Comments and Discussion

COMMENT BY

GARY GORTON[1]   Decentralized finance (DeFi) is a blockchain-based set of smart contracts that executes financial transactions without a centralized authority. It relies on member agents jointly making decisions. It is a large and growing sector of crypto space that has the potential to significantly disrupt the financial sector. "Disruptive" in the sense of Christensen (2011), it is a new technology that will reduce or eliminate the need for some set of skills or technologies. For example, the advent of personal computers disrupted the typewriter market. So, the question is: Will DeFi significantly disrupt banking?

Regulators and academics need to understand this space because while DeFi is only embryonic currently, it will grow and morph. Makarov and Schoar clearly and comprehensively summarize the ongoing developments, giving us an introduction to this space. Their overview is important because there is bewildering terminology that is little understood by many.

It is important to keep in mind that we are in the very early days of blockchain, DeFi, smart contracts, and stablecoins. These early days are somewhat like these two examples: in 1899, there were 30 American car companies, and by the end of the next decade an additional 485 had started up. But this number dropped from 253 in 1908 to only 44 by 1929 and three companies—Ford, General Motors, and Chrysler—accounted for

80 percent of cars produced.[2] Much of the activity in crypto space is akin to this type of tournament competition, where only a handful will survive.

A second example has to do with network effects. The internet began in 1969 when ARPANET was started by the Defense Advanced Research Projects Agency (DARPA), a part of the Department of Defense. By the 1970s there were many networks, but they were not interoperable, that is, they could not talk to each other, so to speak. Technological progress in the form of packet switching, a way to group data so that they can be transmitted over a digital network, allowed the networks to be connected.[3] Currently, there are about 1,000 blockchains, which are not (very) interoperable.[4] And the blockchains are not very scalable. Nor is crypto space interoperable with the current financial sector, including banks and the payment system. But all this will change.

Today, DeFi is more of a promise than a reality. Many DeFi activities vaguely resemble what banks do, like borrowing and lending, trading derivatives, and trading cryptocurrencies (foreign currencies in the case of banks). But these activities take place in a narrowly restricted area: crypto space. Agents lend cryptocurrencies for interest and trade derivatives on Bitcoin, for example. All these activities can also be done on crypto exchanges, where loans and derivative positions must be collateralized and face margin.

Compared to crypto exchanges, it is argued that the promise of DeFi is that there is no central authority. Rather, there is a governance protocol, as described by Makarov and Schoar. In fact, the founding premise of DeFi is that the decentralized nature of DeFi governance avoids agency problems. There is no central authority that must be incentivized and monitored. For DeFi to grow, this avoidance of agency problems must be very efficient. I discuss this below.

Can DeFi disrupt the banking system? Banks intermediate between borrowers and lenders. Banks issue short-term debt and use the proceeds to make loans. Real investment projects are financed by banks. Currently, only one large DeFi platform has its own native currency. MakerDAO has a currency called Dai, which I discuss below. There are currently no loans made off-chain, though this could change in the future.

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2. History, "Automobile History," https://www.history.com/topics/inventions/automobiles.
3. See Mowery and Simcoe (2002) and Roberts (1978).
4. See EarthWeb, "How Many Blockchains Are There in 2022?," https://earthweb.com/how-many-blockchains-are-there/#:~:text=Currently%2C%20there%20are%20at%20least, platforms%20provided%20in%20this%20industry.

For a DeFi platform to become a bank, it would have to be interoperable with the existing payments system and have a bank charter giving it access to a Federal Reserve master account.[5] Currently, the only way to link to the world outside cyber space is via an oracle, as explained by Makarov and Schoar. An oracle allows a smart contract to retrieve data from outside crypto space. But to make loans, money must be transferred to firms, requiring stablecoins to become more sophisticated. And to make credit decisions, bit data must be imported and combined with AI and smart contracts. This is already occurring.

In what follows, I review these issues.

DEFI AND AGENCY PROBLEMS Eliminating agency problems in firms is an admirable goal. The root of agency problems is the impossibility of writing a complete state-contingent executive compensation contract. Outcomes of executive actions are noisy. There are measurability problems and asymmetric information. The decisions to be made are not known in advance. Incentives are not aligned between principal and agent. Can technology overcome these problems?

A large body of literature on executive compensation is aimed at understanding whether contracts are useful in mitigating agency problems.[6] The explicit premise of DeFi is that it avoids agency problems since there is no central authority. Instead, there is a decentralized governance mechanism. Key questions are: Can the decentralized governance mechanism work if a DeFi gets large? And does it currently work the way it is designed to work? In other words, can agency problems be eliminated?

Agency problems have been the dominant paradigm in corporate finance since the 1970s, first articulated by Alchian and Demsetz (1972) and Jensen and Meckling (1976). The paradigm goes like this: There is a separation of ownership by shareholders and control by managers. Managers are entrenched and often act in their own self-interest. This is costly. Managers can divert corporate resources to themselves. For example, Dyck and Zingales (2004) examined the premium attached to blocks of stock when they traded. The premium represents the value of the private benefits that will accrue to the owner of the block. "Based on 393 control transactions between 1990 and 2000 we find that on average corporate control is worth 14 percent of the equity value of a firm" (538). This premium is viewed

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5. So far, the Federal Reserve has resisted granting fintech banks master accounts; see Hill (2022).

6. See Edmans, Gabaix, and Jenter (2017) for a summary.

as the value of the private benefits that can be extracted by a blockholder; in other words, it is the cost of the agency problem.

As explained by Makarov and Schoar, DeFi is governed directly by shareholders (nodes) via governance tokens. The claim is that there are no agency problems. But while there may be agency costs to an entrenched management, there are also benefits to having a manager. For example, Bennedsen, Pérez-Gonzáles, and Wolfenzon (2020) study the impact of CEOs on performance by analyzing the effect of CEO deaths and the deaths of CEOs' immediate family members: "we find that CEOs' (but not board members') deaths and deaths in CEOs' families are strongly correlated with declines in firm operating profitability, investment, and sales growth" (1877).

Currently, DeFi platforms are not so large and complicated, so their current governance system may well work. But these platforms can grow by becoming larger or by having an increased number of separate DeFi platforms. In either case, it is not clear that decentralized governance will work. There are issues of expertise and attention.

Indeed, it is not clear that decentralized governance currently works the way its proponents claim. Sun, Stasinakis, and Sermpinis (2022) collected information for the MakerDAO ("Maker") protocol performance, including all voters, their choices, and votes in Maker governance polls from August 2019 to October 2021. MakerDAO is one of the oldest and most influential DeFi platforms. They conclude that "by examining Maker governance polls, we find that voters are centralized in a small group, and voting power is unequally distributed among these voters. In most voting activities, the largest voters could account for a significant proportion of votes" (15). This is also consistent with Azouvi, Maller and Meiklejohn (2019), who argue that a few key developers have unilateral decision-making power in blockchain governance.

These findings, albeit only two studies, suggest that agency problems arise endogenously. Some participants become the agents and the others become principals. Further, there are good reasons why we delegate to agents. Agents have more expertise than other participants do, and agents' sole job is to pay attention to the task, whereas other participants have no or little expertise and not enough time to pay close attention.

There are, however, proposals to make different kinds of governance tokens, say different colors, by which some agents are designated "experts" and only they can vote on some decisions (Kaal 2021). Of course, this just pushes the problem down a layer. Who decides who the experts are? Who decides which decisions only the experts can vote on? Having a group of

anonymized individuals who decide to follow a certain protocol to make decisions does not seem like a viable alternative to corporate governance for large, complicated, organizations.

Of course, there are other forms of ownership besides that of the residual claimants, the shareholders. Cooperatives and mutual associations are ownership forms that more closely resemble DeFi organizations (Hansman 1996). When do cooperatives succeed? Holmström (1999): "Collective decision making is always difficult. But it is more difficult the more the interests of the parties diverge. A group with common interests will have a much easier time to reach a good decision than a group with highly divergent interests" (407). The plywood cooperatives in the Northwest of the United States have been around for seventy years (Craig and Pencavel 1992). But in the case of DeFi, many of the major platforms are essentially controlled by the core teams who developed the DeFi. For example, approximately 46 percent of the DeFi Compound's tokens were distributed to shareholders, founders, and the Compound team (Dale 2020). But that leaves 54 percent for the Compound developers.

WILL DEFI DISRUPT THE BANKING SYSTEM? Banks create short-term debt that earns a convenience yield, and they lend out the proceeds to corporate or retail borrowers. These are the core activities of banks. Currently, DeFi activities are self-referential, meaning that all the activities occur in crypto space using a cryptocurrency. Borrowing and lending refers to lending a cryptocurrency to use for other purposes, like buying another crypto-currency. Lending is at about $35 billion currently, compared to $180 billion in the stablecoin market.[7] DeFi derivatives are used to hedge the price risk associated with a cryptocurrency or to exploit speculative opportunities. These activities have nothing to do with the "real world," and many of these activities are essentially zero-sum games.

Stablecoin issuers, however, are banks. Stablecoins are digital tokens residing on a blockchain that their issuers say are backed one-to-one with cash or safe assets. And their terms of service say that they are redeemable at par on demand. In other words, stablecoin issuers are banks (Gorton and Zhang 2021). And their peg to the dollar holds about 85 percent of the time (Gorton, Ross, and Ross 2022). But stablecoin issuers are not DeFi organizations.

There is one DeFi platform that issues a stablecoin—MakerDAO—and the coin is called Dai.[8] MakerDAO offers a smart contract where a user

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7. DeFi Pulse, https://www.defipulse.com/.
8. MakerDAO, "The Maker Protocol: MakerDAO's Multi-Collateral Dai (MCD) System," https://makerdao.com/en/whitepaper.

deposits collateral, which can be any Ethereum-based cryptocurrency, for a loan of an equivalent value of Dai. Maker maintains Dai at one dollar using a system of collateral and price feeds, managed by the MKR token holders; these are the governing agents. Dai has traded at a dollar only 53 percent of the time, whereas other top stablecoins hold their one-to-one peg about 85 percent of the time (Gorton, Ross, and Ross 2022). It is not clear why Dai cannot hold the one-to-one peg.

To be a bank means the entity issues money that has a convenience yield and makes loans to real sector firms. Stablecoins currently are of limited use. You cannot buy your groceries with stablecoins. In fact, stablecoins have a negative convenience yield—an *inconvenience yield* (Gorton, Ross, and Ross 2022). This will change as technology makes blockchains more scalable and interoperable. But stablecoin issuers do make loans, by holding commercial paper. According to Kim (2022), a one standard deviation change in the daily issuance (= $330 million) of the top three stablecoins results in a 7 percent increase in commercial paper issuance the next day (= $198 million). So, although stablecoins might appear to be small compared to the regulated banking system, they are large enough to move money markets.

Lending by DeFi organizations could be made via smart contracts using big data.[9] But the crucial input is the big data. Ant Group, for example, has used big data in many forms in its financial ecosystem. One notable example is its "310 lending model" for making loans to small businesses. The "310" stands for a three-minute application, one-second approval, and zero human intervention. In five years, the loan business grew to $103.4 billion (Ding and others 2018). The algorithm for doing credit analysis is AI based on big data from the use of Taobao, a large online shopping platform. Data are the key here. Di Maggio, Ratnadiwakara, and Carmichael (2022) study one fintech lending platform: "Comparing actual outcomes of the fintech platform's model to counterfactual outcomes based on a 'traditional model' used for regulatory reporting purposes, we find that the latter would result in a 70% higher probability of being rejected and higher interest rates for those approved" (abstract).

DeFi organizations could make loans like banks, but they do not have access to any big data, especially proprietary data. This raises the question of whether DeFi can truly be self-contained, so to speak. Oracles are a way for a DeFi platform to reach out to the world to get data, like current interest rates or FX rates, as discussed by Makarov and Schoar. But today this

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9. An example is Aave; see Meegan and Koens (2021).

appears very limited. In principle, data could be imported through an oracle to make lending decisions, but what data? In addition, the DeFi platform would have to be able to analyze the data with machine learning. Currently, there is work being done to combine AI with DeFi.[10]

INTEROPERABILITY For disruption of the financial system, DeFi platforms would have to be interoperable in two senses: (1) blockchain to blockchain, and (2) DeFi platform or stablecoin issuer to the existing payments system. I will focus on the second sense of interoperability.[11]

To be a bank, there must be a link to the existing payments system and to brick-and-mortar banks. In other words, the bank must have a Federal Reserve master account. In May 2021, the Federal Reserve issued a proposal outlining some criteria for who could obtain a master account.[12] As would be expected, there was the usual stuff about financial stability and so on, but there were no real details about any criteria.[13]

Nevertheless, it is hard to stop the tsunami of innovation. Physical cash, paper notes, and coins have been the key medium of exchange in conventional financial systems for a long time. But now it seems clear that blockchain-based systems are here to stay. Firms are adjusting to this new reality. One example is Visa, which recently announced that it would accept the stablecoin USD Coin (Christodorescu and others 2021).[14]

One can imagine banks being dramatically altered. Liabilities will be stablecoins and lending will be through platforms. Clearing and settlement, as it is currently constituted, will be eliminated. International payments will not go through inefficient chains of correspondent banks. Remittances will be much cheaper.

CONCLUSION Blockchain is and will be disruptive. DeFi will probably have limited use. And DeFi is borderless, so it will be difficult to regulate. "Banking" and "money" are changing their forms. But fundamentally their economic structures remain the same. Banks produce money, which is short-term debt redeemable on demand at par. How then can these new technologies be disruptive? We will see.

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10. See Badruddoja and others (2021), Sadman and others (2022), and Ouyang, Yuan, and Wang (2015).

11. On the first sense, see Buterin (2016).

12. Federal Reserve System, "Proposed Guidelines for Evaluating Account and Services Requests," https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20210505a1.pdf.

13. For a sample of the controversy, see "Senate Banking Hearing: 'The Semiannual Monetary Policy Report to the Congress.'" https://www.youtube.com/watch?v=cQ2p0FyQVqg.

14. See Visa, "Visa Becomes First Major Payments Network to Settle Transactions in USD Coin (USDC)," March 29, 2021, https://usa.visa.com/about-visa/newsroom/press-releases.releaseId.17821.html.

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