Trading Strategies in Cryptocurrency

Group #18

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Prof. Mikhail Smirnov

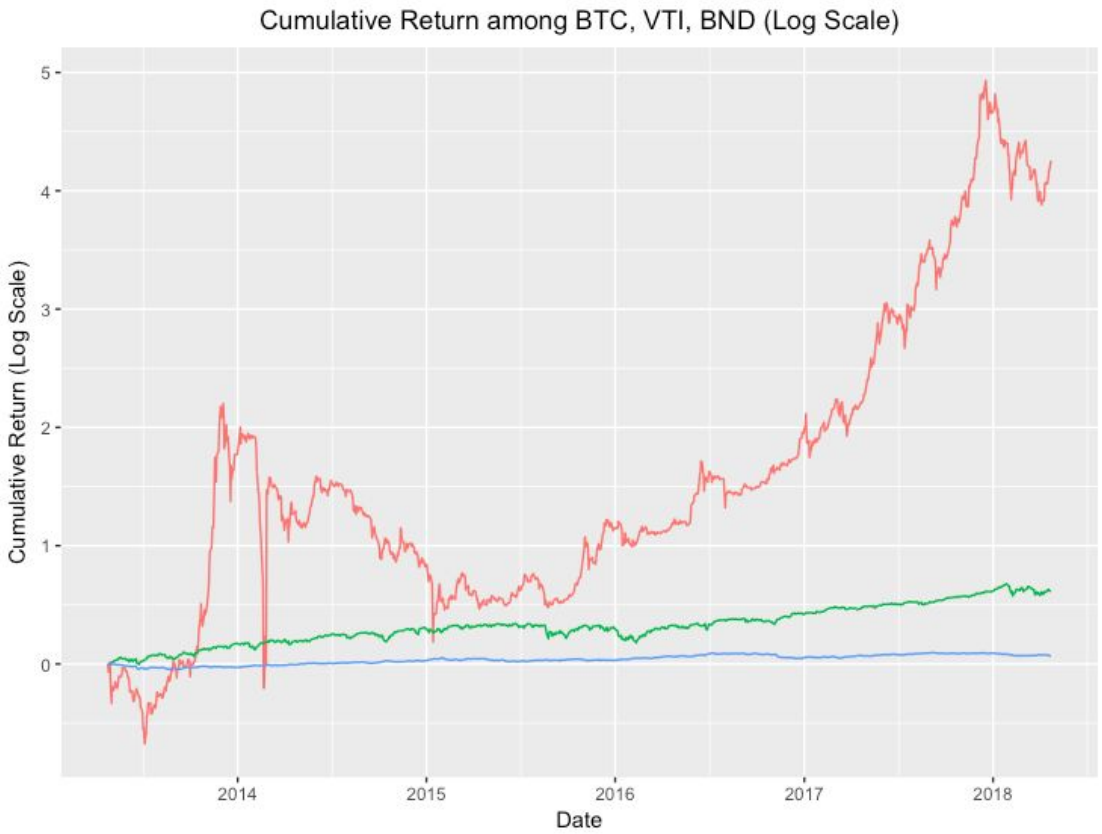
Presentation Date:
Apr. 30th, 2018

Technology used:
Excel, R, MATLAB, Python

Rehearsal:

Date: Apr. 28th, 2018
Time: 9’55”
Place: Butler Library
People: All group members

Motivation



Date: Apr. 2013 - Apr. 2018

	BTC	VTI	BND
Annualized Return	2.49315725	0.19047774	0.02052555
Annualized Volatility	2.17052443	0.15149297	0.03915392
Sharpe Ratio	1.13942843	1.2573371	0.52422727

- Risk free rate is gathered from 10-yr US Treasury Rate (2%)
- If you invest $1 in Apr 2013,
  - $70.5 (BTC) - Max. @ $140
  - $1.85 (VTI)
  - $1.07 (BND)

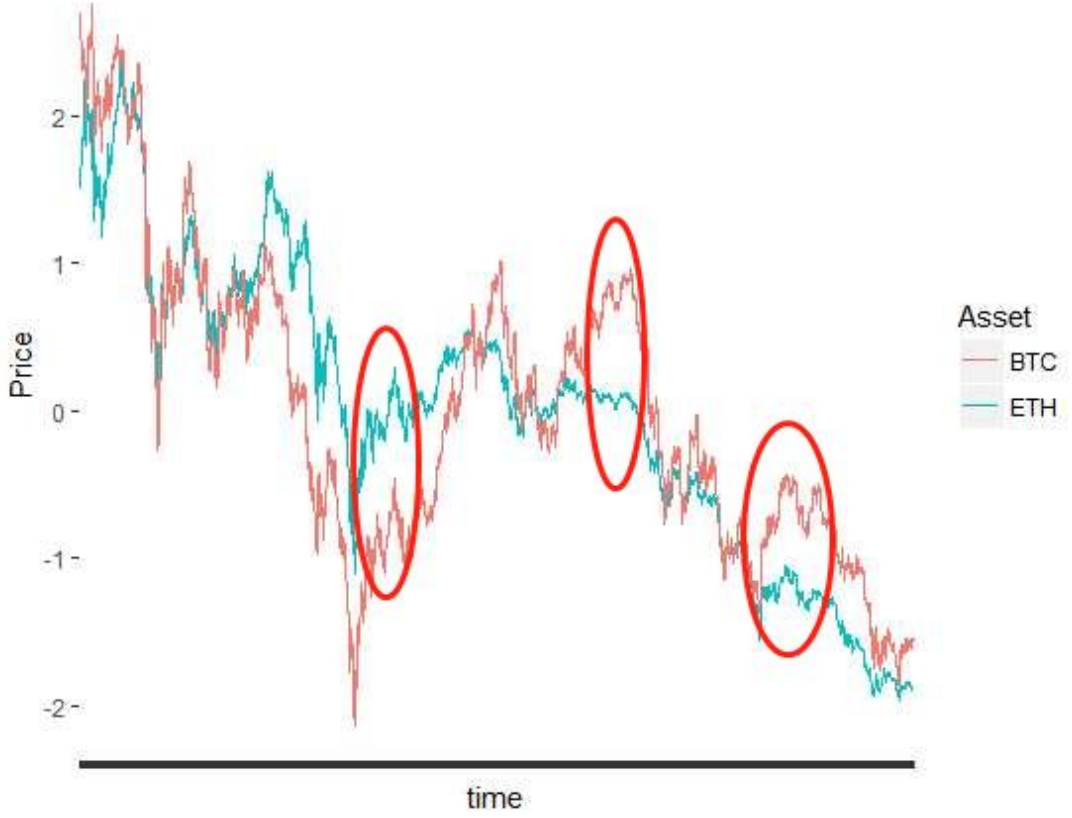
Agenda

1. Pairs Trading Strategy
    a. Concept
    b. Identify correlated instruments/Hypothesis Testing
        i. Co-integration Method
        ii. Distance Method
        iii. Ratio Method
    c. Implement enter/exit strategy
    d. Simulation for future profit
2. Two-Factor Momentum & Value Combined Strategy
    a. Concept
    b. Portfolio Construction
        i. Momentum
        ii. Value
    c. Performance Analysis
3. Drawbacks

Pairs Trading

- A market neutral and profit-making trading strategy in a pair of highly correlated instruments under virtually any market conditions
  - Identify correlated pairs (BTC, LTC, ETH)
  - Identify potential trading opportunities from the price pairs
    - Cointegration test
    - Distance test
    - Ratio test
  - Compute potential future profits using simulation
- Data
  - High frequency data (1/9/2018~4/3/2018)

Identify Trading Opportunities(BTC & ETH)



Test for Correlation

- Cointegration method
  - Assume price follows lognormal distribution
  - Find the linear regression between the prices of two assets, and test for non-increasing error

$$\ln(P_{At}) = \mu + \gamma * \ln(P_{Bt}) + \varepsilon_t$$

$$\varepsilon_t = \rho\varepsilon_{t-1} + \upsilon_t$$

$$|\rho| < 1$$

```
> coint.matrix
          ETH       BTC       LTC       XRP
ETH        NA 0.9862207 0.9991214 0.9919685
BTC 0.9828900        NA 0.9710207 0.9704971
LTC 0.9953614 0.9705915        NA 0.9957114
XRP 0.9895007 0.9713648 0.9969984        NA
```

```
> ind.matrix
      ETH  BTC   LTC   XRP
ETH    NA TRUE FALSE  TRUE
BTC  TRUE   NA  TRUE  TRUE
LTC FALSE TRUE    NA FALSE
XRP  TRUE TRUE FALSE    NA
```

Test for Correlation

- Distance method
  - Find two assets with minimum distance

```
> dist.matrix
           ETH       BTC       LTC       XRP
ETH     0.0000 539.4193 1275.5275  338.3001
BTC   539.4193   0.0000  582.4786  376.2725
LTC  1275.5275 582.4786    0.0000 1198.1004
XRP   338.3001 376.2725 1198.1004    0.0000
```

$$D = \sum_{t=1}^{T} (N_t^A - N_t^B)^2$$

- Ratio test
  - Test for constant ratio between two assets(ADF)

$$y_t = c + \phi y_{t-1} + \beta_1 \Delta y_{t-1} + \cdots + \beta_p \Delta y_{t-p} + \varepsilon_t$$

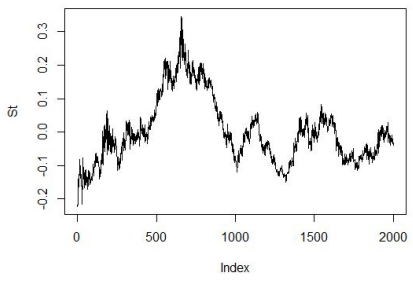
$$H_0 : \phi = 1$$

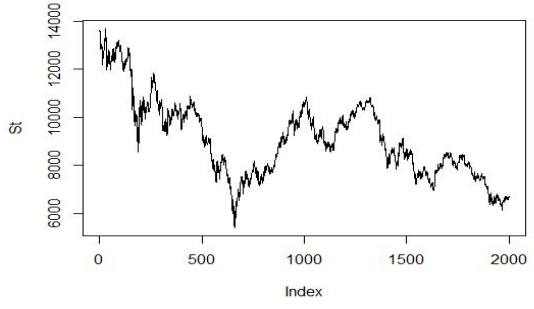
```
##   choice1 choice2 P.value
## 1     eth     btc   0.918
## 2     ltc     btc   0.663
## 3     ltc     eth   0.577
## 4     eth     xrp   0.557
## 5     ltc     xrp   0.263
## 6     btc     xrp   0.084
```

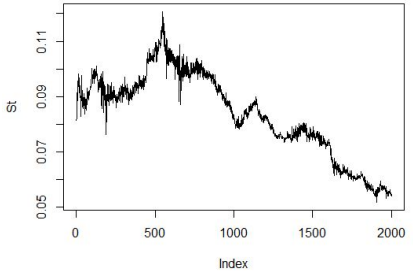
Compare Profits (BTC & ETH)

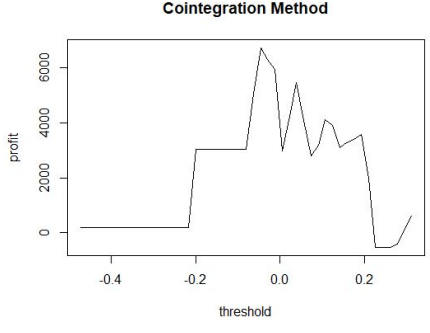
If $S_t > q \rightarrow$ *Short position in A, long position in B*

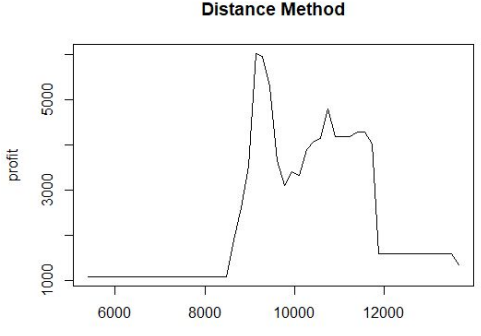
If $S_t > -q \rightarrow$ *Short position in B, long position in A*

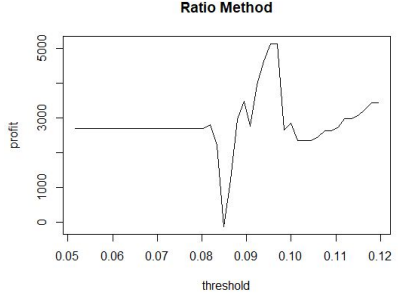












$$S_t = \mu + \hat{\gamma} * \ln(P_{Bt}) - \ln(P_{At})$$

$$S_t = S_{At} - S_{Bt}$$

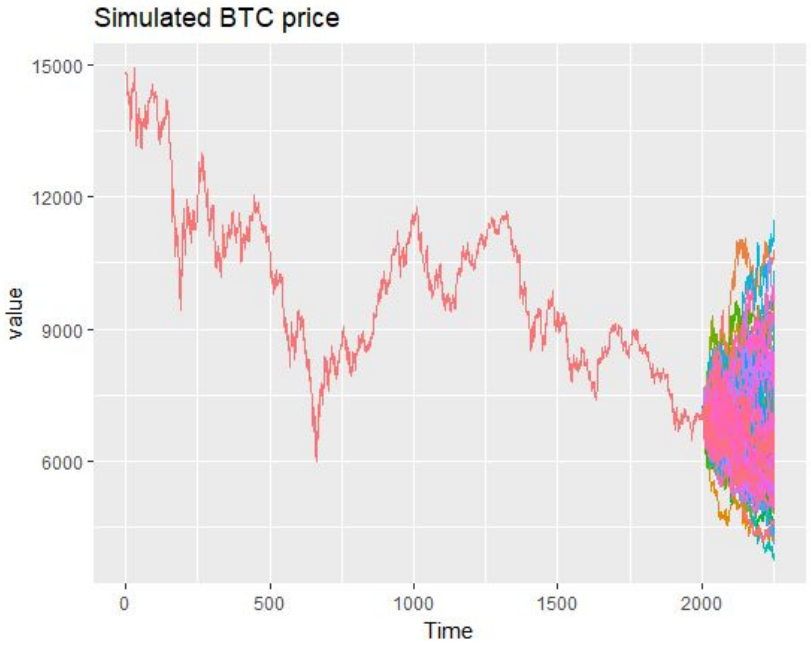
$$S_t = S_{At}/S_{Bt}$$

```
> max(q_var[,2])
[1] 6733.704
```

```
> max(q_var)
[1] 6026.108
> threshold[which.max(q_var)]
[1] 9128.09
> mean(threshold)
[1] 9532.687
```

```
> max(q_var)
[1] 5139.072
> threshold[which.max(q_var)]
[1] 0.09540484
> mean(threshold)
[1] 0.0856047
```

Simulation(BTC & ETH, T=250)

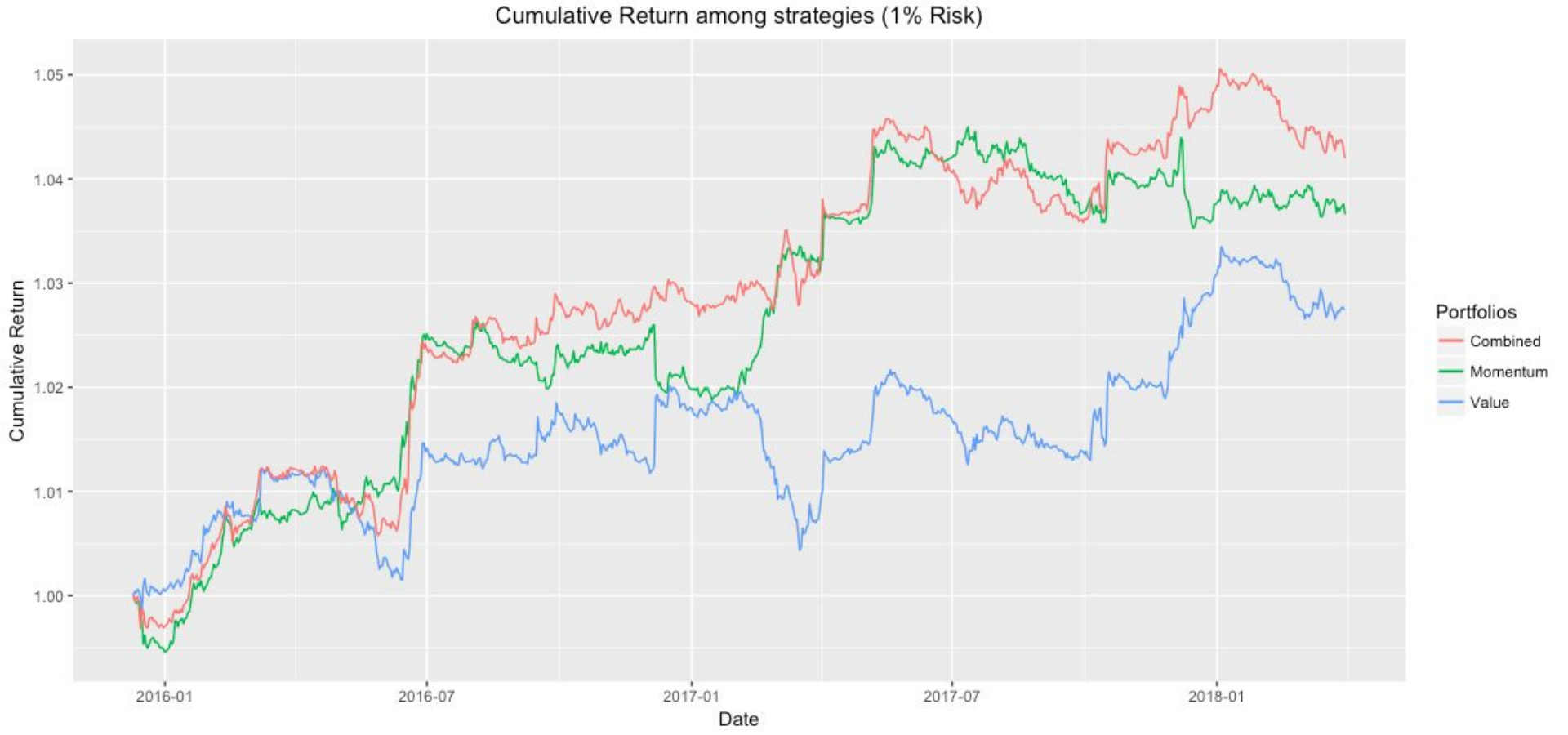



```
> mean(max)
[1] 2446.28
```

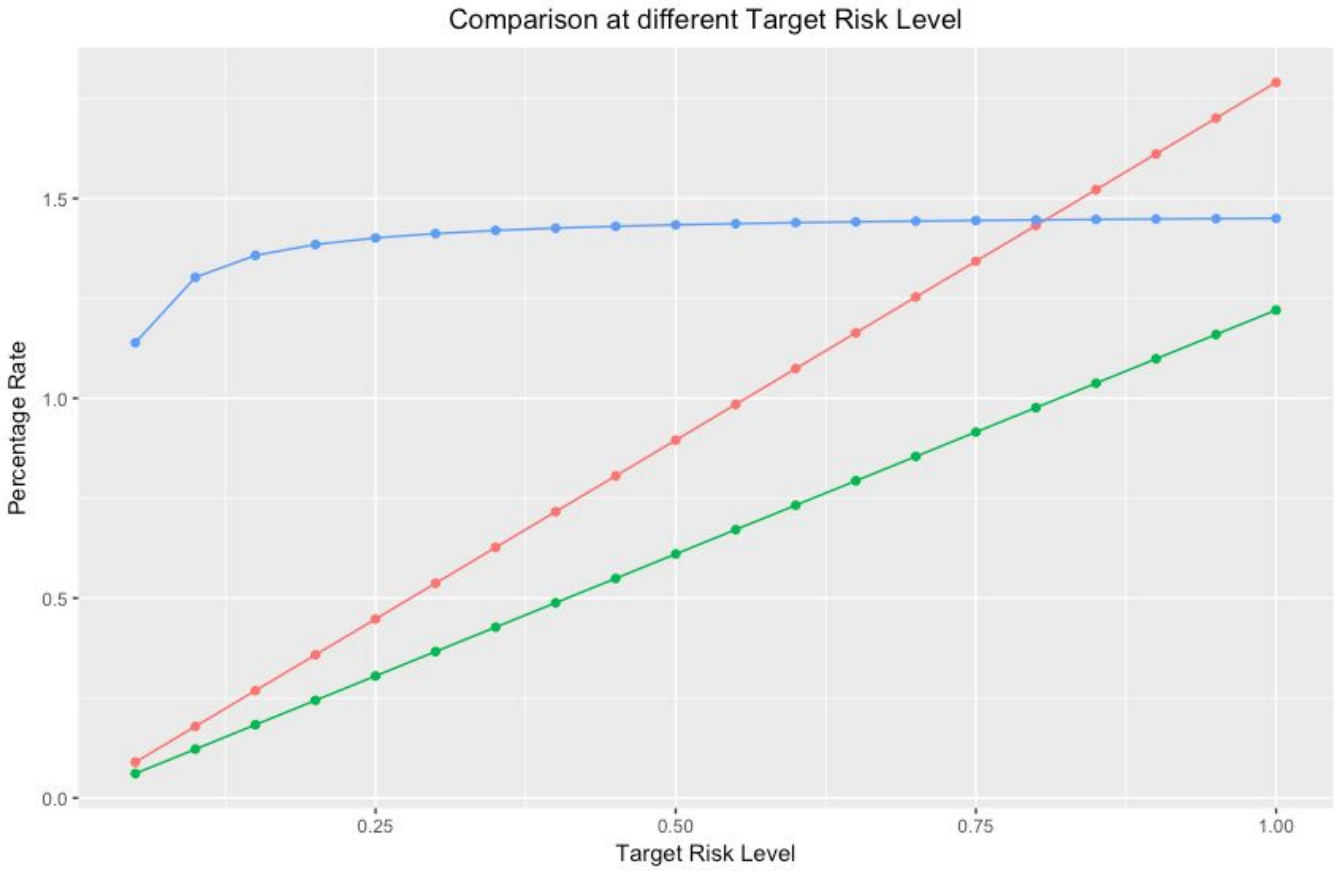
Two Factor Strategy

- Factors:
  - Momentum:
    - Measured as total return of an index over a specified horizon (trailing 1 month)
    - overweight assets with higher momentum and underweight those with lower momentum
  - Value:
    - Comparison of the market capitalization of the currency to fundamental metrics
    - Overweight assets with lower value and underweight those with higher value metric
    - Fundamental Metric: Network Value to Transactions Ratio (NVT) = Network Value (Market Cap) divided by the USD volume transmitted through the blockchain
- Currency Selection:
  - BTC, LTC, ETH, XRP, XLM, DASH, XEM
  - Criteria: Top 15 market cap, long time horizon since inception, sufficient data points
- Time Period:
  - Nov. 2015 - Mar. 2018
- In relatively high frequency investing where portfolios are rebalanced every day

Two Factor Strategy (Cont'd)

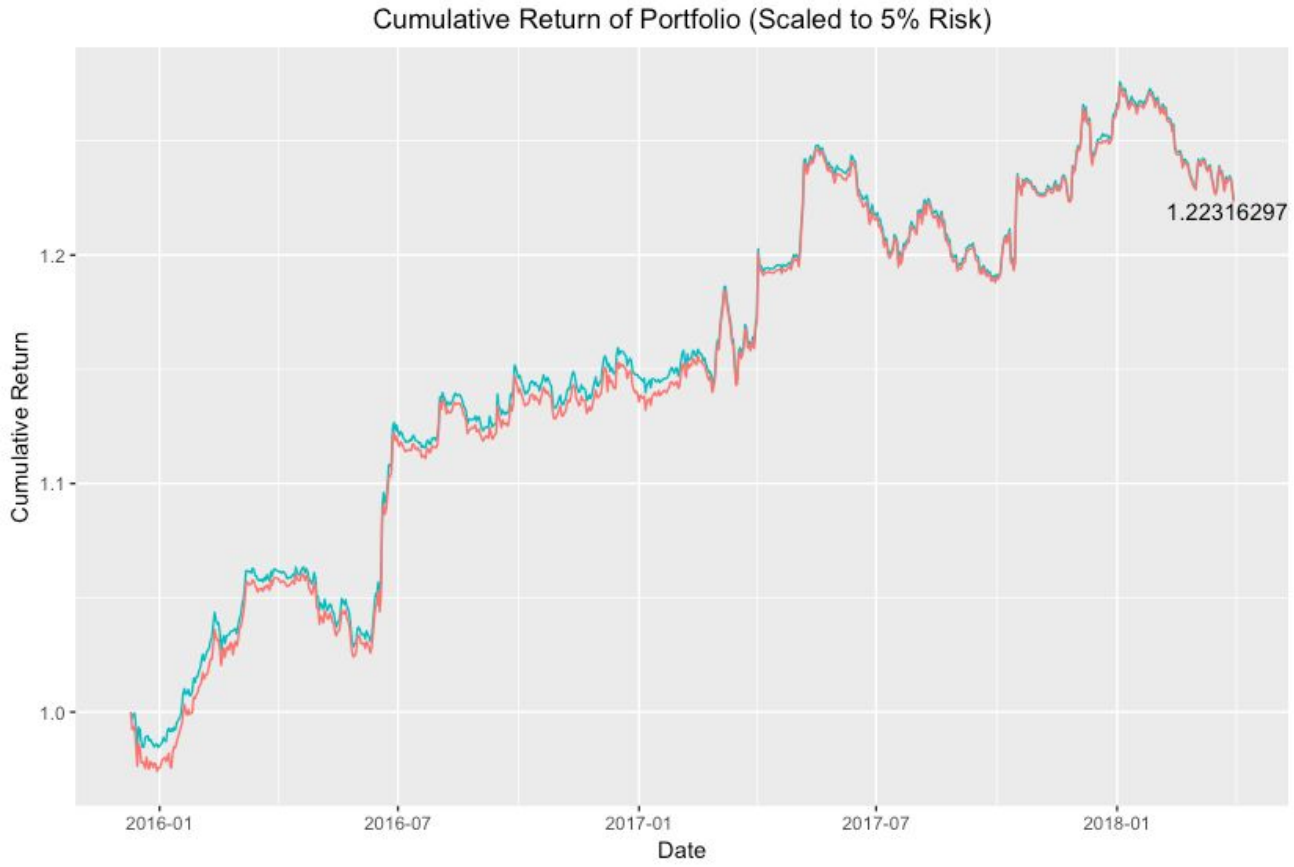


Two Factor Strategy (Cont'd)



- The slopes of the annualized return and volatility lines are simply constant because they are just multiples of each other
- Sharpe ratio increases as target risk level increases

Two Factor Strategy (Cont'd)



- Only 4 out of the 7 cryptocurrencies have data available on the transaction costs
- The other 3 are estimated based on averages
- Most of the time, the T-cost is only few basis points

Drawbacks

1. Access to Data
    a. Transaction costs are only partially gathered
    b. Shorting fees are not considered
    c. Inadequate high frequency data resources
2. Limited Time Horizon
3. Hard but feasible to short cryptocurrency (Bitfinex, Poloniex)
4. Market instability

Reference

https://coinmetrics.io/nvt/#assets=btc

https://bitinfocharts.com/comparison/bitcoin-transactionfees.html

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https://bitcointalk.org/index.php?topic=1931802.0

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