

Blockchain and DeFi implications to economic growth and antitrust policies

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1. What is DeFi?
2. Real-world application of DeFi
3. DeFi implications to antitrust policies
 - a. Barriers to Entry
 - b. Open Finance
 - c. DAO design
4. DeFi implications to economic growth
 - a. Potential benefits
 - b. Risks and challenges
5. Looking forward
6. Policy recommendation: Balanced embedded regulation

1. What is DeFi?

DeFi, short for Decentralized Finance, postulates that financial services should not rely on centralized intermediaries (such as banks, brokers or governments) but should be provided by final users for final users directly. This can be achieved through a peer-to-peer software grounded on Blockchain technology (Schär, 2021). DeFi needs Blockchain technology to function securely and effectively since Blockchain is a digital decentralized ledger that provides transparency given its immutable and public nature (IBM, 2022). This technology records transactions and tracks assets, allowing users to see the origin and the end of each transaction without intermediaries.

DeFi provides an alternative to traditional financial services avoiding the costs of having a third party as an intermediary (Roose, 2022). Moreover, it raises a distributed innovation process that lets information flow in a managed way between users (Chesbrough, Vanhaverbeke & West, 2014). Therefore, DeFi seeks to enable individual users to financially interact with each other through lending, borrowing, asset management or obtaining insurance, without intermediaries (Chohan, 2021).

The two main differences between DeFi and traditional finance are automation and decentralization. DeFi runs on the blockchain to replicate its encrypted records on numerous nodes

all over the world (Pilkington, 2016). For the most part, this technology is still unregulated since the system participation is anonymous and no central party can decide who can and who cannot participate. The following table 1 provides a comparison of main characteristics between traditional and decentralized financial services for illustrative purposes.

Table 1. Brief comparison between Traditional and Decentralized Finance

<i>Characteristic</i>	<i>Traditional Financial Services</i>	<i>Decentralized Finance (DeFi)</i>
<i>Availability</i>	Office hours	Always available
<i>Cost of service</i>	High	Low
<i>Degree of automation</i>	Low	High
<i>Flexibility</i>	Low	High
<i>Funds transfer speed</i>	Slow	Fast
<i>Investment allocation</i>	Decided by intermediaries	Decided by owner
<i>Regulated</i>	Yes	No
<i>Risk of loss</i>	Low	High
<i>Self-custodial</i>	No	Yes
<i>Structural basis</i>	Centralized	Decentralized
<i>Transparent</i>	No	Yes

Source: Author's elaboration based on Schueffel (2021) and Jin & Vinella (2022).

2. Real-world application of DeFi.

A textbook example of how DeFi can impact the actual financial world would be a security (share of a company) purchase. In traditional finance, customers first need to go through the process of opening a bank account. Then, they must transfer enough funds to the new bank account. Afterwards, they have to contact the appropriate bank's representative to place the buy order. The bank in turn needs to find a broker to fulfill the order. The broker then takes the order to the stock exchange. Finally, the broker gets the security for the customer. Then, the information should go backwards: stock exchange to broker, broker to bank and finally bank to customer. This is an oversimplified example of how to buy a security in traditional finance, requiring three intermediaries back and forth: bank, broker, and stock exchange institution.

This long process represents high costs and time inefficiencies, plus every step is a potential source of error throughout the buying process (Schueffel, 2021). However, the same security purchase via DeFi would be: Any user can connect through the internet to a DeFi exchange. There, the user can place the purchase order for a digital asset (token). A token is a codified property title for any type of asset, such as securities. Smart contracts automatically execute the purchase order as soon as the required parameters are met. As users are the custodian of their own assets, the token is transferred directly from the seller's wallet to the buyer's wallet (Schueffel et al, 2019). DeFi don't need any intermediary.

As of July 2022, \$42.98 billion U.S. dollars (USD) have been locked into DeFi contracts¹. Figure 1 shows the evolution of Total Value Locked (TVL) in DeFi Contracts in USD. From mid-2020 to date there has been a tremendous amount of attention and money flowing into DeFi systems. At its highest point, in November 2021, TVL in DeFi contracts reached \$107.5 billion USD. This graph shows both, the steep growth of DeFi and the volatility of cryptomarkets, in such a short period of time. Risks and opportunities for real world applications arise from these digital markets.



Figure 1. Total Value Locked (TVL) in DeFi Contracts in USD

Source: Author's elaboration with data and software from *difipulse.com*

As we write, new companies are creating ecosystems to establish innovative ways for entrepreneurs and small companies to access capital by connecting their user's traditional real assets as collateral and giving them credit from decentralized platforms. An example is Centrifuge, which is a lending protocol on DeFi that focuses on making alternative credit more accessible for small businesses and entrepreneurs by offering access to liquidity pools with stable yields to interested users looking to invest². Centrifuge's idea of "unlocking liquidity for real world assets" is a new option where users with traditional assets like cars and houses can convert those assets into an NFT (Non Fungible Token). Users then get access to their liquidity pools with a variety of different loans with different interest rates³.

3. DeFi implications to antitrust policies

Antitrust refers to the laws and policies that regulate the concentration of economic power to avoid monopolies and anticompetitive practices⁴. These laws and regulations provide market stability,

¹ According to DeFi Pulse network. Consulted July 19, 2022. <https://www.defipulse.com/>

² "What Is Centrifuge? CFG Token Kraken. Accessed July 18, 2022. <https://www.kraken.com/learn/what-is-centrifuge-cfg>

³ Centrifuge: Real World DeFi. Accessed July 18, 2022. <https://centrifuge.io/>

⁴ Cornell Law School. Legal information Institute. Accessed July 19, 2022. <https://www.law.cornell.edu/wex/antitrust#:~:text=Antitrust%20refers%20to%20the%20regulation,federal%20statutes%20and%20state%20statutes.>

social welfare and fair competition. To analyze antitrust implications in DeFi, three main issues should be taken into account: Barriers to entry to financial markets, Open Finance and DAO design.

a. Barriers to Entry

The introduction of DeFi to financial market is not expected to be smooth. As in any other market, a new competitor or service must overcome some challenges in order to gain market share. As Jin & Vinella (2022) recognized, a significant response from current financial service providers is anticipated since they will not simply give up their market share. DeFi faces specific barriers to entry to financial markets such as high initial investment costs. Furthermore, a rapid adoption of these new services by consumers is not expected. Actually, users normally take some time to learn, trust and adapt to new technologies. When it comes to financial services, involving customer's money, we expect technology to be adopted at an even slower pace.

Traditional financial system actors are powerful and, obviously, financially capable. In fact, the actual financial system is big and complex enough to potentially scare any new competitor. According to the Boston Consulting Group (2021), financial assets account for roughly 60% of net wealth all over the world, representing around \$250 trillion of USD. Only in the U.S., the FDIC (2022) lists 4,787 bank institutions divided into 82,184 branch offices, managing \$24,066 billion USD in financial assets. Only one bank (J.P. Morgan Chase) has more than 51 million digital customers in the U.S. (Green, 2019). On the other hand, the largest DeFi network, Bitcoin, has less than 15 thousand active nodes all over the world (Jin & Vinella, 2022).

Another factor that plays a role as an entry barrier for DeFi is that not every financial system customer trusts or uses computers. Older age groups, poor people or rural dwellers, among other vulnerable groups, may have a limited access or understanding of electronic devices with capabilities to engage in DeFi. Even if some people have access to this kind of technology, that doesn't mean they have the necessary skills to use it. For this reason, DeFi may widen the financial inclusion gap. Not only disadvantaged groups that typically lack access to traditional financial services, but even people who use computers or smart devices may not have sufficient skills to participate in DeFi.

Additionally, most people prefer human contact over automated services. When it comes to finance, personal experience feels more trustworthy than software doing what it is programmed to do (Mims, 2021). Software is not very flexible compared to interacting with another human being. Take for example a phone call. Most people prefer to speak directly with a company's representative rather than going through many options to get what you need. Generally, people are change-resistant, so in order for DeFi to be accepted by consumers, trust should be built. Building trust in a technology-based service it's another entry barrier compared to traditional financial services that provide human interaction and physical locations.

Moreover, incumbent financial services providers have enough capabilities to build blockchain or DeFi applications themselves. They could easily acquire DeFi start-ups instead of having to compete

against them. Big banks in the U.S. are already investing heavily on this matter.⁵ J.P. Morgan invests \$12 billion USD each year on emerging technology⁶. Moreover, incumbent financial services providers have enough political influence to make the government enact regulatory barriers arguing there's a need to control the tax base. In short, new DeFi service providers have to overcome both financial and political challenges in order to succeed in the financial market against incumbent participants.

b. Open Finance

Open Finance was introduced as a regulatory tool to foster competition in the financial services sector. In short, Open Finance is a data-portability system that allows consumers to share their financial data to enable competition across providers and destroy data-driven barriers of entry to financial markets. This way, new companies can use historical financial data to create and offer new services targeting the specific requirements of customers. As Awrey & Macey (2022) noted, Open Finance can level the informational playing field and foster competition among incumbent financial institutions and a new generation of companies trying to satisfy consumers that look for faster payments, to borrow money, invest their savings, exchange currency, manage budgets and so on.

As a policy objective, Zetzsche, Arner and Buckley (2020) argue that Open Finance is justified on pro-competition grounds, looking for market efficiency, economies of scale and to address situations where data determines competitive strength. Open Finance can prevent industry concentration. American and Chinese information technology (IT) markets have tended towards oligopoly or monopoly in the past decade. Arguably, the main asset of Google, Facebook, Amazon and Alibaba is the data pool of consumers and suppliers (Ramos & Villar, 2018). With this data they can better advertise, determine prices, offer new tailored services and reach more clients.

It has been long studied by antitrust scholars that when investors prefer growth in the future over profits today, predatory pricing is a meaningful strategy since they are looking to recover present losses with a future gain of control over the critical supplies and infrastructure on which their competitors depend. Information and data concentration promote monopolistic behavior and market collusion (Patterson, 2017), leading to higher prices at the expense of consumers. Open Finance represents a novel tool for antitrust authorities to avoid potential harm to consumers in financial markets.

If strategically applied by a jurisdiction, Open Finance should enable consumers to quickly, simply, and securely move their financial data between competitors of financial services like banks, retirement funds and insurance companies (Nicholls, 2019). This should make the entrance of new suppliers of financial services cost-possible, providing new products, better customer service and

⁵ Bloomberg: JPMorgan Finds New Use for Blockchain in Trading and Lending accessed July 19, 2022 <https://www.bloomberg.com/news/articles/2022-05-26/jpmorgan-finds-new-use-for-blockchain-in-collateral-settlement> and J.P. Morgan: Blockchain solutions to complex business challenges <https://www.jpmorgan.com/onyx/blockchain-launch.htm>

⁶ This \$12 Billion Tech Investment Could Disrupt Banking. Accessed July 19, 2022. <https://www.jpmorganchase.com/news-stories/tech-investment-could-disrupt-banking>

stimulating prices down. Blockchain, via DeFi's Distributed Ledger Technology (DLT), could help to decentralize access to critical data, making the tech and financial market accessible to new participants and funding accessible to more businesses and entrepreneurs, stimulating economic growth.

c. DAO designs

DAO, an acronym for Decentralized Autonomous Organization, is a concept introduced by Ethereum co-founder Vitalik Buterin in 2014. Basically, DAOs are constructed by a series of interrelated smart contracts to achieve members' objectives. A smart contract is a code that automatically executes transactions on a blockchain network when previously established requirements are fulfilled. "The ideal of a decentralized autonomous organization is easy to describe: it is an entity that lives on the internet and exists autonomously" (Buterin, 2014).

DAOs can generate pro-competitive effects, such as increased efficiencies and lower costs for both, members of these organizations and final consumers. But, following Torpey & Pitell (2022), they also pose significant legal risks: DAOs can expose its members to unlimited liability. As of July 2022, only two States recognize DAOs as limited-liability legal entities. Wyoming passed legislation in 2021 and now Vermont recognizes limited liability to DAOs members when registered as a "Blockchain Based LLC"⁷. On top of these risks, DAO creators should consider the antitrust implications of their DAO design.

Under most jurisdictions (U.S., Europe, Mexico, Canada), some antitrust offenses trigger criminal penalties that include serving time in jail. If automated decisions made in a DAO have the capacity to fix prices, divide markets, exchange sensitive information or restrain trade in violation of applicable law, then the creators and participants of a DAO may be personally rendered as liable for criminal charges against free markets. Digital corporate regulations may be a step forward, but not enough to protect a DAO that enables coordination across competitors, such as colluding to decide what products to sell or what pricing strategies to implement.

Considering these antitrust risks at the early design phase is crucial in the DAO development since the decentralized and automated nature of such organizations might make it almost impossible to remediate legal violations in a cost-effective way instead of definitely dismantling the organization to solve a legal problem. In fact, DAOs designed with a profit orientation could also raise automated monopolistic behaviors and concentration risks if it gains a dominant position even in a particularly small market. Therefore, design of the protocol and smart contracts of a DAO should take into account the law and its changing nature.

In short, DAOs may have several pro-competitive benefits. They can enable businesses to operate more efficiently and have an appealing internal governance via electronic voting arrangements. However, they can raise a number of legal challenges that should be addressed from their

⁷ Vermont General Assembly. *The Vermont Statutes Online*. Title 11: Corporations, Partnerships And Associations. Chapter 025: Limited Liability Companies. Subchapter 012: Blockchain-based Limited Liability Companies. 11 V.S.A. § 4173. <https://legislature.vermont.gov/statutes/section/11/025/04173>

conception. The decentralized nature of DAOs and the distribution of control across many members make it essential to ensure that legal consequences are taken into account even before day one of operations.

4. DeFi implications to economic growth

a. Potential benefits

The Organization for Economic Cooperation and Development states that DeFi applications have the potential to deliver significant economic efficiencies through the transfer of value without the need for trusted centralized intermediaries, bringing faster and cheaper automation of transactions (OECD, 2022). With DeFi it is possible to reduce transaction costs and promote transparency as all transactions are publicly available. No human involvement is needed since the transactions are triggered based on data provided by the protocol or external nodes such as “Oracles”⁸.

Furthermore, DeFi has a money-multiplier effect. Applications for lending can canalize full short-term savings into lending immediately, without solvency and liquidity restrictions from the traditional banks. Therefore, entrepreneur funding and short-term loaning would be more widely available in the market, promoting new economic opportunities. This could be translated into new business made possible, more investments, expansion of GDP and further tax collection increase. Even new jobs could be offered as new participants in financial and other markets become available.

The Financial Stability Board (FSB, 2019), an international organization that monitors and makes recommendations about the global financial system, said that the application of DeFi technology may reduce the financial instability risks associated with traditional financial institutions. The expected dispersion of financial service providers could increase diversification of the financial system and reduce the concentration of suppliers. The too-big-to-fail problem may be moderated in a way that bankruptcy of few institutions is no longer a potentially catastrophic event for the economy as a whole.

Talking about cyber security reasons, with DeFi there is no central or single attack point. A decentralized setting should be stronger against cyber risks in terms of the integrity of financial records and service availability (FSB, 2019). Furthermore, DeFi’s promise of interoperability could help promote innovation and build a vibrant financial ecosystem (Carter & Jeng, 2021). Most of the benefits mentioned above relate to efficiency, economic expansion, transparency and security. Now we should assess if these benefits can outweigh potential risks listed next.

b. Risks and challenges

When it comes to financial inclusion, small and medium-size business owners and managers may not have the sufficient understanding of DeFi systems to engage with them. In fact, crypto-asset volatility may have a significant impact on their finances if they are not fully understood. Speaking

⁸ Oracles are entities that connect blockchains to external systems, thereby enabling smart contracts to execute based upon inputs from the real world. Source: <https://chain.link/education/blockchain-oracles>

of trust, proponents of DeFi state that the system provides trust through disintermediation and decentralization. But it should be considered that users must trust the creator of the smart contract that executes the transaction. Almost no user would have enough technical skills to evaluate the smart contract code. Therefore, users must trust software developer instead of trusting a big and regulated financial institution as an intermediary.

Nowadays, there is no unique regulation to DeFi networks. Decentralized networks are automated and community-governed. Therefore, it is hard to identify decision-making actors that can be held responsible for network outcomes. This makes supervision, accountability, and even legal notifications difficult. The current legal system's procedures are designed considering centralized decision-making bureaucracies, with physical venues, like the incumbent financial institutions. On the other hand, DeFi systems are worldwide structures, with no defined physical location nor jurisdiction, generating uncertainty and challenges for law enforcement (OCDE, 2022).

As for consumer protection, even if no minority group can manipulate DeFi networks with governance structures that require more than 50% of community votes, if most nodes decide to act in an illegal or unfair way, this can affect all participant nodes, including consumers. This can lead to fraud and asset seizure, since DeFi does not depend on a custodial system. It is not clear for every DeFi project if changes in existing smart contracts can be decided by the community, even with the opposition of some participants. This way, consumers are exposed to changes of the initial terms of the contract they agreed upon.

Contrary to what DeFi advocates sustain, it is not impossible to manipulate it. The most vulnerable part of the process seems to be the manipulation of Oracles. These nodes feed external data into the blockchain. If erroneous or fraudulent information is introduced, it can lead to massive consequences. For example, if manipulated price data is introduced into the blockchain, it can trigger massive buys or sells that otherwise wouldn't happen under the Smart Contract parameters. This could result in considerable losses to users. Moreover, the permanent nature of the blockchain renders these frauds as irreversible, even when they involve manipulated information or scams.

Today, investor and financial consumers are significantly more exposed to suffer a detriment in their assets than they would if they use a regulated centralized finance institution. As far as we know, DeFi users don't have any defense mechanism in case of failure of the protocol, being difficult to identify a responsible actor to claim to. There are no dispute resolution mechanisms nor recovery methods, exposing participants to a potential total loss of their investment. This risk is accentuated given that DeFi projects can be launched by any programmer with no testing or due diligence mandated by law the vast majority of jurisdictions by this time.

Another important issue to point out is the possible existence of an "admin key" to the code. to repair a DeFi protocol if it performs in an erratic manner, developers should keep an admin key to enter the code and fix it. At the same time, this solution brings significant risks for users since admin keys can access user sensitive information or change protocol operation from its roots at any time. Founders or developers could also use the admin key to seize investor's assets all of a sudden. In short, despite the fundamentally decentralized nature of DeFi, human intervention is still present in

governance, either by concentrated holdings of voting tokens or through the admin keys if they were created.

Last risk is the transparency risk. DeFi protocols doesn't necessarily mean improved user awareness of financial risks. Even when the code is transparent, it wouldn't be enough for the average financial service user because a sophisticated level of technological and financial knowledge is required to understand the implicit risks of the system. Users would need both, coding skills and deep financial literacy, in order to understand the financial risks of the protocol (OCDE, 2022). Even users at the top of the game could have a difficult time assessing financial risks in DeFi protocols.

5. Looking forward

A rigorous academic evaluation must be performed to assess if the potential benefits of DeFi can outweigh the potential risks it represents to legal and economic systems. In the meanwhile, we suggest specific considerations to legislators and regulators that can moderate the economic threats. Actually, there is a way in which DeFi itself can resolve the main concerns for financial market regulators worldwide: the introduction of embedded regulation into the protocol of DeFi. This concept can tilt the cost-benefit balance in favor of DeFi, having the potential to unlock its full potential and at the same time taking care of regulators' concerns.

Who is responsible for misrepresentation or faults in automated outputs of DeFi? Accountability and enforcement issues brought to the table by blockchain implementation can be summarized in difficulties of establishing liable persons to sue and determine the applicable law and jurisdiction. As Zetzsche, Arner and Buckley (2020) argue, DeFi could be subject to law either anywhere or everywhere, last one being so problematic that it could deter participants from engaging in decentralized finance protocols. As the rule of law in financial services is a major concern for all actors, including developers, consumers and governments, here's where RegTech can help.

RegTech, acronym for Regulatory Technology, means using technology (hardware and software) for regulatory compliance and supervision. But one step forward from RegTech is the concept of "embedded supervision" as proposed by Raphael Auer, which can decentralize both finance and its regulation. Embedded supervision is a "regulatory framework that provides compliance in decentralized markets to be automatically monitored by reading the market's ledger. This reduces the need for firms to actively collect, verify and deliver data" (Auer, 2022).

In this order of ideas, competent authorities should adapt to market evolution and design monitor systems in the same language of DeFi. Legal parameters could be embedded into DeFi code to secure regulatory objectives of screening as part of the authorization requirements to enter financial markets. This embedded supervision can significantly reduce compliance costs for both supervisors and market participants. This way, markets could be automatically monitored by reading the blockchain and protocols of DeFi. Embedded supervision is, in fact, an automated form of compliance.

Zetzsche, Arner and Buckley go one step further from embedded supervision concept, and advocate for “embedded regulation” (2020). Under this approach, the key regulatory objectives of market behavior, integrity and stability, should be included as part of the design of any DeFi system. Every protocol should implement regulatory features as part of its own automated structures, requiring input of specific data, quality conditions and other forms of traditional regulatory standards for the financial system. Embedded regulation can also address the jurisdiction uncertainty of DeFi. The country of supervisors authorizing an embedded regulation system could make clear their jurisdiction and applicable law.

Legal issues should be addressed now to take advantage of new technologies like blockchain to decentralize finance. DeFi has the potential to bring more efficient financial markets and promote economic growth. Antitrust considerations and accordingly RegTech adaptation of embedded rules governing DeFi systems are essential for proper market functioning. We suggest that financial regulators should begin to invest in DeFi research now to be able to properly understand and design embedded regulation requirements for DeFi systems. Authorities all around the world should evolve and, more importantly, cooperate, since the traditional National State model may not be adequate anymore to successfully tackle by its own the challenges of this fully interconnected world.

However, excessive regulation may also discourage entrepreneurial pursuits related to DeFi projects and restrict the very aspects that make DeFi unique among financial processes. In order for DeFi to maintain its status as an efficient alternative to traditional finances, it must remain free of intermediaries and unrestricted in its ability to incite innovation. We propose that embedded regulation should only be enforced to the extent that it provides clarity and security to users of the DeFi protocols. Terms relating to the implementation and use of this technology should be clearly defined and simplified to increase adoption of this promising alternative. Ultimately, a balance must be established between the necessary regulation structure and the freedom to innovate.

6. Policy recommendation: Balanced embedded regulation

Blockchain technology is heading towards improving security, transparency and saving costs in the financial system via DeFi, but it is still a disordered and mostly unregulated area. We urge financial regulators to invest heavily in DeFi research to be able to properly understand and design embedded regulation requirements for DeFi systems going live in the future. However, authorities must consider that excessive regulation would discourage DeFi implementation. A balanced embedded regulation is proposed to achieve both objectives: provide certainty to the financial system and promote freedom to innovate.

If a well-balanced embedded regulation is accomplished, public policy objectives of consumer protection and financial market competition will be met, as well as unlocking the potential that Decentralized Finance has to offer in terms of cost-efficiency and availability of funding for entrepreneurs and businesses. Expected economic growth and its consequent increase in tax collection are quite likely to outweigh the authorities’ investment costs of developing balanced embedded regulation requirements as outlined in this paper.

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