

Momentum or Contrarian. Which Is the Most Valid in the Case of Cryptocurrencies?

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2018-05-29



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What?

- Investigate the presence and potential strength of momentum and contrarian effects in the cryptocurrency market

Why?

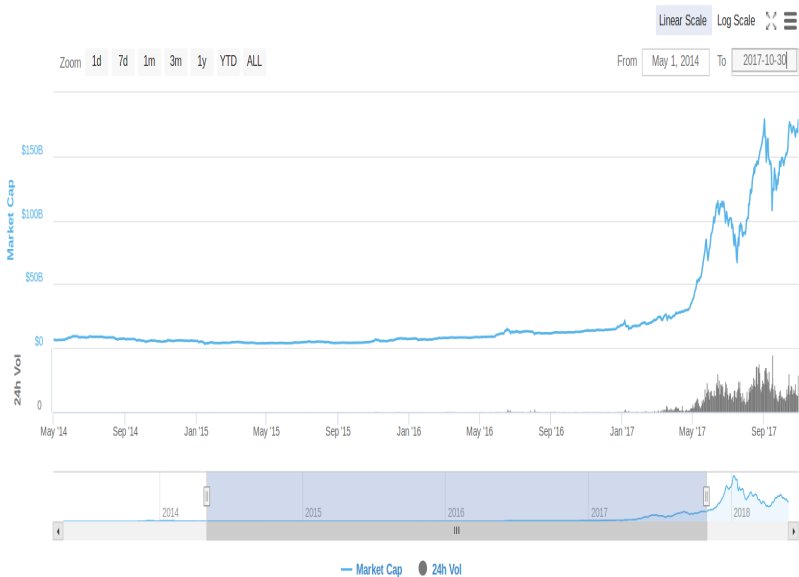
- Momentum/contrarian effects were identified in the past on young and inefficient markets
- Cryptocurrency market is young, volatile, and rapidly growing
- No one has investigated this yet
- Construct an investment strategy giving abnormal rates of return?

How?

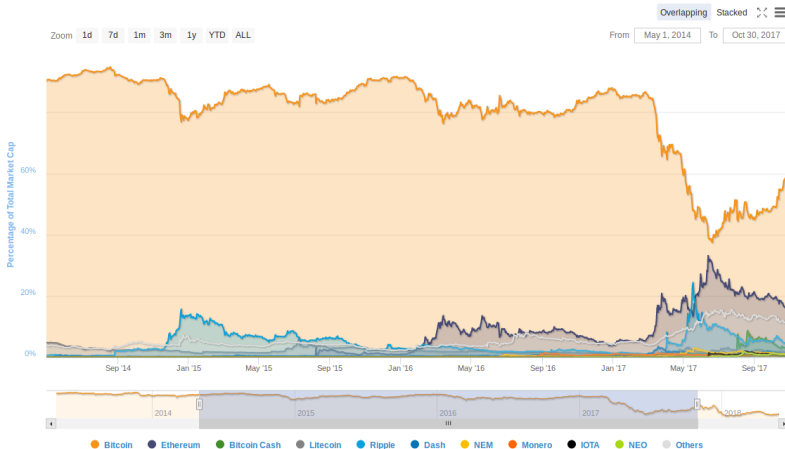
- Construct ranking of TOP100 crypto with the highest market cap
- Construct momentum/contrarian portfolios
- Calculate descriptive statistics
- Benchmark against reference strategies
- Perform sensitivity analysis of parameters

- 1 Briefly about cryptocurrency markets
- 2 Briefly about momentum/contrarian
- 3 Hypothesis
- 4 Methodology
- 5 Data
- 6 Results
- 7 Summary
- 8 Research extensions

Total Market Capitalization



Percentage of Total Market Capitalization (Dominance)



coingecko.com

Momentum/Contrarian - classical anomalies present on young and ineffective markets.

- Momentum - Tendency for the trends of price changes to continue
- Contrarian - Tendency for the trends of price changes to reverse

Main Hypothesis:

The momentum and/or contrarian effects are currently present on the cryptocurrency market.

Research Questions:

- 1 How strong magnitude?
- 2 Which effect is stronger?
- 3 Short/medium/long- term?
- 4 Practical possibility of profit?

During each day:

- 1 Filter out crypto having 14-day MA volume lower than $VF = 100$ USD
- 2 Pick 100 crypto with the largest market cap

We arrive with a $N_{days} \times 100$ matrix that from now on we will call The TOP100.

Note

We now can use TOP100 to construct rankings for any ranking intervals $RA \geq 1d$.

- 1 %N - the percent of TOP100 assets that will be used in portfolio construction
- 2 Reallocation period (RE) - distance between two neighbouring reallocation days
 - Reallocation day - the day we update the composition of our investment portfolio based on some kind of ranking (market cap TOP100 in our case).
- 3 Ranking window (RA) - time interval used in TOP100
 - In general $RA \neq RE$
- 4 Transaction costs (TC) - as a percentage of total portfolio value
- 5 Volume filter (VF) - the threshold value for 14-day MA filter

We use TOP100 to construct the following portfolios:

- 1 **Momentum** - equally-weighted investment in %N = 25% of cryptocurrencies with the **highest** weekly rate of return, assume RE = 1w and TC = 1.0%
- 2 **Contrarian** - equally-weighted investment in %N = 25% of cryptocurrencies with the **lowest** weekly rate of return, assume RE = 1w and TC = 1.0%

And judge their performance in comparison with the benchmark portfolios:

- 1 **S&P B&H** - buy and hold reference investment using the S&P500 index and the same time horizon
- 2 **BTC B&H** - buy and hold reference investment using the BTCUSD pair and the same time horizon
- 3 **EqW** - equally weighted reference investment in all the assets present on TOP100, assume same parameters RE = 1w and TC = 1.0%
- 4 **McW** - market cap weighted reference investment in all crypto present on TOP100, assume same parameters RE = 1w and TC = 1.0%

Using on TOP100, calculate the total gross rate of return:

$$R_{0,T}^{(p)} = \prod_{t=1}^T \left(1 + \sum_{i=1}^N w_{i,t} r_{i,t} - \Delta W_t^R \cdot TC \right) - 1, \quad (1)$$

where:

- N – the total number of assets
- T is the investment's total time horizon (measured in days)
- $w_{i,t}$ is the percentage (weight) of the i -th asset in the whole portfolio p on day t
- $r_{i,t}$ is the simply accruing daily rate of return of the i -th asset on day t
- ΔW_t^R is the total portfolio turnover rate (in percent) on day t
- TC is the total percent transaction costs

To benchmark our strategies we also need:

- 1 annualised rate of change (ARC):

$$\text{ARC} = \left(1 + \frac{P_T}{P_0}\right)^{\frac{365}{T}} - 1, \quad (2)$$

- 2 annualised standard deviation (ASD):

$$\text{ASD} = \sqrt{\frac{365}{T} \sum_{t=1}^T (r_t - \bar{r})^2}, \quad r_t = \frac{P_t}{P_{t-1}} - 1 \quad (3)$$

- 3 maximum drawdown coefficient (MDD):

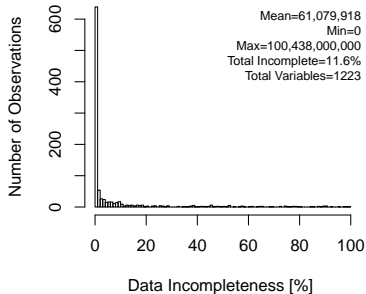
$$\text{MDD}(T) = \max_{\tau \in [0, T]} \left(\max_{t \in [0, \tau]} P_t - P_\tau \right) \quad (4)$$

- 4 information ratio coefficients (IR1, IR2):

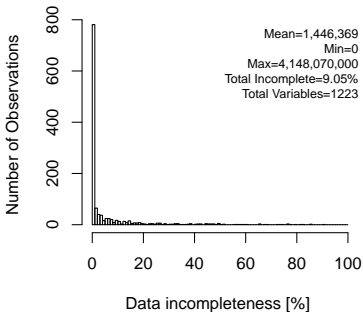
$$\begin{aligned} \text{IR1} &= \text{ARC/ASD} \\ \text{IR2} &= \text{sign(ARC)ARC}^2 / (\text{ASD} \cdot \text{MDD}) \end{aligned} \quad (5)$$

- 1 Daily OHLC prices, market cap and 24h-volume data
- 2 In-sample time horizon: 2014-05-12 to 2017-10-28 for 1200+ cryptocurrencies
- 3 BTCUSD and S&P500 daily close prices as benchmarks
- 4 Data source: `www.coinmarketcap.com`

Market Cap



Volume (24h)

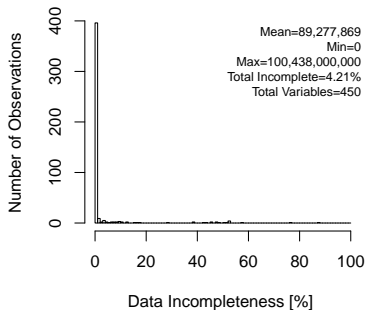


Missing values handling:

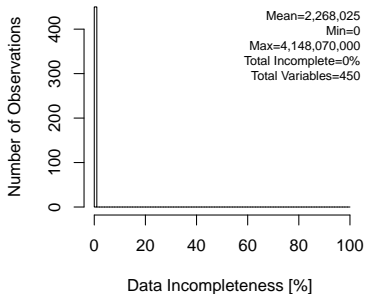
- 1 Close: Fill missing observations with last non-missing entry
- 2 MarketCap: Calculate missing from the circulating supply
approximate formula: $MC_t = (1 + r_t) MC_{t-1}$.
- 3 Volume: Filter out all observations for which 14-day rolling mean
volume $< VF = 100$ USD

After that \rightarrow construct TOP100.

Market Cap



Volume (24h)



First 10 cryptocurrencies in TOP100 as of 2017-10-28

Name	%ARC	%ASD	%MDD	IR1	IR2	Start Date	MarketCap [USD]	Volume (24h) [USD]	%MISS
bitcoin	109.8	66.4	73.3	1.7	2.5	2014-05-12	96,369,600,000	1,403,920,000	0.0
ethereum	714.8	154.9	84.3	4.6	39.1	2015-08-08	28,410,400,000	264,424,000	0.0
ripple	176.6	155.0	85.4	1.1	2.4	2014-05-12	7,806,200,000	26,864,900	0.0
bitcoin-cash	9.7	245.9	58.5	0.0	0.0	2017-08-02	6,183,520,000	781,037,000	0.0
litecoin	61.4	110.5	90.0	0.6	0.4	2014-05-12	2,966,700,000	71,063,200	0.0
dash	289.8	147.2	92.9	2.0	6.1	2014-05-12	2,152,090,000	47,092,100	0.0
nem	1,246.5	180.1	75.0	6.9	115.1	2015-04-01	1,781,830,000	4,671,300	0.0
bitconnect	Inf	206.5	51.6	6,212.7	Inf	2017-01-20	1,558,580,000	10,550,800	0.4
neo	2,989.8	270.8	85.6	11.0	385.4	2016-10-26	1,443,000,000	25,368,200	0.0
monero	218.6	155.4	95.5	1.4	3.2	2014-05-21	1,327,650,000	25,397,400	0.0

Last 10 cryptocurrencies in TOP100 as of 2017-10-28

Name	%ARC	%ASD	%MDD	IR1	IR2	Start Date	MarketCap [USD]	Volume (24h) [USD]	%MISS
zencash	288.7	386.5	82.7	0.7	2.6	2017-06-07	49,749,900	1,464,900	0.0
edgeless	18,466.6	377.6	70.8	48.9	12,752.3	2017-04-07	49,017,500	961,797	2.9
aragon	-11.4	188.6	65.6	-0.1	0.0	2017-05-20	48,817,400	376,313	0.0
ric	339.1	213.9	77.0	1.6	7.0	2017-04-22	48,397,600	231,263	5.3
taas	2,726.2	149.6	59.0	18.2	842.2	2017-05-12	46,407,500	230,103	51.8
nolimitcoin	8,500.0	635.2	92.0	13.4	1,236.6	2016-09-12	45,917,600	84,228	19.5
nav-coin	396.0	472.9	94.9	0.8	3.5	2014-06-12	45,209,300	502,409	20.5
loopring	718.2	343.1	73.2	2.1	20.5	2017-09-03	42,275,700	188,744	23.2
wings	4,405.1	291.0	73.1	15.1	911.7	2017-04-28	41,613,800	434,531	3.3
kin	-100.0	180.3	56.9	-0.6	1.0	2017-09-28	39,996,200	38,250	6.5

Legend:

- Inf - more than 100,000
- Start Date - the first day the asset has appeared on TOP100
- %MISS - percentage of missing data

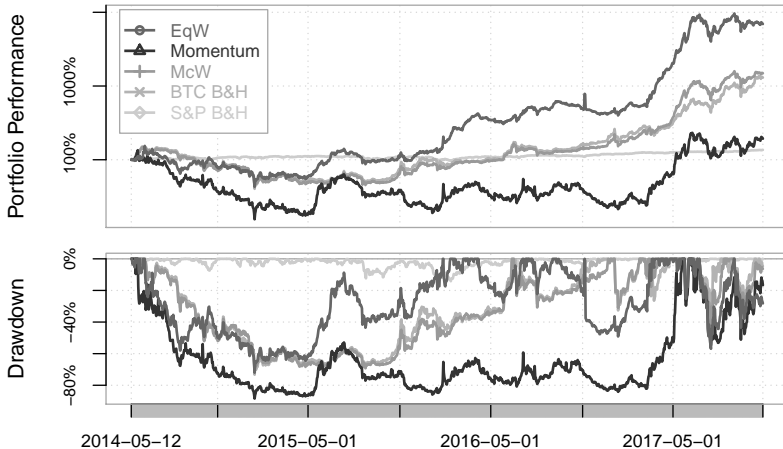
Name	%N	RE	RA	%TC	VF	%ARC	%ASD	%MDD	IR1	IR2	%MT
S&P B&H	-	-	-	-	-	9.3	12.3	14.2	0.8	0.5	0.0
BTC B&H	-	-	-	-	-	109.6	66.3	73.3	1.7	2.5	0.0
McW	100	1w	-	1.0	100	117.8	64.7	71.2	1.8	3.0	3.7
EqW	100	1w	-	1.0	100	239.4	88.9	72.0	2.7	9.0	27.5
Momentum	25	1w	1w	1.0	100	20.9	111.1	88.4	0.2	0.0	151.8
Contrarian	25	1w	1w	1.0	100	273.2	128.0	60.3	2.1	9.7	164.3

Legend: McW - MarketCap weighted strategy, EqW - Equally Weighted strategy, %N - percent of TOP100 currencies used to construct the portfolio, RE - reallocation period, RA - width of the ranking window used to calculate the highest/lowest rates of return, %TC - total transaction costs, VF - volume filter threshold, %ARC - annualised rate of return, %ASD - annualised standard deviation, %MDD - maximum drawdown, IR1, IR2 - risk-weighted gain coefficients, %MT - portfolio mean turnover ratio. Time horizon: 2014-05-12 – 2017-10-28

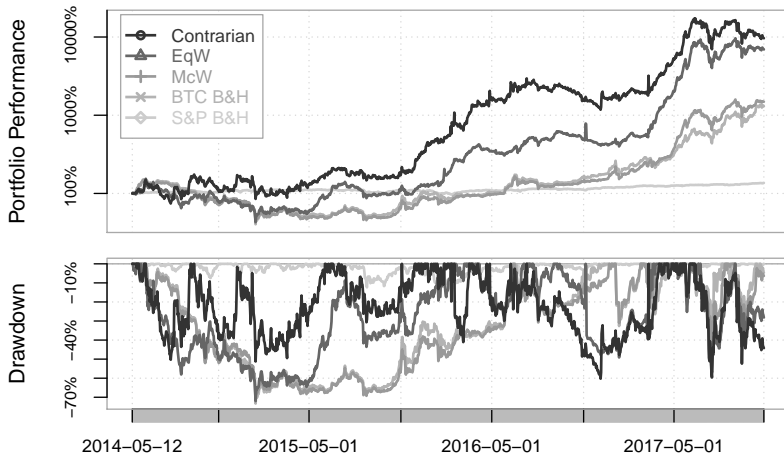
Time horizon: 2014-05-12 – 2017-10-28

- 1 EqW portfolio is the most efficient among other benchmarks
- 2 Strong outperformance of contrarian strategy over reference portfolios
- 3 Momentum portfolio performs better than reference portfolios from regulated markets being worse than crypto benchmarks

Momentum, %N=25, RE=1w, RA=1w, TC=1.0%, VF=100



Contrarian, %N=25, RE=1w, RA=1w, TC=1.0%, VF=100



- 1 %N = 5%, 10%, **25%**, 50%
- 2 Reallocation period RE = 1d, **1w**, 1m
- 3 Ranking window RA = 1d, **1w**, 1m
- 4 Transaction costs TC - 0.5%, **1.0%**, 2.0%
- 5 Volume filter VF = **100**

Sensitivity Analysis I: In-sample

					Benchmark Strategies											
Name					%ARC	%ASD	%MDD	IR1	IR2	%MT	%ARC	%ASD	%MDD	IR1	IR2	%MT
S&P B&H					9.3	12.3	14.2	0.8	0.5	0.0	9.3	12.3	14.2	0.8	0.5	0.0
BTC B&H					109.6	66.3	73.3	1.7	2.5	0.0	109.6	66.3	73.3	1.7	2.5	0.0
McW					117.8	64.7	71.2	1.8	3.0	3.7	117.8	64.7	71.2	1.8	3.0	3.7
EqW					239.4	88.9	72.0	2.7	9.0	27.5	239.4	88.9	72.0	2.7	9.0	27.5
Parameters					MOMENTUM					CONTRARIAN						
%N	RE	RA	%TC	VF	%ARC	%ASD	%MDD	IR1	IR2	%MT	%ARC	%ASD	%MDD	IR1	IR2	%MT
25	1d	1w	1.0	100	-96.5	125.8	100.0	-0.8	-0.7	68.5	19,319.2	107.1	57.3	180.4	60,836.3	80.9
25	1w	1w	1.0	100	20.9	111.1	88.4	0.2	0.0	151.8	273.2	128.0	60.3	2.1	9.7	164.3
25	1m	1w	1.0	100	199.2	117.2	79.6	1.7	4.3	159.1	103.3	138.8	77.9	0.7	1.0	162.4
25	1w	1d	1.0	100	-12.2	107.8	89.2	-0.1	0.0	150.8	429.5	173.5	77.2	2.5	13.8	153.3
25	1w	1w	1.0	100	20.9	111.1	88.4	0.2	0.0	151.8	273.2	128.0	60.3	2.1	9.7	164.3
25	1w	1m	1.0	100	170.7	114.9	65.0	1.5	3.9	83.0	208.9	111.3	87.6	1.9	4.5	95.6
1	1w	1w	1.0	100	-100.0	805.3	100.0	0.0	0.0	191.1	4,787.8	1003.8	99.6	4.8	229.3	196.7
2	1w	1w	1.0	100	-99.5	415.2	100.0	-0.2	-0.2	191.1	9,013.1	674.5	96.4	13.4	1249.6	193.9
3	1w	1w	1.0	100	-95.4	361.5	100.0	-0.3	-0.3	188.1	6,233.0	474.1	92.6	13.1	885.3	192.2
4	1w	1w	1.0	100	-76.9	298.0	100.0	-0.3	-0.2	185.0	4,587.4	380.8	83.6	12.0	661.2	191.2
5	1w	1w	1.0	100	-68.3	250.3	99.9	-0.3	-0.2	180.8	3,992.2	322.1	78.4	12.4	631.3	191.2
10	1w	1w	1.0	100	-11.9	168.7	96.7	-0.1	0.0	169.4	1,460.0	211.0	70.1	6.9	144.0	184.6
25	1w	1w	1.0	100	20.9	111.1	88.4	0.2	0.0	151.8	273.2	128.0	60.3	2.1	9.7	164.3
50	1w	1w	1.0	100	77.8	89.6	85.7	0.9	0.8	110.3	199.0	112.6	62.8	1.8	5.6	119.4
25	1w	1w	0.5	100	80.6	110.7	84.8	0.7	0.7	151.8	474.4	127.5	58.0	3.7	30.5	164.3
25	1w	1w	1.0	100	20.9	111.1	88.4	0.2	0.0	151.8	273.2	128.0	60.3	2.1	9.7	164.3
25	1w	1w	2.0	100	-46.4	112.5	98.2	-0.4	0.2	151.8	55.8	129.6	72.3	0.4	0.3	164.3
10	1d	1d	1.0	100	-100.0	231.5	100.0	-0.4	-0.4	173.6	Inf	219.9	76.1	Inf	Inf	180.9
25	1w	1w	1.0	100	20.9	111.1	88.4	0.2	0.0	151.8	273.2	128.0	60.3	2.1	9.7	164.3
50	1m	1m	1.0	100	240.0	94.2	61.5	2.5	9.9	116.2	151.9	115.2	81.9	1.3	2.4	130.3

- ① Sensitivity analysis confirms the initial results
- ② Results for various parameters reveal substantial volatility
- ③ Strong monotonic effect in case of the efficiency of contrarian and momentum strategies:
 - Contrarian portfolio increase their efficiency when:
 - RE decreases
 - RA decreases
 - %N decreases
 - Momentum portfolio increase their efficiency when:
 - RE increases
 - RA increases
 - %N increases

- 1 Investigation of the correlation matrix gives us a tip that any investigated cryptocurrency portfolio has a huge diversification potential when combined with regular investment portfolios represented by S&P500 B&H strategy.

	S&P B&H	BTC B&H	McW	EqW	Momentum	Contrarian
S&P B&H	1.0000	-0.0169	-0.0126	-0.0104	-0.0427	0.0127
BTC B&H	-0.0169	1.0000	0.9475	0.6090	0.4900	0.4237
McW	-0.0126	0.9475	1.0000	0.6785	0.5412	0.4748
EqW	-0.0104	0.6090	0.6785	1.0000	0.6672	0.5950
Momentum	-0.0427	0.4900	0.5412	0.6672	1.0000	0.3335
Contrarian	0.0127	0.4237	0.4748	0.5950	0.3335	1.0000

Time horizon: 2014-05-12 – 2017-10-28

- 1 Strong contrarian and momentum effect on cryptocurrency market
- 2 Contrarian is much stronger than Momentum and reference strategies
- 3 Sensitivity analysis performed for various parameters confirms our initial results
- 4 Strong monotonic effect in case of efficiency of contrarian and momentum strategies

- 1 Reproduce results on 1-minute data
- 2 Repeat calculations for quotes against BTC instead of USD
- 3 Check the results for larger set of parameters and more conservative transaction costs and liquidity constraints
- 4 Show the results on out-of-sample data starting from 2017-10-28
- 5 Repeat calculations for only these cryptos which are quoted on the largest and most reputable cryptoexchanges
- 6 Prepare an on-line interactive version of this research with weekly update of each strategy

Thank you!

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