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Weak efficiency of the cryptocurrency market: a market portfolio approach

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ABSTRACT

Cryptocurrencies have attracted the attention of many investors and policymakers given the increase in popularity of Bitcoin. In this context, we analyse the cryptocurrency market by means of cap-weighted and equally weighted market portfolios that include all the altcoins available for three different periods (2015–2017, 2016–2017 and 2017). By using the most traditional tests of efficiency, we observe three main features of the cryptocurrency market: it is weak-form inefficient due to the behaviour of all the altcoins, it is more inefficient over time, especially in 2017, and the creation of new cryptocurrencies has not significantly changed the efficiency of the market.

KEYWORDS:

Cryptocurrency altcoin Bitcoin market efficiency

JEL CLASSIFICATION:

G14 G15

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

[1] From 1 January 2014 to 31 December 2017 there are only 13 cryptocurrencies that have been trading the entire sample period. This period has not been analysed due to the scant number of digital currencies in comparison with the rest of the market portfolios.:

[2] We have only analysed those cryptocurrencies that have been trading for at least one year (2017) in order to obtain robust results. The list of the different cryptocurrencies is provided as supplementary material.

[3] Considering our data, during 2015–2017 there are 59 cryptocurrencies, in 2016 (sample period 2016–2017) there are 22 new cryptocurrencies, compared to 2015 (sample period 2015–2017), and in 2017 there are 37 new cryptocurrencies, compared to 2016 (sample period 2016–2017).

[4] Given that we are analysing three different periods, including different years (2015–2017, 2016–2017 and 2017), we cannot compare the test results of weak-form efficiency of these three sample periods since a different outcome could arise from a particular behaviour of the cryptocurrencies in one of the years that is not included in the rest of the sample periods. To avoid this issue, we focus on each year separately since the time span that we analyse is the same, i.e. one year. Therefore, the result will be related to the different number of altcoins rather than the sample period.

[5] We use simple returns, instead of logarithm returns, in order to create properly the market portfolio since, mathematically, the logarithm of the sum is not equal to the sum of logarithms, i.e. it is not possible to create a market portfolio with logarithm

returns. For robustness purposes, having calculated the returns of the market portfolio, we transform the simple market returns into logarithm market returns, ln(1+rm,t)=rm,tl, obtaining similar results (see Table A1 in the Appendix).

[6] This definition of random walk is the most restrictive one, which is denoted as random walk 1 by Campbell, Lo, and MacKinlay et al. (1997). We obtain the random walk 2 and 3 by relaxing the main assumptions. The random walk 2 includes processes characterized by independent but not identically distributed increments. On the other hand, for the random walk 3, we only hold the uncorrelated increments assumption, i.e. processes with dependent but uncorrelated increments (Campbell, Lo, and MacKinlay et al. 1997; Escanciano and Lobato 2009b).

[7] Despite the fact that there is not a strict connection between random walks and the Efficient Market Hypothesis (e.g. LeRoy (1973) and Lucas Jr (1978) show that the Efficient Market Hypothesis holds at the same time that prices do not follow random walks), in the empirical finance literature, authors are focused on the weak-form efficiency to examine whether future price changes are purely unpredictable based on the asset's price history (LeRoy 1973; Escanciano and Lobato 2009b).

[8] We test the joint hypothesis that all the autocorrelation coefficients (up to 3 lags) are simultaneously zero.

[9] Given that in the case of the BDS test it is necessary to choose the embedding dimensions, specifically from 2 to 5, in the results we show the average of the statistics and p-values.

[10] The only exception is found in the DFA test when analysing the sample period 2015–2017 for the cap-weighted market with logarithm returns (see Table A1 in the Appendix).

Additional information

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