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A Review of Research on Financial Data Security Regulation

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Abstract

This paper presents a comprehensive overview of the research advancements in financial data security regulation in China, with a particular emphasis on issues pertaining to financial data security and the protection of personal financial information. The study delineates several strategies for ensuring financial data security, including the establishment of a robust security protection framework, the implementation of a "sophisticated regulation" approach, the enhancement of risk prevention measures, the creation of a comprehensive financial data classification system, and the safeguarding of financial data throughout its lifecycle. Scholars have proposed a variety of specific measures, such as the utilization of trust models and authentication technologies to bolster data security, the establishment of monitoring mechanisms for third-party data trust institutions, the adoption of technology-driven regulatory methodologies, and the improvement of cross-border financial data flow management. Furthermore, considerations regarding data quality, management challenges, the application of innovative technologies, and the competitive landscape of data sharing are critical for the standardization of financial data. Despite notable progress in both domestic and international financial data governance and regulation, several key areas remain inadequately addressed, including the establishment of uniform standards for cross-border data flows, the coordination among international regulatory bodies, and the integration of emerging technologies. Future research should adopt a more comprehensive and in-depth approach to develop an inclusive, adaptive, and forward-looking global financial data governance and regulatory framework. Such efforts are essential for promoting global financial stability and innovation while safeguarding consumer data rights and enhancing transparency and equity in financial markets.

Keywords

Financial data security, cross-border data flow, personal information protection, data governance.

1. Introduction

In the digital economy era, data has emerged as a pivotal production factor. Financial data are not only essential for the operational decision-making and risk management of financial institutions but also provide critical data support for socio-economic development and regulatory oversight. However, with the expansion of financial services and the exponential growth of data, the governance and protection of financial data have become increasingly complex and pressing, elevating the issue to a significant national strategic concern. Financial data governance encompasses various challenges, including monopoly, circulation, security, and standardization, all of which have profound implications for market stability, user privacy, and data interoperability. Although there has been notable progress in global financial data governance and protection, the rapid pace of technological advancement and business innovation has introduced new challenges that must be addressed. A comprehensive exploration of financial data governance and regulation is essential for facilitating the digital

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transformation of the financial sector and ensuring the stable and healthy development of financial markets.

2. Overview of Research on Financial Data Security Regulation in China

2.1. Financial Data Security and Personal Financial Information Protection

2.1.1. Financial Data Security Protection Rules

The concept of security is an important value to adhere to in social development, and it is particularly crucial to uphold this principle in the governance of financial data. Scholars in China have proposed five strategies for ensuring the security of financial data:

First, Constructing a Security Protection Framework. Yu Shengqi (2021) [1] and others have proposed a security protection framework based on trust models and authentication technologies to safeguard financial data from cyberattacks. Luo Yizhi (2020) [2] has suggested improved database security management techniques to better protect financial databases. Sun Tao (2021) [3] has proposed a security protection framework oriented towards the financial industry, based on the Internet of Things, to shield financial data from external network attacks.

Second, Adopting the Concept of "Sophisticated Regulation". Tian Aoni (2022) [4] advocates for establishing a monitoring mechanism for third-party data trust institutions to promptly detect violations and improve the quality of financial data usage. Yang Dong (2018) [5] posits that technology-driven regulation is an emerging governance approach that should leverage big data, cloud computing, artificial intelligence, and blockchain to construct a technology-driven regulatory system, thereby enhancing regulatory efficiency and intelligence. Furthermore, Yang Fan (2019) [6] argues for the establishment of a regulatory framework related to market structure, creating a standardized infrastructure system that encompasses multiple stakeholders. Su Yuhai (2020) [7] suggests cooperative regulation between financial institutions and regulatory bodies, advocating for the development of a financial data regulatory platform to achieve real-time oversight of financial data and mitigate systemic risks.

Third, Strengthening Risk Prevention and Control. Liu Shiqi (2022) [8] and others have proposed financial data security protection rules based on authentication technologies to ensure the security of financial data. Xing Zongfei (2022) [9] emphasizes the need to strengthen the IT emergency management of the Peoples Bank of China to safeguard the security of the financial system. Cheng Xuejun (2021) [10] explores the applications, risks, and challenges of artificial intelligence in consumer finance scenarios, recommending the enhancement of fundamental research in AI, the establishment of data sharing platforms, the improvement of consumer rights protection, the cultivation of interdisciplinary talents, and the promotion of a dual approach to AI governance and legal governance.

Fourth, Establishing a Robust Financial Data Classification and Categorization Mechanism. Zhong Hong (2021) [11] and Dong Lingguang (2021) [12] emphasize the critical importance of establishing a sound financial data classification mechanism. They argue that constructing a data security framework supported by data authorization and supervision should include: adopting different responsibility and authorization rules, establishing a comprehensive data management system, clarifying data usage rights and security management requirements, and defining the responsibilities and access rights of personnel at all levels of information processing to prevent information leakage. Zhang Boyuan (2022) [13] highlights the complexity and sensitivity of cross-border financial data flow and suggests the establishment of dynamic regulatory rules for financial data classification and categorization based on a principle of balancing interests to better safeguard national information security and citizens privacy.

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Fifth, Ensuring Financial Data Security Protection. Throughout the Entire Data Lifecycle. Zhan Weibiao (2021) [14] advocates for a thorough examination of management points at each stage of the data lifecycle, proposing the establishment of an information security management platform centered on data security. Zhang Zhaohui (2021) [15] suggests that effective technical measures, such as data erasure and data obfuscation, should be implemented during data collection, storage, transmission, and cleansing stages to prevent unauthorized access by third parties. Additionally, aligning these measures with a more detailed financial data security management strategy will contribute to the establishment of a comprehensive financial data security management system.

2.1.2. Protection of Personal Financial Data Rules

In recent years, the protection of personal financial data has emerged as a focal point in legal research. Scholars have engaged in in-depth discussions on various aspects, including safeguarding the exit rights of financial consumers, establishing a paid usage mechanism for personal financial information, improving consumer privacy remedies, protecting personal credit data, and addressing cross-border personal financial data protection.

Regarding the safeguarding of financial consumers exit rights, Fang Le (2022) [16] advocates for the formulation of differentiated "consent exception rules" to uphold the right of clients to refuse authorization for the use of their personal financial information. Cheng Xuejun (2021) [17] suggests the introduction of an explainability mechanism to enhance consumers understanding and trust in algorithmic decision-making. Feng Kai (2020) [18] points out that existing "opt-out" mechanisms have shortcomings and calls for the establishment of more reasonable and effective policies and mechanisms.

In terms of establishing a paid usage mechanism for personal financial information, Wang Yun (2021) [19] emphasizes that personal financial data possesses independence, scarcity, and high value. Therefore, a paid usage mechanism for financial customers personal information should be established to clarify the purpose, scope, and duration of financial institutions use of personal financial data.

Regarding the improvement of consumer privacy remedies, Li Siqi and Miao Yuting (2019) [20] propose methods to address challenges such as the difficulties faced by financial consumers in providing evidence and the lengthy litigation process. These methods include establishing diversified remedy channels and leveraging the roles of financial industry associations and independent third-party organizations. Sun Jin et al. (2023) [21] argue for strengthening legal frameworks for personal information protection to enhance judicial remedies for privacy damages.

In the context of personal credit data protection, scholars have discussed various approaches, including safeguarding consumer rights, enhancing regulatory enforcement, employing diverse technological measures, and reinforcing management and accountability. Tang Mingqin (2011) [22] argues for legislative measures to ensure consumer rights. Feng Wenjie (2022) [23] recommends strengthening the regulation of credit agencies and increasing penalties for violations to bolster the protection of personal credit data. Zhang Xiaoran (2021) [24] advocates for the adoption of various technological means to secure personal credit electronic data. Tian Kun et al. (2021) [25] suggest employing both technological and managerial strategies to enhance personal information security while strengthening regulatory and accountability mechanisms. Wu Xuli (2019) [26] proposes the improvement of personal credit systems and the establishment of robust mechanisms for the protection of personal credit information, along with the exploration of technological applications in credit data protection.

Regarding cross-border personal financial data protection, Peng Yue (2022) [27] advocates for balancing data flow and privacy through methods such as trade exceptions and trade matters. Huang Xianqing (2020) [28] calls for the establishment of specialized privacy enforcement

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agencies. Wen Shuying (2021) [29] suggests that China should actively participate in the formulation of international rules and cross-border privacy protection frameworks. Feng Yang (2018) [30] believes that countries should collaboratively construct and reach consensus on international standards. Wang Ting (2022) [31] analyzes the current situation of cross-border financial data flow mechanisms in China and proposes countermeasures, including strengthening supervision, improving laws and regulations, and establishing a cross-border personal financial data security protection mechanism.

2.2. Efficient Flow of Financial Data Elements

In Chinese academic circles, research on the efficient circulation of financial data elements has become a prominent topic. The main points are as follows:

2.2.1. Financial Data Rights Debate

Guo Bing (2017) [32], along with colleagues, proposed an analysis of the personal fund management model of banks from the perspectives of data property rights, privacy rights, revenue rights, and the right to know. They suggested establishing a personal data bank aimed at protecting individuals data rights and interests through data sharing and trading. Huang Hai (2021) [33] advocates for clarifying the ownership of government data assets and utilizing blockchain technology to enhance privacy protection and supervisory management. Zhang Jing (2023) [34] asserts that clear data ownership is a prerequisite for data exchange. He emphasizes that the core of credit data transactions lies in valuation and pricing, recommending the use of credible third-party platforms to provide data quality assessment and auditing services to enhance the credibility and transparency of data transactions.

2.2.2. Promoting the Construction of a Financial Data Flow System

Wang Guosai (2022) [35], along with colleagues, argued that the financial industry needs to establish an industry consensus to ensure that data flow is easily regulated, thereby preventing information leakage caused by the misuse or abuse of technology. They emphasized the necessity of building data circulation infrastructure at the industry level to facilitate the orderly flow of information. Lin Huizeng (2022) [36] pointed out that data development must occur under the premise of strengthening consumer information security protection, in order to promote the orderly circulation of data and achieve deep integration between institutional construction and legal improvement. Li-Nan Cai (2022) [37] suggests updating traditional fiduciary theory by amending laws and introducing judicial interpretations to meet the demands of the data era. License (2020) [38] and colleagues propose that personal data should be permitted to be shared among financial holding companies and their affiliates, while sharing and circulation to non-affiliated parties should be restricted. They also recommend establishing liability and remedies for data leakage to promote the circulation of credit information and avoid moral hazard and adverse selection, thus safeguarding the sound development of the financial market.

2.2.3. Establishment of an Open Banking Model

Xing Hui-Qiang (2021) [39] and Chen Meng (2020) [40] argue that the open banking model can dismantle the data monopoly held by traditional banks in the financial services sector. This model introduces third-party institutions and technology companies, establishes a user-centered business ecosystem, and enhances the efficiency and innovation of financial services. Xing Hui-Qiang (2021) [41] emphasizes that the open banking model serves as both the theoretical foundation and the most valuable application scenario for the introduction of data portability. He suggests that China should initially implement data portability through open banking. Xing advocates for a step-by-step, phased implementation strategy, whereby the industry management should evaluate the accumulated experience to determine whether to

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gradually introduce the right to data portability and establish a fund to support the protection of personal information.

2.3. Financial Data Monopoly

In the digital age, financial data has become a crucial means of production and economic resource. The phenomenon of financial data monopoly has emerged as a significant issue affecting fair competition in financial markets, prompting extensive research within the academic community.

2.3.1. Forms of Financial Data Monopoly

He Huizhang and Li Fengsen (2023) [42] argue that new forms of monopolization include platform ecological monopoly, data monopoly, algorithmic collusion, hub-and-spoke agreements, and stranglehold acquisitions. Xie Fusheng and Wu Yue (2021) [43] contend that platform competition is driven by factors such as users, attention, data, and algorithms, distinguishing it from the competition among traditional product-producing firms. This has led to three levels of monopoly among platform firms: horizontal monopoly platforms, large monopoly platform complexes, and hierarchical nested platform ecosystems.

2.3.2. Causes of Financial Data Monopolization

Domestic scholars identify four primary causes of financial data monopolization. First, the characteristics of the digital economy; second, the regulatory philosophy; third, the influence of networks and algorithms; and fourth, the ecosystem competitive advantage of fintech platforms and the function of data aggregation. He Huizhang and Li Fengsen (2023) [44] argue that characteristics of the digital economy, such as platformization, network effects, and virtualization, along with the regulatory philosophy characterized by tolerance and moderation, are the main drivers of this new form of monopolistic behavior. Chen Meng (2022) [45] points out that the innovation and integration of Internet finance complicate monopoly regulation, while the black box effect of platform data further increases the difficulty and cost of regulation. Liu Nailiang and Lv Haojie (2022) [46] suggest that fintech platforms leverage their ecosystem competitive advantages and data aggregation functions, which contribute to the monopolization of fintech data and heighten systemic financial risks.

2.3.3. Impact of Financial Data Monopolies

Domestic scholars primarily explore the impact of financial data monopolization from three perspectives: harming consumer interests, increasing financial risks, and undermining market competition. Han Mei (2022) [47] highlights that the phenomenon of data monopolization in the digital financial market enables relevant institutions to implement differentiated pricing through data manipulation, resulting in consumer losses. Xuechun Zhang and Xiaoxue Tang (2021) [48] note that Internet platform companies exhibit issues of data abuse, which adversely affect individuals credit data subjects and simultaneously undermine the healthy development of the financial industry. Zhang Ming (2021) [49] points out that large technology companies demonstrate a data-driven development logic, benefiting from their extensive customer bases and the vast amounts of data they collect and can process. However, their advantageous position in data collection due to technological resources makes them highly susceptible to triggering financial data monopolization, negatively impacting competition and stability in the financial market.

2.3.4. Strategies to Address Financial Data Monopolization

Strategies for addressing financial data monopolization primarily encompass two aspects.

First, there is a need to strengthen the construction of the antitrust legal system. He Huizhang and Li Fengsen (2023) [50] emphasize the necessity of promoting the interconnection and interoperability of digital platforms while balancing data sharing and openness with privacy protection. They advocate for enhancing the antitrust legal framework and synchronizing

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competition enforcement with competition advocacy. Sun Fangjiang (2021) [51] argues for the acceleration of data legislation concerning Internet platforms and suggests further guidance for leading organizations to assume corresponding social responsibilities. Feng Sixian and Yang Jing (2021) [52] propose that the digital RMB should be promoted steadily, along with strengthening legislative protections for data ownership and financial regulation.

Second, it is essential to reinforce the supervision and governance of financial platforms. Xuechun Zhang and Xiaoxue Tang (2021) [53] contend that divesting personal credit data, implementing macro-prudential regulation of platform companies, and enforcing functional regulation of subsidiaries are crucial steps in addressing the issue. Liu Nailiang and Lv Haojie (2022) [54] suggest constructing a governance mechanism for fintech data monopolization, with financial data governance as its backbone, and coordinating financial regulation with antitrust regulation to jointly prevent disorderly capital expansion. Chen Meng (2022) [55] argues for the improvement of the antitrust regulatory framework and methodology, enhancing regulatory penetration and evidence collection capabilities, and increasing the effectiveness of antitrust enforcement. Xie Fusheng and Wu Yue (2021) [56] recommend strengthening platform economic governance to limit monopolistic practices and mitigate the adverse effects of financial convergence on competition, innovation, consumer rights, and financial stability. Zhan Jia (2021) [57] points out the need to enhance the design and analytical framework of antitrust enforcement and establish a regularized mechanism.

2.4. Standardization of Financial Data

In terms of institutional construction, Lin Zheng and Yi Ronghua (2022) [58] argue that a robust regulatory framework for financial information should be established to enhance Chinas position and strength in global financial data governance. Chen Zhenyun (2022) [59] suggests that a financial platform for data trading and sharing should be created, data ownership laws should be clarified, and the enforcement of personal information protection should be strengthened.

Regarding security management, Yang Fuyu (2020) [60] emphasizes that the standardization of financial data must comply with legal requirements, improve and implement data security standards and technologies, and classify and manage data to ensure its security. In terms of international integration, Liu Xiaoxin (2019) [61] believes that the work on financial data standardization should draw on international experiences, and China should actively participate in the development of microdata standards while strengthening research and development in regulatory technology.

2.5. Cross-border Flow of Financial Data

Research on the cross-border flow of financial data primarily focuses on two aspects: cross-border data flow rules and regulatory rules for cross-border data flow.

2.5.1. Cross-Border Financial Data Flow Regulations

In the study of cross-border financial data flows, Chinese scholars have proposed a variety of governance and regulatory measures, ranging from inclusive governance, hierarchical regulation, and fine-grained regulation to front-end approval and long-arm jurisdiction. These measures emphasize data sovereignty and the dominant role of international cooperation and rule-making in ensuring the safety and smoothness of financial data flows.

Regarding the rules governing cross-border financial data flows, Ma Yanfei et al. (2020) [62] argue that there is currently no dedicated law in China for the protection of cross-border financial data, which exposes internet financial enterprises to legal risks as they expand internationally. They suggest that China should learn from international legislative experiences related to cross-border data flow and adopt corresponding measures tailored to the country's specific circumstances. Guo Dexiang et al. (2022) [63] advocate for a clearer definition of the

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scope of protection for personal financial information and data, the strengthening of relief mechanisms, and active participation in international rule-making. Ma Guang and Bu Xiaochui (2022) [64] propose that, based on the principle of data sovereignty, the rules governing the transmission of financial information should be enhanced within free trade agreements, advocating for a shift from being mere followers of international rules to becoming active rule-makers, thereby safeguarding China's interests in financial services and digital technology.

In terms of regulatory frameworks for cross-border data flows, Zheng Zhihang (2024) [65] highlights that data sovereignty requires a balance between individual control, national jurisdiction, and global rights and interests. Effective governance must consider the cultural, legal, and economic contexts of each country to achieve successful global data governance. Zhong Hong et al. (2022) [66] suggest that the regulatory scope and authority concerning cross-border financial data should be clearly defined, and that activities involving the cross-border flow of financial data should be prudently regulated to maintain a balance between security and liquidity. Si Weipan (2023) [67] explores the evolution of the European Union's governance regarding the cross-border transfer of personal data, emphasizing that China should actively promote international regulatory collaboration and establish a mutual trust mechanism for cross-border personal data transfers, grounded in respect for each country's data sovereignty.

Furthermore, Lai Xiaopeng and Guo Ziwei (2024) [68] analyze the legal risks associated with cross-border financial data flows and recommend the establishment of a cross-sectoral collaboration mechanism alongside a unified regulatory framework, underscoring the importance of a comprehensive domestic regulatory system. Peng Delai et al. (2022) [69] argue for the exploration of tiered regulatory rules for cross-border financial data flows based on risk assessments, tailored to different levels of risk and types of data. Lin Jie et al. (2021) [70] advocate for the formulation of dynamic data values and finely-tuned regulatory measures for various scenarios, emphasizing the need to assess the cross-border security of credit data and strengthen regulations on data transmission to navigate the complexities of the evolving cross-border data environment. Finally, Han Hongling et al. (2021) [71] suggest implementing prior approval, long-arm jurisdiction, and cross-border regulatory cooperation to establish a more effective regulatory framework.

This comprehensive analysis highlights the multifaceted approach Chinese scholars are taking towards the governance and regulation of cross-border financial data flows, emphasizing the need for both domestic and international collaboration to address the challenges posed by the digital era.

2.5.2. Cross-Border Data Flow Regulations

In terms of regulatory rules for cross-border data flows, the primary focus is on four categories of perspectives: first, constructing a more inclusive governance framework for cross-border financial data to enhance data mobility; second, establishing a robust hierarchical regulatory framework; third, refining regulatory measures and implementing stringent oversight; and fourth, executing a pre-approval process, establishing long-arm jurisdictional rules, and enhancing regulatory cooperation. Zhong Hong et al. (2022) [72] propose clarifying the regulatory scope of cross-border financial data, defining the regulatory authority of relevant subjects, prudently regulating activities related to the cross-border flow of financial data, and building a more inclusive governance framework while adhering to the red line of national security. Peng Delai et al. (2022) [73] argue that hierarchical regulatory rules for cross-border financial data flows should be explored based on risk assessments. Lin Jie et al. (2021) [74] contend that dynamic data values and detailed regulatory measures should be formulated for different scenarios, assessing the cross-border security of credit data and strengthening the regulation of data transmission. Tian Di et al. (2021) [75] suggest distinguishing between personal and non-personal data and enhancing the protection of outbound data from credit

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bureaus. Han Hongling et al. (2021) [76] recommend implementing prior approval, long-arm jurisdiction, and fostering cross-border regulatory cooperation.

3. Overview of Foreign Research on Financial Data Security Regulation

Foreign scholarship in the domain of financial data governance encompasses a broad spectrum of topics, including financial data security, the protection of financial consumer rights and interests, financial data quality, the efficient flow of financial data, financial data monopolization, the pivotal role of financial data governance in sustainable development, and the establishment of financial data standardization.

3.1. Regulatory Frameworks for Financial Data Security

Research on financial data security by foreign scholars is primarily concentrated on three dimensions: regulatory frameworks, regulatory technologies, and the enhancement of IT governance and regulatory mechanisms within financial institutions.

3.1.1. Regulatory Frameworks and Cybersecurity for Financial Data

The establishment of effective regulatory frameworks and cybersecurity mechanisms is paramount. Katterbauer et al. (2022) [77] argue for the development of novel regulatory and compliance frameworks, alongside robust cybersecurity measures, to safeguard financial data security and privacy. Kiayias et al. (2022) [78] highlight the necessity of balancing privacy protection with financial regulatory requirements, particularly in the context of implementing central bank digital currencies. Langley et al. (2021) [79] advocate for the fortification of financial data security and privacy protections, proposing the establishment of transparent data usage rules and regulatory frameworks to ensure compliance and security on fintech platforms. Kathryn (2017) [80] emphasizes that information gaps significantly contribute to shadow banking and systemic risk, necessitating comprehensive and accurate financial data collection and analysis to mitigate these issues. Barry (2021) [81] presents policy recommendations aimed at addressing the challenges posed by the platform economy, including the enhancement of regulatory cooperation and the establishment of regulatory sandbox mechanisms.

3.1.2. Technological Innovations in Financial Data Security

The adoption of new technologies is crucial for improving financial data security. Jaiswall et al. (2022) [82] advocate for the use of Generative Adversarial Networks (GANs) to synthesize financial data for fraud detection models, addressing the challenge of insufficient data and enhancing the accuracy and reliability of fraud detection. GANs consist of a comparative framework for blockchain interoperability implementation, which contributes to realizing blockchain interoperability. Asimadi et al. (2017) [83] advocate for a semantic approach to integrating, processing, and querying financial information embedded in the XBRL Business Reporting Standard, aiming to provide new insights and analytics within the financial ecosystem. Alexander et al. (2016) [84] note that while financial analytics can significantly benefit from big data, barriers remain in cleansing, integrating, modeling, and analyzing data across multiple sources, with a primary focus on extracting valuable financial information and addressing challenges in financial data integration.

3.1.3. IT Governance and Regulatory Oversight

There is a pressing need to strengthen IT governance and regulatory oversight within financial institutions. Kasamani (2020) [85] presents an evidence-based information technology controls framework, grounded in the NIST 53-800 framework, to enhance internal data governance and regulatory compliance within financial institutions. Bellomarini et al. (2021) [86] propose a reasoning-based approach to address privacy protection issues in financial data exchange, aiming to enhance the security and reliability of such exchanges while safeguarding

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personal privacy and sensitive information. Boissay et al. (2021) [87] examine the risks related to data privacy and market competitiveness arising from the entry of large technology firms into the financial services sector. Kregel et al. (2020) [88] note that technological innovations significantly impact the methods of financial data collection and processing, highlighting the privacy risks associated with the involvement of tech companies in financial services.

3.2. Financial Data Quality

Research on financial data quality encompasses two primary aspects.

3.2.1. Data Standardization in Financial Regulation

From the perspective of financial data standardization, Berner (2019) [89] explores the significance of data standardization in financial regulation and the challenges encountered in its implementation. The study argues that financial regulation must address coordination issues, delayed benefits, and other obstacles to achieve better data standardization and improved data governance.

3.2.2. Data Governance Modeling in Finance

Karkoskova (2022) [90] combines BCBS239 standards and the DAMA methodology to model data governance for financial institutions. BCBS239, set by the Bank for International Settlements, aims to standardize data management for G-SIBs to ensure compliance, while DAMA offers a framework for data management, including classification, definitions, architecture, and security. BCBS239 and DAMA principles provide a robust basis for improving data governance in finance. These articles focus on the processes involved in building and implementing a data governance model, emphasizing the importance of data quality, security, and sharing management. They provide a series of concrete recommendations and measures to better respond to the digital transformation and innovation needs of financial institutions.

3.3. Efficient Flow of Financial Data Elements

Efficient circulation of financial data elements is a crucial topic in the realm of financial data governance. International scholars have primarily approached this subject from the following perspectives.

3.3.1. Integration and Interoperability of Financial Data

Research in this area focuses on achieving efficient flow and interoperable sharing of financial data to enhance market efficiency. Neulinger (2022) [91] proposes a comparative framework for blockchain interoperability implementation, which contributes to realizing blockchain interoperability. Asimadi et al. (2017) [92] advocate for a semantic approach to integrating, processing, and querying financial information embedded in the XBRL Business Reporting Standard, aiming to provide new insights and analytics within the financial ecosystem. Alexander et al. (2016) [93] note that while financial analytics can significantly benefit from big data, barriers remain in cleansing, integrating, modeling, and analyzing data across multiple sources, with a primary focus on extracting valuable financial information and addressing challenges in financial data integration.

3.3.2. Financial Data Mining and Risk Management

Scholars have explored the application of data science techniques to identify and manage potential risks in financial markets. Maiti et al. (2021) [94] investigate the current state of intelligent methods and data mining techniques used to detect fraud in corporate financial statements. Azzawi et al. (2021) [95] suggest that data mining techniques and mathematical inductions can develop models to improve risk management operations and enhance business opportunities for banks and insurance companies. Farmer et al. (2021) [96] discuss the necessity for next-generation stress testing models that comprehensively consider the financial macro-environment for effective regulation and oversight of macro-financial dynamics in the

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global economy. Pernagallo et al. (2019) [97] present a primitive model of information overload, illustrating how such overload leads financial markets to deviate from traditional assumptions of information efficiency, focusing on understanding and responding to information overload in financial markets. Additionally, Das et al. (2019) [98] argue that extending widely used data science methods in social networks can facilitate monitoring systemic risk, concentrating on how to utilize these techniques to identify and address potential risks within the financial system.

3.3.3. Consistency and Governance of Financial Data

Research in this area emphasizes improving the quality of financial data to provide more accurate information for market participants. Fan et al. (2019) [99] explore the potential of formal inconsistency measurement techniques in the integration of financial data sets, defining a series of consistency rules for bank holding companies and legal entities. Bijlsma et al. (2019) [100] propose that a comprehensive analysis of financial account data and international investment position information can elucidate the interconnectedness within the financial system, thereby enhancing the understanding and management of systemic risk. Mancini (2021) [101] underscores the importance of data portability and interoperability in the financial sector for fostering competition among digital platforms.

3.3.4. Cross-border flow of financial data

In the research on cross-border financial data flows, foreign scholars have proposed a variety of regulatory and governance measures, ranging from constructing a comprehensive international framework and strengthening compliance with data localization policies to promoting legal safeguards in bilateral investment treaties and the implementation of digital trade agreements, emphasizing the importance of data sovereignty and international cooperation. These studies aim to reduce legal uncertainty and enhance the security and efficiency of cross-border financial transactions to ensure smooth and compliant global financial data flows. Through multi-level legal and policy harmonization, the scholars call on countries to work together to meet the challenges and opportunities presented by cross-border data flows.

In the context of the regulation of cross-border data flows, J. Chaisse (2023) [102] suggests that the increase in international investment is closely linked to cross-border data flows, which underpin global transactions. Domestic laws play a key role in the fragmentation of international investment law, and the laws of different countries may affect the cross-border transfer of financial data. Therefore, a comprehensive international framework to manage cross-border data flows is crucial, especially in the financial sector, where financial institutions need to ensure compliance and data security. Qianwen Zhang and Andrew E. P. Mitchell (2021) [103] point out that data localization policies significantly affect foreign investors by increasing operational costs and restricting data flows, which reduces cross-border investment attractiveness. Such policies may conflict with the principle of treatment of countries in international investment treaties, affecting risk assessment and compliance capabilities in the financial sector. A. N. Artemova (2023) [104] suggests that Russia's personal data law is in line with legal trends in other countries (e.g., the EU, the U.S., and China) in terms of extraterritorial applicability, reflecting the increasing stringency of financial data regulation globally. In addition, D. Popović and Svetislav V. Kostić (2018) [105] emphasize that cross-border flow of financial data involves complex legal and regulatory frameworks, and that legal uncertainty (e.g., retroactive interpretation of tax laws) may affect the security and predictability of cross-border investments and financial transactions. Such legal uncertainty may expose firms to unanticipated tax risks when conducting cross-border financial transactions, which may affect their investment decisions.

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In terms of rules for cross-border financial data flows, J. Chaisse and C. Bauer (2019) [106] suggest that bilateral investment treaties (BITs) may facilitate the transmission and use of cross-border financial data by providing a degree of protection for digital assets and legal security for foreign investors. N. Mishra and A. Valencia (2023) [107] note that digital trade agreements have important implications for the cross-border flow of financial data. These agreements (e.g., CPTPP, RCEP, ASEAN e-commerce agreement, and the Digital Economy Partnership Agreement (DEPA)) provide a legal framework and policy coordination for international cooperation in financial services by promoting the liberalization and facilitation of cross-border flow of data, which reduces legal barriers and uncertainties between different countries, and thus promotes the security and efficiency of financial transactions. Meanwhile, A. Hammad (2021) [108] mentions that new regional trade agreements (e.g., CPTPP, EPA, and USMCA) promote the free flow of data and regulate digital trade barriers, and these frameworks prohibit the localization of data centers and facilitate the cross-border data flows. Chiu-Wan Liu (2022) [109] points out that China's private fintechs play a key role in promoting cross-border financial data flows, and these platforms have not only facilitated the internationalization of the digital renminbi (e-CNY), but have also influenced other countries' financial policies and digital economy strategies.

3.4. Impacts of Monopolization of Financial Data

With the rise of tech companies in the financial services sector, the issue of data monopolization has come to the fore.

In terms of the monopoly phenomenon and its impact, Croxson et al. (2023) [110] argue that platform-based firms gain market advantage by monopolizing financial data, which may lead to unfair competition in the market and limit the development of financial inclusion. Klinge et al. (2023) [111] suggest that large tech firms accelerate their infrastructural dominance of the economy and society through corporate financialization, which strengthens their monopoly position and affects market competition. Birch et al. (2020) [112] focus on the interaction between innovation and finance, as well as the use of data rental rights, arguing that this could lead to the monopolization of financial data, restricting access and competition for other players. Boot et al. (2020) [113] contend that the rise of new communication channels could deconstruct the traditional banking business model, providing opportunities for financial data monopolization. Petry (2021) [114] emphasizes the key role of exchanges in the issue of financial data monopolization due to their possession of market data and the power to set market rules, which has far-reaching implications for capital markets and the participants involved. Feldman et al. (2021) [115] argue that the power of the financial sector has implications for non-financial firms, which may be exacerbated by the issue of data monopolies.

3.5. Financial Data Governance for Sustainable Development and Inclusion

3.5.1. Importance of Financial Data Governance for Sustainable Development

Financial data governance plays a crucial role in advancing sustainable development. Marbuah et al. (2022) [116] emphasize that comprehensive and accurate collection and analysis of financial data, as well as assessing the impact of bank financial flows on climate goals, can provide essential data support to regulators and thus promote sustainable development in the financial sector. Zachariadis (2020) [117] suggests that financial data sharing necessitates a thorough consideration of technological, regulatory, security, and privacy issues. Borgogno (2020) [118] examines the impact of account access rules and the data-sharing behaviors of large technology companies on the construction of financial data standardization. Such comprehensive frameworks are essential for ensuring that data governance aligns with sustainability objectives. Hurwitz (2020) [119] focuses on the application of policy tools such as digital transaction obligations, data portability, and interoperability. These tools not only

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help mitigate monopolistic behaviors in the marketplace of digital platforms but also have significant implications for financial data governance, thereby fostering a more sustainable financial ecosystem. Innovative technologies and applications play a vital role in financial data standardization. Mosteanu (2020) [120] discusses the application of XBRL (eXtensible Business Reporting Language) and blockchain technologies in this context, emphasizing the importance of financial data consistency, comparability, and security. Maiti et al. (2022) [121] explore advanced data integration methods adopted in banking, financial, and insurance software during the COVID-19 pandemic, aiming for seamless integration among different data sources. Croxson et al. (2023) [122] propose various policy approaches, including data standardization, data sharing, and cooperation, to promote platform-based financial inclusion and the sustainable development of digital finance. These strategies are crucial for ensuring that financial services are accessible and equitable, contributing to broader sustainability goals. Data sharing and the competitive environment are essential considerations.

3.5.2. Standardization of Financial Data

As a critical foundation for decision-making by financial institutions and market participants, the quality, consistency, and availability of financial data significantly impact the stability and efficiency of financial markets. In recent years, the construction of financial data standardization has attracted considerable attention from international scholars, focusing on several key aspects.

Data integration and consistency are essential. White et al. (2021) [123] emphasize the important role of standardized financial data in enhancing integration and interoperability. Harmonized standards and specifications facilitate the integration and analysis of financial data from diverse sources and formats. Patel (2019) [124] argues that big data integration techniques can eliminate data silos, thereby improving data consistency, availability, and comparability. Data quality and reliability are crucial considerations. Alexander et al. (2017) [125] and Boritz (2020) [126] contend that financial data standardization positively influences the quality and reliability of financial data. Standardization enhances the consistency and comparability of data, providing a more accurate and reliable basis for financial analysis and decision-making.

The institutional environment and management challenges associated with financial data standardization are significant. Quaglia (2022) [127] discusses the challenges and management dilemmas of financial data standardization within a complex institutional context. Financial data standardization can be facilitated by coordinating and managing financial data flows and leveraging regulatory technologies to enhance data consistency and comparability. Berner (2019) [128] focuses on challenges related to diverse data sources, differences in data formats, data quality issues, and conflicts among regulatory requirements and standards. He proposes several solutions, including strengthening international cooperation and coordination, developing harmonized data standards and specifications, employing technical tools and platforms to support the data standardization process, and enhancing data quality management and regulatory capacity.

4. Conclusion

Significant progress has been made in both domestic and international research on financial data governance and regulation, providing essential guidance for regulatory practice. However, current research falls short in several key areas: developing uniform standards for cross-border data flows, achieving harmonization among international regulators, and integrating emerging technologies into existing regulatory frameworks. Furthermore, there is a notable lack of attention to the impact of cultural differences on financial data governance and regulation. This oversight raises important questions about how to promote global financial stability and

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innovation while safeguarding consumer data rights and enhancing transparency and fairness in financial markets.Future research on financial data governance and regulation should be deepened and broadened to facilitate more comprehensive explorations aimed at establishing an inclusive, adaptive, and forward-looking global financial data governance and regulatory framework.

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