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Investigation on the Impact of Digital Finance Development on Regional Financial Risks

Xi Li[1,a,*]

[1]*Philippine Christian University, Manila, Philippines*
[a] *xili9426@foxmail.com*
[*]*Corresponding author*

Abstract: *With the rapid development of information technology, digitization has become an important trend in economic and social development. As an important component of the digital economy, digital finance (DF) has the characteristics of convenience, efficiency, and inclusiveness, and has received high attention from governments and financial institutions in various countries. The impact of DF development on regional financial risks is receiving increasing attention. This article explored the impact and mechanism of DF development on regional financial risks from the perspective of DF development, and further analyzed the inspiration of DF development on regional financial risk management. This article conducted empirical research through experimental and control groups. The results indicated that in mature digital financial markets, digital financial services could to some extent improve service utilization and reduce regional financial risks. In areas where the digital financial market was relatively underdeveloped, there was a higher level of regional financial risk. At the same time, the development of DF also faced issues such as information security and regulatory deficiencies. It was necessary to strengthen regulation and risk management to promote the healthy, stable, and sustainable development of DF. Therefore, while promoting economic development and social progress, DF also needed to pay attention to management and governance issues to ensure the sustainable development of DF.*

Keywords: *Regional Financial Risks, Digital Finance, Impact Mechanisms, Risk Management, Support Vector Machines*

1. Introduction

The development of DF is one of the important trends in the global financial industry, which not only promotes economic development and improves the level of financial services, but also brings new financial risks. Especially in regional finance, the development of DF has a more significant impact on financial risks. Therefore, this article aimed to explore the impact of DF development on regional financial risks, and provided reference for effective prevention and control of regional financial risks. First, the application of DF in regional finance has promoted Financial innovation, improved the efficiency and quality of financial services, and injected new vitality into economic development. For example, the emergence of digital financial products such as mobile payments and internet finance has greatly facilitated people's lives and entrepreneurship. At the same time, the innovation of digital financial products has also promoted the improvement of the financial market and improved the transparency and fairness of the market. This is conducive to attracting more funds to flow into the region and promoting sustained economic growth. However, the development of DF has also brought new financial risks. First of all, the innovation of digital financial products is fast, and there is insufficient market supervision, which may lead to credit risk, operational risk, system risk and other risks. Secondly, the application of DF has also brought impacts to traditional financial institutions, which may lead to the instability of the financial system. Finally, the uneven development of digital financial products may also lead to economic structural imbalances and regional crises. Therefore, in the process of applying DF, it is necessary to do a good job in financial supervision and management. On the one hand, the government and regulatory authorities need to strengthen regulatory efforts, regulate the order of the digital financial market, and prevent and resolve financial risks. On the other hand, financial institutions need to strengthen their technological innovation capabilities, improve the quality and safety of digital financial products, and work closely with regulatory authorities to jointly create a stable digital financial market. In short, the development of DF has both positive and negative impacts on regional financial risks. Only by fully understanding the potential risks and opportunities of

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DF and taking corresponding regulatory and management measures in a timely manner can regional financial risks be effectively prevented and resolved, and the healthy development of the economy be promoted.

During the economic crisis, an organization called the "Global Financial Safety Net" provided support and protection for people. This is a global safety net composed of the International Monetary Fund, regional financial arrangements, and bilateral exchange agreements, which has undergone significant changes since the financial crisis. What are the impacts of these changes on its application? Fritz Barbara deepened her understanding of fund management institutions in the region from a mechanistic perspective through case studies by the Arab Monetary Fund and the Eurasian Stability and Development Fund [1]. Ozili Peterson K conducted a comprehensive review of financial inclusivity in various regions around the world. Pointed out certain debates in the research field of financial inclusion and in the policy field related to financial inclusion [2]. Kirikkaleli Dervis aims to elucidate the most popular phenomenon in economics and financial literature, which is the relationship between Greek economic growth and financial development within the risk range [3]. However, these scholars did not conduct an analysis based on the impact of DF development on regional financial risks, but only explored it from a superficial perspective.

In order to solve the bottlenecks and contradictions in traditional financial services and improve the quality and efficiency of financial services, this article conducted research on the impact of DF development on regional financial risks, analyzed how to use machine learning algorithms to predict and manage regional financial risks, and conducted simulation experiments to explore regional financial risks.

2. Investigation Methods on the Impact of DF Development on Regional Financial Risks

2.1. Impact of DF Development on Regional Financial Risks

Although the development of DF has brought many positive factors, it has also brought certain risks. Especially for regional finance, the impact of DF development is relatively complex, with both advantages and disadvantages, thus requiring in-depth analysis [4-5].

(1) Favorable aspects

The efficiency of financial services has been improved and operational costs have been reduced: Digital financial services can improve the efficiency of financial services and save costs such as manpower, material resources, and financial resources. DF can move financial services that previously consumed a lot of time and manpower offline, thereby reducing the cost of financial services and solving the problem of high labor and time costs.

More convenient and personalized financial services are provided: Through digital financial services, financial institutions can provide personalized financial services according to the different needs of customers. For example, in traditional banks, opening accounts, loans, and other businesses often require processing at the bank counter, and the collection of customer information is also relatively cumbersome. With digital financial services, customers can complete these businesses online, thus avoiding the hassle of waiting in line saving time as well as reducing costs [6-7].

Financial risks have been dispersed: The popularization and use of digital financial services have attracted more and more capital flows. Compared to traditional finance, the market for DF is more transparent, and digital financial services typically appear in small and dispersed forms, which can effectively diversify financial risks. In addition, digital financial services can also provide investors with more diversified and personalized investment choices, thus reducing the risk of a single investment.

(2) Adverse aspects

New security issues and technological risks have been brought: The development of DF has also brought new security issues and technological risks, such as payment risks, information leakage, etc., thereby increasing financial risks [8-9]. For example, in the digital financial market, some transaction systems such as virtual currencies and mobile payments are severely insecure. Attackers are prone to obtaining users' personal and financial information through hacker means, thus leading to theft and illegal transfer of funds and resulting in economic losses.

The traditional financial business model has been impacted: The rise of DF has also had a certain

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impact on traditional financial business to some extent. For example, in fields such as digital credit services, financial information consulting, and P2P (Peer-to-Peer) online lending, the emergence of DF has affected the operational form of traditional financial institutions. Therefore, financial institutions such as banks, securities, and insurance have also begun to try to carry out diversified businesses.

Regulatory loopholes and difficulties may be caused: The development of DF may cause some regulatory loopholes and difficulties, such as lack of regulation and improper regulation, thereby increasing financial risks [10-11]. For example, in the field of DF, there are also many regulatory loopholes and difficulties in the registration management and standardized operation of some online lending platforms and virtual currency trading platforms, which pose great challenges to financial risk management.

The above has sorted and analyzed the impact of DF development on regional financial risks, indicating that the development of digital financial services has both positive and negative factors.

2.2. Management of Regional Financial Risks by the Development of DF

In the process of DF development, how to reduce regional financial risks and achieve sustainable development of the financial industry is an urgent problem to be solved. Therefore, in terms of the impact of DF development on regional financial risks, the following insights can also be proposed:

(1) Strengthening financial supervision and reducing financial risks

The development of DF often brings new risks and challenges, and it is still necessary to strengthen supervision and management, curb risks, and protect the stability and healthy development of the financial market. Regulatory authorities need to use information technology to process and analyze financial data, promptly identify problems, and prevent financial risks [12].

(2) Promoting the comprehensive development of DF

Digitalization can effectively improve the financing conditions for small and micro enterprises and individuals, thus enabling them to better participate in market competition. Promoting the comprehensive development of DF can provide enormous support and guarantee for regional economic development, and reduce financial risks.

(3) Improving technical and technological level

In the process of DF development, the application of internet technology, big data, cloud computing, blockchain, artificial intelligence and other technologies has become an important means of DF development. Therefore, various financial institutions, regulatory units, and all personnel engaged in DF related work need to strengthen their own technological research and use, and effectively improve their technical capabilities and levels.

(4) Strengthening popular science education and improving public financial literacy

The development of digital financial services requires the active participation and support of users and the public. However, due to a lack of financial knowledge, the public has some misunderstandings about digital financial services, thus making it difficult to use them correctly, thereby increasing regional financial risks. Therefore, it is necessary to strengthen popular science education and improve the public's financial literacy.

2.3. Application of Support Vector Machine in Digital Financial Risk Management

Support Vector Machine (SVM) is an important machine learning algorithm in digital financial risk management, with high accuracy and interpretability. By using SVM to model and predict historical data, financial institutions can identify potential risks and develop corresponding risk management strategies. This article would introduce the commonly used formulas of SVM and its application in digital financial risk management.

The SVM classification function is as follows:

$$f(x) = sign(W^T x) + b \tag{1}$$

Among them, w represents the normal vector of the decision boundary, and b represents the offset. In the research on the impact of DF development on regional financial risks, SVM classification function can be used to model historical data to predict future financial risks.

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The SVM optimization problem is as follows:

$$\min_{w,b}(1/2\,\|w\|^2), s.t.\, y_i(\mathrm{W^T x}) + \mathrm{b} \geq 1 \tag{2}$$

Among them, $\|\mathrm{w}\|$ represents the norm of the weight vector, and $\mathrm{y_i}$ represents the label of sample i (+1 or -1). SVM needs to solve this optimization problem every time it trains to find the best hyperplane, so as to realize the learning of historical data.

The kernel function is as follows:

$$K(x_i, x_j) = \emptyset(x_i)^T \emptyset(x_j) \tag{3}$$

$\mathrm{K(x_i, x_j)}$ represents the similarity between $\mathrm{x_i}$ and $\mathrm{x_j}$ in the feature space, and $\emptyset$ represents the feature mapping function. Kernel functions can enable SVM to perform classification tasks in nonlinear situations. In the study of the impact of DF development on regional financial risks, kernel functions can be used to map historical data to higher dimensional feature spaces, thereby improving the model's generalization ability and classification accuracy.

SVM is a widely used algorithm for financial risk management and prediction, with high accuracy and interpretability. In the study of the impact of DF development on regional financial risks, SVM can analyze and predict historical data by establishing appropriate models, thus providing reference basis for practical applications.

3. Evaluation of Regional Financial Risk Experimental Results

3.1. Experimental Design

With the continuous development of information technology and the popularization of the Internet, DF has developed rapidly and become an important component of the financial industry. The development of DF has a significant impact on innovation, efficiency improvement, and risk management in the financial industry. However, in the process of DF development, it would also bring some new risks and challenges. Especially in the field of regional finance, the impact of the development of DF on regional financial risks has not been fully studied. Therefore, this article aimed to explore the impact of DF development on regional financial risks, thus providing theoretical reference and practical guidance for regional financial risk management.

This article selected 12 similar regions as the research objects. Among them, 6 regions already had relatively mature digital financial markets and were set up as experimental groups; the other six regions had no or relatively underdeveloped digital financial markets, and were set as a control group.

Through literature review, expert interviews, and other methods, the main factors affecting regional financial risks were identified, and the research subjects were investigated and analyzed to grasp the basic situation of the financial industry in the two regions, the development of DF, and the performance of regional financial risks.

Based on the actual situation of the research object, indicators for the impact of DF development on regional financial risks were developed. Experimental plans were designed, and experiments were conducted on them;

Through the collection and analysis of experimental data, the impact of DF development on regional financial risks in the two regions was compared, and conclusions were drawn.

3.2. Regional Financial Risk Evaluation

Regional financial risk refers to the risks faced by financial markets, institutions, and products within a certain region. These risks may affect the stability of financial markets and the healthy development of financial institutions, thereby affecting the economic development and social stability of the entire region. If there are high risks in the financial markets and institutions of a region, it would have a significant impact on the local economy and society, and may trigger financial and economic crises. Therefore, monitoring and evaluating regional financial risks and taking corresponding risk management measures are important means to protect the security and stability of financial markets and institutions. Regional financial risk indicator: non-performing loan ratio: This reflects the default situation of financial institutions' loans. The higher it is, the higher the regional financial risk; capital

ISSN 2706-6827 Vol. 5, Issue 7: 39-47, DOI: 10.25236/IJFS.2023.050707

adequacy ratio of financial institutions: This reflects the risk tolerance of financial institutions. The higher the capital adequacy ratio, the stronger the risk management ability of financial institutions; profit margin of financial institutions: This reflects the profitability of financial institutions, and the higher the profit margin, the higher the operational efficiency of financial institutions. Figure 1 shows the regional financial risk analysis. Figure 1 (a) shows the experimental group, and Figure 1 (b) shows the control group. Table 1 shows the comparison of the mean values of regional financial risk indicators.

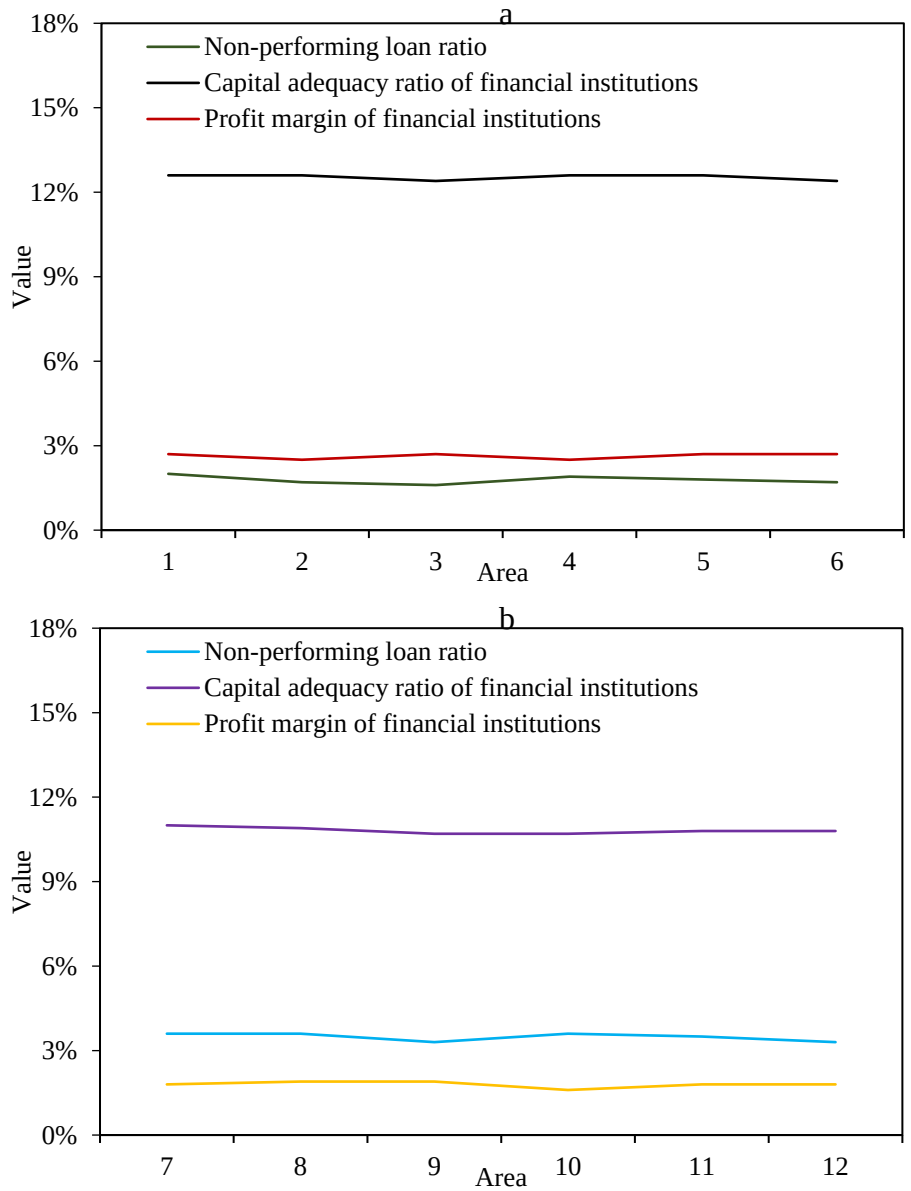

Figure 1 (a) shows the experimental group
Figure 1 (b) shows the control group

Figure 1 Regional financial risk analysis

Table 1 Comparison of mean regional financial risk indicators

	Experimental group	Control group
Non-performing loan ratio	1.8%	3.5%
Capital adequacy ratio of financial institutions	12.5%	10.8%
Profit margin of financial institutions	2.6%	1.8%

In terms of regional financial risks, in the experimental group of mature digital financial markets, the non-performing loan ratio was 1.8%, the capital adequacy ratio of financial institutions was 12.5%, and the profit rate of financial institutions was 2.6%; in the control group with relatively

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underdeveloped digital financial market, the non-performing loan ratio was 3.5%, the capital adequacy ratio of financial institutions was 10.8%, and the profit margin of financial institutions was 1.8%. This indicated that regions with relatively underdeveloped digital financial markets had higher regional financial risks.

The impact of digital financial services on regional financial risk was measured by measuring the financial risk levels of different regions and institutions, and the financial risk levels of each region were scored. Figure 2 shows the regional financial risk level score, Figure 2 (a) shows the experimental group, and Figure 2 (b) shows the control group.

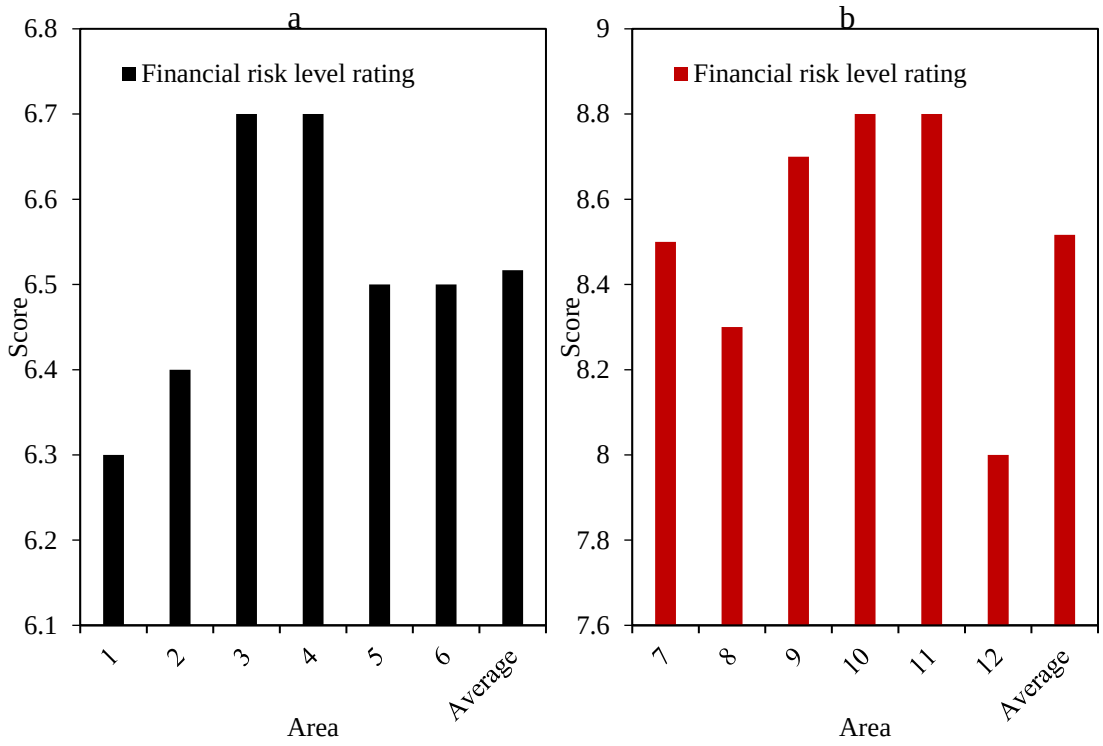

Figure 2 (a) shows the experimental group *Figure 2 (b) shows the control group*

Figure 2: Regional financial risk level scoring

From the figure, it could be seen that the average value of the experimental group was 6.5, while the average value of the control group was 8.5. Therefore, it could be considered that digital financial services had a certain positive effect on reducing regional financial risks.

3.3. Evaluation of the Development of DF

The development of DF refers to the use of emerging technologies such as the Internet, mobile communication, big data, and artificial intelligence to innovate financial service models and products, and promote the development of the financial industry towards digitization, intelligence, and openness. The development of DF has a significant impact on the economy and society. DF can provide more convenient, high-quality, and personalized financial services for enterprises and individuals, improve the efficiency and quality of financial services, and promote economic development and social progress. At the same time, DF also faces some challenges, such as information security and regulatory deficiencies. It is necessary to strengthen regulation and risk management to promote the healthy, stable, and sustainable development of DF. DF development indicators: Scale of digital financial services: This reflects the popularity and number of users of digital financial services. The higher the value, the better the development of DF; the level of innovation in digital financial services: This reflects the level of innovation in digital financial services, and the higher the level, the more dynamic the development of DF; security of digital financial services: This reflects the level of security of digital financial services, and the higher the level, the more reliable the development of DF. Figure 3 shows the development analysis of DF, Figure 3 (a) shows the experimental group, and Figure 3 (b) shows the control group. Table 2 shows the comparison of the mean values of DF development indicators.

ISSN 2706-6827 Vol. 5, Issue 7: 39-47, DOI: 10.25236/IJFS.2023.050707

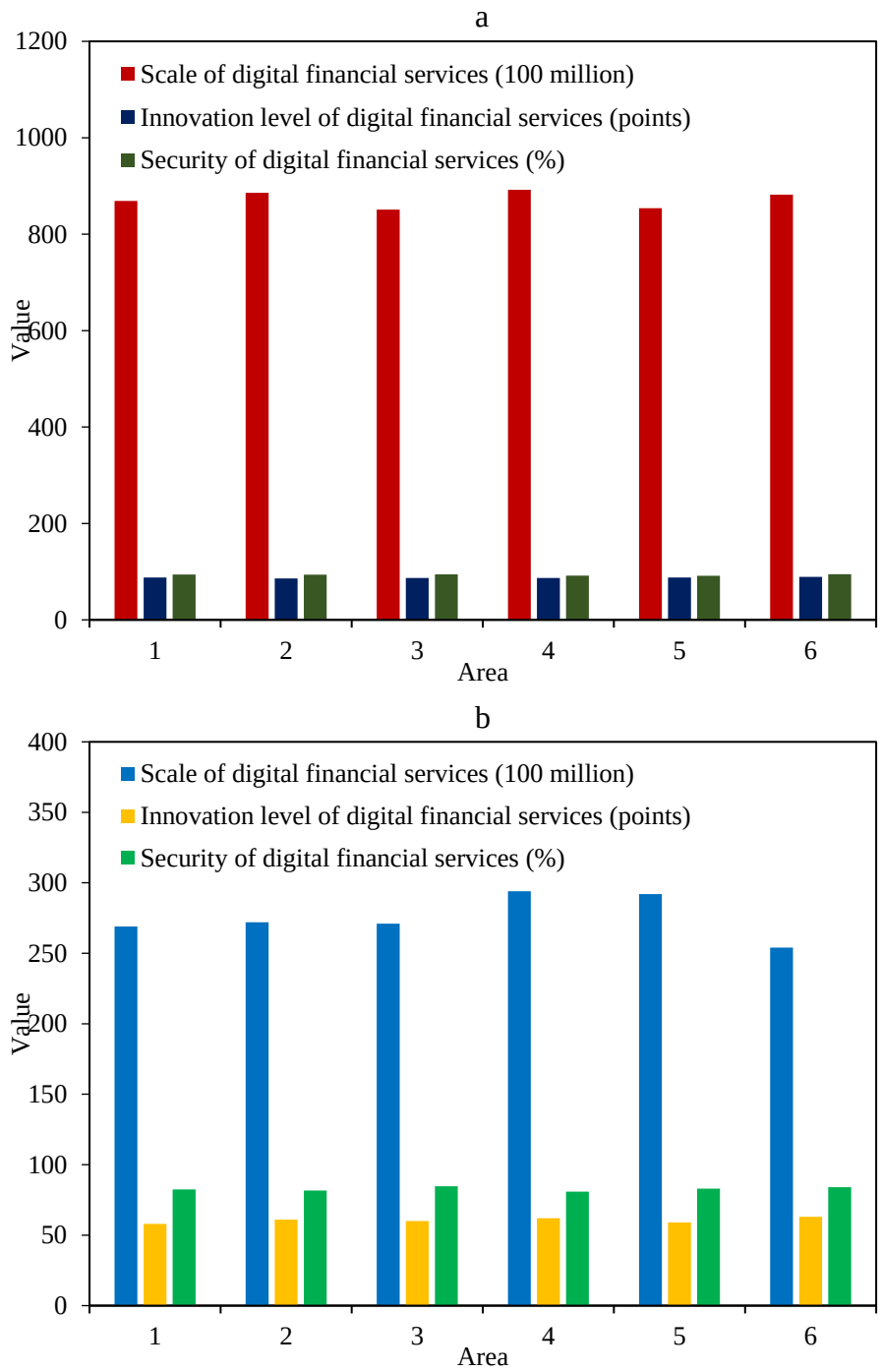

Figure 3 (a) shows the experimental group
Figure 3 (b) shows the control group

Figure 3. Analysis of the development of DF

Table 2 Comparison of mean values of DF development indicators

	Experimental group	Control group
Scale of digital financial services (100 million)	872	275
Innovation level of digital financial services (points)	88	61
Security of digital financial services (%)	93.3	82.8

It could be seen that in the experimental group of mature digital financial markets, the scale of digital financial services reached 87.2 billion, the innovation level score of digital financial services was 88, and the security of digital financial services was 93.3%; in the control group with relatively underdeveloped digital financial markets, the scale of digital financial services reached 27.5 billion, the

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innovation level of digital financial services was scored as 61, and the security of digital financial services was 82.8%. This indicated that digital financial services could improve service utilization to a certain extent, and the development of DF could help reduce regional financial risks.

4. Conclusions

The impact of DF development on regional financial risks has always been a hot topic of concern in academia and practice. With the continuous development of DF, it plays an increasingly important role in the financial industry and becomes an important means of financial innovation, efficiency improvement and risk management. This article explored the impact of DF development on regional financial risks, and the research results indicated that digital financial services had a certain positive effect on reducing regional financial risks. In the mature digital financial market, the non-performing loan ratio is low, the capital adequacy ratio of financial institutions is high and the profit rate is high. In areas where the digital financial market is relatively underdeveloped, regional financial risks are relatively high. Digital financial services can improve service utilization to a certain extent, and the development of DF can help reduce regional financial risks. Therefore, strengthening the supervision of DF and promoting the development of DF are of great significance for regional financial risk management.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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