Decentralized Finance and Central Bank Communication

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ACADEMIC THESIS

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Abstract

Arbitrage in Crypto Markets: An Analysis of Primary Ethereum Blockchain Data

The Ethereum blockchain is a decentralized computing platform providing peer-to-peer financial services. Decentralized exchanges, which run on the blockchain, enable matching of buyers and sellers without any central third party, and are distinct from the centralized "off-chain" cryptocurrency markets often studied in the literature. The decentralized markets facilitate trade in cryptocurrencies and other digital assets and have daily turnovers of several billion dollars. In this paper, I study how arbitrageurs on the blockchain contribute to price discovery and price efficiency in decentralized "on-chain" markets. I collect a transaction-level dataset of primary data from the Ethereum blockchain and cleanly identify a set of completed cross-exchange and triangular arbitrages. To investigate the speed at which arbitrage opportunities are eliminated, I study how sensitive arbitrage profits are to when the trades execute. I show that most arbitrage profits are made immediately after the occurrence of price anomalies, indicating that decentralized markets adjust fast after a shock to the no-arbitrage price.

Keywords: Arbitrage, Price efficiency, Decentralized exchanges, Ethereum, Blockchain, Decentralized finance, Automated market maker, Cryptocurrency
JEL classification: C55, E42, G12, G14, G23

Price Discovery in Constant Product Markets

Constant product markets are the most common type of automated market maker designs, which has become increasingly popular in the advent of blockchain technology. This paper develops a price discovery framework for constant product markets that comprises three parts. Firstly, I derive a quadratic relationship which expresses trades in terms of price changes. Secondly, I model trade interactions in a structural VAR system. Thirdly, I translate the impulse responses from the VAR to returns through the quadratic equation. The empirical analysis reveals how large trades carry important market information and a small but sophisticated group of adversarial traders, much like high frequency traders in traditional markets, play a key role in price discovery on the largest decentralized exchange Uniswap.

Keywords: Price discovery, Constant product market, Automated market maker, Decentralized exchange, Cryptocurrency, Decentralized finance, Blockchain, Ethereum, MEV, Uniswap
JEL classification: C55, C57, E42, G12, G14, G23

Evolution of Topics in Central Bank Speech Communication

This paper studies the content of central bank speech communication from 1997 through 2020 and asks the following questions: (i) What global topics do central banks commonly discuss? (ii) How have these topics evolved over time? I turn to natural language processing, and more specifically Dynamic Topic Models, to answer these questions. The analysis consists of an aggregate study of nine major central banks and a case study of the Federal Reserve, which allows for region specific control variables. I show that: (i) Central banks address a broad range of topics. (ii) The topics are well captured by Dynamic Topic Models. (iii) The global topics exhibit strong and significant autoregressive properties not easily explained by financial control variables, suggesting that the topics could exhibit a "narrative effect".

Keywords: Central bank communication, Monetary policy, Textual analysis, Dynamic topic models, Narrative economics
JEL classification: C38, C55, E52, E58

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