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Can cryptocurrencies be a safe haven: a tail risk perspective analysis

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ABSTRACT

Cryptocurrencies are one of the most promising financial innovations of the last decade. Different from major stock indices and the commodities of gold and crude oil, the cryptocurrencies exhibit some characteristics of immature market assets, such as auto-correlated and non-stationary return series, higher volatility, and higher tail risks measured by conditional Value at Risk (VaR) and conditional expected shortfall (ES). Using an extreme-value-theory-based method, we evaluate the extreme characteristics of seven representative cryptocurrencies during 08 August 2015–01 August 2017. We find that during the sub-period of 01 August 2016–01 August 2017, there are finite loss boundaries for most of the selected cryptocurrencies, which are similar to the commodities, and different from the stock indices. Meanwhile, we find that left tail correlations are much stronger than right tail correlations among the cryptocurrencies, and tail correlations increased after August 2016, suggesting high and growing

systematic extreme risks. We also find that cryptocurrencies to be both left tail independent, and cross tail independent with four selected stock indices, which implies part of the safe-haven function of the cryptocurrencies, indicating their ability to be a great diversifier for the stock market as gold, but not enough to be a tail hedging tool like gold.

KEYWORDS:

Cryptocurrency | tail risk | tail correlation | diversification | hedge

JEL CLASSIFICATION:

C13 | C22 | G10 | G11 | G15

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Notes

[1] Usually GARCH(1,1) is good enough and is a robust model; more ARCH or GARCH terms can be added if necessary.

[2] If the price movement exhibit apparent different patterns over different periods, we have to divide the sample into two or more sub periods and analyse them separately, otherwise serial correlation may exist even if including ARMA terms into the model.

[3] The data period is about a two-year period of 725 observations per cryptocurrency. The start point is selected so that the seven selected cryptocurrencies have all come to

be traded and quoted in the exchanges. Before 08/08/2015, the total market capitalization of the cryptocurrency market had been less than 16 billion dollars, the daily transaction volume was also low and the liquidity was not good.

[4] https://ripple.com.

[5] We use ln(T) (where T is the length of the time series) as the lag of Ljung-Box tests, which is suggested by Tsay (2005) and followed by other papers (For example, Fang and Miller 2007). We use lag = 1 and lag = 6 for Engle tests of ARCH effect. In the literature, researchers usually choose 2 or 3 different (low order) lags to see if ARCH effect exists (for example, Engle 1982).

[6] A further test suggests that this autocorrelation cannot be removed by purely using ARMA, and we have to divide the sample into two or more sub-periods and then use ARMA to remove this autocorrelation for extreme value analysis to be applied. For all the cryptocurrencies, we use 03/01/2017 as a breakpoint; for Ripple, we use 05/01/2017 as another breakpoint, to fit the ARMA-GARCH model and get the pseudo return.

[7] We can prove that when Z>zq, and under the assumption of GPD, we have $E[Z|Z>zq]=zq+\sigma-\xi u 1-\xi$.

[8] The left tail distributions of the four stock indices (S&P 500, Euro Stoxx 50, Nikkei 225, CSI 300) are estimated to be Fréchet type (long tails) during the sample period, and the two commodities (Gold PM Fixing and WTI Crude oil Indices) are estimated to be Weibull type tails (truncated tail distribution), so conditional extremal boundaries only apply to the two commodities.

Additional information

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