

Can Attention Explain the Returns of Cryptocurrencies?

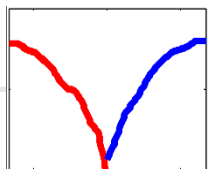
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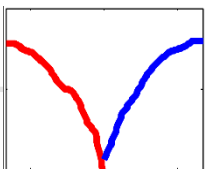
Structure

1. Motivation
2. Methodology
3. Data
4. Results
5. Conclusion
6. Literature



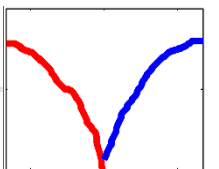
Motivation

- 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.

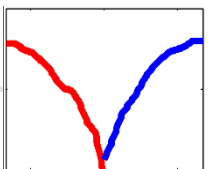
(Sewell, 2001)

$$E(Y|Y_{t-k}, X_{t-k}) \neq E(Y|Y_{t-k})$$

- Granger's view:

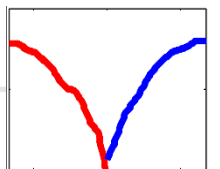
$$\sigma^2(Y|U) < \sigma^2(Y|\overline{U - X})$$

- Requires stationarity of time series



Stationarity

- Tests:
 - **ADF** (Augmented Dickey- Fuller Test)
 $H_0 = non - stationary\ ts$
 $H_1 = stationary\ ts$
 - **KPSS** (Kwiatkowski–Phillips–Schmidt–Shin Test)
 $H_0 = stationary\ ts$
 $H_1 = non - stationary\ ts$



Granger causality

- Testing for causality

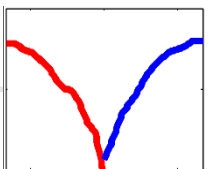
$$Y_t = \sum_{j=1}^m \alpha_j Y_{t-j} + \sum_{i=1}^n \beta_i X_{t-i} + \varepsilon_t$$

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

- F-test

$$H_0: \beta_1 = \beta_2 = \dots = \beta_n = 0$$

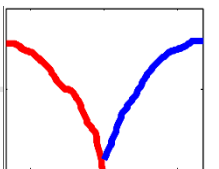
$$H_1: \textit{otherwise}$$



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)

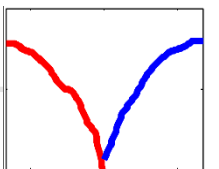
Source: https://en.wikipedia.org/wiki/Granger_causality



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)



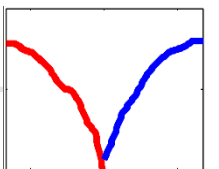
Regression

- Contemporaneous regression

$$\begin{aligned} (\log returns)_t = & \beta_0 + \beta_1 \log(svi)_t + \beta_2 (\log s\&p500 returns)_t \\ & + \beta_3 \log(vix)_t + \beta_4 \log(btc volume)_t + \beta_5 (btc volatility)_t \\ & + \beta_6 \log(epuix US)_t \end{aligned}$$

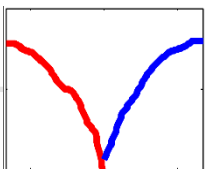
- Predictive regression

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



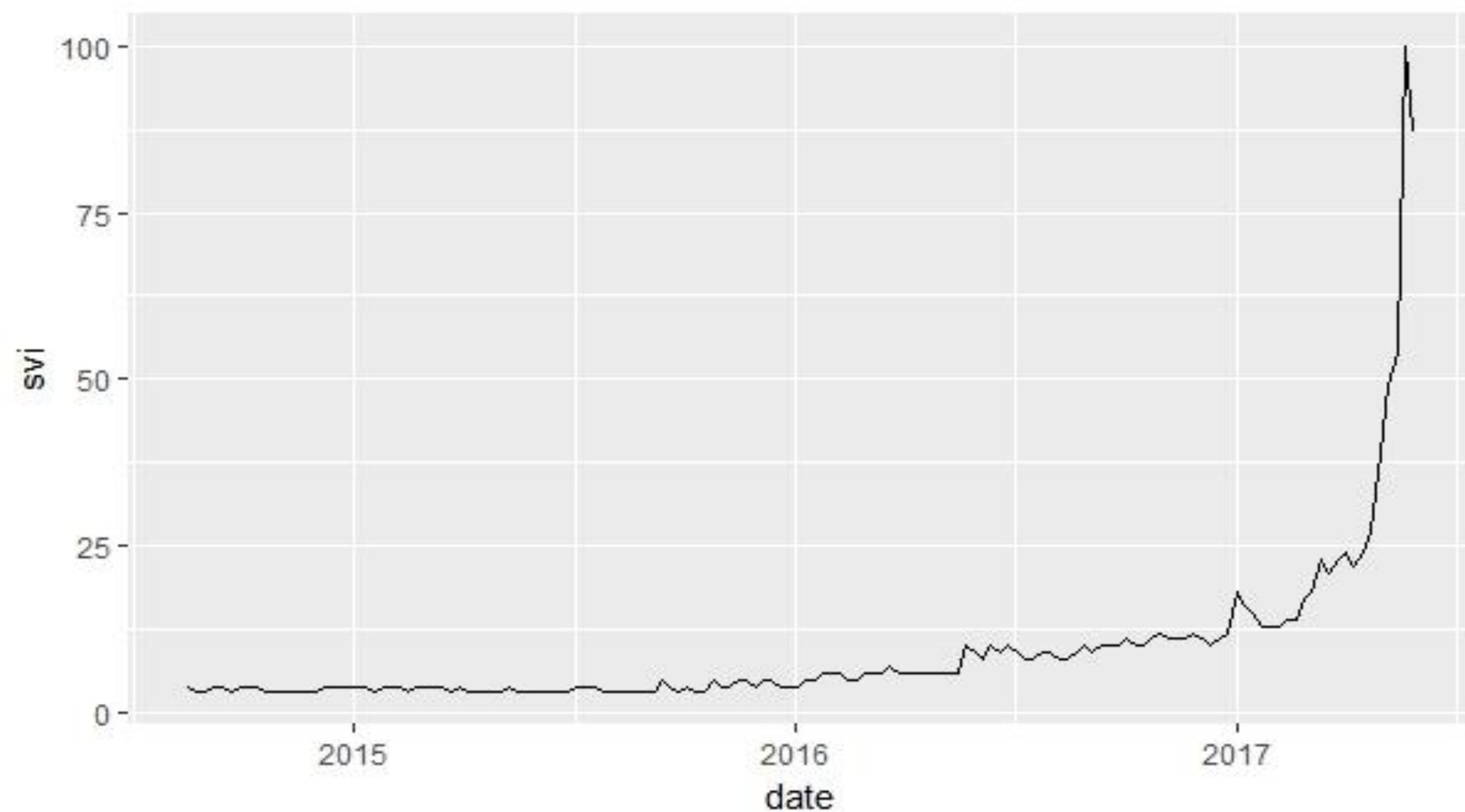
Data

- Google Search Volume Index (SVI)
 - “*Cryptocurrency*” term search
 - 17.8.2014 - 3.6.2017
 - Weekly data
 - Source: <https://trends.google.com/trends/>

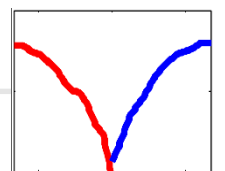


SVI

SVI “Cryptocurrency” term search, 17.8.2014 - 3.6.2017

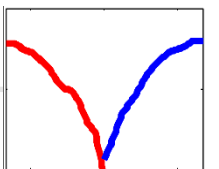


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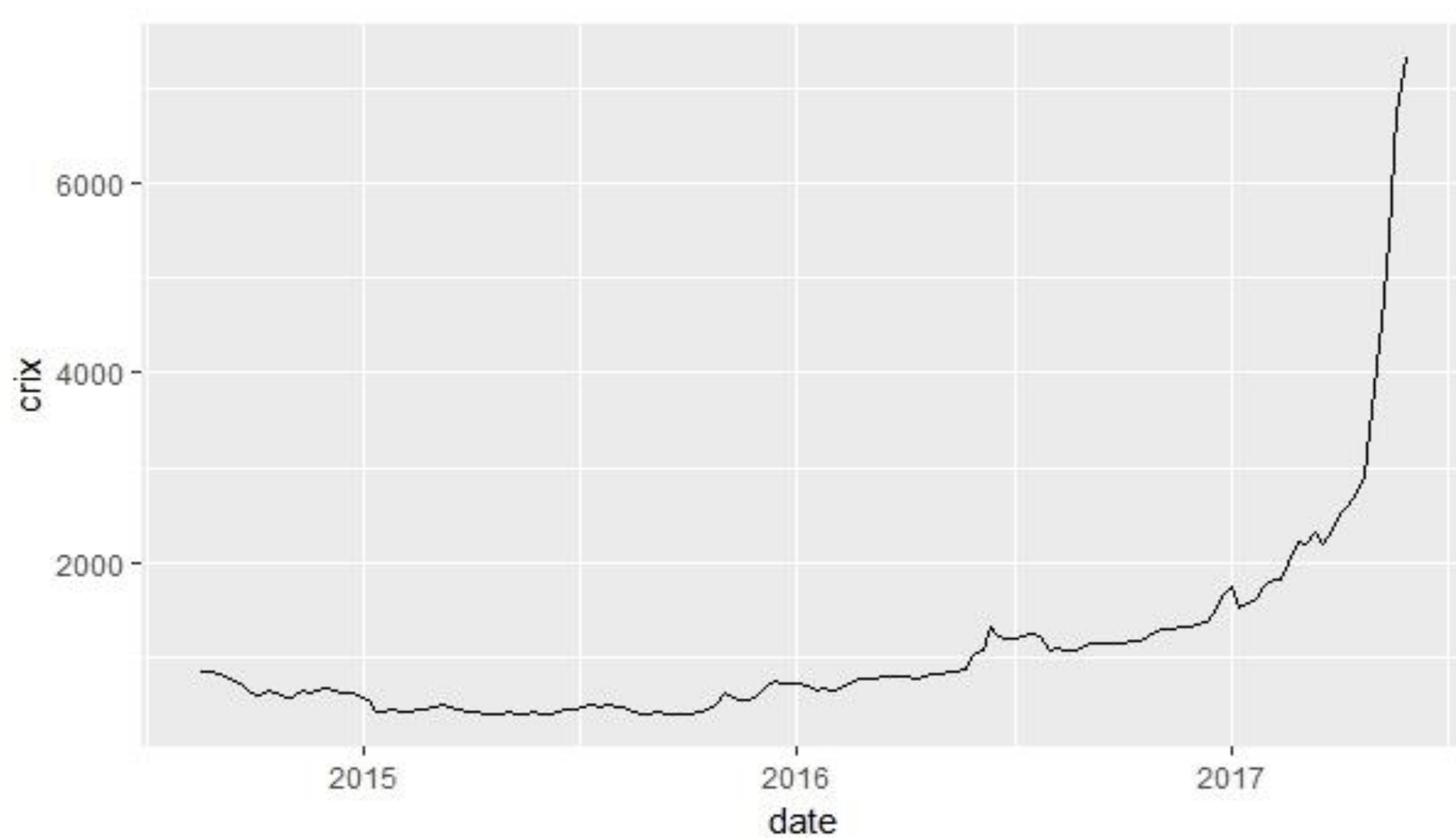
Data

- CRIX (*Trimborn, Härdle, 2016*)
 - Average per week
 - $lreturns_t = \ln\left(\frac{p_t}{p_{t-1}}\right)$
 - Source: <http://crix.hu-berlin.de/>

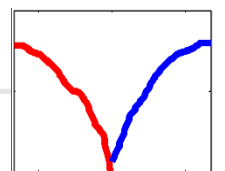


CRIX

Average weekly levels of CRIX, 17.8.2014 - 3.6.2017

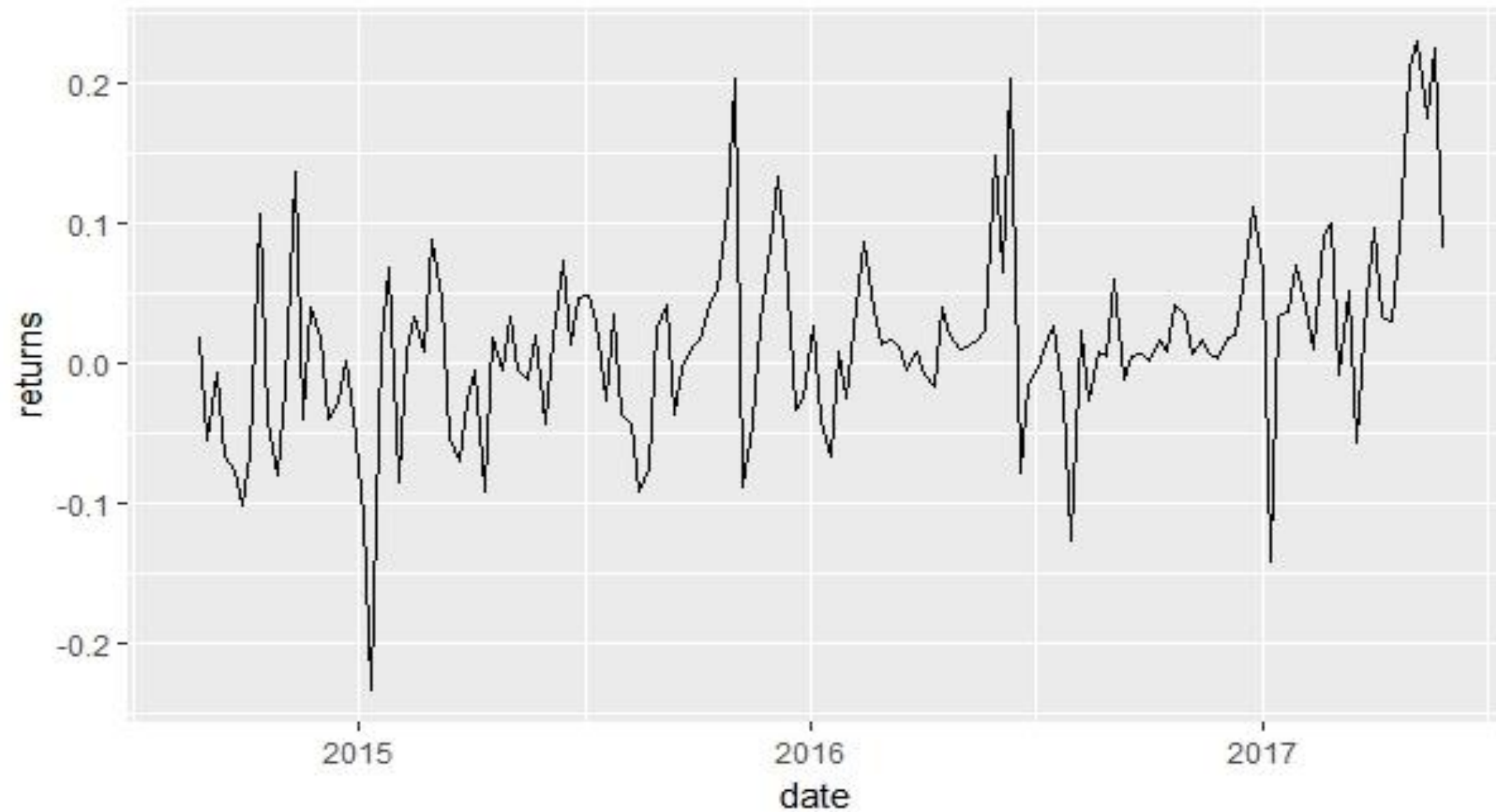


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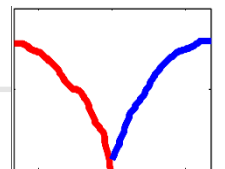


CRIX

Returns on CRIX, 17.8.2014 - 3.6.2017

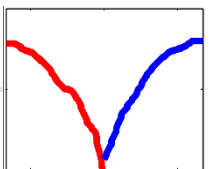


Can Attention Explain the Returns of
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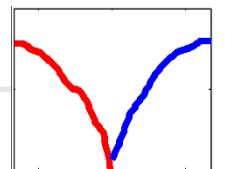
Data

- *s&p 500 log returns*
 - Source: <https://fred.stlouisfed.org/>
 - Average per week
- *log Volatility Index (VIX)*
 - Source: www.cboe.com
 - Average per week



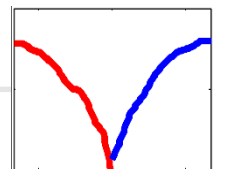
Data

- *log BitCoin Trade Volume*
 - Average per week
 - Source: <https://www.quandl.com>
- *Bitcoin Price Volatility*
 - Garman-Klass (1980)
 - Average per week
 - Source: <http://www.coindesk.com/>



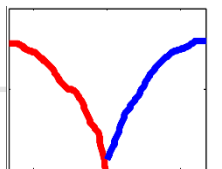
Data

- *log EPUIX US*
 - 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>



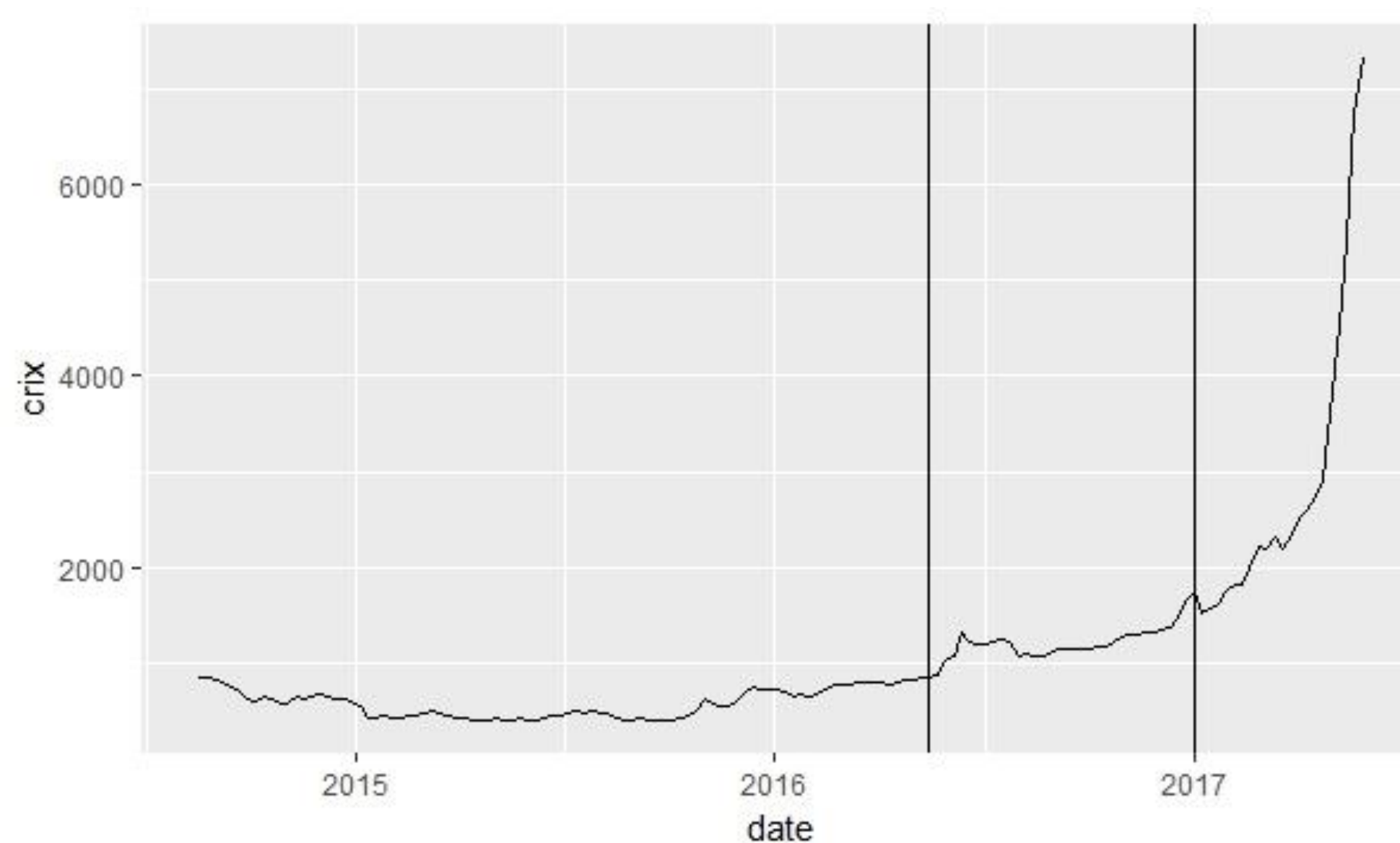
Results

- Granger Causality
 - “*Crypto*” vs “*Cryptocurrency*”
 - Breaking Points
 - Results
- Regression
 - Contemporaneous
 - Predictive

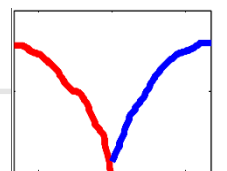


Breaking Points

- CRIX breaking points:

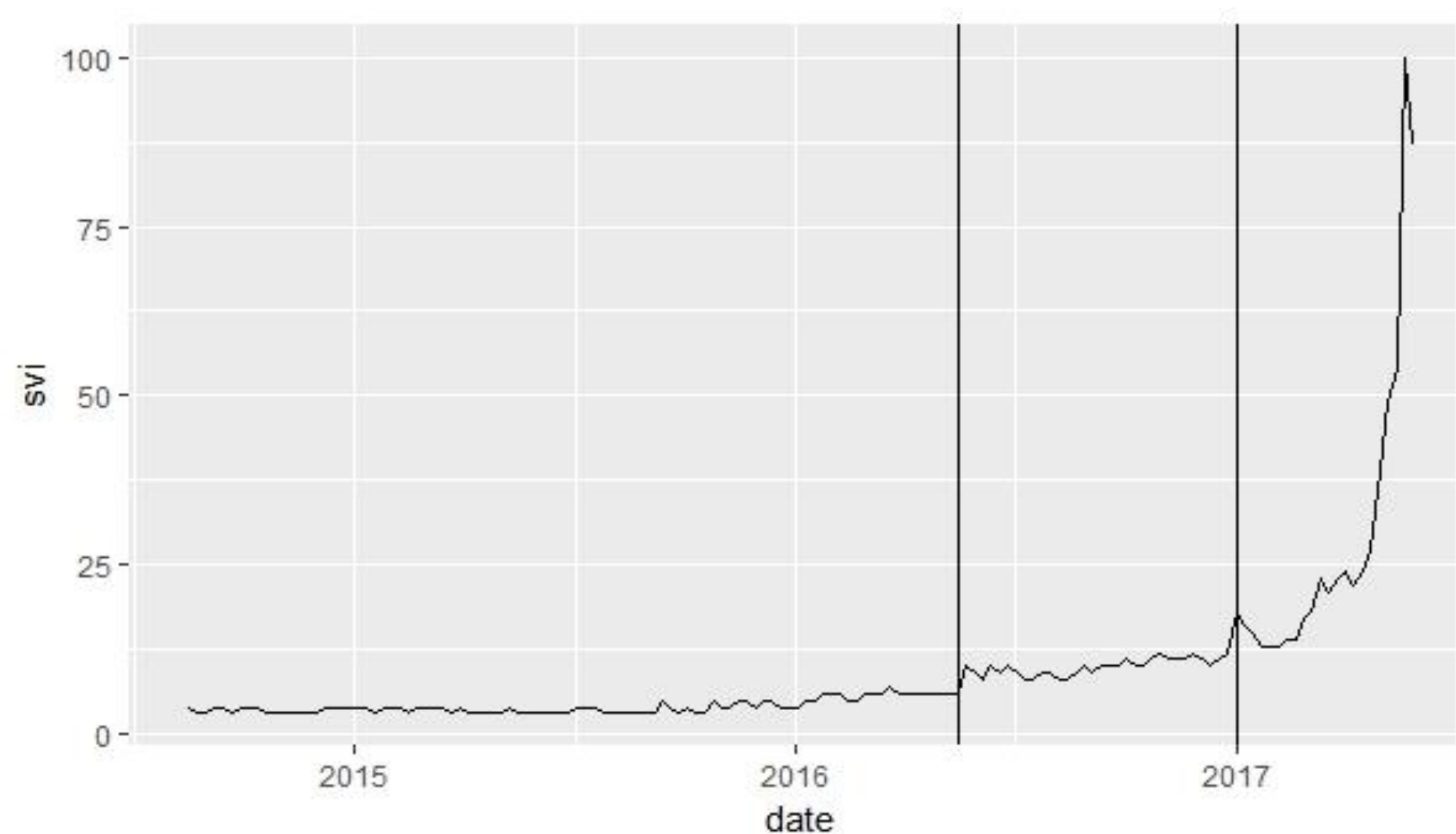


- CRIX breaking points:
 1. 22.5.2016
 2. 1.1.2017

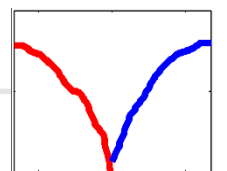


Breaking Points

- SVI breaking points

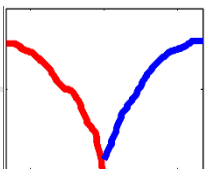


- “Cryptocurrency”*
svi breaks:
 - 15.5.2016
 - 1.1.2017



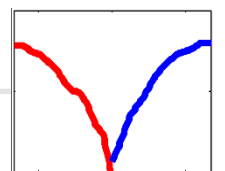
Granger causality

- Results separated into 3 periods, according to the breaks in svi
- Every table consist of p-values for regressions, across the number of lags
- Every table shows the results for “crypto” and “cryptocurrency” svi
- Note that the periods are different, as the breaking periods are different!
- Statistically significant results marked with green color



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



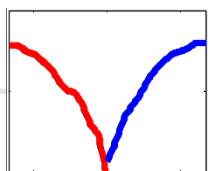
Regression

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$$\begin{aligned} (\logreturns)_t = & \beta_0 + \beta_1 \log(svi)_t + \beta_2 (\log s\&p500\ returns)_t \\ & + \beta_3 \log(vix)_t + \beta_4 \log(btc\ volume)_t + \beta_5 (btc\ volatility)_t \\ & + \beta_6 \log(epuix\ US)_t \end{aligned}$$

- Predictive regression

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



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				
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				

First period (17.8.2014-15.5.2016)

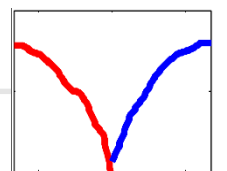
Heteroskedasticity!

Second period (15.5.2016-1.1.2017)

Heteroskedasticity



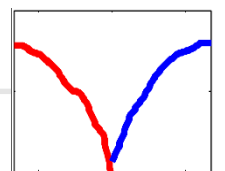
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Regression- Contemporaneous


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)



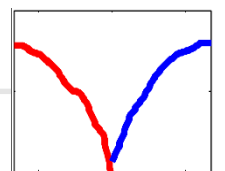
Regression- Predictive

Coefficients	Estimate	Std. Error	t value	Pr(> t)	First period (17.8.2014-15.5.2016)
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					
Coefficients	Estimate	Std. Error	t value	Pr(> t)	Second period (15.5.2016-1.1.2017)
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					





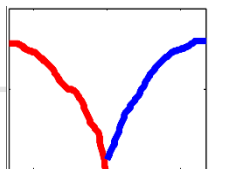
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Regression- Predictive

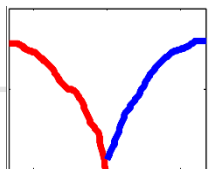
Coefficients	Estimate	Std. Error	t value	Pr(> t)
Intercept	2.29729	1.42961	1.607	0.13038
log(svi)	0.13074	0.06234	2.097	0.05464 .
log_sp500_returns	-3.31771	2.39116	-1.387	0.18698
log(vix)	-0.56375	0.20712	-2.722	0.01653 *
log(volume)	-0.07469	0.12965	-0.576	0.57371
volatility	-0.18614	0.05155	-3.611	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)



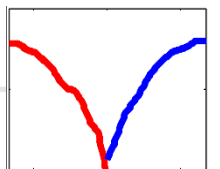
Conclusion

- Change in the nature of relationship between attention and returns on cryptocurrencies
- More data for more precise conclusions



Literature

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