VCRIX

volatility index for
crypto-currencies

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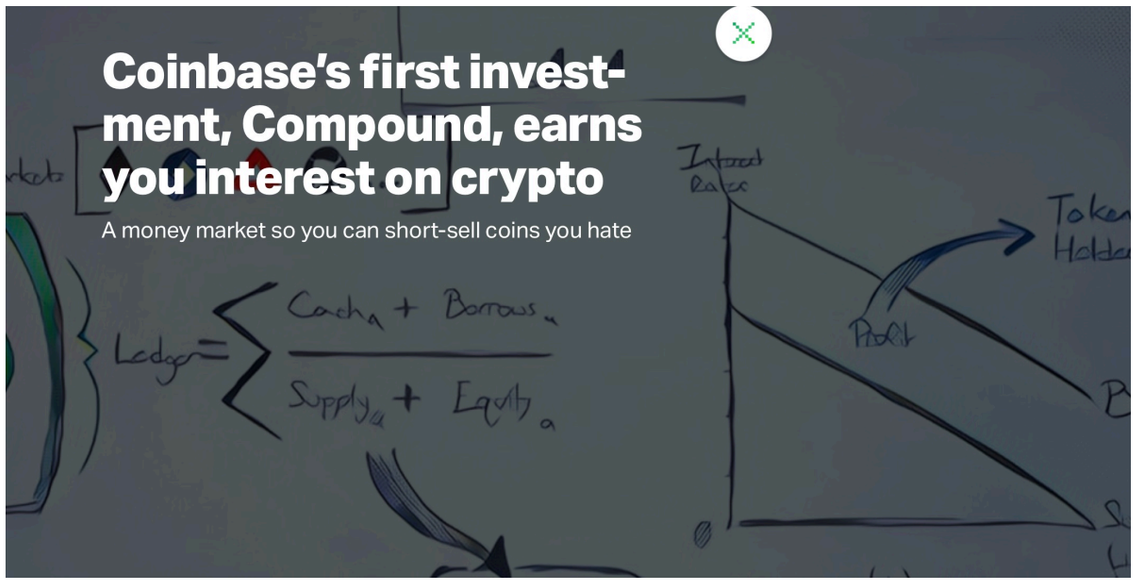
Motivation

LEDGER X

Deribit™



CRIX

Motivation

- CRIX is Laspeyres type index - benchmark for the crypto-market
- Weights (w) are defined by market cap, k - number of constituents
- # of members chosen by AIC

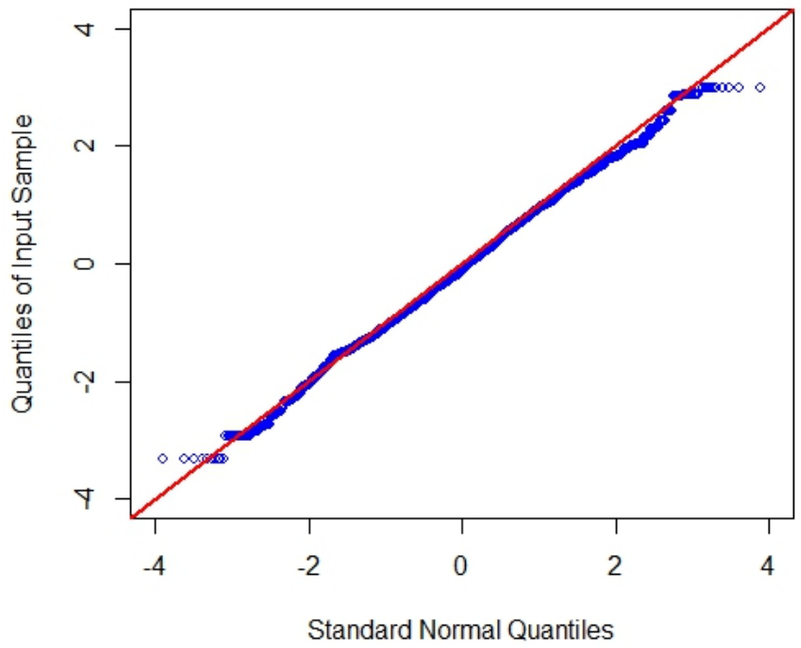
$$CRIX_t = \frac{\sum_{i=1}^{k} P_{it} Q_{it}}{Divisor_t}$$

Motivation

- Option Pricing on CRIX and CCs, Chen CYH et al (2018)
- Stochastic Vola Corr Jump model
- VCRIX as a natural component for option pricing

$$d\log Y_t = \mu dt + \sqrt{V_t} dW_{y,t} + Z_{y,t} dN_t$$

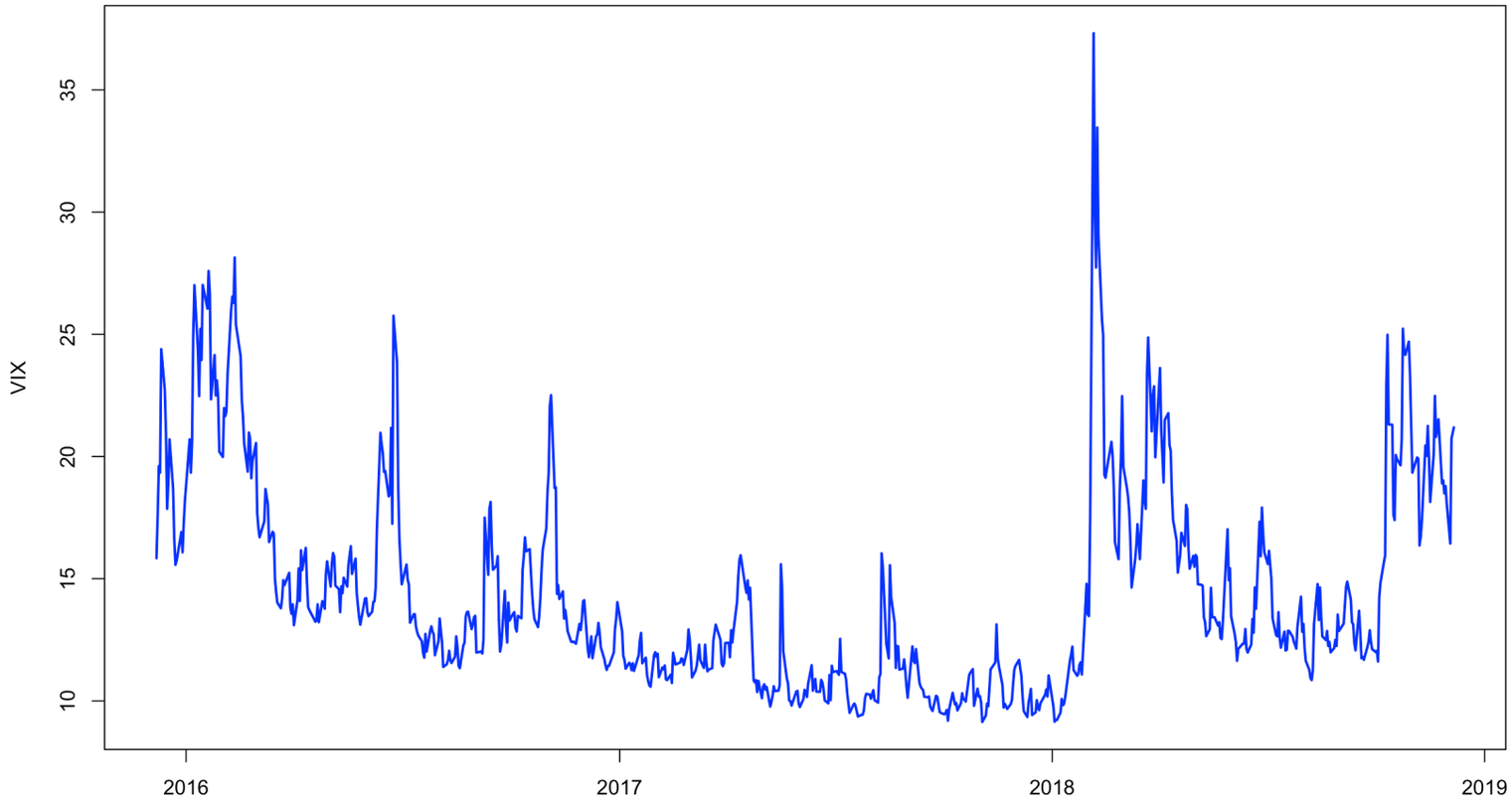
$$dV_t = \kappa(\theta - V_t)dt + \sigma_V \sqrt{V_t} dW_{v,t} + Z_{v,t} dN_t$$



Outline

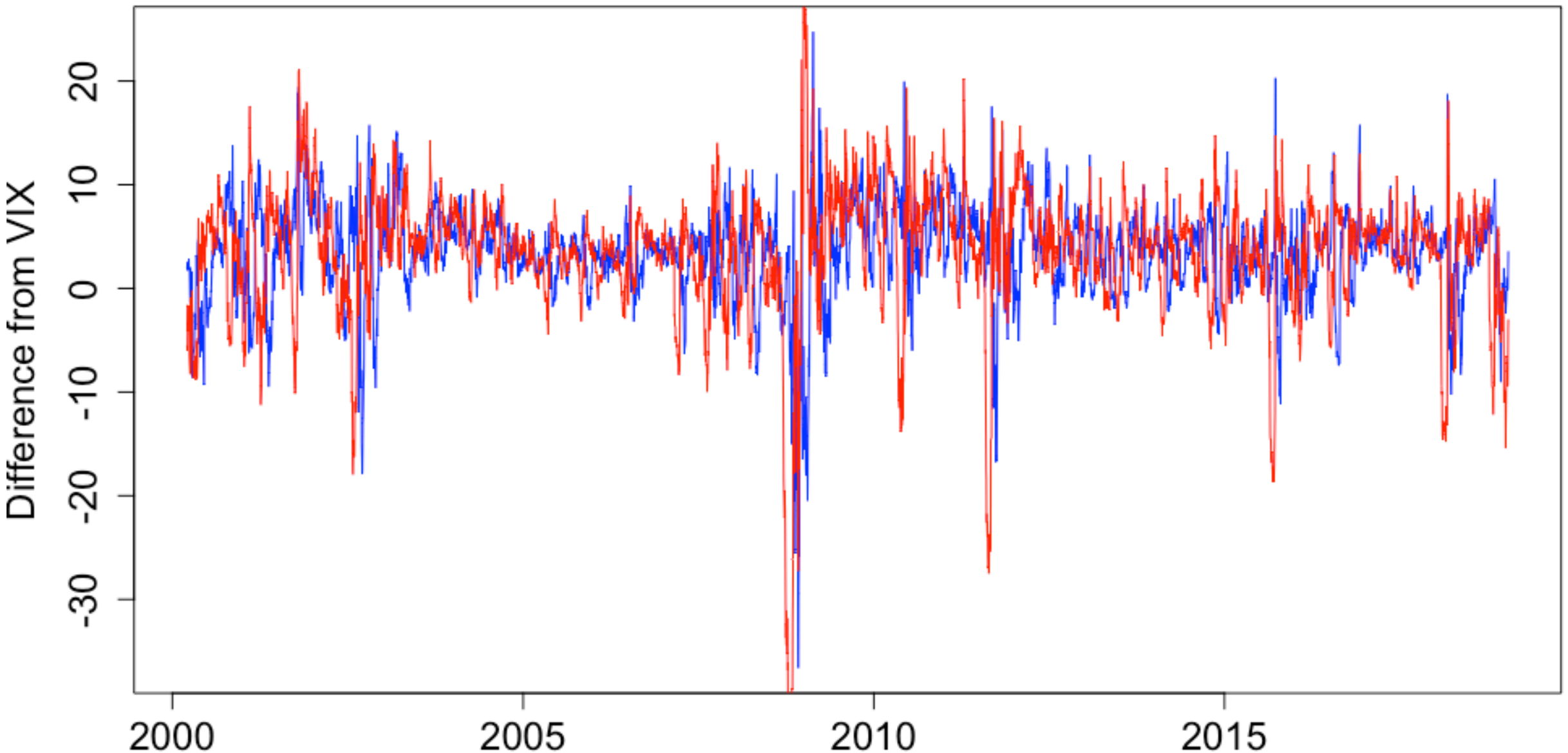
1. Motivation
2. Methodology
3. Implied volatility proxy
4. Backtesting
5. VCRIX
6. VIX simulation
7. Conclusion

Methodology



- VCRIX as analogue to VIX from CBOE - it will cover the market, not just BTC
- index must provide the proxy to implied volatility in absence of derivative market
- index must be forward-looking and offer predictive power

Implied volatility proxy

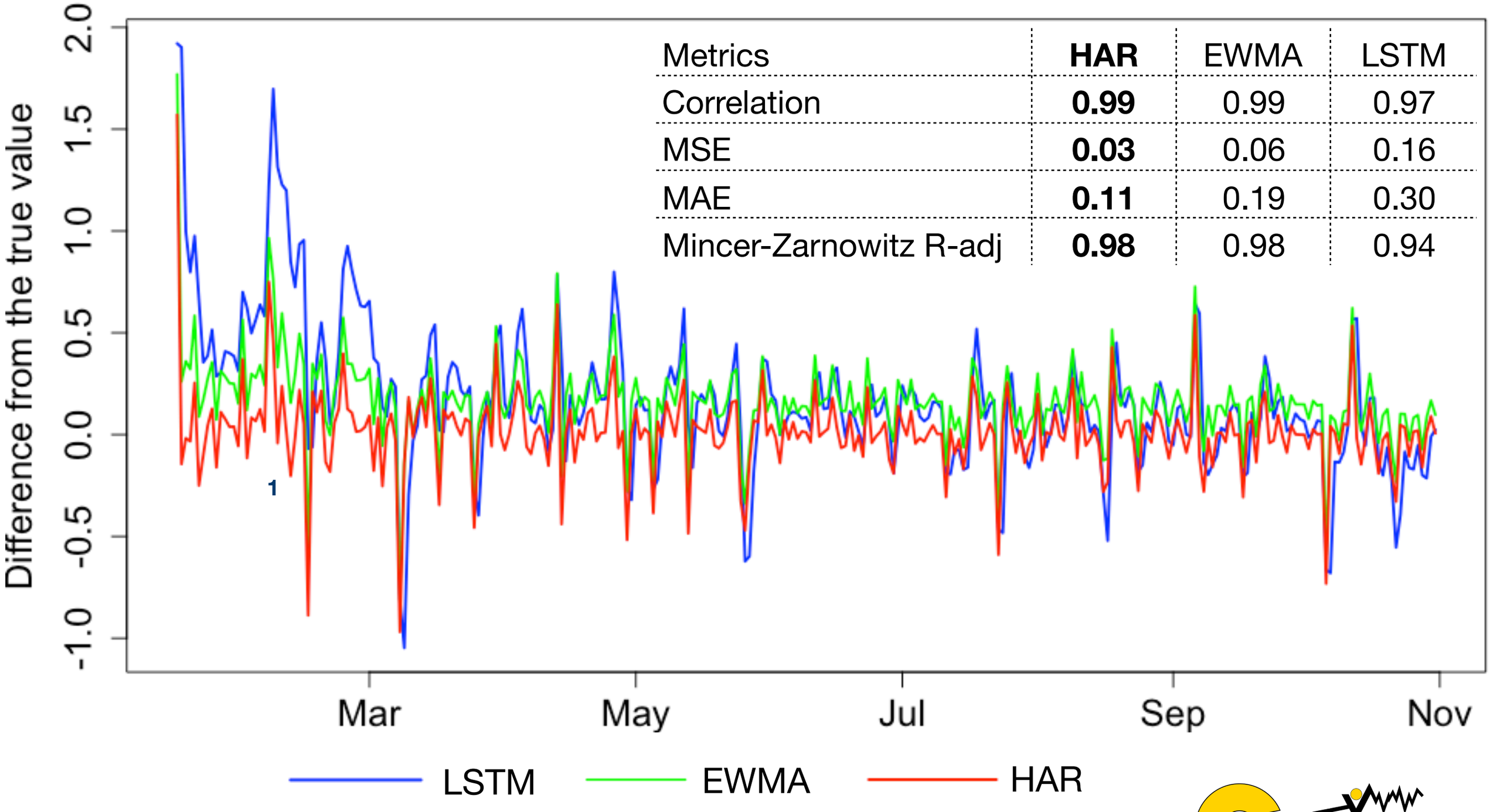


VIX-historic volatility correlation **0.76**

VIX-forward volatility correlation **0.56**

Backtesting (2018)

Metrics	**HAR**	EWMA	LSTM
Correlation	**0.99**	0.99	0.97
MSE	**0.03**	0.06	0.16
MAE	**0.11**	0.19	0.30
Mincer-Zarnowitz R-adj	**0.98**	0.98	0.94



VCRIX

- log-returns of CRIX from 12.2015 to 03.2019 (T = 1686, RV=realised volatility, in case of VCRIX a 30-day rolling volatility)

$$VCRIX = \frac{RV^d_{t+1d}}{Divisor}$$

$$RV^d_{t+1d} = \alpha + \beta^d RV^d_t + \beta^w RV^w_t + \beta^m RV^m_t + \omega_{t+1d}$$

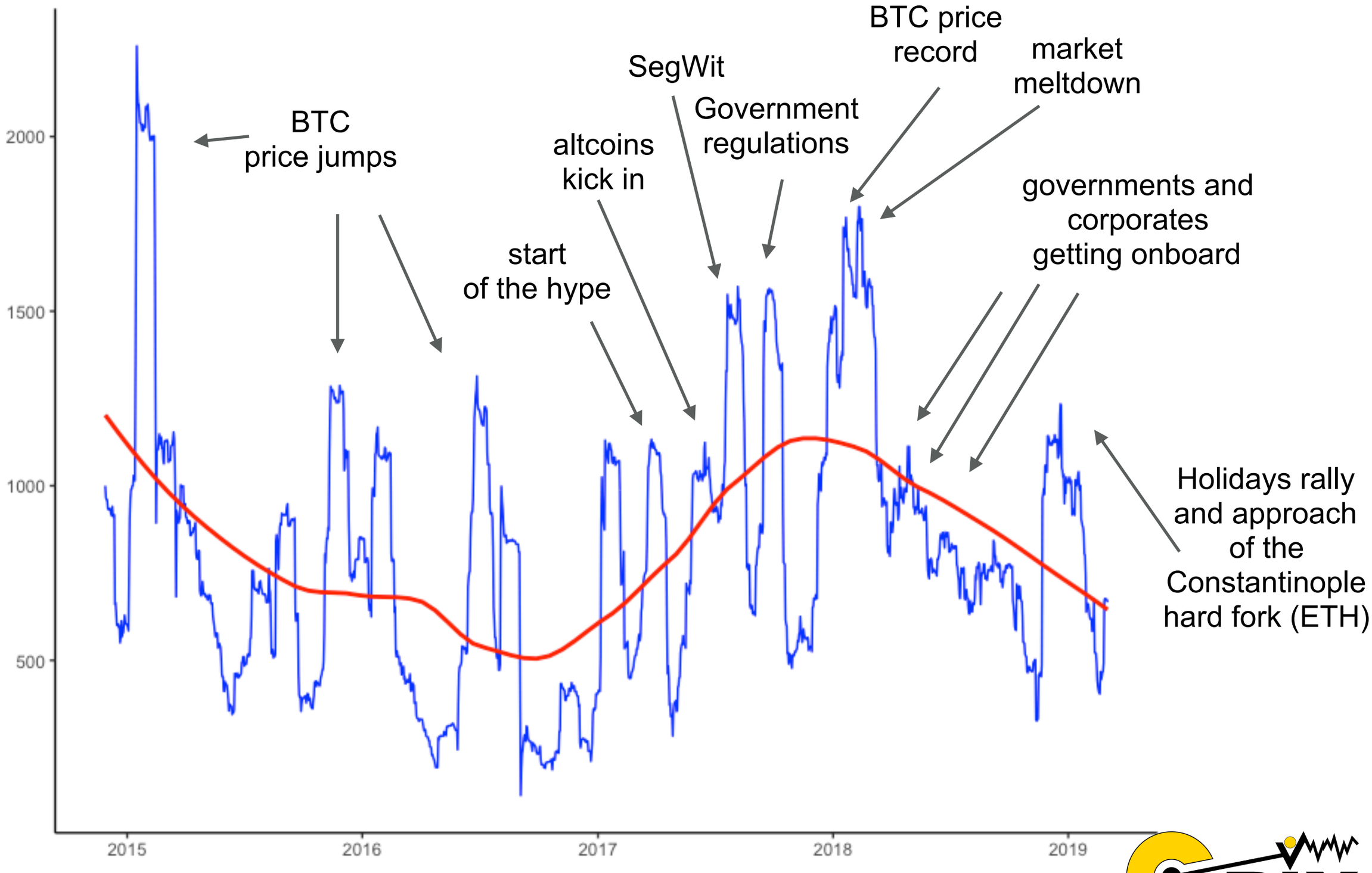
$$RV^w_t = 1/7(RV^d_t + RV^d_{t-1d} + ... + RV^d_{t-6d})$$

$$RV^m_t = 1/30(RV^d_t + RV^d_{t-1d} + ... + RV^d_{t-29d})$$

where d, w, m stand for daily, weekly and monthly

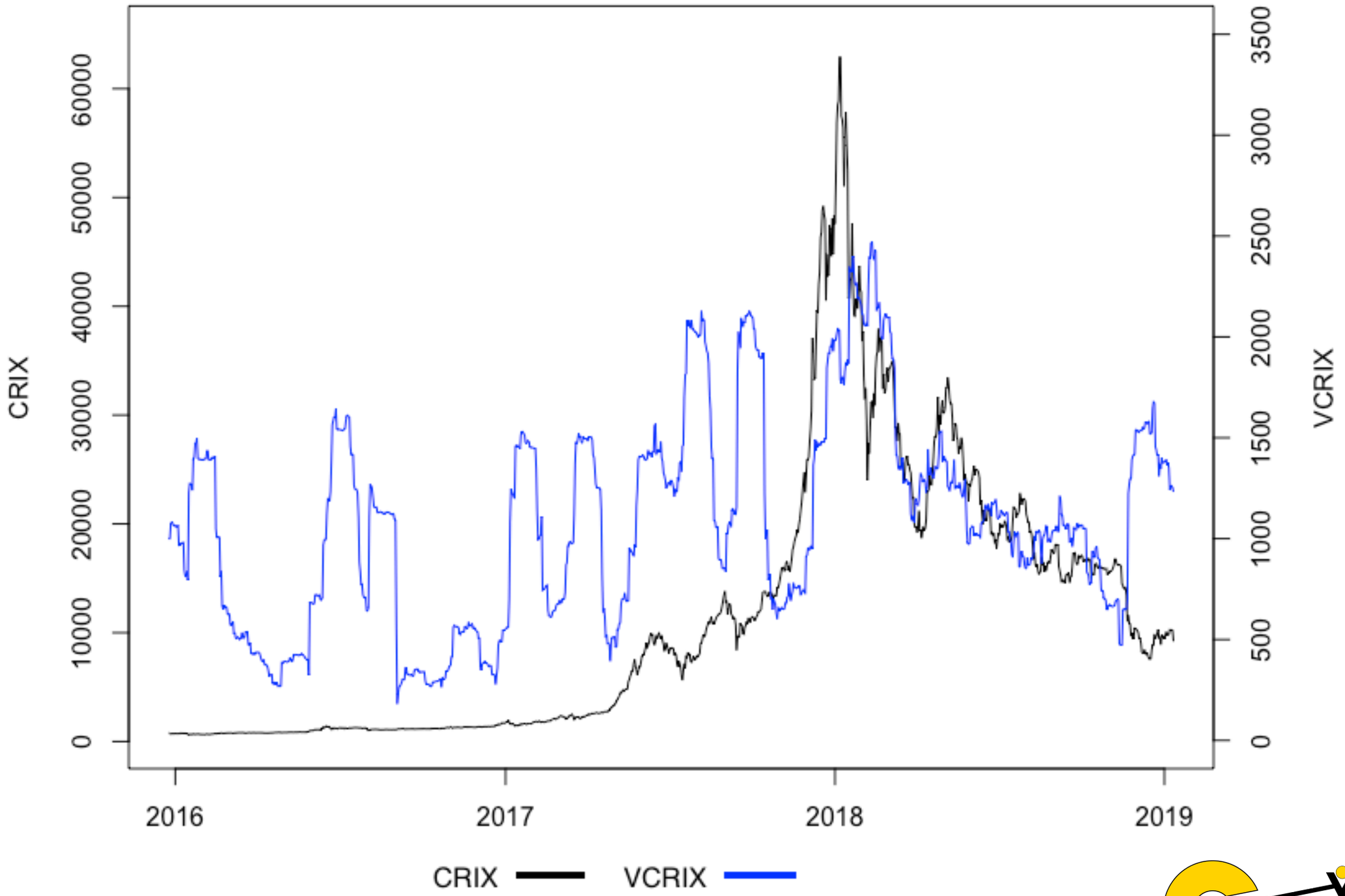
- $VCRIX_1$ = 1000
- Divisor adjusts to changes in constituents

VCRIX



LOESS mean (span 0.6)

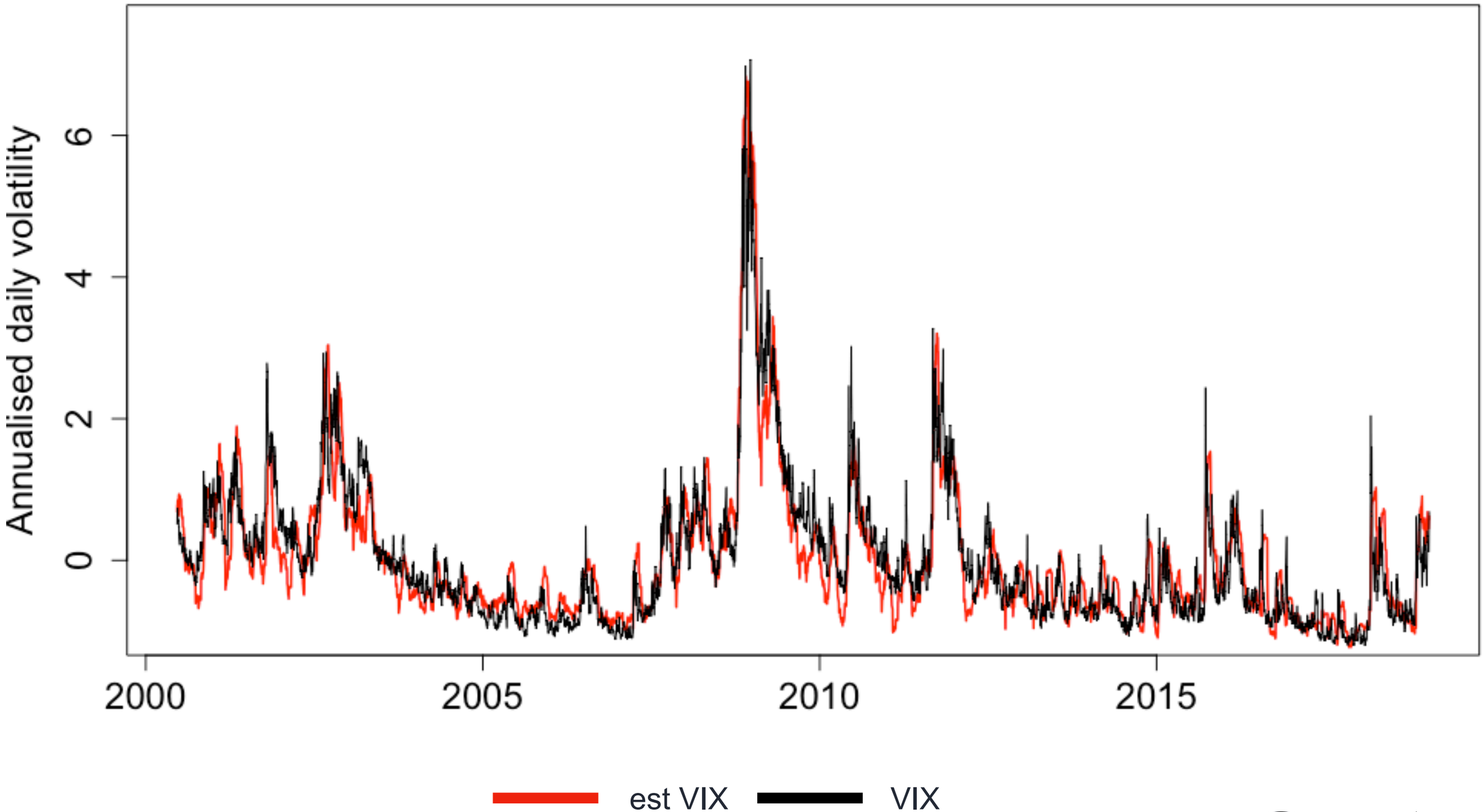
VCRIX vs CRIX



VIX simulation

- Simulation of VIX for evaluation of methodology
- 21-day rolling volatility of returns on S&P 500 ETF (^SPY) for 20 years
- Scaled time series showed correlation of **89%**

VIX simulation



- successful estimation of implied volatility for crypto-currencies
- VCRIX provides a daily forecast for the mean daily volatility (30d)
- next step - adjustment of the model to capture the behavioural component (LSTM as a candidate)

VCRIX

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