Editorial on the Special Issue on Cryptocurrencies

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1 Introduction

Computer science has created the economic world that von Hayek (1976) envisioned, with de-nationalized and independent money creation. At the same time, crypto-currencies operate in a fundamentally different way. They require no trust in a central bank, other national authorities, or in private financial institutions. Trust derives from mathematical algorithms, and the blockchain technology ensures consensus on each electronic transaction in a purely peer-to-peer network. Private digital currencies revive the ideas of the “Chicago Plan” and pose novel challenges for policy makers.

Moreover, like all new technologies, money by cryptographic convention comes with risks. In markets for traditional nominal claims, much is known about their risks: not so in the markets for cryptos. There, market participants face huge challenges due to the uncertainty about the statistical features of crypto prices. The joint presence of several hundred crypto-currencies intensifies the problem: Due to the low cost of launching, a multitude of different blockchain-based currencies has been introduced, with varying degrees of technological innovation and financial success.

Digital payments have become a central feature of everyday life. To most businesses and households, this means fast transfer of funds unlimited by geographical distance. Orthogonal to such gradual improvements, however, the evolution of virtual currencies has created new and decentralized organized media of exchange. Like modern fiat money, crypto-currencies provide no claim to any physical asset, but circulate on the basis of trust and credibility; this notwithstanding, they have reached significant market value and transaction volumes. Total market capitalization of virtual currencies now exceeds \$270 billion, <https://coinmarketcap.com>.

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To condense the market valuation of the cross-section of the most liquid cryptos, the market index CRIX was created at HUB, and has been in the focus of recent econometric research. With appropriate econometric calibration, math-finance tools now allow the pricing of contingent claims with cryptos or CRIX as underlying, (Chen et al. 2017). Elendner et al. (2017) studied a cross-section of crypto-currencies, investigating the implications for finance and economics. Their findings support the role of crypto-currencies as financial assets, providing diversification benefits to an investment portfolio due to their low correlation with standard financial assets and with each other.

The momentum of crypto-currency usage has created high-frequency markets, as for instance www.kraken.com. This additional information in combination with dynamic high-dimensional interdependencies asks for modeling of the dynamic evolution of the joint distributions of crypto-currency risk structures. Such risk structures are conveniently captured in Gaussian-like elliptical dependencies that open a dynamic econometrics view on crypto-currency networks.

The introduction of digital currencies has also a broad range of consequences for economic and monetary systems. Financial intermediaries are no longer necessary for transferring value, while free entry into the digital money market imposes constraints on monetary policy and its design. Economic theory faces a challenge of incorporating this new monetary phenomenon and accounting for its statistical properties. Old monetarist theories of free banking addressed the decentralized nature of digital currencies and the free entry into this specific money market. However, effects of digital currencies on monetary policy design have yet to be studied. The Riksbank (Swedish central bank), the Bank of England and the People's National Bank of China have begun to explore the introduction of a centralized digital currency, given that such a system does not yet exist and little research has been done in this area (e.g. Barrdear and Kumhof 2016). A structural analysis of such a monetary system is not possible solely from an economic point of view, because computational aspects of digital money algorithms must also be taken into account. A sound analysis of cryptos involves multiple disciplines: computer science, mathematics, statistics, and economics are necessary.

The objective of this special issue is an interdisciplinary discussion on the novel phenomenon of crypto-currencies and a collaborative analysis of its economic consequences from the macro-economic, the statistical and the financial points of view.

2 Contents of this special issue

The articles included in this special issue are briefly reviewed below.

Aste (2019) studies the dependency and causality structure of the cryptocurrency market investigating collective movements of both prices and social sentiment related to almost two thousand cryptocurrencies traded during the first 6 months of 2018. The major, most capitalised cryptocurrencies, such as Bitcoin, have a central role in the price correlation network but only a marginal role in the sentiment network and in the network describing the interactions between the two. Overall this study uncovers a

complex and rich structure of interrelations where prices and sentiment influence each other both instantaneously and with lead–lag causal relations.

In Bistarelli et al. (2019), the authors study model-based arbitrage in multi-exchange models for Bitcoin price dynamics. They show that simple strategies of strong arbitrage arise by trading across different Bitcoin exchanges taking advantage of a common risk factor.

Bundi and Wildi (2019) analyse the Bitcoin time-series of prices and verify the pertinence of the efficient market hypothesis. They challenge recent claims that Bitcoin markets have become more efficient recently by showing or by proposing simple trading strategies based on moving average filters, on classic time series models as well as on non-linear neural nets. They find that trading performances are significantly positive, with both linear and non-linear approaches performing mostly similar.

The paper “Blockchain analytics for intraday financial risk modelling” by de Dixon et al. (2019) studies the transaction graph and its properties as an early-warning indicator for large financial losses. The authors identify certain sub-graphs that exhibit predictive influence on the price and volatility of Bitcoin.

Guégan and Henot (2019) associate with each blockchain a probative value which permits to assure in case of dispute that a transaction has been really done. They illustrate their proposal using 13 blockchains providing a ranking between these blockchains for their use in a business environment.

Calibrating a series of Markov models on the volatility surface of Bitcoin options, Madan et al. (2019) examine the pricing performance and the optimal risk-neutral model parameters. In addition, they study the implied liquidity of Bitcoin call options, based on conic finance theory.

Pagnottoni and Dimpfl (2019) search for the Bitcoin trading platform that is the most important one in terms of price discovery. Their conclusion is that the Chinese OKCoin platform is the leader in price discovery of Bitcoin, followed by BTC China.

Shorish (2019) starts with the observation that a cryptocurrency token acts as a multipurpose instrument that may fulfil a variety of roles, such as facilitating digital use cases or acting as a store of value. As a consequence, valuing such a token is complicated. The author derives a general pricing model for cryptocurrency tokens, using a hedonic pricing framework.

Finally, Silantsev (2019) studies the impact of individual order book events on a resulting price change. The study demonstrates that the cryptocurrency market shares many features with conventional markets, specifically on microstructure levels. Differences can be mostly attributed to lower average depths of the order book, which spawn other discrepancies related to how order books absorb order flow. One of the main findings of the paper is that price changes can be explained very accurately by the trade flow imbalance.

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