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The Challenges Posed by Decentralized Finance to Traditional Financial Regulatory Frameworks and Pathways for Restructuring

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Abstract. Decentralized Finance (DeFi) refers to an open financial ecosystem built on blockchain technology that does not require the participation of centralized institutions. The technology and operational mechanisms it employs represent a significant "paradigm mismatch" with the current financial regulatory framework. This paper examines the comprehensive impact of DeFi on existing financial regulation from multiple perspectives, including the blurring of regulatory authority and a lack of accountability; the difficulty in identifying regulatory targets and the ambiguity in determining their nature; the ineffectiveness of regulatory rules and the absence of relevant provisions; overlapping jurisdictions, and difficulties in enforcement. Through a comparative study of regulatory experiences in the United States, Europe, and other regions, this paper proposes solutions such as shifting the existing regulatory philosophy toward functional regulation, embedding compliance requirements into the underlying technology at the institutional level, and strengthening international cooperation at the operational level, while also discussing the specific context in China. This paper identifies a threefold paradigm mismatch between decentralized finance and traditional financial regulation, giving rise to multiple regulatory challenges such as difficulties in holding entities accountable, ambiguity in defining regulatory targets, ineffective regulatory rules, and obstacles to cross-border enforcement. A comparison of regulatory practices in the U.S. and Europe reveals that it is difficult for any single country to independently manage the risks associated with globalized DeFi.

Keywords: Decentralized Finance, Financial Regulation, Functional Regulation, Smart Contracts, Regulatory Restructuring

1. Introduction

Decentralized finance (DeFi) is an emerging financial model that deeply integrates blockchain technology [1]. As a globally accessible internet-based financial ecosystem, DeFi aims to replace the traditional financial system—which is heavily regulated, opaque, and based on technologies and standards from decades ago [2]. In recent years, the DeFi industry has experienced rapid growth, achieving a total value locked (TVL) of up to $233.71 billion across multiple blockchain ecosystems and applications. However, DeFi's rapid expansion has been accompanied by deep-seated risks, such

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as the absence of regulatory frameworks and a lack of systematic planning [2]. Traditional financial regulation is based on an institutional regulatory paradigm, targeting licensed financial institutions and limited by territorial jurisdiction—this institutional framework, built upon a centralized financial system, is facing unprecedented regulatory challenges when confronted with a financial ecosystem that is "decentralized, borderless, and without a central authority." This paper aims to systematically reveal the paradigm mismatch between DeFi and traditional regulation, analyze the multidimensional challenges DeFi poses to the regulatory framework, and, based on a comparison of regulatory practices in other jurisdictions, explore pathways for restructuring the regulatory framework, with the goal of providing a theoretical reference for improving China's DeFi regulatory policies.

2. The rise of DeFi and the intrinsic conflict with regulatory paradigms

The DeFi technical architecture is based on distributed ledgers, smart contracts, and consensus mechanisms, and is characterized by code-based governance, minimal intermediation, permissionlessness, and anonymity [2]. Traditional financial regulation, however, operates under an institutional regulatory model. Under this model, regulatory authorities target licensed financial institutions, achieving their regulatory objectives by issuing licenses, requiring institutions to maintain adequate solvency, mandating public disclosure, and conducting on-site inspections. This approach requires a market environment where the responsible parties are clearly defined, transaction counterparties are identifiable, and geographic locations are well-defined [3].

There are three types of paradigm mismatches between the two: In terms of the logic of agents, traditional regulation attributes responsibility to "people," whereas governance in DeFi relies on "code"; when losses result from defects in smart contracts, it is difficult to determine who bears liability; In terms of spatial logic, regulation is geographically bound, whereas DeFi protocols are global and borderless, leading to jurisdictional issues in cross-border transactions; in terms of temporal logic, laws and regulations lag behind, while technological advancements in DeFi occur on a daily or even hourly basis; smart contracts can be updated or forked at any time, creating a persistent regulatory gap [4]. This is precisely the root cause of all subsequent problems.

3. Multidimensional challenges DeFi poses to traditional regulatory frameworks

3.1. Blurred regulatory entities and lack of accountability

The greatest regulatory dilemma facing DeFi is the "inability to identify responsible parties"—that is, the blurring of regulatory entities makes it impossible to assign accountability. Traditional financial regulation targets licensed financial institutions, each of which has a clear legal entity, registered address, board of directors, and actual controller. However, DeFi protocols are generally created by decentralized autonomous organizations (DAOs) or anonymous teams of developers. A DAO is a new type of autonomous organization operating online in the form of code, and it exists in a legal gray area under current laws and regulations [5]. Composed of capital, narrative, technology, and their interrelationships, the legal personality of a DAO is at odds with existing legal provisions.

The result of this lack of a clear regulatory authority is a void in accountability. When security issues, fraud, or harm to investor interests arise in DeFi protocols, regulatory authorities are unable to identify a specific entity to hold legally accountable, and users who suffer losses are unable to seek redress through legal means. Financial regulation of virtual currencies faces challenges such as

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a lack of supporting laws and regulations, as well as unclear regulatory authorities and responsibilities.

3.2. Difficulties in identifying and classifying regulatory targets

The second challenge DeFi poses to regulation is the difficulty in "identifying the subject," meaning that regulatory targets are hard to define and categorize. Novel concepts emerging from DeFi—such as liquidity mining, flash loans, and yield aggregators—are difficult to classify under existing categories of financial instruments.

A more fundamental issue is the lack of consensus regarding the nature of crypto assets themselves. Opinions vary among countries as to whether cryptocurrencies are securities, commodities, currency, or virtual property. In the United States, there is internal disagreement on this issue: Democrats believe that the vast majority of cryptocurrencies should be classified as "securities" and subject to strict regulation by the Securities and Exchange Commission (SEC), while Republicans advocate treating cryptocurrencies such as Bitcoin and Ethereum as "commodities" and placing them under the jurisdiction of the Commodity Futures Trading Commission (CFTC) [6]. Smart contracts are both code and contracts, so their nature is ambiguous —are they legally binding contracts, or merely technical tools for executing code? This uncertainty creates a regulatory vacuum regarding "who should regulate them and how."

3.3. Regulatory failure and regulatory gaps

The third regulatory challenge posed by DeFi is "inability to regulate effectively," meaning that existing regulatory rules are largely ineffective in the DeFi context, and there are significant regulatory gaps.

The ineffectiveness of existing rules manifests in many ways. Anti-money laundering (AML) regulations require financial institutions to conduct Know Your Customer (KYC) due diligence; however, the anonymity of DeFi makes KYC unfeasible. Disclosure regulations require issuers to provide information on their financial condition and operations, but there is no such thing as an "issuer" in DeFi protocols. Capital adequacy regulations require financial institutions to maintain a certain ratio of capital buffers, but the concept of "capital" does not exist in DeFi protocols. Furthermore, a vast number of DeFi activities fall outside the scope of any regulation [7]. For example, regarding stablecoins, although developed countries such as the United States and Europe have established regulatory frameworks based on the transparency of reserve assets and the scope of operations, there remain significant loopholes in the oversight of the minting process, leverage ratios, and risk contagion. This constitutes what is known as a "legal vacuum," which is detrimental to investor rights and also poses the risk of systemic risks spreading to traditional financial markets [8].

The decentralized and cross-border nature of DeFi undermines the foundation of territorial jurisdiction, leading to jurisdictional disputes—both positive and negative—among nations. Furthermore, due to anonymity and the global distribution of protocols, it is difficult to enforce rulings, making it necessary to establish a new approach to cross-border dispute resolution and law enforcement cooperation.

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4. Comparison of extraterritorial regulatory practices and implications

The United States has adopted a market-oriented approach, planning to introduce laws related to stablecoins and digital assets in 2025 and establish a three-tier regulatory framework; however, the division of jurisdiction between the SEC and the CFTC remains a subject of controversy [9]. Europe has enacted the MiCA legislation to establish a centralized regulatory framework, which classifies crypto assets and sets forth disclosure and conduct-based regulatory requirements throughout their entire lifecycle, representing the most comprehensive initiative in the region to date [8]. Overseas experience demonstrates that regulation must strike the right balance between security and innovation; centralized legislation is preferable to a decentralized approach; and since no single country can control the process of globalization, international cooperation is essential.

5. Pathways for reconstructing the regulatory framework

5.1. Paradigm shift: from entity-based regulation to function-based regulation

The fundamental challenge DeFi poses to traditional regulation is that it overturns the regulatory foundation of "entities." Since "entities" cannot be identified or effectively managed, regulators must chart a new course—shifting the focus from "who is doing it" to "what is being done."

Functional regulation focuses on the functions of financial activities rather than on regulating the entities themselves. In the DeFi context, this means that instead of asking "who is operating the protocol," the focus should be on "what financial services the protocol provides"—such as lending, trading, asset management, or payment and settlement—and regulatory requirements should be formulated accordingly [10].

5.2. Institutional innovation: embedding compliance elements into the underlying technology

Once this shift in philosophy is established, the next step is to consider "how to regulate." The characteristics of DeFi code governance also present a new possibility for regulation—transforming compliance requirements into code parameters and implementing them at the technical level.

This approach is known as "Regulatory Technology" (RegTech) and "embedded regulation" [5]. Traditional "ex post supervision"—that is, regulation that occurs only after a violation has taken place—can no longer meet the needs of DeFi's rapid development. Instead, the focus should be on "ex ante embedding," which involves incorporating anti-money laundering screening, transaction limits, risk disclosures, and other measures directly into the smart contract code during its development [11].

5.3. Mechanism development: advancing international regulatory coordination

The global nature of DeFi means that regulatory efforts by any single country are unlikely to be effective. When one country tightens regulations, DeFi activities may simply migrate to jurisdictions with looser regulations; when a country attempts to enforce the law, the defendants and assets involved may be spread across dozens of countries. Therefore, the restructuring of the regulatory framework must include a dimension of international coordination. It is worth noting that there is a certain alignment between the "decentralization" of blockchain and the "denationalization" of private international law, which provides a theoretical basis for the application of conflict-of-laws principles in the DeFi sector. International regulatory coordination does not involve re-establishing

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centralized control over DeFi, but rather building a multi-centered, networked governance mechanism based on the recognition of the reality of decentralization.

5.4. Optimizing China's approach

Due to the global nature of DeFi, regulation by any single country acting alone is ineffective. When one country tightens regulatory measures, DeFi may shift to jurisdictions with weaker regulation; when a country attempts to investigate a case and gather evidence, the defendants and assets involved may be scattered across multiple countries. Therefore, a new regulatory framework should incorporate elements of international cooperation. Furthermore, the "decentralization" of blockchain shares certain commonalities with the "denationalization" in private international law, which also opens up possibilities for the application of private international law in DeFi. International regulatory cooperation does not entail establishing a centralized control mechanism on top of DeFi, but rather forming a polycentric, networked management model based on the premise of accepting decentralization [7].

China has adopted a cautious, risk-management-oriented approach to the regulation of cryptocurrencies and DeFi, which has, to a certain extent, prevented the occurrence of financial risks but also involves issues of overregulation that need to be addressed [9]. By clarifying the dual-track approach of "prohibition within China and strict regulation overseas," China can continue to enforce a comprehensive ban on domestic virtual currencies and related activities while incorporating real-world assets (RWAs) into the overall management system. The CSRC's filing system opens a "narrow window" for legitimate business operations, marking a shift from an outright ban to a ban with a "narrow window." We should refine the framework for coordination between central and local authorities and collaboration among various departments. Provincial-level people's governments should be responsible for risk prevention, control, and resolution within their jurisdictions, while local financial regulatory authorities should take the lead in establishing effective communication and coordination mechanisms with central authorities, thereby shifting governance from centralized crackdowns to routine, integrated operations.

6. Conclusion

Due to its characteristics of code-based governance, minimal intermediation, and global, permissionless access, DeFi poses a comprehensive challenge to the institutional standards, principle of territoriality, and rule-based approaches upon which traditional financial regulation relies. These challenges stem from issues such as the blurring of legal subjects, the difficulty in determining legal objects, the ineffectiveness of regulations, and jurisdictional difficulties—all resulting from differing technological and legal paradigms. International experience also demonstrates that unilateral solutions are ineffective. The solution lies in simultaneously shifting the regulatory paradigm toward functional regulation, institutionally integrating compliance with technology, and strengthening international cooperation through institutional mechanisms. China needs to support innovation while mitigating risks, striking the right balance between the two, and participating in global digital financial governance with an open and inclusive attitude. This paper does not employ empirical quantitative methods to measure the contagion of DeFi risks, nor does it provide a detailed analysis of specific domestic cases; thus, there remains potential for further research. Future studies could explore the implementation of compliance embedded in smart contracts, cross-border cooperative regulatory rules for DeFi, and a differentiated digital finance regulatory system tailored to China's national conditions.

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