Can Attention Explain the Returns of Cryptocurrencies?
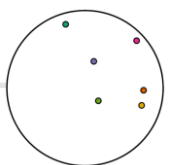
Đorđe Dotlić

Ladislaus von Bortkiewicz Chair of Statistics
Humboldt-Universität zu Berlin
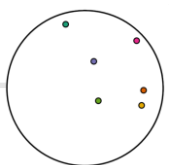http://lvb.wiwi.hu-berlin.de

Structure

1. Motivation

2. Methodology

3. Data

4. Results

5. Conclusion

6. Literature
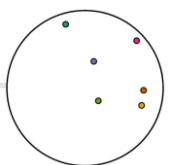
Motivation

- ## Theoretical relevance

- ## Practical relevance

  - ### Cryptocurrency market analysis

Methodology

- ## Granger causality

- ## Regression

  - Contemporaneous
  - Predictive

Granger causality

A variable X Granger-causes Y if Y can be better predicted using the histories of both X and Y than it can using the history of Y alone.
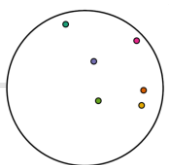(Sewell, 2001)

$$E(Y|Y_{t-k}, X_{t-k}) \neq E(Y|Y_{t-k})$$
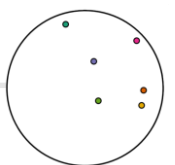
- Granger's view:

$$\sigma^2(Y|U) < \sigma^2(Y|\overline{U - X})$$

- Requires stationarity of time series

Stationarity

- Tests:

  - **ADF** (Augmented Dickey- Fuller Test)

    $$H_0 = non-stationary \text{ ts}$$
    $$H_1 = stationary \text{ ts}$$

  - **KPSS** (Kwiatkowski–Phillips–Schmidt–Shin Test)

    $$H_0 = stationary \text{ ts}$$
    $$H_1 = non-stationary \text{ ts}$$
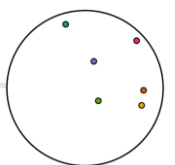
Granger causality

- Testing for causality

$$Y_t = \sum_{j=1}^{m} \alpha_j Y_{t-j} + \sum_{i=1}^{n} \beta_i X_{t-i} + \varepsilon_t$$

$$Y_t = \sum_{j=1}^{m} \alpha_j Y_{t-j} + \vartheta_t$$

- F-test

$$H_0: \beta_1 = \beta_2 = \cdots = \beta_n = 0$$
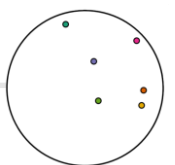$$H_1: otherwise$$

Granger causality

- ## Limitations:

  - ### Humean definition of causality

  - ### Third variable

- ## Extensions:

  - ### Robust to non-normally distributed error term (Hacker, Hatemi, 2006)

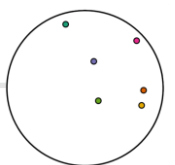 - ### Asymmetric causality testing (Hatemi, 2012)

Source: https://en.wikipedia.org/wiki/Granger_causality

Structural breaks

"Unexpected shift in a time series that can cause huge forecasting problems." (Gujarati, 2007)

- Approaches in testing:

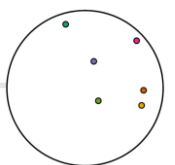 - Chow test (1960)

  - Bai- Perron (2003)

Regression

- Contemporaneous regression

$$(logreturns)_t = \beta_0 + \beta_1 \log(svi)_t + \beta_2 (logs\&p500\ returns)_t$$
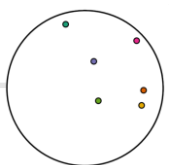$$+\beta_3 \log(vix)_t + \beta_4 \log(btc\ volume)_t + \beta_5 (btc\ volatility)_t$$
$$+ \beta_6 \log(epuix\ US)_t$$

- Predictive regression

$$(logreturns)_{t+1} = \beta_0 + \beta_1 \log(svi)_t$$
$$+\beta_3 \log(vix)_t + \beta_4 \log(btc\ volume)_t + \beta_5 (btc\ volatility)_t$$
$$+ \beta_6 \log(epuix\ US)_t$$

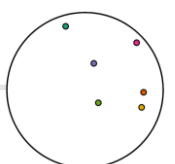# Data

- Google Search Volume Index (SVI)

    - *"Cryptocurrency"* term search

    - 17.8.2014 - 3.6.2017

    - Weekly data

    - Source: https://trends.google.com/trends/
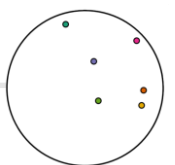
SVI

SVI "*Cryptocurrency*" term search, 17.8.2014 - 3.6.2017
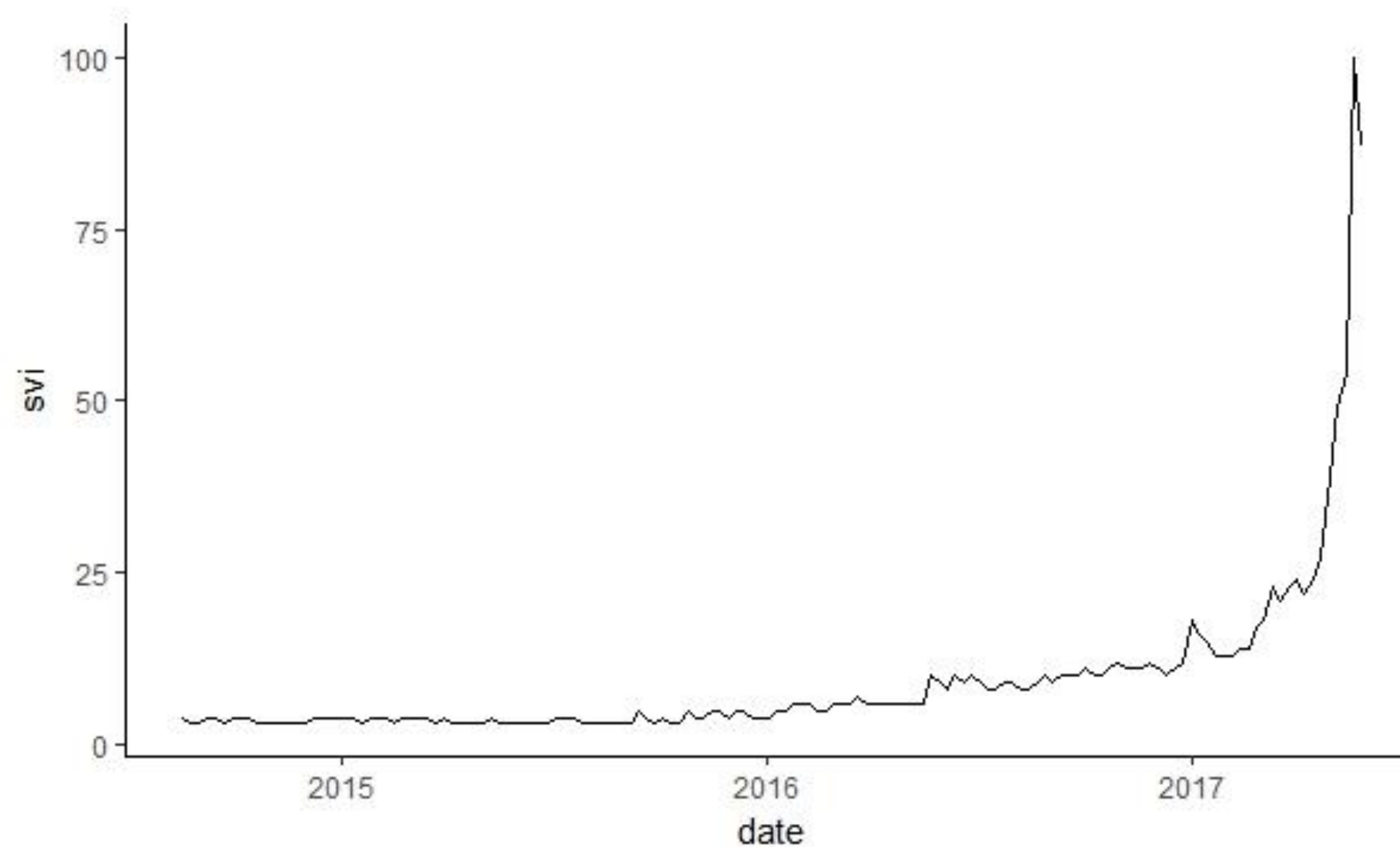
Data

- CRIX (*Trimborn, Härdle, 2016*)

  - Average per week

  - $logreturns_t = \log(\frac{p_t}{p_{t-1}})$

  - Source: http://crix.hu-berlin.de/

CRIX

Average weekly levels of CRIX, 17.8.2014 - 3.6.2017
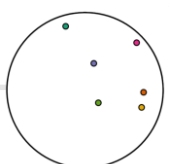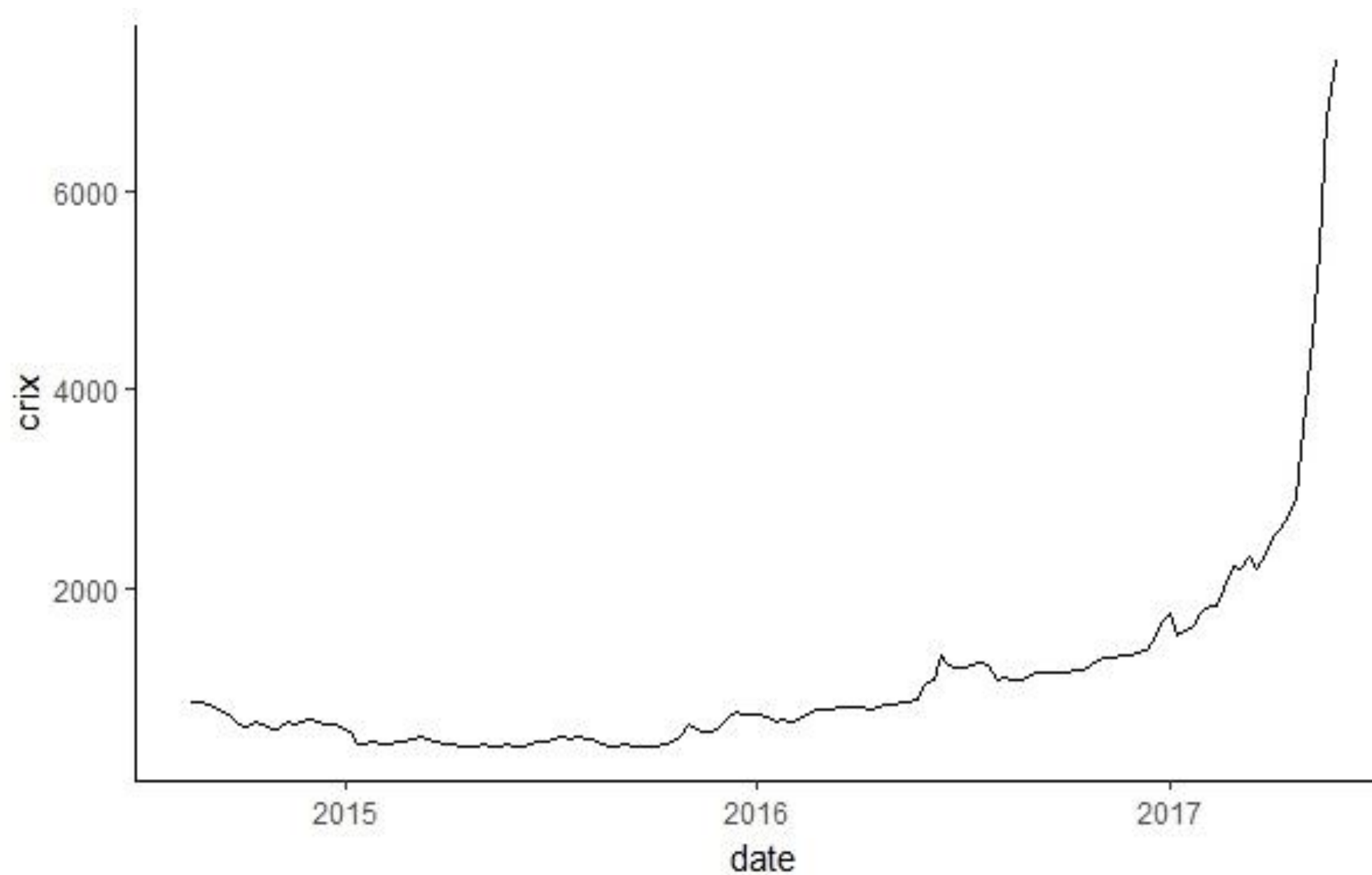
CRIX

Returns on CRIX, 17.8.2014 - 3.6.2017
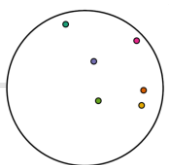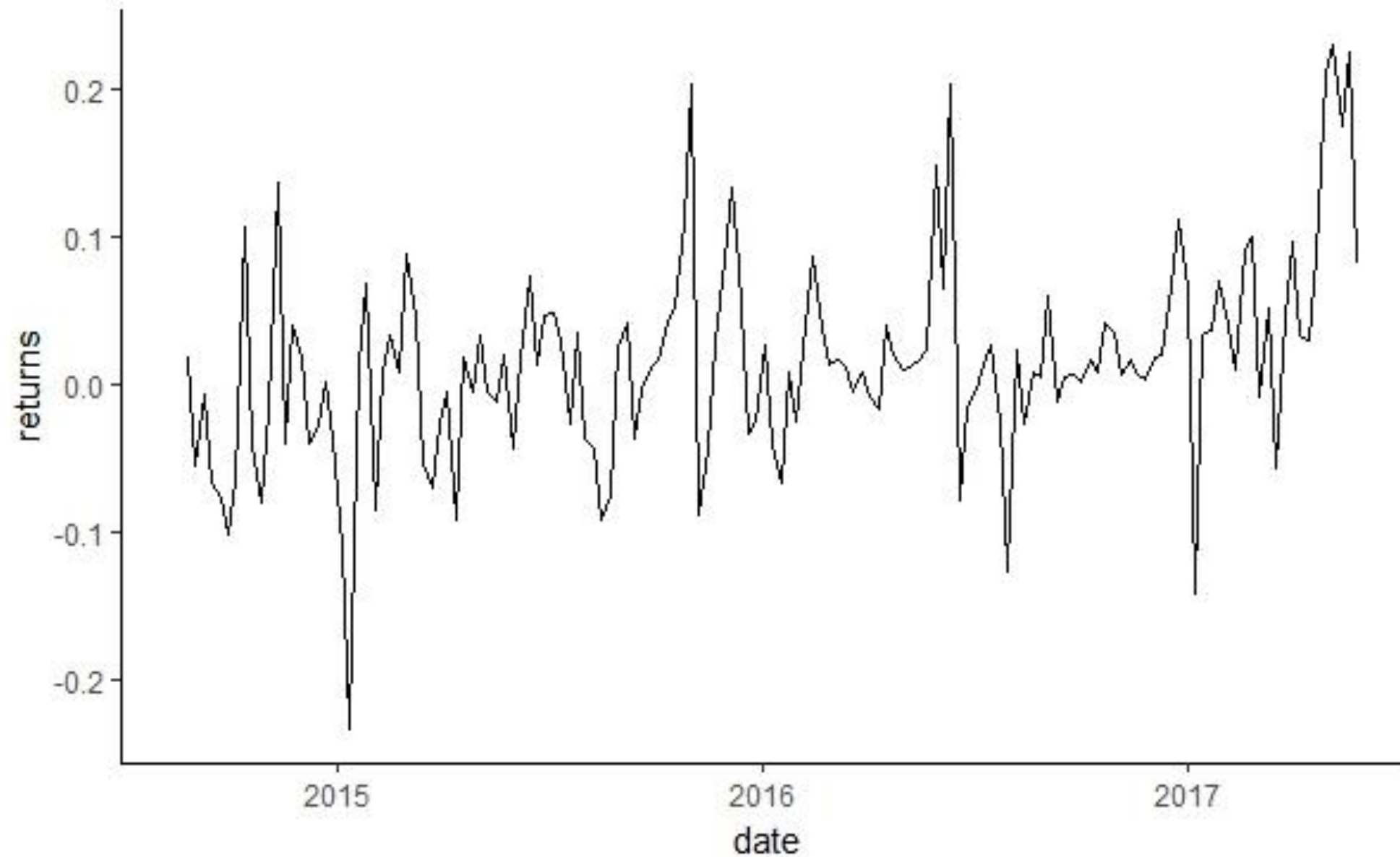
Data

- *s&p 500 log returns*

    - Source: https://fred.stlouisfed.org/

    - Average per week

- *log Volatility Index (VIX)*

    - Source: www.cboe.com

    - Average per week
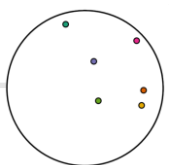
Data

- *log BitCoin Trade Volume*

  - Average per week

  - Source: https://www.quandl.com

- *Bitcoin Price Volatility*

  - Garman-Klass (1980)

  - Average per week
    OHLC according to CET

  - Source: http://www.coindesk.com/
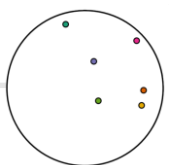
Data

- *log EPUIX US*

    - Economic Policy Uncertainty Index

    - Average per week

    - https://www.bloomberg.com/news/articles/2017-02-23/bitcoin-price-sets-intraday-record-on-trump-policy-uncertainties

    - Source: http://www.policyuncertainty.com/index.html

Results

- ## Granger Causality

  - ### Breaking Points

  - ### Results

- ## Regression

  - ### Contemporaneous

  - ### Predictive
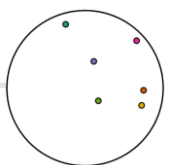
Breaking Points

- ## CRIX breaking points:
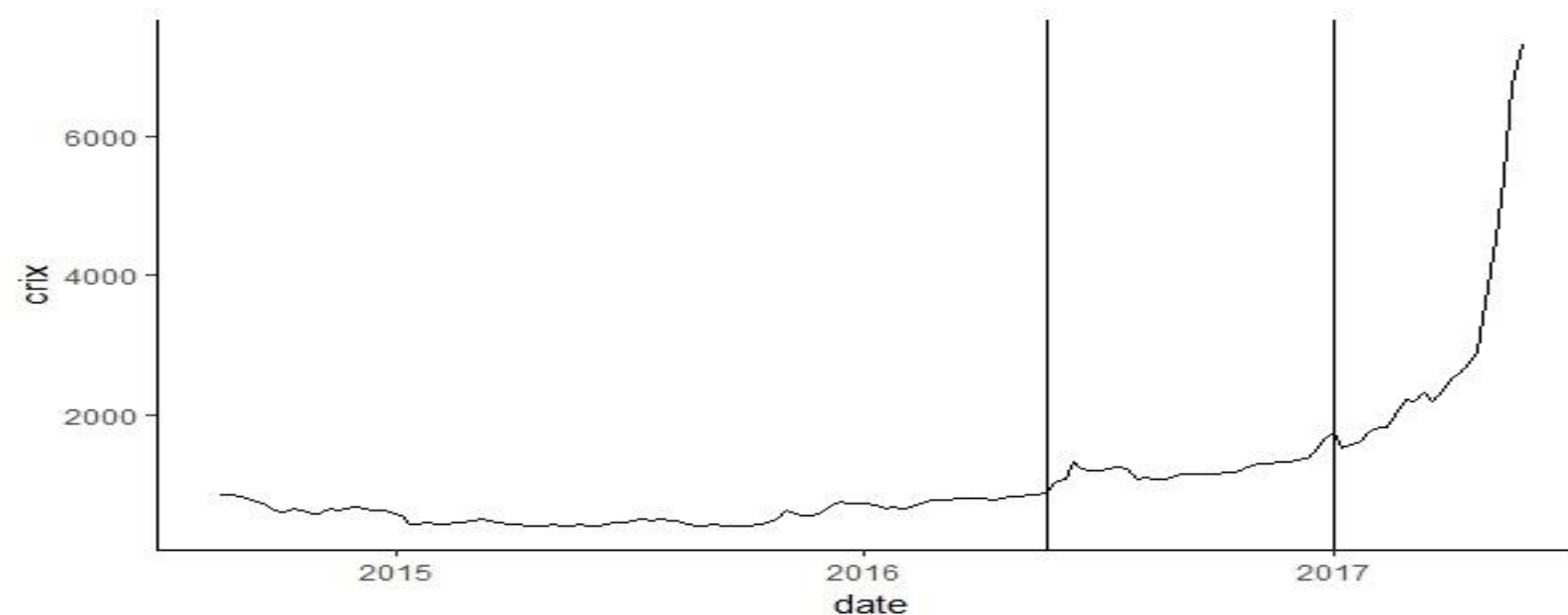
- CRIX breaking points:
1. 22.5.2016
2. 1.1.2017

- *"Cryptocurrency"* svi breaks:
1. 15.5.2016
2. 1.1.2017

Can Attention Explain the Returns of Cryptocurrencies?
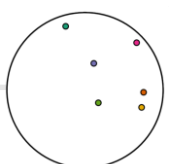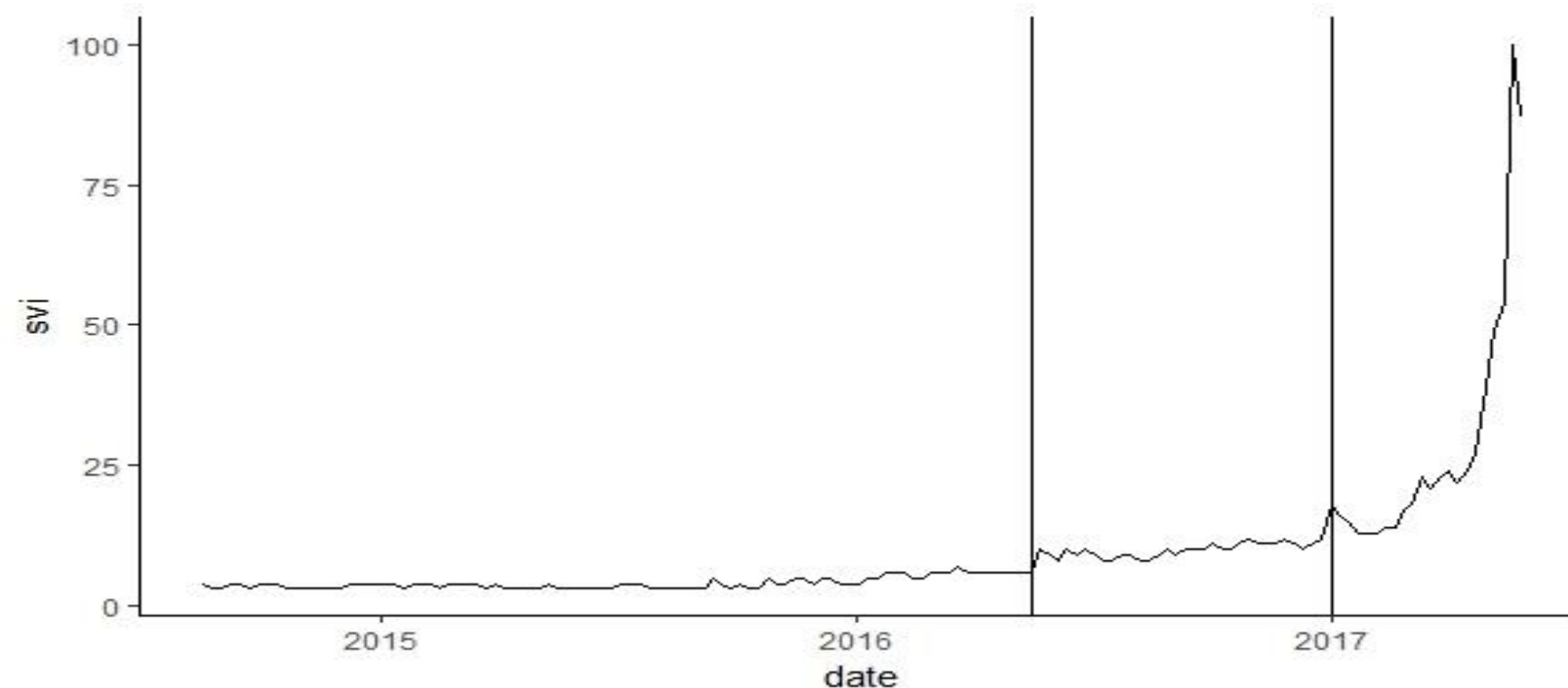
Granger causality

- First period (17.8.2014-15.5.2016)

  - No causality

- Second period (15.5.2016- 1.1.2017)

  - Returns "drive" Attention (SVI)

- Third period (1.1.2017-3.6.2017)

  - Attention "drives" Returns

Regression

- Contemporaneous regression

$$(logreturns)_t = \beta_0 + \beta_1 log(svi)_t + \beta_2(logs\&p500\ returns)_t$$
$$+\beta_3 log(vix)_t + \beta_4 log(btc\ volume)_t + \beta_5(btc\ volatility)_t$$
$$+ \beta_6 log(epuix\ US)_t$$

- Predictive regression

$$(logreturns)_{t+1} = \beta_0 + \beta_1 log(svi)_t$$
$$+\beta_3 log(vix)_t + \beta_4 log(btc\ volume)_t + \beta_5(btc\ volatility)_t$$
$$+ \beta_6 log(epuix\ US)_t$$

Regression- Contemporaneous

Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	-0.64389	0.24335	-2.646	0.00972 **
log(svi)	-0.02194	0.02824	-0.777	0.43943
log_sp500_returns	0.39205	0.42530	0.922	0.35926
log(vix)	-0.02979	0.04039	-0.738	0.46284
log(volume)	0.07048	0.02106	3.347	0.00122 **
volatility	-0.01098	0.02228	-0.493	0.62326
log(epuix)	-0.02574	0.03111	-0.827	0.41040
Adjusted R-squared: 0.09967 F-statistic: 2.661 on 6 and 84 DF, p-value: 0.02061				

First period (17.8.2014-15.5.2016)

Heteroskedasticity!

Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	-3.35625	1.15177	-2.914	2.914 **
log(svi)	0.04135	0.09423	0.439	0.66452
log_sp500_returns	-0.52312	1.25788	-0.416	0.68105
log(vix)	0.07050	0.09171	0.769	0.44928
log(volume)	0.25723	0.09163	2.807	0.00954 **
volatility	-0.13070	0.07989	-1.636	0.11434
log(epuix)	-0.01739	0.03179	-0.547	0.58914
Adjusted R-squared: 0.1379 F-statistic: 1.826 on 6 and 25 DF, p-value: 0.1345				

Second period (15.5.2016-1.1.2017)

Heteroskedasticity
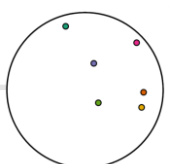
Regression- Contemporaneous

Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	0.753203	1.800076	0.418	0.682
log(svi)	0.083039	0.067612	1.228	0.238
log_sp500_returns	0.598569	3.097685	0.193	0.849
log(vix)	-0.215357	0.268251	-0.803	0.435
log(volume)	-0.002835	0.155079	-0.018	0.986
volatility	-0.060274	0.066724	-0.903	0.381
log(epuix)	-0.073831	0.147273	-0.501	0.623
Adjusted R-squared: 0.2978 F-statistic: 2.484 on 6 and 15 DF, p-value: 0.07158				

Third period (1.1.2017 - 3.6.2017)
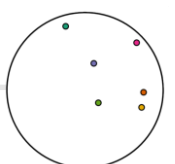
Can Attention Explain the Returns of Cryptocurrencies?

Regression- Predictive

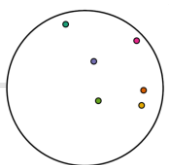| Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	-0.71351	0.24696	-2.889	0.00491 **
log(svi)	-0.01416	0.02866	-0.494	0.62256
log_sp500_returns	0.59778	0.43161	1.385	0.16972
log(vix)	-0.01385	0.04099	-0.338	0.73623
log(volume)	0.05636	0.02137	2.637	0.00996 **
volatility	-0.03235	0.02261	-1.431	0.15610
log(epuix)	0.02166	0.03157	0.686	0.49450

Adjusted R-squared: 0.07335 F-statistic: 2.187 on 6 and 84 DF, p-value: 0.05209

First period (17.8.2014-15.5.2016)

Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	-3.60281	1.08565	-3.319	0.00277 **
log(svi)	0.04183	0.08882	0.471	0.64175
log_sp500_returns	1.49674	1.18567	1.262	0.21847
log(vix)	0.03647	0.08645	0.422	0.67669
log(volume)	0.28655	0.08637	3.318	0.00278 **
volatility	-0.16272	0.07530	-2.161	0.04048
log(epuix)	-0.02317	0.02996	-0.773	0.44664

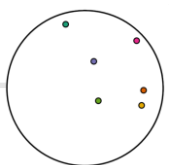Adjusted R-squared: 0.2478 F-statistic: 2.702 on 6 and 25 DF, p-value: 0.03669

Second period
(15.5.2016-1.1.2017)

Can Attention Explain the Returns of
Cryptocurrencies?

Regression- Predictive

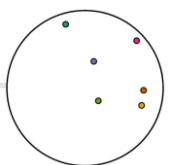| Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	2.29729	1.42961	1.607	0.13038
log(svi)	0.13074	0.06234	2.097	0.05464 .
log_sp500_returns	-3.31771	2.39116	-1.387	0.18698
log(vix)	-0.56375	0.20712	-2.722	0.01653 *
log(volume)	-0.07469	0.12965	-0.576	0.57371
volatility	-0.18614	0.05155	-3.611	0.00284 **
log(epuix)	-0.03904	0.12097	-0.323	0.75165
Adjusted R-squared: 0.6015 F-statistic: 6.032 on 6 and 14 DF, p-value: 0.002706				

Third period (1.1.2017 - 3.6.2017)
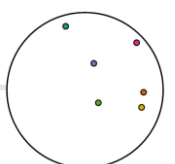
Conclusion

- Change in the nature of relationship between attention and returns on cryptocurrencies

- More data for more precise conclusions

Literature

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