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Research on the Financial Mechanism of Sci-Tech Finance and the Market-Oriented Allocation of Data Elements

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Abstract: Countries around the world and China are actively promoting the cultivation of the data element market. As an important field of integration between finance and technology, "sci-tech finance" has also attracted much attention. The combination of the two has formed a new development logic under the background of the digital economy. Data elements possess asset-like attributes, quasi-public goods characteristics, and financial properties, but their marketization faces challenges such as difficulty in confirmation of rights and pricing. Sci-tech finance has a "dual-drive" function, which can promote the integration of science and technology with finance. There is an inherent compatibility between the two, the efficient allocation of data elements requires the support of sci-tech finance to solve problems such as right confirmation and pricing, and the development of sci-tech finance also relies on the empowerment of data elements. On this basis, sci-tech finance promotes the transformation of data elements from resources to capital through four major mechanisms: pricing, financing, allocation, and risk supervision. This research provides theoretical support for the market-oriented reform of data elements and decision-making reference for financial support for technological innovation and data allocation. In the future, it is necessary to further improve the construction and supervision of the data element market to facilitate the integration of the digital economy and the real economy.

Keywords: Data elements; Market-oriented allocation; Sci-tech finance

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1. Introduction

Globally, countries have introduced data strategies and laws to cultivate the data element market and release its value. China has successively issued major policies such as the "Opinions on Building a Basic Data System to Better Play the Role of Data Elements" and has repeatedly deployed important tasks to accelerate the cultivation of China's data element market, indicating that China's development focus has gradually shifted from the construction of single-point big data capabilities to the overall optimal allocation of the data element market [1].

At the same time, "sci-tech finance" has attracted much attention as a new field of integration between finance and technology. Sci-tech finance generally refers to the institutional arrangement of supporting technological innovation and industrial development through financial means, and it also reflects the digital transformation of finance itself [2].

Under the background of the digital economy, the combination of sci-tech finance and data elements has spawned a new development logic. The realization of the value of data elements cannot do without the intervention of financial mechanisms. Only through effective pricing, transaction, investment and financing can data resources be transformed into assets and integrated into the economic cycle. On the other hand, sci-tech finance is highly dependent on data-driven approaches. Data has become a core element for financial institutions in risk control, credit granting, and product innovation. The full circulation of data elements will greatly improve the efficiency of financial services. Studies have shown that the input of data elements can enhance the R&D and risk control capabilities of financial institutions, and especially in underdeveloped areas, it can better promote the coordinated development of finance and technology and narrow the regional gap [3].

In addition, the financialization of data elements has made them a new engine for financial innovation. Therefore, exploring the inherent mechanism of the market-oriented allocation of data elements with the participation of sci-tech finance is of important theoretical and practical significance: it can not only enrich the financial theoretical foundation for the market-oriented reform of data elements but also provide decision-making reference for financial support for technological innovation and data resource allocation in the digital economy era.

2. Logical foundation of sci-tech finance and the market-oriented allocation of data elements

Connecting the above two concepts, it can be found that sci-tech finance and the market-oriented allocation of data elements share an inherently compatible logical foundation.

The efficient allocation of data elements requires the support of sci-tech finance. The integration of data into the market faces challenges such as difficulties in right confirmation, pricing, circulation, and monetization. Issues that financial mechanisms excel at addressing are formulating standards to facilitate right confirmation and pricing, and establishing platforms as well as investment and financing channels to smooth data circulation and monetization. Without financial participation, it is difficult for data elements to transform from static resources into dynamic capital. Hence, sci-tech finance precisely provides the institutional environment for this transformation.

The development and expansion of sci-tech finance rely on the empowerment of data elements. The digital transformation of finance requires a large amount of high-quality data as "fuel," and abundant, circulating data provides a steady stream of momentum for sci-tech finance innovation. When financial institutions share data from governments, industrial and commercial departments, taxation authorities, etc., they can improve customer credit investigation, optimize credit risk assessment models, and enhance the accuracy of capital allocation.

Moreover, the integration of the two generates synergistic effects. Sci-tech finance injects capital momentum and technical means into the marketization of data elements, while data elements provide new business scenarios and innovative materials for sci-tech finance. The two interweave to form a positive feedback loop of synergistic efficiency. Fintech can optimize factor allocation and improve total factor productivity; financial mechanisms activate data value, spawn more digital technology innovations, and expand the scale of the digital economy [4]. Conversely, the financial industry's demand for data drives the development of data collection, governance, and

analysis industries, improves data infrastructure, and boosts data supply. This virtuous cycle has become a new engine for high-quality economic development. Based on this, policies propose constructing a sci-tech finance system compatible with technological innovation and encouraging financial institutions to integrate and utilize multi-source data to enhance service capabilities.

3. Mechanism analysis of sci-tech finance promoting the market-oriented allocation of data elements

Sci-tech finance plays a role in the market-oriented allocation of data elements mainly through four major mechanisms: pricing, financing, allocation, and risk supervision. It discovers data value through scientific pricing, revitalizes data assets through innovative financing, optimizes data flow and allocation through market mechanisms, and ensures sustainable development by controlling risks through supervision.

3.1. Pricing mechanism

The pricing mechanism is the foundation for the marketization of data elements. Reasonable data pricing is not only a prerequisite for data element transactions but also a necessary condition for data assets to participate in financial activities such as mortgages and securitization. The data element pricing mechanism is a process in which the value of data elements evolves along the path of "value formation-price discovery-competitive transaction" and is externalized into the price of data products [5]. For a long time, due to the lack of unified standards and transparent markets, data products have mostly adopted a negotiated pricing method on a case-by-case basis, with an imperfect price formation mechanism leading to high data transaction costs and low transaction willingness. Sci-tech finance, through technological and institutional innovations, is gradually improving the data pricing mechanism.

One aspect is the introduction of independent evaluation and algorithm-based pricing. Independent data asset evaluation institutions are established to assess data value using big data analysis and artificial intelligence algorithms. Algorithm-based pricing comprehensively considers factors such as data costs, benefits, supply, and demand, determining price ranges more objectively and reducing information asymmetry and human biases. Another aspect is the construction of market-oriented pricing platforms. With the support of sci-tech finance, efforts are made to accelerate the development of factor trading platforms such as data exchanges, based on market and supply-demand relationships. Competitive quotes are formed through market-oriented methods like listed bidding, auctions, and market-making, facilitating the discovery of data's equilibrium price. A further aspect is the improvement of pricing systems and standards. For instance, the "Twenty Guidelines for Data" call for improving the income distribution system for data elements, which also involves regulating data pricing and value distribution.

Through these mechanisms, sci-tech finance has established a scientific pricing system for data elements. A transparent and reasonable pricing mechanism will reduce data transaction costs and uncertainties, help awaken dormant data resources and transform them into flowing capital, laying the foundation for subsequent data asset financing and circulation.

3.2. Financing mechanism

The financing mechanism is a crucial link in transforming the value of data elements into real productive forces. For data resources to fully exert their role, they must obtain financial support for development and utilization

through investment and financing activities, and data assets themselves can also serve as financing tools. Through product and model innovation, sci-tech finance has opened up multiple channels for data asset financing. One such channel is data pledge financing. Financial institutions carry out data pledge loan business, providing loans with enterprises' data assets or their income rights as collateral. Studies have shown that the improvement of data assetization can significantly alleviate the financing constraints of small and medium-sized enterprises [6]. When the value of data assets is recognized and banks accept them as collateral for credit enhancement, it can broaden the financing channels for sci-tech enterprises.

Another channel is data asset securitization. This involves packaging illiquid but stable-income data assets into Asset-Backed Securities (ABS) to raise funds from the capital market. Currently, data asset securitization is still in the exploration stage, and the evaluation models and legal frameworks need to be improved. Other financing approaches include raising funds by transferring or pledging data usage rights and income rights (such as data trusts and pre-sold data usage rights). These methods have low risks and retain the long-term value of data. In addition, by establishing big data industry funds, digital economy funds, and other similar vehicles, capital is guided to flow into fields such as data collection, storage, transaction, and security, supporting the construction of data infrastructure and applications through equity investment.

The diversified financing mechanism enables the value of data elements to be monetized in advance and reinvested in reproduction. Financial empowerment not only provides capital support for sci-tech enterprises but also increases enterprises' innovation investment by alleviating financing constraints, thereby fully releasing the value contained in data elements.

3.3. Allocation mechanism

The allocation mechanism refers to the realization of efficient flow and optimal combination of data elements across various economic sectors through market transactions and resource deployment. By building market platforms and improving transaction systems, sci-tech finance promotes cross-entity and cross-regional allocation of data elements, enhancing overall allocation efficiency. The measures are as follows:

(1) The first measure is the development of a multi-level data trading market. Driven by sci-tech finance, national, provincial, and industry-specific data trading platforms are evolving rapidly, connecting data supply and demand through methods such as listed trading, auctions, and data exchanges. Studies have shown that establishing data trading platforms can significantly improve regional total factor productivity [7]. Therefore, it is essential to develop a multi-level data element market tailored to regional and industrial characteristics, giving full play to the market's decisive role in data allocation;

(2) The second measure is to facilitate cross-industry and cross-regional data flow. Mechanisms such as data alliances and cross-regional data exchanges are adopted to break down "data silos" and promote broader data circulation. The government has built a national public data opening platform, while financial institutions share data with taxation, industry and commerce, logistics, and other departments to advance cross-field data integration. Additionally, efforts are needed to explore safe and orderly cross-border data circulation mechanisms;

(3) The third measure is to enhance the efficiency of data element allocation. The efficiency of data element allocation is reflected in whether required data can flow to the right place at the right time and at a reasonable price. In this regard, sci-tech finance primarily achieves this by improving matching efficiency, reducing transaction costs, and expanding effective supply.

Overall, sci-tech finance promotes the extensive flow of data elements through market mechanisms, ensuring that "data can be found, afforded, and effectively utilized." In the future, efforts should be made to accelerate the construction of a unified, open, and orderly national data element market, break down industrial and regional barriers, and enable data, this "new type of oil", to truly circulate, thereby better serving the innovative development of the real economy.

3.4. Risk supervision mechanism

The risk supervision mechanism is an essential link in ensuring the healthy development of the data element market. The marketization of data elements has brought new risk challenges, including property rights disputes caused by unclear data right confirmation, security risks arising from data abuse and privacy leakage, as well as market risks and systemic risks in the process of data transactions. In the context of sci-tech finance, balancing the release of data element value with effective risk control tests the wisdom and technical means of supervision. The main mechanisms include the following:

(1) Improve the system for protecting data property rights and interests: Clear ownership of data property rights is a prerequisite for data transactions. Financial institutions should adjust their risk control rules, clarify the rights and responsibilities of all parties through legislation, and establish mechanisms for infringement penalties and dispute arbitration. Clear property rights and protected interests will enhance confidence in transactions and reduce disputes and abuse;

(2) Maintaining a fair competitive market order: It is necessary to avoid the fragmentation of local data markets and prevent large platforms from monopolizing the data market, improve anti-monopoly laws and regulations, and ensure participation opportunities for small and medium-sized entities. Only by effectively protecting legitimate traffic competition can innovation be truly protected, creating a fair competitive market environment in the era of "stock competition" [8];

(3) Strengthening data security and privacy protection: The circulation and utilization of personal information are important aspects of the development of the digital economy and the market-oriented allocation of data as a production factor [9]. However, the circulation of data elements will inevitably bring risks of data leakage and abuse, especially when involving personal sensitive information. Nevertheless, the legal protection of privacy rights achieves broader protection through "very open, abstract, and uncertain legal concepts" [10];

(4) Preventing financial risks and systemic risks: Vigilance should be maintained against risks caused by the financialization of data assets. Regulators should formulate prudent rules and strengthen risk monitoring and early warning; enhance the monitoring and early warning of speculation in the data transaction market, and conduct timely intervention when necessary. It is recommended that the National Data Administration take the lead in multi-department collaborative supervision, conduct regular inspections to identify hidden risks, and ensure the stable operation of the data element market.

4. Conclusion

In summary, data elements possess asset-like financial attributes, and with the involvement of sci-tech finance, they can realize the value transformation from resources to capital. Price discovery is improved through algorithmic evaluation and transaction platforms; dormant data is revitalized through pledge, securitization, and data trusts; cross-regional and cross-industry flow is optimized through multi-level markets and standard systems; and safety

and efficiency are balanced through property rights separation, privacy computing, and prudent supervision. Based on this, efforts should be made to accelerate the construction of a unified national data element market, improve the rules for right confirmation and income distribution, refine evaluation and disclosure standards, enrich data financial products and risk mitigation tools, consolidate infrastructure such as computing power and privacy computing, enhance regulatory technology capabilities, and form a positive cycle of data, capital, innovation, and industry. Looking ahead, the iteration of infrastructure such as generative artificial intelligence, federated learning, secure multi-party computation, and digital renminbi will further reduce transaction costs and expand the boundaries of compliant circulation. The integration of cross-border data elements with green and inclusive scenarios will enhance the resilience and inclusiveness of the financial system. The superposition of data dividends, technological dividends, and institutional dividends is expected to continuously improve total factor productivity, promote the in-depth coupling of the digital economy and the real economy, and support the development of new quality productive forces and high-quality development.

Disclosure statement

The author declares no conflict of interest.

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