ZEPPELIN UNIVERSITÄT

CHAIR OF EMPIRICAL FINANCE AND ECONOMETRICS

It never rains but it pours

Modeling extremal financial losses and their clustering behaviour with high-frequency cryptocurrency data

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Abstract

High-frequency cryptocurrency log-returns feature fat tails and volatility clustering. By combining Extreme Value Theory approaches and intensity modeling, we aim at capturing both dynamics to provide better Value-at-Risk (VaR) estimates. More concretely, we implement two multivariate, self-exciting Peaks-over-Threshold (POT) methods in order to model and forecast extremal losses in the high-frequency return series of Bitcoin, Ethereum, and Litecoin. To do this, we extend the point process formulation of the POT models to include dynamic modeling of the arrival rate of extremal events and spillovers across extremal losses through Hawkes-POT and the autoregressive conditional intensity ACI-POT models. By treating the intensity of the arrival of extremal events as nonconstant, we successfully capture significant excitations within and across the cryptocurrencies and thus model the clustering behavior of extremal losses. Further, we backtest the intraday VaR computation performance of both models, and observe the best performance for the ACI-POT model as well as for the most extremal risk forecast, such as 99.9% VaR.

Keywords: High-Frequency Data, Extreme Value Theory, Intensity models, Self-Exciting Processes, Cryptocurrencies, Point Processes