Abstract
Blockchain technologies, specifically those related to cryptocurrencies and NFTs, have recently been garnering a significant amount of public interest. Blockchain has been lauded as being potentially transformative across a wide variety of industries, including decentralized finance, supply chain management, healthcare, file storage, and more. However, it has also been the source of much investor angst, evidenced by numerous media headlines replete with instances of fraud and catastrophic asset losses. In this paper, we examine whether the current incarnations of blockchain technologies provide a well-functioning market to its participants. We apply Roth’s market design framework to evaluate whether blockchain marketplaces provide safety, thickness, low congestion and low repugnance. We find that blockchain marketplaces in their current state do not represent a well-functioning market. We conclude by suggesting additional avenues of research and explore whether even in their suboptimal market-state, they can still provide value to organizations.

Introduction
The popularization of blockchain technology and their related applications, in particular cryptocurrencies and non-fungible tokens (NFTs), has generated increasing interest from technologists, investors, hedge funds, individual investors, and managers who wish to explore their relevance to their organizations. Transaction volumes between buyers and sellers of cryptocurrencies such as Bitcoin and Ethereum, and NFTs such as the Bored Ape Yacht Club and Cryptopunks have been increasing at a rapid pace in the past several years. Blockchain enthusiasts have also asserted that the core technology can be applied to a multitude of other industries, including supply chain management, academic research, healthcare management and more, potentially expanding the traditional operational flow of these sectors, and reconfiguring the dynamics of the key stakeholders that reside within them. However, there currently exists a dichotomous phenomenon where within a single news cycle, blockchain enthusiasts laud high-profile transactions such as the sale of Beeple’s digital art NFT at Christie’s for $69 million USD (asserting that these high dollar value transactions that occur within private auction houses are validation that blockchain has hit the mainstream) and blockchain critics (who are no strangers to this script) deride these transactions as immoral, without functional value and are fed solely by investor greed, or even nefarious intent. Thus, it is unclear whether the current state of the blockchain market is structured in a way that will enable and facilitate the growth of cryptocurrencies, NFTs and blockchain critics excoriate such transactions as immoral, without functional value to organizations.

Roth’s Market Design Framework
In this section, we briefly review Roth’s framework for well-functioning markets and discuss how we use his methodology to evaluate the blockchain market. He argues that a good market needs to exhibit three key characteristics:

Thicknes – there needs to exist an adequate number of market participants who can freely transact with each other. In other words, there must be a sufficient number of sellers for every buyer, and vice versa.

Safety – participants must be confident they are not being defrauded, and there must be low incentive for participants to engage in strategy behavior that game the market.

Congestion – market participants must be reasonably assured that their transactions will be completed quickly, so they can move on to the next transaction with confidence that the available set of products to buy or sell is not stuck in other transactions.

Roth notes that a fourth factor, repugnance, can also constrain good market design, that is, if the nature of the product or service being sold is distasteful to potential market participants, or can be perceived as being objectionable to other market participants, it may hinder the development of an efficient market, even if the preceding three conditions are met.

Roth utilizes case studies, many of which are examples from his own consultations of municipalities and other public entities that wanted to improve market outcomes. In this paper, we examine whether the current incarnations of blockchain marketplaces is where the technology is headed today, as seen in the swath of headlines replete with instances of fraud and catastrophic asset losses. In the case of new economists who were seeking professorships upon completing of their doctoral studies, there was a disconnect between applicants and hiring departments, where hiring departments would spend an extended period of time sourcing, interviewing and making offers to candidates, only to have their offers rescinded if the departments had knowledge of the candidates’ marital status. In the case of matching candidates for kidney transplants, some patients may have knowledge of the candidates paired with them, preventing them from accepting offers. In the case of supply chains, some firms may be reluctant to use supply chains that have experienced instances of fraud, leading to firms being bypassed. In the case of the sale of NFTs, some firms may be reluctant to offer services related to NFTs, leading to the sale of NFTs being bypassed.

Figure 1. A conceptual model of the relationship between market safety on market thickness, adapted from Park et al. (2022)

The authors also explore the impact of congestion on this relationship (P2, Figure 1).

market congestion

market safety

market thickness

P2

P1

The data specification therefore becomes:

\[
\ln(\text{MT}) = \beta_0 + \beta_1 \ln(\text{MS}) + \beta_2 \ln(\text{MC}) + \beta_3 \ln(\text{MS}) \times \text{MC}
\]

Where:

MS = market safety (ln is natural log transformed)
MC = market congestion
MT = market thickness (ln is natural log transformed)

While we do not separately empirically test this moderating effect in this paper, we discuss market congestion in the design of efficient markets in the next section.

Discussion and Conclusion
Using evidence from the cryptocurrency and NFT markets, we argue that they fail to sufficiently provide market safety, thickness, and low congestion to existing and potential users. Thus, blockchain technologies currently fail to satisfy Roth’s requirements for a well-functioning marketplace. One interesting point to note with Roth’s exploration of the conditions for an efficient market, he examined cases where an inefficient market was improved to become an efficient one, and in most cases, the solution was the establishment of a centralized intermediary that could act as a clearing house to better match buyers and sellers.

The problem was using such a strategy to solve issues related to safety, thickness and low congestion in blockchain marketplaces is that it is fundamentally incompatible with the core philosophy of the blockchain – to remove the need for an intermediary or a third party to government the trust mechanisms between network participants. In other words, the configuration of the network itself, and the rational economic behavior of the participants should obviate the need for any centralization. Any attempt to incorporate a centralization or third party to which disgruntled participants can appeal transactions would disrupt the natural laws governing blockchain development.

Roth does use an example of how decentralization was preserved in a previously poorly functioning market, that eventually became well-functioning. In the case of new economists who were seeking professorships upon completing of their doctoral studies, there was a disconnect between applicants and hiring departments, where hiring departments would spend an extended period of time sourcing, interviewing and making offers to candidates, only to have their offers rescinded if the departments had knowledge of the candidates’ marital status. Roth notes that several versions of blockchain networks emerge, if current trends persist and blockchain applications fail to get meaningful, widespread adoption. The current, and original version of the blockchain, namely Bitcoin and similar early-version cryptocurrencies such as Ethereum, may maintain its niche status (we are fully cognizant of the fact that some investment portfolio managers may argue that it’s already evolved out of its niche status) which some asymptotic limit of the number of users. That is, while user adoption for Bitcoin may continue to increase, there will likely be some point at which diminishing returns are encountered.

In order to benefit from the advantages blockchain offers with respect to decentralization and immutability, some organizations may embrace the tradeoffs related (scalability, security and decentralization) and create a version of the blockchain that fits the operational needs of their firms. Several supply chain initiatives already exist that use permissioned blockchains to improve their operational workflows. In permissioned blockchain, nodes or maintainers are invited to participate, and these nodes are the stewards of the blockchain. Once they are invited, they wield significant power to negate the previous chain of transactions. However, because there are few participants, the chain can easily scale, and congestion is a virtual non-issue. We suggest that perhaps the goal of blockchain technologies isn’t to enable the proliferation of many different types of well-functioning marketplaces. While the creation of novel marketplaces is where the technology is headed today, as seen in the swath of cryptocurrency and NFT marketplaces such as Binance, KuCoin, OpenSea and more, it may be a more fruitful exercise for ecosystem participants to view blockchain technologies as a tool to enable current operational workflows than to become good markets in and of themselves.

Before any such determination can be made, it is likely that a rich suite of empirical research must be conducted to determine a) if the conclusions drawn from this paper remain consistent across a deep normological net of independent and dependent variables representing market outcomes and the pre-conditions of safety, thickness, congestion and repugnance, b) if blockchain modifications that can be made to the core protocol itself that may lend decentralized ledger technologies to be more consistent with the development of good markets, and c) if the aspirations for a well-functioning market should be abandoned altogether and organizations that realize this and instead embrace the technology as a utility to improve its own productivity may be a better approach to evaluate the usefulness of the blockchain. What is clear to us today, is that we are in agreement with Roth’s remark that “transactions and institutions matter at a level of detail that economists have not often had to deal with, and in this, respect, all markets are different. But there are general features.” We argue that blockchain technologies in their current form do not represent well-functioning markets. Whether examining blockchain marketplaces further, expanding the “level of detail” will force an adjustment to these conclusions, is yet to be seen.

References
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