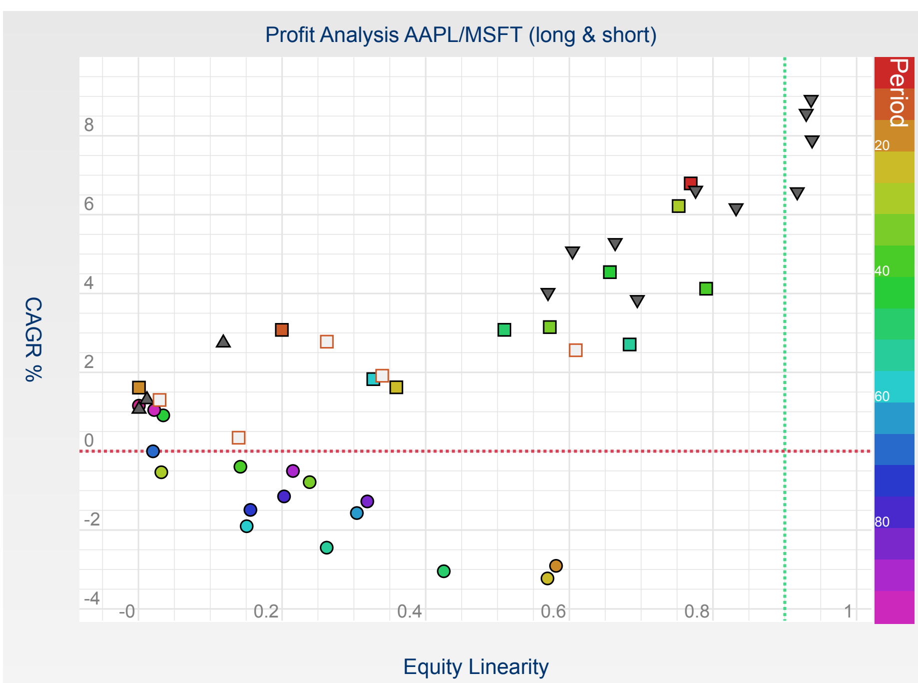
Profit Analysis

Profit analysis is a set of backtests performed using multiple pair trading models over significant portion of parameter space. Backtest results are displayed in a form of scatter plot. In addition, you can see aggregated statistics in the left panel. All backtests are performed using 100% margin (leverage 1:1). This is the profit analysis where backtested strategies are allowed to open both **long and short** positions:

AAPL / MSFT MSFT / AAPL

Median CAGR %:	1.91
Worst CAGR %:	-3.23
Best CAGR %:	8.92
Average CAGR %:	2.12
CAGR Standard Deviation %:	3.17
Med. Max. Drawdown %:	12.43
Median Linearity:	0.425
Median Sharpe Ratio:	0.643
Worst Sharpe Ratio:	-0.701
Median System Score:	0.064
Worst System Score:	-0.596
Best System Score:	7.330

Hover on any point in the scatter plot to see more info, click on it to see detailed backtest (opens in a new window).

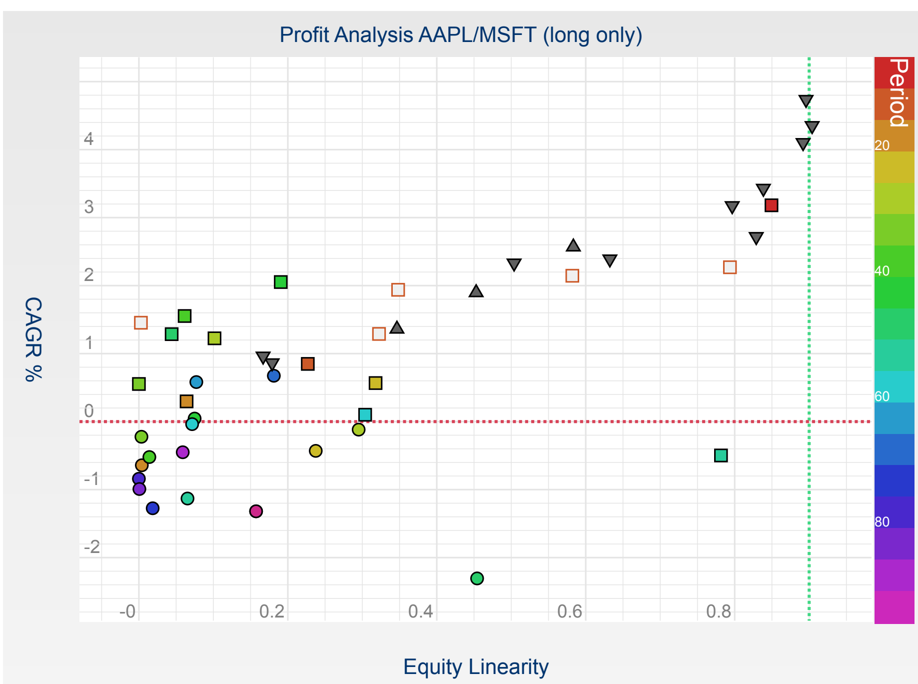


This is the profit analysis where backtested strategies are allowed to open **long positions** only:

[AAPL / MSFT](#) [MSFT / AAPL](#)

Median CAGR %:	0.86
Worst CAGR %:	-2.31
Best CAGR %:	4.74
Average CAGR %:	0.97
CAGR Standard Deviation %:	1.61
Med. Max. Drawdown %:	7.91
Median Linearity:	0.227
Median Sharpe Ratio:	0.415
Worst Sharpe Ratio:	-0.784
Median System Score:	0.003
Worst System Score:	-0.238
Best System Score:	3.405

Hover on any point in the scatter plot to see more info, click on it to see detailed backtest (opens in a new window).

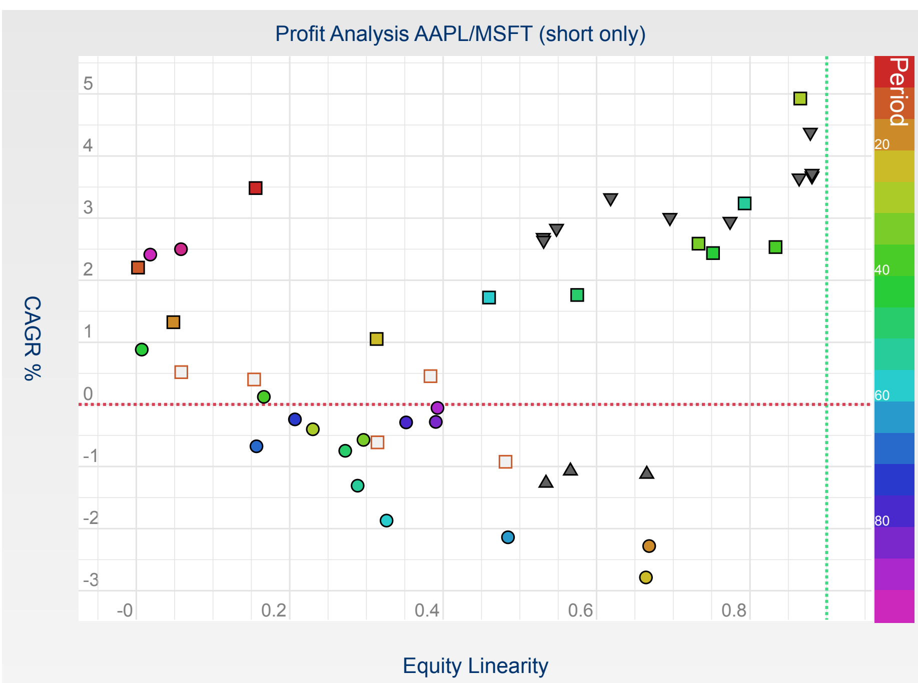


This is the profit analysis where backtested strategies are allowed to open **short positions** only:

[AAPL / MSFT] [MSFT / AAPL]

Median CAGR %:	1.72
Worst CAGR %:	-2.79
Best CAGR %:	4.93
Average CAGR %:	1.06
CAGR Standard Deviation %:	1.93
Med. Max. Drawdown %:	11.21
Median Linearity:	0.481
Median Sharpe Ratio:	0.658
Worst Sharpe Ratio:	-0.831
Median System Score:	0.001
Worst System Score:	-0.817
Best System Score:	3.194

Hover on any point in the scatter plot to see more info, click on it to see detailed backtest (opens in a new window).



Profit Analysis (Inverted!)

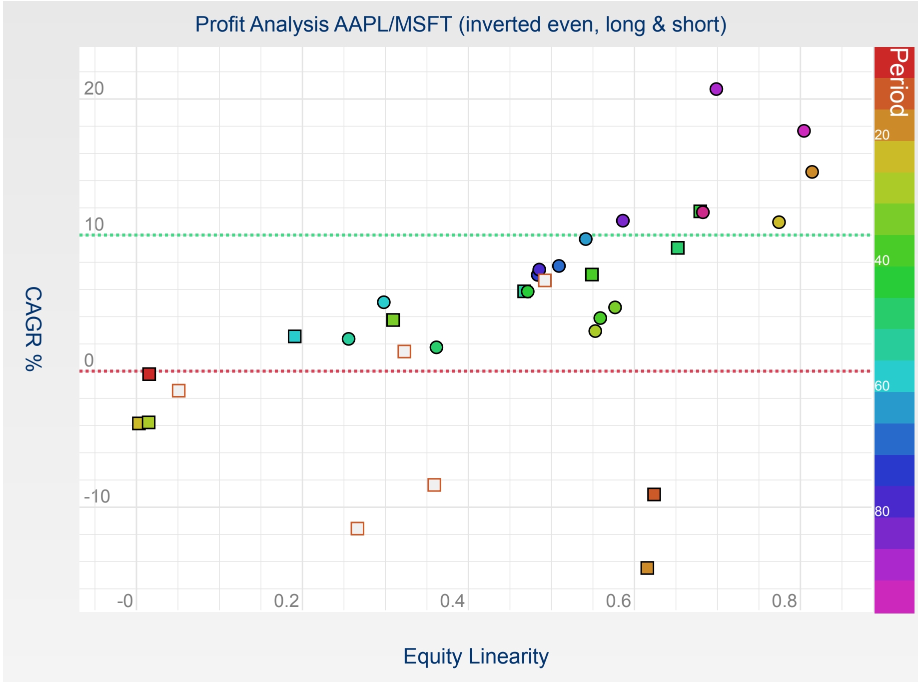
This profit analysis has been performed using strategies with inverted signals and transformed prices. Mostly useful for trading pairs composed of an inverse ETF in order to stay market-neutral (more info) (https://wiki.pairtradinglab.com/wiki/Trading_Pairs_Based_on_Inverse_ETFs). **"even"** means that the first leg is both inverted and transformed, **"odd"** means that the first leg is transformed but the second leg is inverted.

Backtested strategies have been allowed to open both **long and short** positions:

AAPL / MSFT (even) AAPL / MSFT (odd) MSFT / AAPL (even) MSFT / AAPL (odd)

Median CAGR %:	5.06
Worst CAGR %:	-14.47
Best CAGR %:	20.73
Average CAGR %:	4.26
CAGR Standard Deviation %:	7.80
Med. Max. Drawdown %:	31.64
Median Linearity:	0.492
Median Sharpe Ratio:	0.626
Worst Sharpe Ratio:	-0.999
Median System Score:	0.613
Worst System Score:	-3.374
Best System Score:	9.188

Hover on any point in the scatter plot to see more info, click on it to see detailed backtest (opens in a new window).

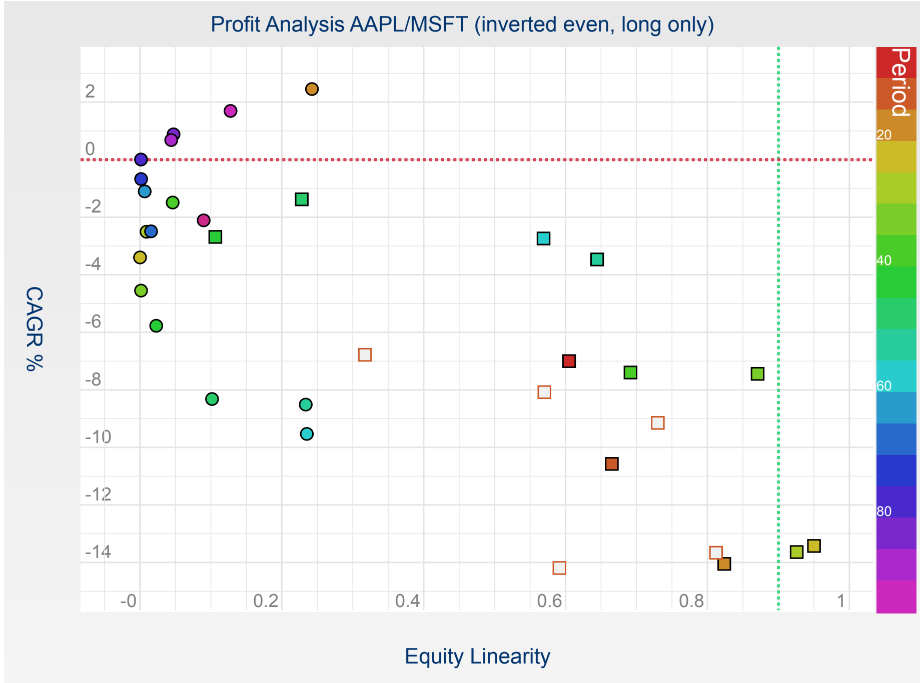


This is the profit analysis where backtested strategies are allowed to open **long positions** only:

AAPL / MSFT (even)   AAPL / MSFT (odd)   MSFT / AAPL (even)   MSFT / AAPL (odd)

Median CAGR %:	-4.55
Worst CAGR %:	-14.19
Best CAGR %:	2.45
Average CAGR %:	-5.47
CAGR Standard Deviation %:	4.89
Med. Max. Drawdown %:	28.91
Median Linearity:	0.234
Median Sharpe Ratio:	-0.681
Worst Sharpe Ratio:	-2.349
Median System Score:	-0.016
Worst System Score:	-11.516
Best System Score:	0.035

Hover on any point in the scatter plot to see more info, click on it to see detailed backtest (opens in a new window).

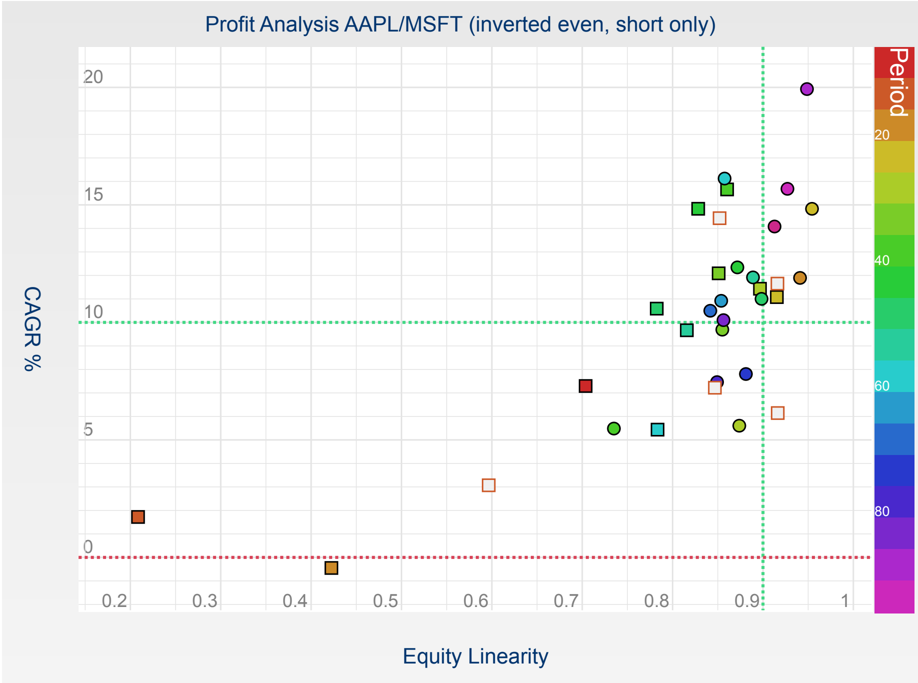


This is the profit analysis where backtested strategies are allowed to open **short positions** only:

AAPL / MSFT (even) AAPL / MSFT (odd) MSFT / AAPL (even) MSFT / AAPL (odd)

Median CAGR %:	10.92
Worst CAGR %:	-0.45
Best CAGR %:	19.93
Average CAGR %:	10.22
CAGR Standard Deviation %:	4.39
Med. Max. Drawdown %:	18.43
Median Linearity:	0.856
Median Sharpe Ratio:	1.199
Worst Sharpe Ratio:	0.154
Median System Score:	6.795
Worst System Score:	-0.034
Best System Score:	17.015

Hover on any point in the scatter plot to see more info, click on it to see detailed backtest (opens in a new window).



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