
Legal Issues in Designing DeFi Regulation

Young Yoon Park*

This paper presents factors to consider when designing DeFi regulations. DeFi regulations may be established by imposing obligations on developers and operators, who exist even in extreme decentralization cases. However, the requirements in current financial legislation, which heavily rely on intermediaries' organization and personnel, are difficult to apply to DeFi. Instead, under DeFi, information can be obtained, analyzed, and aggregated on the blockchain and reported to the authority automatically and regulatory requirements may be reflected in the smart contract and automatically executed. This may require mandatory code audits by supervisory authorities and civil technology experts prior to execution, to check whether legal requirements are embedded in the code. In addition, measures addressing the risk-contagion effects in macroeconomic crisis, potentially arising from DeFi's connectivity with traditional finance, must be considered.

Keywords

DeFi, Blockchain, Finance Regulation, Financial Intermediary, Embedded Regulation, Code Audit

I. Introduction

Decentralized Finance (DeFi) refers to technology that reduces or eliminates the role of one or more intermediaries and the need for centralized procedures to provide

* Attorney-at-Law (Korean Bar) practicing at Yulchon LLC. B.A./M.A. in Economics (Seoul N.U.), J.D. (magna cum laude, Yonsei), LL.M. (King's College London). ORCID: <https://orcid.org/0000-0003-4443-1622>. The author may be contacted at: yypark@yulchon.com / Address: Parnas Tower, 38th Floor, 521 Teheran-ro, Gangnam-gu, Seoul 06164 Korea.

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financial services.¹ DeFi replicates finance services such as lending, borrowing, or asset management, but executes those transactions via automated smart contracts. It does not envisage the roles played by intermediaries. DeFi poses the same risk as traditional finance in terms of investor protection; however, current financial legislation focusing on intermediaries is not likely to be a proper measure for dealing with DeFi. Meanwhile, blockchain technology, the basis of DeFi, validates and records transactions on multiple nodes distributed online, it does not require an intermediary to intervene in such transactions. If such technology is applied to financial transactions, the role of intermediaries connecting the demanders and suppliers of money can be excluded or minimized.

The emergence of DeFi has a significant impact on financial regulation. Financial consumers may not know what happens within intermediaries regarding financial services. Under this condition, consumers' trust that intermediaries will act in their best interests with due care necessary is required, so that financial transactions are entrusted to intermediaries. Statutory obligations to intermediaries (including market entry requirement, business conduct rules, and prudential regulations) tend to create such trust. Hence, financial regulation centers on intermediaries. The expansion of intermediary-free DeFi services may undermine the fundamental basis of financial regulations.

In general, the regulation of DeFi is somewhat different from that of crypto-assets. Blockchain technology is decentralized in nature, but crypto-assets circulating on the blockchain are issued by entities with central substances in many cases. Likewise, crypto-asset transactions depend heavily on Centralized Exchanges (CEX), which are centralized bodies. Hence, the global discussion on crypto-assets has mainly focused on applying the current securities regulations or enacting new rules very similar to current securities regulations, with slight modifications based on blockchain technology. These approaches are not effective for DeFi, as it has an operating method that is distinct from traditional finance.

In recent years, DeFi services are growing, despite temporary fluctuations. Against this backdrop, this paper presents factors to consider when designing DeFi regulations. DeFi includes developers and operators, even in extreme decentralization cases, although they are not equipped with a physical location or clear organizational structure. DeFi regulations may be established by imposing obligations on developers and operators. However, the same requirements in current financial legislation, such as incorporation and capital requirements, are difficult to apply to DeFi. In

¹ Financial Stability Board, *Decentralised Financial Technologies: Report on Financial Stability, Regulatory and Governance Implications* (June 6, 2019), at 2, <https://www.fsb.org/wp-content/uploads/P060619.pdf>.

designing DeFi regulations, information can be obtained, analyzed, and aggregated on the blockchain and reported to the authority automatically for supervisory purposes. In addition, regulatory requirements may be reflected in the smart code and automatically executed. This may require mandatory code audits by supervisory authorities and civil technology experts prior to execution, to check whether legal requirements are embedded in the code.

II. Components, Characteristics, and Examples of DeFi Services

A. Components and Characteristics of DeFi Services

The major DeFi services are based on the Ethereum network.² Ethereum take advantage of being easily combined with computer code (smart contracts) executed on the blockchain network.³ This is a strong advantage compared with Bitcoin, the first universal blockchain network. A decentralized application (Dapp) combines a smart contract with a user interface and runs on ethereum blockchain network.⁴ DeFi services are automatically executed through Dapps and smart contracts without traditional intermediaries.⁵

Other important elements of the DeFi system are addresses and wallets. An address refers to the location where crypto-assets are stored and smart contracts are executed. A wallet is software that produces and manages this address. Each individual, not an intermediary, owns digital assets in their own wallets and manages them under DeFi.⁶ Smart contracts eliminate or minimize the role of intermediaries in financial transactions.⁷ While trust in traditional finance lies in intermediaries, DeFi technologies instill trust through their intrinsic design.⁸ Hence, DeFi minimizes the room for discretion enjoyed by intermediaries.

² Ethereum was invented by Russian programmer Vitalik Buterin and is said to have been developed with a decentralized app in mind. See Ville Kirvesoja, Advantages and Disadvantages of Decentralized Financial (DeFi) Service 8 (JYX Digital Repository, 2022), <https://jyx.jyu.fi/handle/123456789/81722?locale-attribute=en>.

³ *Id.* at 18.

⁴ Blockchain Governance Initiative Network, Potential Points of Failure for Stablecoins - Did the Silicon Valley Bank Collapse Lead to DeFi Instability? (24 July 2023), at 8, https://bgin-global.org/pdf/BGIN_WD_SR011_Study_Report_Potential_Points_of_Failure_of_Stablecoins.pdf.

⁵ Kirvesoja, *supra* note 2, at 20-1.

⁶ *Id.* at 22.

⁷ This is distinguished from fintech where intermediating role is simply transferred from banks to fin-tech companies like Pay Pal. See *id.* at 14.

⁸ *Id.* at 19.

The nature of decentralization comes first from the fact that transactions are validated and recorded on distributed nodes in the blockchain network. While investors' properties, rights, and obligations are concentrated in intermediaries under traditional finance, such a concentration does not occur under DeFi. Consequently, the risk in financial transactions is decentralized. Furthermore, in the DeFi service, decision-making appears to be decentralized among governance-token holders.⁹

Blockchain networks are classified into private, public, and hybrid types, depending on whether there are restrictions on network participation.¹⁰ Highly decentralized DeFi operates on a public blockchain. In most DeFi services, tokens representing rights derived from financial transactions are issued and circulated,¹¹ providing a basis for DeFi services to expand and connect with each other.

A stablecoin is a crypto-asset whose value is pegged to fiat currency or other assets and is purported to maintain value stability. DeFi does not necessarily require stablecoin as a component. However, stablecoins appear to be widely used in DeFi because highly volatile crypto-assets such as Bitcoin and Ether are not suitable for financial transactions.¹²

B. Major DeFi Services

1. Lending and borrowing

The anonymous nature of the blockchain prevents credit checks in DeFi Lending. Hence, DeFi loans generally require a high collateral ratio.¹³ Lending platforms are primarily provided with crypto-assets as collateral under lockup conditions. For instance, a person who intends to obtain a loan can borrow a stablecoin, such as USDT, which is lower than the collateral value, by providing Bitcoin as collateral. If the collateral ratio falls below a predetermined level owing to a decrease in the value of collateral, the loan is collected through the liquidation of the collateral.

On the opposite side of the loan, a crypto-asset deposit service, commonly referred to as 'staking' is provided. DeFi deposits provide higher interest rates than commercial banks. The interest rate tends to increase when lock-up conditions are applied in general. Again, there is no procedure for verifying a depositor's identity.¹⁴

⁹ Financial Stability Board, *supra* note 1, at 3.

¹⁰ Kirvesoja, *supra* note 2, at 15.

¹¹ *Id.* at 21.

¹² *Id.*

¹³ Johannes Jensen, Victor Wachter & Omri Ross, *An Introduction to Decentralized Finance (DeFi)*, 26 COMPLEX SYS. INFORMATICS & MODELING Q. 50 (2021).

¹⁴ Dong-Won Koh, *Review of Developments of Decentralized Finance and Regulations on Unfair Trading of Crypto-Assets in Korea*, 23 KOR. J. SEC. L. 152 (2022), <https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView>.

Maker DAO and Compound serve as exemplary models of DeFi lending and deposit services. The inception of the DeFi movement is often attributed to Maker DAO, which commenced offering crypto-asset lending services with Ether as collateral in 2017. Users can deposit Ether as collateral to create DAI, a stablecoin pegged to one US dollar. The user may recover the collateral by repaying the interest and principal. However, the collateral is executed if the performance of the obligation is delayed. At the opposite side of loan services, the holder of DAI can deposit it at Maker DAO protocol to receive interest.¹⁵ Another component of Maker DAO, MKR, is a governance token that gives the right to participate in important decision-making in the protocol. It is also utilized as a trading mechanism to stabilize the price of DAI at one dollar.¹⁶

Crypto-assets deposited by users in Compound are added to the crypto-asset pool and constitute a source of loan. Instead, depositors receive cTokens, representing the right to redeem the principal and interest in Compound. In contrast, users can borrow crypto-assets by providing cTokens as collateral. Compound automatically adjusts interest rates for deposits and loans.¹⁷

2. Decentralized Exchanges

The trading of crypto-assets depends on two distinct exchanges: Centralized Exchanges (CEX) and Decentralized Exchanges (DEX). CEX purchases crypto-assets using its own fund, stores them in its own wallets, and plays the role of brokering transactions between sellers and buyers of its own crypto-assets. The transaction is validated not by the blockchain network, but by the CEX operator.¹⁸ Therefore, a crypto-asset purchaser on CEX has the right to redeem CEX in relation to the crypto-assets purchased.

In this respect, CEX plays the role of a stock exchange, broker, central depository, and clearing house.¹⁹ Similar to traditional exchanges, CEX receives fees from users in exchange for the above services. Like in traditional intermediaries, risks are concentrated around CEXs. If the CEX becomes the target of a hacking attack or encounters a shutdown, the entire transaction inevitably stops.²⁰ Transactions through CEX are based on trust in CEX. Therefore, if the exchange commits an illegal

kci?sereArticleSearchBean.artiId=ART002839441.

¹⁵ Maker DAO Whitepaper, <https://makerdao.com/ko/whitepaper>.

¹⁶ *Id.*

¹⁷ Compound Whitepaper, <https://compound.finance/documents/Compound.Whitepaper.pdf>.

¹⁸ Kristin Johnson, *Decentralized Finance: Regulating Cryptocurrency Exchanges*, 62(6) WM. & MARY L. REV. 1954 (2021).

¹⁹ *Id.* at 1955.

²⁰ *Id.* at 1954.

act, it may result in investor losses.²¹

CEX is far from decentralization or disintermediation.²² Rather, DEX does not hold its own crypto-assets, but only provides an interface in which all bid and ask prices are disclosed. When a contract is concluded on the DEX interface, the transactions are executed and validated through smart contracts on a blockchain network. The crypto-assets being traded are then transferred from the seller's wallets to the buyer's wallets.²³

In DEX, trust lies in the smart contract and not in exchange.²⁴ DEX is effective because the exchange itself is not susceptible to hacking;²⁵ highly transparent in that the transaction history is disclosed²⁶ and excludes intermediaries such as depositories or central counterparty clearing houses (CCPs).²⁷ Although the DEX transaction speed is slow, its relatively high fees (gas) are incurred on the blockchain network and there is a risk of loss of keys held by individuals.²⁸

3. Asset management

Asset Management DeFi is a protocol for pooling crypto-assets funded by multiple investors and distributing them to investment targets, analogous to asset management or investment funds in traditional finance. This protocol seeks to maximize the return on investment by continuously adjusting the funds allocation among investment targets. Some of these protocols operate in the same manner as passive funds that track stock indices. In the protocol, investors are given tokens representing the right to claim a distribution of investment returns,²⁹ analogous to equity in mutual funds in traditional finance.³⁰

Set Protocol provides a platform on which users can create and operate new funds by implementing their own asset-management strategies in smart contracts.

²¹ Fabian Schär, *Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Market*, 103(2) FED. RES. BANK ST. LOUIS REV. 160 (2021).

²² Johnson, *supra* note 18, at 1954-55.

²³ *Id.* at 1955.

²⁴ Koh, *supra* note 14, at 8.

²⁵ *Id.*

²⁶ Hyeob Kim, Min-Su Kim & Hyuk-Jun Kwon, *Capability and Limitations of De-Fi (Decentralized Finance)*, 26(2) J. SOC. E-BUS. STUD. 148 (2021).

²⁷ Schär, *supra* note 21, at 160.

²⁸ *Id.* at 148.

²⁹ Jensen, Wachter & Ross, *supra* note 13, at 51.

³⁰ Investment-purpose Decentralized Autonomous Organization (DAO) is similar to, but conceptually different from DeFi Asset Management. Decisions of the DAO are made based on by votes by governance-token holders. The voting process, results, and financial position are all disclosed in a transparent manner. One example is MetaCartel Ventures, a DAO established on July 7, 2019, for the purpose of investment such as venture capital.

Fund managers' discretion is not permitted beyond pre-determined rules in smart contracts.³¹ In Betoken, fund managers are allocated cryptographic assets deposited in the protocol. Betoken protocol was designed to ensure that fund managers would receive management assets and rewards in proportion to their performance.³²

III. Necessity to Regulate, Challenges, and Risks posed by DeFi

A. Risks Inherent in DeFi

DeFi provides an opportunity to achieve high efficiency by eliminating or minimizing the role of intermediaries in finance. DeFi transactions are typically concluded within a matter of minutes, contingent on the time required for blockchain nodes to validate the process. In contrast, transactions involving intermediaries can often extend over several days before being finalized.³³ DeFi services can be easily delivered by any person who has the idea on a financial service and implements them in code. The reduction in time and cost,³⁴ the expansion of competition from new entrants, and service diversity are likely to contribute to the welfare of financial consumers.³⁵

However, DeFi does not solve all the problems of traditional finance, but raises new problems. As aforementioned, DeFi can achieve high efficiency by eliminating intermediaries. However, under DeFi, it is difficult to expect multiple intermediaries to monitor each other's misconduct, as in traditional finance.³⁶

An inherent advantage of DeFi is its high level of transactional security. This is because smart-contract codes are disclosed to the public and subject to scrutiny. The errors (bugs) and potential risks of DeFi can be verified in public spaces.³⁷ However, unchecked errors or weaknesses in smart contracts can also be targets for DeFi hacking.³⁸ The 2016 DAO scandal was an example in which hackers took advantage of errors in smart contracts to steal approximately USD 50 million worth of Ether.

Smart contracts are executed as designed, and the transaction results are disclosed and subject to investigation. In this respect, DeFi is transparent and able to exclude

³¹ Schär, *supra* note 21, at 168.

³² Betoken Whitepaper, <https://github.com/Betoken/Whitepaper/blob/master/BetokenWhitepaper.pdf>.

³³ Kirvesoja, *supra* note 2, at 51.

³⁴ Schär, *supra* note 21, at 153.

³⁵ Financial Stability Board, *supra* note 1, at 1.

³⁶ Johnson, *supra* note 18, at 1933.

³⁷ Kirvesoja, *supra* note 2, at 25.

³⁸ Schär, *supra* note 21, at 170.

manipulation of transaction results or arbitrary interventions.³⁹ The so-called agent problem, referring to the agency seeking its own interest by sacrificing the principal in financial intermediaries, is thus reduced. However, information asymmetry cannot be resolved completely using DeFi. This is because only experts can read and understand the code, and experts may even overlook the flaws or risks inherent in smart contracts.⁴⁰

It is very difficult to exclude certain people from the provision of services owing to the open nature of DeFi.⁴¹ DeFi can be expanded to financial services for those with low credit scores who have not been able to access traditional finance on a global scale.⁴² However, the anonymity of blockchain transactions makes it difficult to implement customer checks, which are the core of the anti-money laundering (AML) framework. The non-application of the AML system raises concerns that DeFi may be used as a channel for criminal or terrorist funding.

DeFi can easily be combined or expanded across multiple services.⁴³ For example, the DAI loaned by Maker DAO can be included in Compound's liquidity pool. The high composability enables explosive growth of DeFi in a short time. This raises the possibility that DeFi could become a channel for crisis contagion.⁴⁴ If any error occurs in a smart contract, it can have an infectious effect not only on the relevant DeFi service, but also on the entire DeFi world.⁴⁵ For example, the price of financial assets, including crypto-assets worldwide, plummeted due to concerns about the spread of the Covid-19 in March 2020. This led to a decrease in the value of collateral in DeFi loan services such as Maker DAO, which resulted in collateral liquidation.⁴⁶

In addition, traditional financial institutions may assimilate DeFi,⁴⁷ which may link the DeFi world to the entire financial market and economy.⁴⁸ Major stablecoins try to maintain value by retaining assets, such as US dollars or traditional finance products,

³⁹ *Id.* at 154.

⁴⁰ Caroline Crenshaw, Statement on DeFi Risks, Regulations, and Opportunities (Nov. 9, 2021), <https://www.sec.gov/news/statement/crenshaw-defi-20211109>.

⁴¹ Kirvesoja, *supra* note 2, at 50; Schär, *supra* note 21, at 169.

⁴² Kim, Kim & Kwon, *supra* note 26, at 146.

⁴³ Schär, *supra* note 21, at 169.

⁴⁴ Lewis Gudgeon et al., *The Decentralized Financial Crisis 1-2* (2020 Crypto Valley Conference on Blockchain Technology, 2020), <https://ieeexplore.ieee.org/document/9150192>.

⁴⁵ Schär, *supra* note 21, at 171.

⁴⁶ Iwa Salami, *Challenges and Approaches to Regulating Decentralized Finance*, 115 AM. J. INT'L L. 426 (2021).

⁴⁷ Dirk Zetsche, Douglas Arner & Ross Buckley, *Decentralized Finance*, 6 J. FIN. REGUL. 177 (2020).

⁴⁸ Kirvesoja, *supra* note 2, at 28; OECD, *Why Decentralised Finance (DeFi) Matters and the Policy Implications* (2022), at 13, <https://www.oecd.org/finance/Financial-Market-Developments-and-Conditions-in-Asia.htm>.

in preparation for conversion requests, which may become another channel.⁴⁹ The bank-run crisis of the US Silicon Valley Bank in March 2023 shows such a possibility. Circle, the issuer of a stablecoin called the USDC, has deposited funds received in exchange for stablecoin issuance in a Silicon Valley bank, and the bank's crisis has heightened concerns that Circle may not be able to convert USDC into dollars.⁵⁰ This led to a sharp decline in the value of another stablecoin, DAI as USDC was one underlying asset of DAI issuance.⁵¹ In the opposite path, the crisis arising from DeFi may impact traditional finance and the macroeconomy. If DeFi continues to grow,⁵² it is likely to exacerbate economic fluctuations (i.e., procyclicality).⁵³ Problems specific to DeFi also exist. First, DeFi uses an oracle external to the blockchain to determine whether the conditions inherent in smart contracts are satisfied.⁵⁴ The DeFi transactions may be distorted if the information provided to oracle is distorted intentionally or unintentionally.⁵⁵ Second, a new type of front-running that is difficult to imagine under traditional finance. It may be rather committed in DeFi. That is, nodes participating in the validation of transactions (miners) can use information on the content, direction, and scale of the DeFi transactions waiting for validation for their own profit during the validation interval (several minutes in ethereum network).⁵⁶ Third, all transactions on the blockchain are disclosed, but the identity of the person performing the transaction is not disclosed. Anonymity may provide a basis for market abuse, such as market manipulation.⁵⁷

B. Necessity of DeFi Regulation

Because DeFi can potentially replace traditional intermediaries, traditional financial regulations centered on intermediaries may be difficult to apply effectively to DeFi.⁵⁸ An argument opposing DeFi regulation mainly focuses on the transparency of

⁴⁹ Blockchain Governance Initiative Network (BGIN), *supra* note 4, at 24.

⁵⁰ *Id.* at 13.

⁵¹ *Id.* at 15-6.

⁵² Johnson, *supra* note 18, at 1961.

⁵³ Financial Stability Board, *supra* note 1, at 1.

⁵⁴ Kirvesoja, *supra* note 2, at 28.

⁵⁵ Rubén Buenfil & Alexander Romanowski, *Decentralized Finance Regulation to Foster Competition and Economic Growth*, 38 ANÁLISIS ECONÓMICO 136 (2023), <https://analisiseconomico.azc.uam.mx/index.php/rae/article/view/818/590>.

⁵⁶ Kirvesoja, *supra* note 2, at 29. *See also* Jensen, Wachter & Ross, *supra* note 13, at 49-50; Andrew Verstein, *Crypto Assets and Insider Trading Law's Domain*, 105(1) IOWA L. REV. 30 (2019).

⁵⁷ US Securities and Exchange Commission [SEC], Statement on DeFi Risks, Regulations, and Opportunities, Statement by Caroline A. Crenshaw, Commissioner (Nov. 9, 2021), <https://www.sec.gov/news/statement/crenshaw-defi-20211109>.

⁵⁸ Zetzsche, Arner & Buckley, *supra* note 44, at 172.

DeFi.⁵⁹ Developers actively check and investigate smart contract codes and present their opinions on GitHub. Computer programs aimed at checking for errors and fraudulent codes in smart contracts appear to be widely used.⁶⁰ In addition, if any investor engages in market abuse on the DEX, as long as all records are disclosed, such behaviors may be detected by the public.⁶¹ According to the argument, regulatory measures by the state are unnecessary as long as the information is made public and investigated in the market. In addition, the fact that DeFi's decisions are made by multiple distributed nodes rather than a specific intermediary, and that there is a means of correcting errors that occur in DeFi, such as hard forks, also undermines the need for oversight.⁶²

However, DeFi cannot resolve information asymmetry completely. Not all investors understand the code. In addition, traditional financial regulations require the disclosure of the information necessary for making investment decisions, such as the financial position of the issuers of securities. Information on the financial status of the crypto-asset issuer on the DEX is not publicly available. In addition, errors or mistakes occurring in smart contracts are highly likely to cause irreversible losses.⁶³ A hard fork is a cumbersome and time-consuming process that can be executed only with the approval of a majority of governance-token holders and is highly likely to cause confusion among the DeFi service users. The fact that there is no easy means to correct erroneous transactions raises the need for the proactive regulation of DeFi.

Regulation may become an obstacle to maximizing the innovative nature of DeFi. However, regulation is believed to promote DeFi transactions by providing predictability. Additionally, investor access to DeFi services is expected to increase if malicious activities are diminished through regulation.⁶⁴ However, regulations must fit the technical characteristics of DeFi so as not to block the growth of the new innovative industry.

IV. Points to Consider in Designing DeFi Regulation

A. Introduction

⁵⁹ Verstein, *supra* note 56, at 5.

⁶⁰ Association pour le Développement des Actifs Numériques [ADAN], *Regulating DeFi in Europe : Issues for Consideration* (Apr. 29, 2023), at 15 <https://www.adan.eu/en/publication/regulating-defi-in-europe-issues-for-consideration>.

⁶¹ Verstein, *supra* note 56, at 5.

⁶² *Id.*

⁶³ Kirvesoja, *supra* note 2, at 28.

⁶⁴ Verstein, *supra* note 56, at 39.

No systematic regulation of DeFi has yet been implemented. For example, EU MiCA⁶⁵ is a systematic framework encompassing cryptoasset-related matters such as issuance and distribution of crypto-assets or crypto-asset service providers. However, DeFi is excluded from the MiCA application.⁶⁶ Rather, MiCA appears incompatible with DeFi, as MiCA requires crypto-asset issuers or service providers to be legal entities of the organizational type.⁶⁷

The US Federal Securities and Exchange Commission (SEC) has continuously attempted to enforce securities regulations by including crypto-assets within the purview of investment contract securities under the Federal Securities Act.⁶⁸ The SEC announced that DeFi would be dealt with in the same way as traditional finance and sanctioned against BlockFi, which was purportedly a DeFi service. However, BlockFi is not a typical DeFi service because it has centralized organization to operate investment activities using the crypto-assets collected in the ICO.⁶⁹ Cases dealing with DeFi services are rare in the SEC sanction cases. DeFi has not been dealt with in general blockchain regulation discussed and enforced in recent years, whose finding indicates that DeFi is extremely difficult to handle from the perspective of regulators.

B. Who is Subject to Regulation?

Financial intermediaries function as the center of attracting demanders and suppliers of funds.⁷⁰ The need for an intermediary can be found in economies of scale that arise from concentrating on the demand and supply of money in one place.⁷¹ This means that there is an effect of reducing the search costs required for money demanders and suppliers to find each other and conclude a transaction.⁷² Intermediaries play the role of collecting and managing funds. Risks are concentrated in these intermediaries. Focusing on intermediaries is an effective way to regulate the entire financial system under these conditions.

⁶⁵ Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937.

⁶⁶ EU MiCA, recital 23.

⁶⁷ MiCA arts. 4(1), 16(1) & 59(1).

⁶⁸ SEC, *Running on Empty: A Proposal to Fill the Gap Between Regulation and Decentralization*, Speech by Hester M. Peirce, Commissioner (Nov. 9, 2021), <https://www.sec.gov/news/statement/crenshaw-defi-20211109>.

⁶⁹ SEC, *In the Matter of BlockFi Lending LLC*, Administrative Proceeding File No. 3-20758, at 5, <https://www.sec.gov/files/litigation/admin/2022/33-11029.pdf>.

⁷⁰ Zetzsche, Arner & Buckley, *supra* note 47, at 175.

⁷¹ Kirvesoja, *supra* note 2, at 13.

⁷² *Id.* at 12.

Traditional finance legislation permits only entities that satisfy market entrance requirements (capital requirements, appropriateness of controlling shareholders, governance requirements, etc.) to engage in financial services and activities (regulated activities) using an authorization system. Financial services and activities performed by unauthorized persons are criminally liable in most jurisdictions. Authorized persons are required to comply with business conduct rules, governance and organizational rules, and prudential rules. In this respect, financial regulation centers on financial intermediaries.

Intermediaries are also expected to possess financial expertise. One of the important goals of financial supervision is to allow more information to be made public to resolve information asymmetry.⁷³ Intermediaries play a role in resolving information asymmetry by utilizing their expertise.⁷⁴ The suitability test of banks in relation to soliciting financial products and investment banks' due diligence as part of their securities underwriting procedures, both of which are mandatory, is understandable in this context.

Enforcement of financial regulation focuses on the role of intermediary, too.⁷⁵ Intermediaries are responsible not only for complying with laws and regulations on their own, but also for monitoring and supervising the compliance of others. For example, the Stock Exchange has the primary power to sanction its members for violations of laws or exchange rules.⁷⁶ When a financial institution entrusts part of its business to a third party, it should guarantee third party compliance with laws and regulations.⁷⁷ The role of the supervisory authority may be reduced by relying on the efforts of such intermediaries.⁷⁸

The services provided by DeFi (e.g., lending, borrowing, securities transactions, and asset management) are, in principle, subject to financial laws, as such activities, in nature, constitute the target of financial regulation (regulated activities). However, finding a target for implementing financial regulations is difficult if no one is responsible for making decisions, coordinating, and implementing financial services and activities under fully decentralized finance.⁷⁹ It is difficult to apply traditional financial regulations focusing on a specific entity with a fixed physical location to

⁷³ *Id.* at 13.

⁷⁴ *Id.* See also Johnson, *supra* note 18, at 1929 & 1931.

⁷⁵ Zetzsche, Arner & Buckley, *supra* note 44, at 177.

⁷⁶ Johnson, *supra* note 18, at 1939.

⁷⁷ Zetzsche, Arner & Buckley, *supra* note 44, at 187.

⁷⁸ *Id.*

⁷⁹ Buenfil & Romanowski, *supra* note 55, at 136.

DeFi where there is no physical place or specific actor in charge of its operation.⁸⁰

Nonetheless, decentralization seems to exist on various spectrums rather than as a binary matter. It is not true that there is no one responsible for DeFi. The degree of decentralization or role of the operator differs for each DeFi service.⁸¹ It is impossible to reflect all possible future scenarios at the time of writing the initial smart contract code,⁸² so that there seems to be at least a minimum number of personnel responsible for the continuous operation of codes. Many DeFi services have admin keys that allow developers to modify the protocols at an early stage.⁸³

The initial founders of Compound Protocol had the authority to discontinue services, such as loans, which was subsequently transferred to a six-member committee at the founder's proposal.⁸⁴ The committee is responsible for the DeFi operations. Although it is theoretically plausible to assume that DeFi operates in a fully decentralized manner without one responsible operator, there appears to be an individual or organization that performs the minimal role necessary to operate DeFi, such as modifying the code in the real DeFi world.⁸⁵

DeFi services seem to base themselves on decentralized decision-making. One means is governance tokens such as AAVE, COMP, and MKR in DeFi services, which give holders the right to vote on protocol decision-making.⁸⁶ However, it appears that voting cannot cover all daily operations, which are still performed by developers or other responsible persons.⁸⁷ DeFi tends to move in response to the recent introduction of crypto-asset regulation, and the moving direction seems mixed. One possibility is that DeFi projects strengthen decentralization and disintermediation to circumvent crypto-asset regulations, which are about to be implemented globally.⁸⁸ However, at the same time, we also find some DeFi services organize themselves to comply with regulations in line with the implementation of crypto-asset regulations, which is driven by necessity to decrease future compliance risk.⁸⁹ Some DAOs were reportedly

⁸⁰ *Id.*

⁸¹ Salami, *supra* note 46, at 427.

⁸² Sean Kwon, *Regulation of DeFi Lending: Agency Supervision on Decentralization*, 24(2) COLUM. SCI. & TECH. L. REV. 409 (2023).

⁸³ Blockchain Governance Initiative Network [BGIN], *Present and Future of a Decentralized Financial System and the Associated Regulatory Considerations* (Nov. 11, 2021), at 23, <https://bgin-global.org/docs>; Verstein, *supra* note 56, at 11.

⁸⁴ Kwon, *supra* note 82, at 386.

⁸⁵ *Id.* at 396.

⁸⁶ BGIN, *supra* note 83, at 18.

⁸⁷ Kwon, *supra* note 82, at 403.

⁸⁸ BGIN, *supra* note 83, at 18.

⁸⁹ *Id.* at 19.

converted to a limited liability companies (LLC) under Delaware State law.⁹⁰ Another aspect is that closed blockchain is operated by traditional finance intermediaries attempting to absorb blockchain technology.⁹¹ In this case, the organization and substance of traditional intermediaries may remain targets of financial regulation.

In this respect, Gary Gensler, the Chairman of the US Securities and Exchange Commission (SEC), repeatedly remarked that US securities regulations could be applied to DeFi by focusing on any centralized part of DeFi.⁹² The US SEC decided that Ether Delta, a DEX platform, violated Article 6 of the US Securities Law, which stipulated the prior registration obligation of securities transaction platforms.⁹³ EtherDelta provides an order-book interface concentrating on buy and sell orders like traditional exchanges. Except for this, transactions were run 24/7 by smart contracts programmed in the Solidity language, and the validation and recording of these transactions were also performed through the blockchain network. Nevertheless, EtherDelta has its own listing rules and performs an audit as part of the crypto-asset listing approval procedure.⁹⁴ A centralized part of the operation still existed even in DEX and became subject to the enforcement of traditional securities regulations.

C. Embedded Regulation

Any person responsible for the operation may be envisaged, even in an extreme degree of decentralization. However, it is still difficult for the DeFi operator to be equipped with the same level of human and physical structures as traditional financial institutions. DeFi will not be maintained if the law dictates that the DeFi operator should maintain capital, human, and organizational resources. As currently stipulated, this will undermine the possibility of financial innovation driven by new technology. One alternative approach is to use the technological traits of DeFi in designing regulations rather than asking the DeFi services to conform to the current financial regulation, which is intrinsically not fit for the new technology.⁹⁵

Embedded supervision assumes that supervisors can obtain the information as

⁹⁰ *Id.*

⁹¹ Johnson, *supra* note 18, at 1952.

⁹² SEC, Prepared Remarks of Gary Gensler on Crypto Markets, Speech by Gary Gensler, Chair of Penn Law Capital Markets Association Annual Conference (Apr. 4, 2022), <https://www.sec.gov/news/speech/gensler-remarks-crypto-markets-040422>.

⁹³ SEC, Cease-and-Desist Order on Zachary Coburn, Release No. 8453 (Sept. 8, 2018), <https://www.sec.gov/files/litigation/admin/2018/34-84553.pdf>.

⁹⁴ *Id.* at ¶ 13.

⁹⁵ Raphael Auer, *Embedded Supervision: How to Build Regulation into Decentralised Finance* 3 (BIS Working Papers No. 811, 2019), <https://www.bis.org/publ/work811.pdf>.

they need to regulate in real time on a blockchain.⁹⁶ This may be possible because the smart contract codes and transaction details are made public on the blockchain and can be analyzed, aggregated, and reported to the authority automatically.⁹⁷ Embedded supervision may be more reliable and less time-consuming than manual compliance by service providers.⁹⁸ It may also reduce the cost of both the service provider's information production and authorities' checks and verifications.⁹⁹ The reduction in regulatory costs supports the expansion of competition in the financial market by providing greater benefits to small financial institutions than to large ones.¹⁰⁰

Embedded compliance or enforcement goes a step further. The requirements stipulated in the financial laws and instructions of the authorities may be implemented in smart contracts. This is a system of decentralization of regulations in addition to the decentralization of finance.¹⁰¹ For instance, Basel III may be embedded by setting certain limitations on the balance of loans and the distribution of risk attributes in smart contracts.¹⁰² Anonymity is a potential threat to DeFi, and AML needs to be introduced in DeFi. AML can be implemented by installing an automated customer-check system in a smart contract. In addition, most jurisdictions have various limitations regarding the allocation of funds in the investment fund industry. Limitations, such as the possible maximum investment amount on one stock or issuer, may be implemented in smart contracts.¹⁰³

This approach could shift the focus of financial regulation from intermediaries to smart contracts. The mandatory prior-disclosure system of a smart contract will be one option, where smart contracts will be subject to checking and verifying with the public, including expert groups, prior to execution.¹⁰⁴ Check and verification may be assumed by state regulators or any public entity, partially or wholly, depending on the system design, as part of embedded regulation. This will be able to effectively substitute the current way of enforcement of regulation (including entrance requirements).¹⁰⁵

⁹⁶ Buenfil & Romanowski, *supra* note 55, at 139.

⁹⁷ Zetzsche, Arner & Buckley, *supra* note 44, at 203.

⁹⁸ Douglas Arner, Raphael Auer & Jon Frost, *Stablecoins: Risks, Potential and Regulation*, 39 FIN. STABILITY REV. 114 (2020).

⁹⁹ Auer, *supra* note 95, at 3.

¹⁰⁰ *Id.* at 4. See also Arner, Auer & Frost, *supra* note 98, at 116.

¹⁰¹ Zetzsche, Arner & Buckley, *supra* note 44, at 172.

¹⁰² Auer, *supra* note 95, at 3.

¹⁰³ Schär, *supra* note 21, at 168.

¹⁰⁴ OECD, *supra* note 45, at 12.

¹⁰⁵ Olivier Fliche, Julien Uri & Mathieu Vileyn, "Decentralised" or "Disintermediated" Finance: What Regulatory Response? (2023), at 34, <https://acpr.banque-france.fr/en/decentralised-or-disintermediated-finance-what-regulatory-response>.

D. Global Nature of DeFi

DeFi's decentralized nature appears to raise concerns related to over-regulation. The argument starts with the fact that each supervisory authority can enforce laws only on a part of the blockchain network. However, this will affect the entire blockchain network. Based on this argument, multiple exercises by each regulator will lead to overregulation,¹⁰⁶ which would be particularly burdensome to DeFi when such regulations conflict.¹⁰⁷ However, as far as DeFi is concerned, the problem lies in no regulation or under-regulation rather than over-regulation. This is related to difficulties in exercising laws on DeFi agents or blockchain networks.

In traditional financial services, the primary center of regulation is the financial company's registration. This seems led by the fact that the current finance law starts from authorization of a financial institution. The design, production, marketing, and execution of financial services or products are primarily under the supervision of intermediary's regulators. The issue of duplicate regulation arises in the next step. For instance, overseas marketing of a financial product may be subject to laws of the state where the product is marketed, in addition to the laws which are applied to intermediaries' registration place. The basic situation of DeFi is not wholly different in that DeFi codes created in one place are used anywhere in the world, and the malpractice of code composers adversely affects users in multiple jurisdictions.

However, the allocation of supervisory powers among regulators does not appear an issue at this point. Additional control points at which each regulator intervenes in traditional financial services include the location of the investor (customer of financial services), marketing location of finance products, and trading location of the product.¹⁰⁸ In practice, these additional points are difficult to apply to DeFi.¹⁰⁹ This is because DeFi minimizes human involvement during the operation. The location of DeFi investors is difficult to ascertain and the solicitation activities of DeFi services do not exist outside the network. The trade of DeFi products involves validation by distributed nodes online, which makes it difficult to ascertain trading place.

Regulation becomes complex when it is difficult to pinpoint specific actionable activities or identify individuals or organizations responsible for executing these activities.¹¹⁰ The basic problem lies in that there seems not to be any means for

¹⁰⁶ Roco Sarel, Hadar Jabotinsky & Israel Klein, *Globalize Me: Regulating Distributed Ledger Technology*, 56(2) VAND. J. TRANSNAT'L L. 441 (2023).

¹⁰⁷ Kirvesoja, *supra* note 2, at 27.

¹⁰⁸ Zetzsche, Arner & Buckley, *supra* note 44, at 185.

¹⁰⁹ *Id.*

¹¹⁰ *Id.* at 187.

supervisory authorities to regulate the blockchain network itself.¹¹¹

The regulation on smart contract developers or persons responsible for smart contracts is a viable option under this situation. This approach is linked to the idea of embedded regulation, as it should be based on the interaction between the code developer and the regulator.¹¹² It is premature to conclude at the current early stage of DeFi. However, other points for regulator to intervene except for the codes does not seem plausible. Presumably, the role of the main regulator supervising the program is higher in DeFi than in traditional finance.

In this situation, if regulations are implemented only in a few jurisdictions or if the regulatory requirements of each jurisdiction differ, the possibility of regulatory arbitrage naturally arises,¹¹³ as DeFi services may change their place easily.¹¹⁴ On the other hand, global nature suggests that regulators may race to the bottom, so that each jurisdiction attracts more DeFi services in its own territory. Blockchain legislations in State of Wyoming which declares itself “blockchain-friendly” or the “Delaware of Digital Assets” is such an example.¹¹⁵

In the case of global financial services, soft laws are established by international organizations at the international level, and each country enacts laws based on them, which tend to harmonize the laws of each jurisdiction.¹¹⁶ The Financial Action Task Force (FATF) has issued guidance on AML measures, which has required each jurisdiction to introduce AML obligations of crypto-assets providers, in recent years.¹¹⁷ The AML rules of each jurisdiction are very similar, even in details such as the definition of crypto-assets, range of crypto-assets service providers (CASP), and duties of CAPS, following FATS guidance. This is a realistic approach to DeFi regulation.¹¹⁸

¹¹¹ Buenfil & Romanowski, *supra* note 55, at 136.

¹¹² *Id.* at 139.

¹¹³ Johnson, *supra* note 18, at 1948.

¹¹⁴ Financial Stability Board, *supra* note 1, at 8.

¹¹⁵ See e.g., Anna Baydakova, *Wyoming: Regulatory Clarity and Crypto-Friendly Banks Fuel Blockchain Revolution*, COINDESK (June 27, 2023), <https://www.coindesk.com/consensus-magazine/2023/06/27/wyoming-regulatory-clarity-and-crypto-friendly-banks-fuel-blockchain-revolution>.

¹¹⁶ Zetzsche, Arner & Buckley, *supra* note 44, at 185.

¹¹⁷ FATF, Updated Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers (2021), at ¶ 15, <https://www.fatf-gafi.org/content/dam/fatf-gafi/guidance/Updated-Guidance-VA-VASP.pdf.coredownload.inline.pdf>.

¹¹⁸ Sarel, Jabotinsky & Klein, *supra* note 106, at 472.

V. Conclusion

DeFi is not fundamentally different from the services provided by traditional finance, such as deposits, loans, and securities transactions. The risks DeFi poses to investor protection and macroeconomic stability are not significantly different from those of traditional finance, either. The principle of “same risk, same rules” naturally requires financial regulation to be applied to DeFi, which eliminates the possibility of regulatory arbitrage.¹¹⁹ While there have been significant strides in crypto-asset regulation overall, such as the development of AML laws, the EU’s MiCA regulations, and the application of the Howey Test in the US, discussions pertaining to DeFi remain comparatively limited. This reflects the difficulties in regulating DeFi, as it derived from the fact that DeFi services do not include intermediaries who are subject to traditional financial regulations.

However, it is not practical to envision financial services devoid of human participation. This regulation can be applied to the code and operation personnel. In this course, some of the current financial legislation is difficult to apply. For instance, the requirement for incorporation or capital requirements above the threshold is not suitable for DeFi. Current regulations need to be modified in many ways and the technological traits of DeFi are utilized. One possible approach is to use the embedded regulations.¹²⁰ In addition, to block possible regulatory arbitrage and race to the bottom, the rules of each jurisdiction must be harmonized.

Thus far, blockchain regulations in general have mainly been concerned with investor protection mechanisms such as the disclosure of white papers. However, the ripple effect of a crisis in DeFi may be heightened due to its high composability and connectivity with traditional finance. As far as DeFi is concerned, it is necessary to introduce measures to block the contagion of risk,¹²¹ whose specific means are yet to be explored.

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¹¹⁹ Arner, Auer & Frost, *supra* note 98, at 97.

¹²⁰ Auer, *supra* note 95, at 2.

¹²¹ Financial Stability Board, *supra* note 1, at 21.