Dependency structures in cryptocurrency market from high to low frequency

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Financial markets are complex systems characterized by strong non-stationary dynamics, feedback loops, and non-linear effects. Despite their complexity, they are governed by a rather stable and partially identified framework of rules, which, jointly with the possibility of being continuously monitored across time, makes them well-suited for statistical characterization. The unrelenting impact stemming from the implementation of new cryptocurrencies, the downfall of established ones, and modifications to existing protocols are key factors that characterize the cryptocurrency market as a peculiar category within financial systems. In this research work, we investigate logarithmic price returns cross-correlations for a set of 25 liquid cryptocurrencies traded on the FTX digital currency exchange. Exploiting two classes of information filtering networks, namely the Minimum Spanning Tree (MST) and the Triangulated Maximally Filtered Graph (TMFG) [1], we model dependency structures among crypto-assets at 6 different time horizons spanning from 15 seconds to 1 day. For each time horizon, we test the graphs' stability, statistical significance, and economic meaningfulness both at an intra-sector and pairwise level.

Results provide a deep insight into the evolutionary process of the time-dependent hierarchical organization of the chosen system of cryptocurrencies. As a further step toward robustness, we compare our results with the ones achieved in the past 20 years of similar research in the field of the stock market [2, 3], uncovering comparable behaviours between the two systems. From an economic and financial perspective, the study of dependency structures among cryptocurrencies at different time scales is relevant both from a theoretical and an applicative point of view. In the first case, comparing the properties of the time-dependent hierarchical organization of the cryptocurrency market with the ones of the equity market (i) allows us to measure its degree of maturity (ii) keeping track, at the same time, of the main evolutionary phases. In the second case, such an analysis is useful as a support instrument towards achieving different goals spanning from portfolio construction tasks (e.g., diversification purposes) to developing multi-asset trading strategies acting at different time scales. Our contribution is hence twofold: (i) we propose a rigorous network-based study of the cryptocurrency market, allowing us to compare emerging dynamics to the ones observed on traditional financial markets (e.g., the "Epps effect"), and (ii) we are the first to describe the evolution of dependency structures among cryptocurrencies at time scales spanning from intra-minute to daily resolution. This study provides a crucial foundation for future research and applications in the field of cryptocurrency investment and risk management.

References

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