

BLOC-516: Principles of Money, Banking, and Finance

Cryptocurrency Valuation

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Learning objectives

- Understand the several different factors considered to interact with cryptocurrency prices



Outline

- Factor models (based on Fama and French, 1993)
- Metcalfe's law
- Sentiment analysis
- Cost of production pricing models
- The “macroeconomic model”
- What about market efficiency?



A three-factor pricing model for cryptocurrencies

- Following Fama and French (1993)
- Factors: **market**, **size**, and **reversal** factors
- For the market factor, they use a cryptocurrency index they construct
- Size is calculated using market capitalization
- They use a proxy measure for momentum
- The model outperforms the “Cryptocurrency CAPM” (**C-CAPM**), which only incorporates the excess market return as an explanatory variable.
- Shen, D., Urquhart, A., & Wang, P. (2020). A three-factor pricing model for cryptocurrencies. Finance Research Letters, 34, 101248.



Metcalfe's law

- **Network effects**
- The value of a network is proportional to the potential number of connections (transactions), which, in turn, is directly related to the square of the number of users n .
- Peterson (2018), Van Villet (2018)
- Used wallets (n) and historical bitcoin prices
- Good fit (in fact, too good to be true), but based on some unrealistic assumptions and there are some econometric issues (e.g., endogeneity bias)
- Use only as a building block (i.e., it adds value, but not the only driver)
- Peterson, T. (2018). Metcalfe's Law as a model for Bitcoin's value.
<http://dx.doi.org/10.2139/ssrn.3078248>
- Van Vliet, B. (2018). An alternative model of Metcalfe's Law for valuing Bitcoin. Economics Letters, 165(1), 70-72.



Sentiment Analysis

- Reaction of the cryptocurrency market to **social sentiment**.
- Sentiment data collected from Google, Twitter etc.
- For example: Lee and Assar (2021)
- Findings: “(1) social sentiment is relatively relevant during a bull compared to a bear market. (2) The cryptocurrency market in a downward state, that is, with a local decreasing trend, tends to be more responsive to positive social sentiment. (3) The market in an upward state, that is, with a local increasing trend, tends to better interact with negative social sentiment.”
- Kim, K., Lee, S. Y. T., & Assar, S. (2021). The dynamics of cryptocurrency market behaviour: sentiment analysis using Markov chains. Industrial Management & Data Systems.



Cost of production pricing models

- Assertion that proof-of-work cryptocurrency prices are largely driven by the **costs of mining** (Hayes, 2017)
- “...three main drivers of cryptocurrency value: the level of competition in the network of producers, the rate of unit production, and the difficulty of algorithm used to “mine” for the cryptocurrency.”
- Hayes, A. (2017). Cryptocurrency value formation: An empirical study leading to a cost of production model for valuing bitcoin. *Telematics and Informatics*, 34(7), 1308-1321.



The “macroeconomic model”

- Based on the **equation of exchange** (Fisher, 1911)
 - $MV = PQ$
- Bitcoin price is $P = MV/Q$
 - where M is the supply of native blockchain coins (21,000,000 limit for BTC), velocity of cryptocurrency (how many times it “changes hands”), and Q is the size of real expenditures on the network.
- Wang (2014)
- “According to this model, the value of bitcoin is determined largely by the willingness of bitcoin holders to save bitcoin...”
- Wang, J. (2014). A simple macroeconomic model of bitcoin.
<http://dx.doi.org/10.2139/ssrn.2394024>.
- Warning: This is a white paper that has never been published, but I include it as the approach is interesting (also, some definitions are missing in the paper etc.).

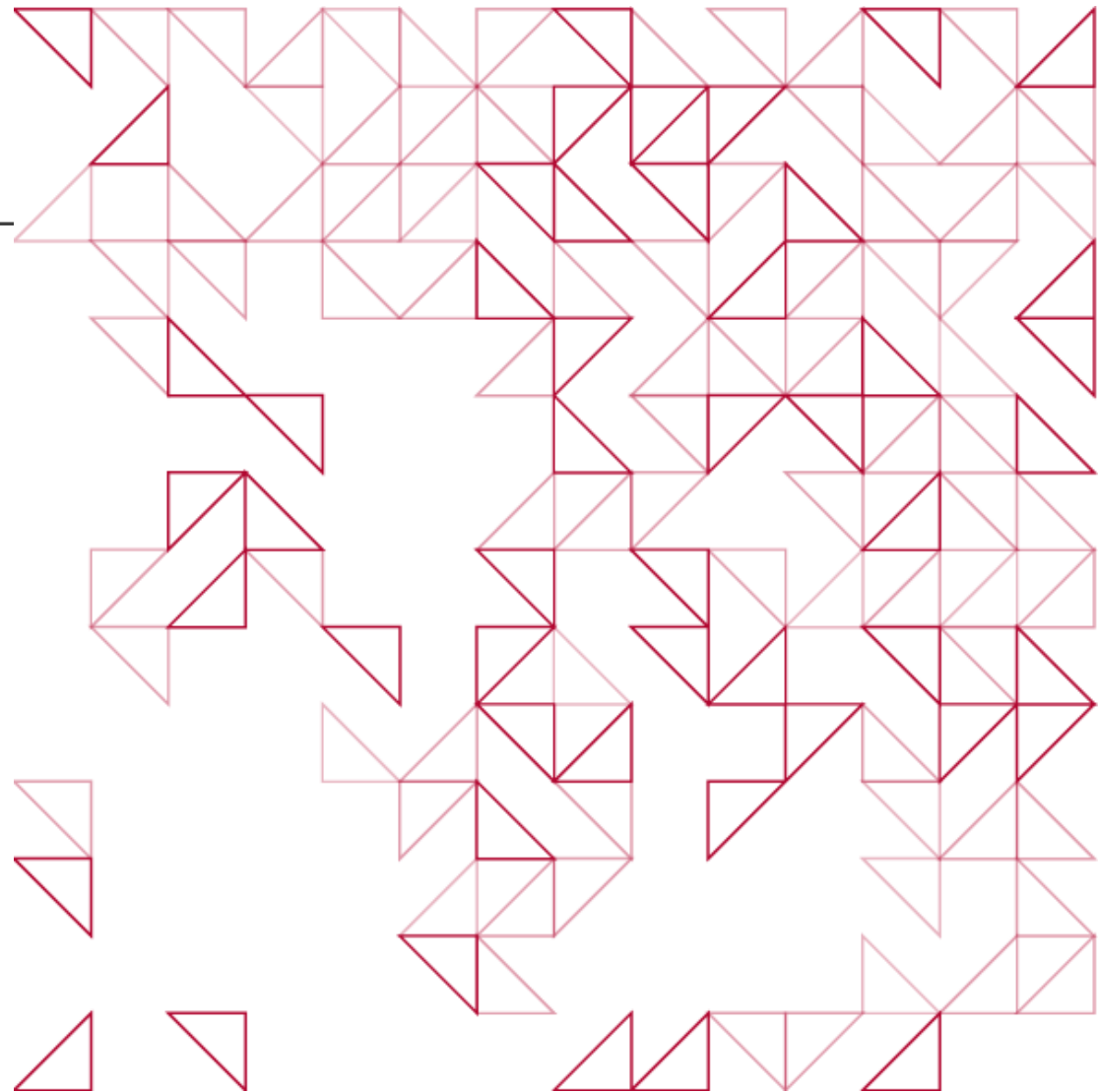


Adaptive market hypothesis and cryptocurrency markets

- AMH (Lo, 2004): reconciliation of economic theories based on the efficient market hypothesis with behavioural economics.
 - Evolution principles such as competition, adaptation, and natural selection are applied.
- See for example Noda (2021)
- “The empirical results show that (1) the degree of market efficiency varies with time in the markets, (2) Bitcoin’s market efficiency level is higher than that of Ethereum over most periods, and (3) a market with high market liquidity has been evolving. We conclude that the results support the AMH for the most established cryptocurrency market.”
- Noda, A. (2021). On the evolution of cryptocurrency market efficiency. *Applied Economics Letters*, 28(6), 433-439.



Readings



Readings

- Feel free to download the papers mentioned in these slides and read the abstract and conclusions sections. You could even read the whole paper if you are interested in methodologies, on how they proxy the several factors, how they analyse the data etc. or if you want to see the maths in theoretical papers.
- Some of the models previously mentioned (plus a few more) are summarized rather nicely in the Literature Review section of the paper:
 - Shanaev, S., Shuraeva, A., Vasenin, M., & Kuznetsov, M. (2019). Towards proof-of-work cryptocurrency valuation: mining games, network effects and the social value of blockchain. Network Effects and the Social Value of Blockchain (March 8, 2019).





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