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Complementarity or Substitution: A Study of the Impacts of Internet Finance and Rural Financial Development on Agricultural Economic Growth

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Abstract: Based on the Chinese county-level panel data from 2014–2018, in the study reported in this paper, we empirically tested the "complementarity and substitution" effects of internet finance and rural finance on rural economic development using the feasible generalized least squares (FGLS) estimation method. The research data were obtained from the *China County Statistical Yearbook*. Similarly, the data of agricultural credit societies were obtained from the unique database of the agricultural credit societies of Shaanxi Rural Finance Research Center, while the internet finance development index was obtained from the Digital Finance Research Center of Peking University. In this research, we found that rural finance and internet finance contribute to rural economic growth. In the context of rural economic growth, internet finance and rural finance development show a substitution effect. The scale and efficiency of rural finance contribute to rural economic growth, while the structure of rural finance has the opposite effect. The development of internet finance reduces the marginal contribution of the rural financial scale and efficiency to rural economic growth. It weakens the negative effect of the rustic financial structure on rural economic growth. Furthermore, the development of internet finance contributes to the rural economic growth of counties of high economic levels but hinders the development of counties of low and medium economic levels. In counties with a high economic status, the development of internet finance and rural finance have a complementary effect on rural economic growth, while in counties of low and medium economic levels, we can observe a substitution effect. These assessments provide guidance, a source for policy recommendations and a reference for researchers and policy makers seeking to optimize the structure and break the monopoly pattern of agricultural credit cooperation in the rural financial market and to strengthen innovation and significantly improve the operational level of rural financial institutions. Moreover, the development of internet financial business and technology is necessary to overcome the demerits of traditional financial institutions.

Keywords: internet finance; rural financial development; agricultural economic growth; complementarity–substitution effect; China

Citation: Mei, B.; Khan, A.A.; Khan, S.U.; Ali, M.A.S.; Luo, J. Complementarity or Substitution: A Study of the Impacts of Internet Finance and Rural Financial Development on Agricultural Economic Growth. *Agriculture* **2022**, *12*, 1786. https://doi.org/10.3390/agriculture12111786

Academic Editor: Francesco Caracciolo

Received: 21 August 2022
Accepted: 24 October 2022
Published: 27 October 2022

1. Introduction

Since the reform and opening up of China's "three rural" economy, it has been developing rapidly. As the core driving factor supporting the economic development of the "three rural areas", finance has played a pivotal role in promoting the growth of the agricultural economy. In the process of the joint development of the agricultural economy and rural finance, the capital capacity and financial demand in rural areas are increasing, but the problem of the insufficient supply of rural finance still exists. Is the scale of funds in rural areas insufficient to match the financing demand? The reason for this problem is that the structural imbalance between the credit supply of rural financial institutions and the financial demand of rural entities has become an important factor limiting the growth of the

agricultural economy [1,2]. Reviewing the history of China's rural financial development, in order to improve the financial supply and financial services in rural areas, the state introduced a series of policy measures in order to deepen the reform of the rural financial market. The 1996, the Decision on the Reform of the Rural Financial System proposed the establishment of rural cooperative banks and the creation of additional branches of the Agricultural Development Bank of China, which laid the foundation for the formation of a rural financial system combining policy and commercial and cooperative financial endeavors. In 2006, in order to compensate for the lack of credit supply from traditional financial institutions, the state relaxed the entry threshold for the banking industry to enter rural areas, and microfinance companies, village banks and rural capital mutual aid societies became the new force among rural financial services. However, in the process of the development of new rural financial institutions, the rural financial supply gradually deviated from the goal of "three rural areas", and credit services supplied to rural areas showed the typical characteristics of "bonsai finance [3]." In 2013, the rise of internet finance caused a new round of changes in the rural financial market, which is both an opportunity and a challenge for the traditional rural financial system [4]. (In a narrow sense, internet finance mainly refers to the development of financial businesses by internet enterprises relying on the advantages of information and technology, but in a broad sense, it includes both internet finance defined in a narrow sense and the internalization of financial enterprises. Based on the availability of the data, this paper uses the narrow concept for its research.) With the introduction of the rural revitalization strategy, the financial needs of rural areas have become increasingly diversified, and the application of internet finance in rural areas has received great attention from the state. The 2019 "Guidance on Financial Services for Rural Revitalization" proposes to actively implement the project of internet financial services for "three rural areas" and make efforts to improve the coverage and credit penetration of rural financial services. Thus, this study aims to address: (a) whether internet finance, which has "taken office" in rural areas, can act as an ideal vehicle with which to provide the financial supply for the development of "three rural areas"; (b) whether internet finance is a "replenisher" or a "pumping machine" for rural financial resources; (c) the feasibility of the entry of internet finance into rural areas as an effective supplement to traditional rural financial institutions in supporting and benefiting farmers; and (d) whether it has reversed the structural imbalance between the financial supply and financial demand in rural areas. Therefore, addressing the abovementioned issues will clarify the relationship between internet finance and traditional rural finance in serving agricultural economic development, which will not only help the government to control the structure of the rural financial market but also provide a realistic basis for the reform direction of the rural financial system.

Domestic and foreign scholars have not reached a consensus regarding the study of rural finance and agricultural economic growth, internet finance, and agricultural economic growth, or the relationship between rural finance and internet finance. The first view on rural finance and agricultural economic growth is the "financial promotion theory", which advocates the notion that rural finance can effectively allocate resources and promote economic development [4]. The second view is the "financial disincentive theory", based on the theory of agricultural credit subsidies, which thoroughly studies the interrelationship between financial development and economic growth in developing countries and suggests that rural finance inhibits agricultural economic growth [5]. Rural finance, under government intervention, does not serve the rural areas, and more rural capital flows out from urban and industrial areas, which is necessary to serve the national economic development strategy. The poor structure of rural finance and the low level of financial efficiency weaken the pulling effect of finance on the economy [1,6]. A third view is the "financial uselessness theory": the idea that the simultaneous growth (or simultaneous decline) of the two may be a quantitative coincidence [7,8]. Studies on the relationship between internet finance and agricultural growth are scarce and do not reach a consensus. Previously, Demir et al. [9] found that internet finance, with its advantages of convenience, inclusiveness

and accessibility, provides a greater coverage of rural "long-tail customers" and, thus, enhances the allocation efficiency of financial capital to promote agricultural economic growth. Traditional rural financial institutions can reduce the acquisition and transaction costs of investment information, expand the scope of services and service groups, and improve the efficiency of resource allocation by learning from internet financial services [10]. The second view is that the development of internet finance has an impact on the rural financial system, which leads to the re-deconstruction of the traditional rural financial market and the seizure of the rural financial market share. Through big data information networks and cloud computing technologies, internet finance has broadened the scope of services and people covering the real "three rural" economic entities that traditional rural financial institutions could not serve in the past [11]. Internet finance has taken advantage of its benefits in terms of transaction costs, information access and payment methods so as to seize the high ground of financial services for the "three rural areas" and reduce the performance of rural financial institutions. Some scholars have also suggested that internet finance has shown strong "financial exclusion" in rural areas, and that the funds seized from traditional rural financial institutions have not served the agricultural economy, especially in the less developed western regions where internet "financial exclusion" is most serious [10,11].

As we can see, scholars at home and abroad have researched rural finance and the agricultural economy, internet finance and the agricultural economy, and the relationship between rural finance and internet finance, and they have accumulated some results. It can be observed that rural finance and internet finance jointly influence the development of the agricultural economy, and internet finance also influences the development of rural finance. Moreover, in the process of serving the growth of the agricultural economy, traditional rural finance and internet finance have "competition–cooperation" and "complementarity–substitution" effects. However, it is noteworthy that few studies have included internet finance in the research framework of the traditional rural finance–agricultural economy relationship. The "complementary–substitution" relationship between the two in agricultural economic growth has not been clarified, nor has the impact of this "complementary–substitution" relationship on agricultural economic growth been explained. In view of this, this paper empirically examines the "complementary–substitution" effect of the development of internet finance and rural finance on agricultural economic growth based on county panel data from 2014–2018. It not only answers the question of the "competition–cooperation" relationship between the two in regard to agricultural economic growth but also provides a reference for the further deepening of the reform of the rural financial market.

The marginal contributions of this paper are as follows. Firstly, this paper is one of the few studies in China that explores the "complementary–substitution" effect of internet finance and rural financial development on agricultural economic growth. Previous scholars have mainly analyzed the opportunities and challenges of internet finance and their effects on rural financial development at the theoretical level. Although the relationship between internet finance and rural finance can be described, the research is limited to these two aspects. As two financial units serving economic development, the interaction between internet finance and rural finance shapes the growth of the agricultural economy. The two are jointly integrated into the agricultural economic framework in this paper so as to describe the "complementary–substitution" relationship. The actual impact on the growth of the agricultural economy when internet finance and rural finance coexist is accurately portrayed. Secondly, we analyze the "complementarity–substitution" effect of internet finance development on rural financial markets in three dimensions: the scale, structure and efficiency of rural finance. We clarify how internet finance regulates the impact of rural financial development on agricultural economic growth and enhance the persuasiveness of the research findings. Thirdly, by analyzing the "complementary–substitution" effect of internet finance and rural finance on counties of different economic levels, the main factors affecting the strength of this effect are clarified. This can provide a basis that the

government can use to formulate different financial regulatory measures and promote the development of rural financial markets according to local conditions.

2. Review of the Literature

With the rapid development of internet finance, its application in rural areas has attracted national attention. Internet finance can, to some extent, compensate for the deficiency of financial support in rural areas and optimize the structure of the rural financial market. Good support policies mean that rural markets can be the next blue sea for internet finance. Some scholars [12–17] have recognized the importance of developing internet finance for rural economic growth. Research by REN and LI [18], based on data from a survey of 2114 rural residents in the Beijing–Jinjin–Hebei region, shows that digital payments, digital lending and service provision help to promote inclusive growth in rural economies [19]. At the same time, internet finance is competing with traditional rural financial institutions. After internet finance enters the rural financial market, there will be less discussion regarding the relationship between internet finance and traditional rural financial institutions in order to support rural economic development. The research focuses on three aspects, the first of which is the analysis of the impact of internet finance on the rural economy and farmers' income. Xing [20], for example, argues that digital finance can reduce transaction costs and support the development of rural digital economies [20]. The development of internet finance minimized the transaction costs of remittance transfers in rural areas, met the need for small, high-frequency transfers among farmers and improved the equalization of household risks [21]. Riley [22] used a study of household survey data from Tanzania to reach a similar conclusion, namely, that using mobile internet payments can help households to perform remittance transfers smoothly by reducing household consumption, and that, as the geographic distance of the remittances increases, households become less dependent on traditional in-village financial-risk-sharing institutions [22]. A study by Sekabira and Qaim [23] using data from coffee-growing farmers in the Ugandan region also showed that farmers who used internet finance eased their household liquidity constraints by selling coffee to other regions [23]. Uduji et al. [24] found that internet mobile payment technology facilitates access to more financing support for smallholder farmers in Nigeria, creating an environment enabling smallholder development and promoting rural economic growth. However, some scholars have come to a different conclusion [24]. Ding [10] argues that the development of internet finance has been accompanied by phenomena that run counter to inclusive finance, such as goal drift, financial exclusion and high costs [10]. Su and Fang [25] also pointed out that the lack of access to the real economy of financial services has led to the financial exclusion of farmers from internet finance, with the western region being the worst affected [25].

The second type of research focuses on the impact of traditional rural financial institutions on the rural economy. There is no clear academic view on whether the relationship between rural economic development and rural finance is positive, negative or variable. This is because empirical research in both developed and developing countries tends to yield very different results, with different scholars reaching different conclusions. For example, Bara et al. [26] found from their experience that rural financial development in SADC is often positively correlated with regional economic growth, using an autoregressive distributed lag model that includes pooled mean groups and dynamic fixed-effect estimations [26].

On the contrary, King and Levine [27] showed that agricultural credit inputs from governments in developing countries are inefficient and limit agricultural growth, and this empirical evidence suggests that government involvement in rural finance has significant negative external effects [23]. As Burgess and Pande [28] conclude based on data from the Bank of India's policy adjustment period of 1961–2000, the rural banking sector in India has changed rural productive and employment behavior, thereby reducing poverty and increasing output. Therefore, in addition to external policy interventions, rural financial development can support rural economic development to a certain extent. However, this

still depends on the overall dynamism of rural financial markets. Boukhatem [29] assessed the direct impact of rural finance on rural economies in low- and middle-income countries and concluded that rural financial development makes an important contribution to rural economic growth. Financial instability, however, can weaken the impact [29].

The third category is the relationship between the emerging internet finance and traditional rural finance [30–34]. Some research achievements have been accumulated in academia, but no consensus has been reached. The main discussion is about whether the relationship between the two is complementary or interchangeable. According to some scholars, traditional rural financial institutions can compensate for their own deficiencies by learning about internet financial services so as to reduce investment information acquisition and transaction costs, expand the range and groups of services, and improve the efficiency of resource allocation [4,6]. Bhutta [35] showed that online lending is more efficient and performs better than traditional bank lending. Hu [36] conducted a study of the development profiles of traditional and internet banks in the United States and found a growing convergence of financial institutions and internet finance, with banks dominating the development of the internet finance industry [29]. Internet finance has become an important way of transforming institutions such as banks. Some scholars also believe that the impact of internet financial products on the rural financial system could rebuild the traditional rural financial market and seize the share of the rural financial market. Through big data, information networks, cloud computing and other technologies, internet finance has broadened the range of services and the population covering the rural economic entities that cannot be served by traditional rural financial institutions [9]. Internet finance takes advantage of its benefits in terms transaction costs, access to information, payment methods, etc., in order to seize the financial service vantage point [10]. In the traditional world of financial repression, banks can lie back and make money. However, the development of internet finance continues to affect commercial banks' original sources of profit, and the banks' "franchise value" has decreased [37]. Banks have increased their risk-taking in order to maintain profitability [38].

In summary, the existing literature focuses on internet finance and the rural economy, rural finance and the rural economy, and internet finance and traditional rural finance. However, regarding the question of whether traditional rural finance and internet finance are "complementary" or "substitute" in regard to the common services of the rural economy, there is still no empirical evidence. Researchers have not theoretically clarified and experimentally tested whether internet finance has enhanced the influence of traditional rural finance on rural finance or weakened it. Therefore, this study integrates internet finance into the research framework of rural financial services designed for rural economic development and examines the impact of internet finance and rural financial development on rural economic growth from the perspective of "complementary advantages". Based on county panel data from 2014 to 2018, this paper offers an empirical study of the "complementarity–substitution" effect of internet finance and rural finance development on rural economic growth. This not only answers the question of the "competition–cooperation" relationship between the two in terms of rural economic development but also provides reference and basis for further deepening the reform of the rural financial market.

3. Theoretical Analysis and Research Hypothesis

3.1. Rural Financial Development and Agricultural Economic Growth

China's rural finance lags behind in comparison with urban finance and is a typical imperfectly competitive market. Agricultural credit cooperatives have long held a monopoly in the rural financial market, and there is a lack of diversified supply bodies. The single structure of rural finance, which primarily provides financial services for the "three rural areas" through indirect financing, has led to a lack of competition and innovation in China's rural financial market [39]. In the imperfectly competitive market, rural finance is endogenous to government finance, and the government uses directional regulation to guide the development of rural finance [40]. On the one hand, the government appropri-

ately subsidizes and regulates the rural financial market to provide a financial channel between financial suppliers and demanders. Meeting the financial needs of those short of funds creates long-term stable capital commitments and improves financial efficiency for economic growth.

On the other hand, excessive government intervention hinders the efficient allocation of financial resources, fails to contribute significantly to agricultural economic growth, and may even produce financial disincentives [27]. In particular, for less economically developed counties, financial market development lags behind, and resource allocation relies too much on government regulation, which may harm agricultural economic growth. Accordingly, this paper proposes Hypothesis 1:

H1. *Rural financial development has a catalytic effect on agricultural economic growth. Relative to economically developed counties, rural financial development's positive effect on less developed counties' agricultural economic growth is low and may even show a negative effect.*

3.2. Internet Financial Development and Agricultural Economic Growth

Internet finance uses technologies such as big data, cloud computing and network delivery to overcome time and geographical space constraints. Efficiently matching the capital demand and investment information in the financial market in a non-physical space expands the financing channels of the "three rural" subjects. It reduces the transaction costs of financial services. Its advantages in terms of information acquisition and screening, risk control and customer selection provide standardized financial services for farmers and small enterprises with high credit risks in the long-tail market [41]. Reducing the credit mismatch and financial exclusion generated by traditional financial institutions due to the "dislike of the rich" reduces the resource allocation rate and the marginal contribution rate of the financial support required to agricultural economic growth. In addition, the development of internet finance may also be a "double-edged sword" for agricultural economic growth. In a loosely regulated policy environment, internet finance may become a new pipeline for rural–urban capital, as it improves the interoperability between rural and urban financial resources. Through internet financial platforms, farmers have access to financial products with higher investment yields, reducing their dependence on traditional saving products and causing rural capital outflows to non-agricultural areas. This is severe in areas with less developed economies and significant urban–rural gaps. Internet finance is more inclined to provide financial supply to urban and other areas when it cannot find ideal creditors and investment projects in local rural areas. Accordingly, this paper proposes Hypothesis 2:

H2. *Internet finance development contributes to the growth of the agricultural economy. Relative to economically developed counties, internet finance has a lower positive effect on agricultural economic growth in less economically developed counties and may even show a negative effect.*

3.3. The "Complementarity–Substitution" Effect of Internet Finance and Rural Financial Development on Agricultural Economic Growth

As far as the application of internet technology in financial business is concerned, the coexistence of internet finance and rural finance has a complementary effect on agricultural economic growth. The entry of internet finance into rural areas is a deconstruction and reshaping of the original rural financial market structure. Internet finance and rural financial institutions form a direct competitive relationship. In response to the impact of internet finance, traditional rural financial institutions begin to learn from its advanced development model to prevent the decline in business performance. Based on their strong customer sources and good brand reputation, traditional rural financial institutions use internet technology to break through the original financial supply barriers and improve the transaction efficiency and financial service quality. They carry out reforms and innovations in regard to business types, financial products and internal audits and management to improve the coverage and supply of financial services and increase the support of rural financial development for agricultural economic growth.

Regarding business competition and capital flows, the coexistence of internet finance and rural finance in rural areas has a substitution effect on agricultural economic growth. This is because internet finance covers the long tail of people that traditional rural financial institutions cannot satisfy and takes on their existing customers by relying on their service advantages. The loss of customers means a decline in the financial supply of rural financial institutions in rural areas. In addition, in the face of the impact of internet finance, on the one hand, traditional rural financial institutions can carry out business innovation to create new business performance points. On the other hand, they may selectively provide the financial supply to wealthy customers and large enterprises to ensure the business performance. This will likely cause farmers and MSMEs to face more robust financial exclusion and reduce the resource allocation efficiency and financial support rate of the rural financial market. Accordingly, this paper proposes Hypothesis 3:

H3. *The development of internet finance and rural finance has a "complementarity–substitution" effect on agricultural economic growth. When the complementarity effect is stronger than the substitution effect, the overall effect is complementary. The overall effect is substitution when the substitution effect is stronger than the complementarity effect.*

3.4. Analysis of the "Complementarity–Substitution" Effect of Internet Finance and Rural Finance in Different Financial Dimensions

The impact of internet finance on the rural financial market can be explored in three dimensions: the financial scale, financial structure and financial efficiency. In terms of the financial scale, the development of internet finance seizes the customer resources of rural financial institutions and reduces the rate of savings in rural areas. The decline in savings directly reduces the supply of credit by rural financial institutions in rural areas and reduces the contribution of the rural financial scale to agricultural economic growth. In terms of the financial structure, internet finance has, to some extent, split the market share of the original rural financial institutions, providing a more diversified financial supply to rural areas and changing the original single-market structure. This has helped to meet diversified financial needs and cover more financing groups, thus enhancing the contribution of the rural financial structure to agricultural economic growth. In terms of financial efficiency, the entry of internet finance into rural areas has, on the one hand, helped traditional rural financial institutions to use internet technology to carry out financial business innovation; increase the accessibility, screening rate and matching of credit and investment information; and improve the efficiency of resource allocation in the rural financial market. On the other hand, rural financial institutions, fearing a decline in performance triggered by competition, have selectively provided their financial supply to low-risk, large- and medium-sized customers, thus reducing the efficiency of rural financial allocation. Accordingly, this paper proposes Hypothesis 4:

H4. *There is a substitution effect of the development of internet finance and the financial scale on agricultural economic growth in different financial dimensions, including a complementary effect between internet finance and the financial structure and an unknown "complementary–substitution" effect between internet finance and financial efficiency.*

3.5. Analysis of the "Complementarity–Substitution" Effect of Internet Finance and Rural Finance in Counties of Different Economic Levels

According to the previous analysis, internet finance and rural financial development have a "complementarity–substitution" effect on agricultural economic growth. Whether the effect is complementary or amounts to substitution depends on the relative size of the two effects. The regional economic level may be an essential factor in determining the relative strength of the two. Compared with less developed counties, economically developed counties have a higher level of development in regard to the internet and other supporting industries (legal, accounting, the credit assessment), which helps rural financial institutions to innovate their businesses and financial products and improve their ability to provide financial services to the economy. In addition, economically developed counties have a

greater variety of rural financial institutions, a lower degree of imperfectly competitive markets and relatively less choice of customers for rural financial institutions in the context of the entire market competition. Economically developed counties have a strong agricultural and rural industrial base, with more investable projects and groups, and internet finance has less impact on the local rural financial institutions. Therefore, its financial resource mismatch possibility is low. Accordingly, this paper proposes Hypothesis 5:

H5. *There are complementary effects of internet finance and rural financial development on agricultural economic growth in developed counties relative to less economically developed counties.*

4. Model Construction and Variable Selection

4.1. Model Construction

In this paper, we use multiple regression analysis to test the "complementary–substitution" relationship between internet finance and rural financial development in regard to agricultural economic growth. The regression coefficients of the interaction term between internet finance and rural finance are analyzed to determine whether they are complementary or substitution. For this reason, we developed the following model:

$$TRI_{it} = a + \beta_1 RF_{it} + \beta_2 IF_{it} + \beta_3 (RF_{it} \times IF_{it}) + \beta_4 \sum_{i=1}^{n} X_{it} + \varepsilon \quad (1)$$

In the above equation, i and t denote the region and year, respectively. *TRI* is the agricultural economy, and RF is rural finance. In this paper, rural financial development is measured by dividing it into three dimensions: the financial scale (FSC), financial structure (FST) and financial efficiency (CRSTE). IF is internet finance, and Xi represents other control variables affecting the growth of the agricultural economy. β_3 is the interaction effect of internet finance and rural financial development on agricultural economic growth. If the coefficient β_3 is positive, this means that the marginal effects of internet finance and rural finance on agricultural economic growth increase in correspondence with each other. This means that internet finance and rural finance are complementary effects on agricultural economic development. If the β_3 coefficient is negative, this means that the marginal effect of internet finance or rural finance on agricultural economic growth decreases with the increase in the other. This indicates that internet finance and rural finance play a substitution role in agricultural economic growth.

4.2. Selection of Indicators and Description

4.2.1. Core Variables

Studies have been conducted to express economic growth in the context of agriculture (TRI) in terms of the value-added of the primary sector. However, the value-added of the primary sector includes the value-added of agriculture and the value-added of forestry, animal husbandry and fishery. However, since the county statistical yearbooks do not have separate entries for agriculture, forestry, animal husbandry and fishery, this paper uses the logarithm of the value-added of the primary sector in the county to measure the growth of the agricultural economy.

Regarding the selection of rural financial development level (RF) indicators, studies have used the financial scale instead [42,43]. Moreover, some scholars have measured the financial development level in terms of finance's scale, structure and efficiency [44,45]. In order to measure these factors comprehensively, this paper takes the financial scale, financial structure and financial efficiency as the three dimensions of the rural financial development level. It then uses the COV-AHP method to assign weights to each indicator [46]. Finally, it calculates the total rural financial development level score, and the measurement results are shown in Table 1. Where λ_{max} is the maximum eigenvalue, CI is the consistency indicator according to which the random consistency ratio CR is calculated to test the consistency of the judgment matrix. The results in Table 1 show that the CR values of the judgment matrix of the indicators at all levels are less than 0.1, indicating that the indicators have

a good consistency. (The random consistency ratio is written as CR = CI/RI, where the consistency index CI = (λmax-n)/(n-1), in which n is the order of the judgment matrix and RI is the average random consistency index, which can be obtained by checking the table. Generally, the consistency of the judgment matrix is acceptable when CI $\leq$ 0.1 or CR < 0.1.) In this paper, we use the scale, structure and efficiency dimensions of rural finance to comprehensively measure the development of rural finance. The indicators of each dimension are selected as follows:

(i) The scale of rural finance (FSC). The principal financial capital in rural areas comes from loans from local financial institutions, such as agricultural credit cooperatives and agricultural and commercial banks. The development of financial markets such as stocks, bonds and funds is narrow in scale. In this paper, we use the ratio of the year-end financial institution loan balance to the GDP in the county to express the FSC [47].

(ii) Rural financial structure (FST). The rationality of the financial structure is an essential indicator of financial development, and the optimal financial structure plays a decisive role in the economy's steady growth [48]. Some scholars use the direct financing ratio and financial market concentration to measure the financial structure [49]. Financial market concentration is the main factor that determines the structure of the financial market and can reflect the degree of competitiveness and monopoly of the financial market. As the main force of the rural financial market, the ratio of the loan volume of the agricultural credit unions to the loan balance of the rural financial institutions can represent the structure of the rural financial market. Therefore, this paper uses the ratio of the credit union loan balance to the loan balance of each financial institution at the end of the year to indicate the rural financial structure.

(iii) Rural financial efficiency (CRSTE). Resource allocation in the financial market is essential for measuring financial development; thus, this paper defines rural financial efficiency as resource allocation efficiency. Most studies have measured rural financial efficiency using a single (financial market deposit–lending ratio) or comprehensive indicator. The financial market deposit to loan ratio can reflect the efficiency of the allocation of financial market deposits to loans in order to promote economic growth. The higher the ratio is, the larger the scale of capital allocation is. Given the lack of county data, the comprehensive measure of this phenomenon may generate multiple cointegrations and affect the accuracy of the estimation results. In this paper, we use the year-end-deposit-to-loan ratio of each financial institution to express the allocation efficiency.

Table 1. Indicator weights and consistency tests for each dimension of rural financial development.

Guideline Level Indicators	Guideline Level Weights	CI	RI	CR	λ_{max}	Relative Weights of Implementation Layers	Absolute Weight of Implementation Layer
Financial scale	0.333	0.000	0.860	0.000	3.000	0.333	0.333
Financial structure	0.245	0.000	0.540	0.000	3.000	0.245	0.245
Financial efficiency	0.422	0.013	0.890	0.019	2.771	0.422	0.422

Regarding the selection of internet financial development indicators (IF), some scholars have used the publicly available internet Financial Development Index from the internet Finance Research Center of Peking University for measurement [50]. As the publicly available Internet Financial Development Index data are provincial and municipal samples, excluding the county-level data index, this paper refers to the study of Zhang and Han [51]. It uses the publicly available county digital financial inclusion index from Peking University's Digital Finance Research Center to represent it [51].

4.2.2. Control Variables

(i) Fixed asset investment (CI). As one of the three driving forces of the country's economic growth, it is necessary to put investment into the control variable. Regional rural capital investment is measured by the county fixed asset investment per capita. Fixed investment not only requires the consideration of current versus past investments but also has dependability [52]. Because of this, this paper draws on the existing practice and uses the perpetual inventory method (perpetual inventory method calculation formula: $K_t = I_t + (1 - \delta)K_{t-1}$) to measure county capital investment.

(ii) Human capital input (EDU). The number of individuals in the labor force and the number years spent in education among the labor force are the main factors used to measure the level of human capital in a region, which has an important impact on regional economic growth. Given that county data do not indicate the average number of years spent in education among the rural labor force, this paper chooses the number of individuals in the labor force to measure human capital, which is expressed as the ratio of rural employees to the rural population in the county. In addition, fiscal support for agriculture is also an essential factor in promoting agricultural economic growth [53]. Given that there are no data on fiscal support for agriculture in the counties, this paper uses the ratio of the general fiscal budget expenditure to county GDP to represent the county fiscal level (FL). The basic education level (BEL) is an essential indicator of regional development. It expresses the ratio of full-time teachers in public primary and secondary schools to the number of school students. The rapid development of new urbanization has brought many employment opportunities and promoted the growth of the agricultural economy. In this paper, we use the ratio of the town population to the total population at the end of the year to measure the urbanization rate (URBAN). The increase in social consumption (CM) is an essential indicator of a country's economic development, which this paper expresses as the total retail sales of social consumer goods per capita. Two characteristic variables, which refer to whether or not it is a county-level city (ML) under consideration and the amount of commonly used arable land area per capita (CCLA), are included to describe the regional characteristics. The control variables in this paper are defined as logarithms.

4.2.3. Data Sources

This paper's core and control variable research data were obtained from the *China County Statistical Yearbook* (*County and City* volume, 2015–2019). The data of the agricultural credit societies are from the unique database of the agricultural credit societies of Shaanxi Rural Finance Research Center. The internet finance development index was obtained from the Digital Finance Research Center of Peking University. Given the availability of the county data, this paper selects 1869 counties from 2014–2018 as the study sample, eliminates counties with missing a large amount of data, and complements individual counties with a small number of missing values by linear interpolation. (Limited by the availability of internet finance county data, the digital financial inclusion indices of the counties are only publicly available from the Digital Finance Research Center of Peking University for the period of 2014–2018. Therefore, this paper takes 2014–2018 as the research time period.) We convert the core variables in the asset category to constant prices using the GDP deflator with 2014 as the base period. To confirm the accuracy of the findings, all the variables were tested for multicollinearity, and the variance inflation factor (VIF) was 3.673, which is less than 10; thus, the model does not have multicollinearity. The results of the descriptive statistics of the core and control variables are shown in Table 2.

Table 2. Variable settings and descriptive statistics.

Variable	Variable Name	Brochure	Average Value	(Statistics) Standard Deviation	Minimum Value	Maximum Value
Core explanatory variables						
Economic growth in agriculture	TRI	9345	3.231	1.178	0.585	9.244
Core explanatory variables						
Rural financial development	RF	9345	0.412	0.122	0.062	0.899
Scale of rural finance	FSC	9345	0.783	0.356	0.059	8.892
Rural financial structure	FST	9345	0.065	0.048	0.001	0.326
Rural financial efficiency	CRSTE	9345	0.972	0.452	0.123	3.327
Internet finance development	IF	9345	87.53	30.22	12.26	146.67
Control variables						
Capital investment ($ million/person)	CI	9345	1.672	5.562	0.156	15.672
Labor input	EDU	9345	0.856	1.782	0.024	4.172
Urbanization level (of a city or town)	URBAN	9345	0.131	0.147	0.098	0.755
Social consumption (million yuan/person)	CM	9345	1.786	0.978	0.012	46.783
Financial level	FL	9345	0.386	0.255	0.056	4.673
Level of basic education	BEL	9345	0.342	0.245	0.178	4.773
Is it a county-level city?	ML	9345	0.183	0.475	0	1
Arable land in common use per capita (ha/person)	CCLA	9345	0.409	133.782	0.003	865.782

5. Empirical Results and Analysis

Panel data provide information about both the time and dimensional cross-sectional data, which have a higher degree of freedom and can effectively control the heterogeneity among the non-observables. Compared with cross-sectional and time-series data, panel data have more advantages in terms of controlling the multicollinearity among variables, reducing the model estimation bias, and improving the validity of the estimation results. Therefore, this paper uses county panel data from 2014–2018 for its empirical analysis. This paper first estimated the possible heteroskedasticity and autocorrelation of the error terms using the Wald test and the Breusch–Pagan LM test. The test found that the model estimation results have heteroskedasticity between groups, first-order autocorrelation within groups and contemporaneous correlation between groups. Therefore, this paper uses the complete FGLS method with different first-order coefficients to estimate the model.

5.1. Estimation Results for the Full Sample

Table 3 shows the results of the empirical tests using the total sample. The first column shows that the effect of the development of internet finance and rural finance on agricultural economic growth is positive at the 1% level when the interaction effect of rural finance and internet finance is not considered. This indicates that developing rural finance and internet finance drives economic growth in rural areas. When comparing the impact coefficients of the two, we find that the marginal contribution of rural finance to agricultural economic growth is higher than that of internet finance. The second column shows the estimation results when the other control variables are added, and the test results remain consistent with the first column. The third column shows the estimation results when the interaction effect of rural finance and internet finance is considered with the addition of the interaction term between the two in the model. Internet finance and rural finance development exhibit substitution effects in promoting agricultural economic growth. Thus, Hypothesis 3 is verified, and the development of internet finance and rural finance has a "complementary–substitution" effect on rural economic growth after entering rural areas. The substitution effect between internet finance and rural finance is stronger than the complementary one, resulting in an overall substitution relationship. That is, the impact of internet finance weakens the supporting role of rural finance in the rural economy.

Table 3. Full sample estimation results.

Variable	(1)	(2)	(3)
RF	0.5534 ***	0.4531 ***	0.1902 **
	(0.0152)	(0.0163)	(0.0133)
IF	0.2842 ***	0.1861 ***	−0.0997
	(0.0122)	(0.0136)	(0.0076)
RF × IF	-	-	−0.1638 ***
			(0.1243)
CI	-	0.1754 **	0.1267 **
		(0.0144)	(0.0153)
EDU	-	0.0543 ***	0.0226 ***
		(0.0045)	(0.0022)
URBAN	-	0.2284	0.1935
		(0.0125)	(0.0102)
CM	-	0.6594 ***	0.5634 ***
		(0.0155)	(0.0142)
FL	-	0.1554 **	0.1232 **
		(0.0101)	(0.0114)
BEL	-	0.5521 **	0.5335 **
		(0.0177)	(0.0175)
ML	-	0.2992 ***	0.1664 ***
		(0.0128)	(0.0143)
CCLA	-	0.0031	0.0028
		(0.0011)	(0.0011)
constant term	−5.6732 ***	−4.2812 ***	−4.1526 ***
	(0.1553)	(0.1422)	(0.1406)
Wald statistic	27,831.283	19,087.283	18,923.827
Sample size	9345	9345	9345

Note: standard errors in parentheses, ** and ***, indicate significance at the 5% and 1% levels, respectively.

5.2. Estimation Results of Interaction Effects in Different Financial Dimensions

After dividing rural financial development into the three dimensions of the financial scale, structure and efficiency, are the interactions between the different dimensions and internet finance in terms of the effect on agricultural economic growth consistent with holistic rural financial development? Moreover, do the interactions exhibit variability across the three dimensions? This paper proceeds to conduct a model estimation using the rural financial scale, rural financial structure and rural financial efficiency in order to answer these questions. Table 4 shows the specific estimation results.

The results show that the financial size, financial efficiency and internet finance significantly positively affect agricultural economic growth. In contrast, the financial structure harms agricultural economic growth. According to the previous section, this paper's financial structure represents the credit unions' market share in the rural financial market, indicating that the higher the market share of the agricultural credit unions in the rural financial market is, the more detrimental this will be to agricultural economic growth. It may be that the rural financial market, which the credit unions have monopolized for a long time, has a homogeneous structure, without excessive competitive behavior. Credit unions lacking deep reforms and business innovations are overwhelmed by increasingly diversified financial needs.

In different dimensions, we test the "complementarity–substitution" effect of internet finance and rural finance. The coefficients of the interaction terms of the internet finance-financial scale and internet finance–financial efficiency in models (5), (7) and (9) are all significantly negative at the 1% level. This indicates that the entry of internet finance into rural areas reduces the marginal contribution of the financial scale and financial efficiency to agricultural economic growth. The interaction term of internet finance–financial structure is significantly positive at the 1% level. This indicates that the higher the level of internet finance development is, the smaller the negative effect of the financial structure on agricultural economic growth will be. Thus, Hypothesis 4 is tested, and there is a

substitution effect between the development of internet finance and the financial scale and financial efficiency on rural economic growth in different financial dimensions, as well as a complementary effect between internet finance and the financial structure. Internet finance replenishes financial resources in the rural market and, to a certain extent, it breaks the monopoly pattern of agricultural credit cooperatives in rural areas. The "catfish effect" increases the competitive behavior of the rural financial market. It changes the rural financial single-market structure, thus reducing the negative impact on agricultural economic growth.

Table 4. Estimation results of the interaction effects in different dimensions.

Variable	Scale of Rural Finance		Rural Financial Structure		Rural Financial Efficiency	
	(4)	(5)	(6)	(7)	(8)	(9)
FSC	0.7536 *** (0.0132)	−0.1906 (0.0155)	-	-	-	-
FST	-	-	−0.1083 *** (0.1336)	−0.1902 (0.1043)	-	-
CRSTE	-	-	-	-	0.2783 *** (0.1023)	0.1904 (0.0215)
IF	0.1865 *** (0.0128)	−0.0993 ** (0.1022)	0.2563 *** (0.0156)	−0.1673 (0.0144)	0.1891 *** (0.0253)	−0.1892 (0.0283)
FSC × IF	-	−0.1783 *** (0.1253)	-	-	-	-
FST × IF	-	-	-	0.1023 *** (0.0126)	-	-
CRSTE × IF	-	-	-	-	-	−0.1632 *** (0.0291)
control variables	control	control	control	control	Control	control
constant term	−5.2893 *** (0.1673)	−5.0192 *** (0.1563)	−6.2782 *** (0.2109)	−6.1023 *** (0.1903)	−6.2631 *** (0.2006)	−6.0182 *** (0.1073)
Wald statistic	18,923.172	18,673.515	19,733.552	19,263.717	19,226.152	18,931.773
Sample size	9345	9345	9345	9345	9345	9345

Note: standard errors in parentheses ** and *** indicate significance at the 5% and 1% levels, respectively.

5.3. Estimated Results of the Interaction Effects on Counties of Different Economic Levels

Are the characteristics of the "complementary–substitution" effects of internet finance and rural finance consistent across counties of different economic levels? Answering this question can help the government to formulate different financial regulatory measures to promote the development of rural financial markets. In this paper, we divide the sample into three subsamples according to the level of GDP per capita in the county by using the triple quantile and conducting separate regression tests on the subsamples. Table 5 shows the results.

The estimation results from models (10), (12) and (14) indicate that rural financial development is significantly positive for agricultural economic growth in all medium-, high-, and low-economic-level counties. Consistent with the estimation results for the national sample, the impact coefficient decreases according to the gradients of high, medium and low. Combining the estimation results of models (1) and (2), Hypothesis 1 is tested. Rural financial development has a catalytic effect on rural economic growth, and the positive effect of rural financial development on rural economic growth in less developed counties is lower relative to economically developed counties. This shows that there is no financial disincentive due to excessive government intervention in the rural financial markets in 2014–2018, although the rural financial markets are imperfectly competitive everywhere. The impact of internet finance development on agricultural economic growth in high-economic-level counties is significantly positive at the 1% level. However, medium- and low-economic-level regions show a negative performance. Hypothesis 2 was tested, and we verified that internet finance development contributes to the growth of the rural economy. Relative to economically developed counties, internet finance has a negative effect on

rural economic growth in less economically developed counties. It is possible that the development of internet finance reduces the reliance of rural customers on saving products and increases investment in income-generating projects, causing capital to flow out of rural areas. In addition, the counties of the middle and low economic levels have insufficient knowledge about, and trust in, internet finance, and the "three rural" subjects show "self-rejection" with respect to internet credit [54].

Table 5. Estimates of the interaction effects on counties of different economic levels.

Variable	High Economic Level Counties		Medium Economic Level Counties		Low Economic Level Counties	
	(10)	(11)	(12)	(13)	(14)	(15)
RF	0.8673 ***	0.1908	0.5682 ***	0.1022	0.2673 ***	−0.1927
	(0.0203)	(0.1534)	(0.0196)	(0.1127)	(0.0153)	(0.1873)
IF	0.2673 ***	−0.2731	−0.1673 ***	−0.3023	−0.2781 ***	−0.3172
	(0.0141)	(0.1036)	(0.0673)	(0.2887)	(0.1092)	(0.2561)
RF × IF	-	0.2116 ***	-	−0.1163 ***	-	−0.1782 ***
		(0.0112)		(0.0352)		(0.0343)
Control variables	control	control	control	control	control	control
Constant term	−7.9021 ***	−7.0572 ***	−7.2012 ***	−7.1038 ***	−7.7832 ***	−7.3354 ***
	(0.2061)	(0.1928)	(0.1736)	(0.1672)	(0.1722)	(0.1801)
Wald statistic	8923.728	8563.112	7928.563	7893.667	8102.662	8244.902
Sample size	3115	3115	3115	3115	3115	3115

Note: Standard errors in parentheses, *** indicates significant at the 1% levels, respectively.

We tested the "complementarity–substitution" effect of internet finance and rural finance on counties of different economic levels. In models (11), (13) and (15), the coefficients of internet finance-rural finance in high-economic-level counties are significantly positive at the 1% level, and they show complementary effects on the process of local agricultural economic growth. On the other hand, the coefficient of internet finance–rural finance for medium- and low-economic-level counties is significantly negative at a 1% level. Both show a substitution effect on the growth of the local agricultural economy. Thus, Hypothesis 5 is verified, and there is a complementary effect of internet finance and rural financial development on rural economic growth in developed counties relative to less economically developed counties. The reason for this may be that rural financial markets in economically developed counties have diversified financial institutions, a higher degree of market competition and more proactive innovation of local financial institutions. In addition, rural financial markets and ancillary industries in developed counties are relatively mature and have a comparative advantage in terms of learning and applying internet technology in order to innovate financial products and enhance financial services. In medium- and low-economic-level counties, rural financial institutions cannot promptly innovate and upgrade business processes, management models and financial products. In order to prevent a decline in business performance, they will further provide financial supplies to wealthy customers, thus creating a mismatch of financial resources that "adds flowers to the cake" rather than "sending charcoal to the snow", resulting in a decline in the marginal contribution of rural financial markets to agricultural economic growth.

5.4. Robustness Tests and Endogeneity Discussion

From the above, it is clear that rural finance and internet finance development significantly impact agricultural economic growth. However, there may be an endogenous relationship between agricultural economic growth, rural finance and internet finance. A better agricultural economy creates more demand for savings and investment in rural areas and drives the development of financial support industries, creating a favorable environment for the development of rural financial markets. Therefore, there is a need to control the endogeneity arising from the two-way causality between the core explanatory variables and the core explanatory variables. This paper uses the first-order lagged term of

agricultural economic growth as an instrumental variable for the core explanatory variables and the mean of the rural finance and internet finance development in counties other than the county in question as an instrumental variable for the core explanatory variables [55]. This is estimated using a systematic GMM model. The estimation results (Table 6) remain stable in accordance with the baseline regression results, indicating the robustness of the empirical results in the previous section.

Table 6. Robustness estimation results.

Variable	Full Sample		High Economic Level Areas		Medium Economic Level Areas		Low Economic Level Areas	
	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
RF	0.5623 ***	0.1887	0.7823 ***	0.1722	0.4783 ***	0.0863	0.1673 ***	−0.1828
	(0.0167)	(0.0165)	(0.0187)	(0.0231)	(0.0155)	(0.1027)	(0.0153)	(0.0235)
IF	0.2110 ***	−0.1823	0.3823 ***	−0.1673	−0.1086 ***	−0.1777	−0.2901 ***	−0.2039
	(0.0144)	(0.1024)	(0.0158)	(0.1023)	(0.0125)	(0.1222)	(0.0253)	(0.1441)
RF × IF	–	−0.1262 ***	–	0.2118 ***	–	−0.1446 ***	–	−0.1889 ***
		(0.0431)		(0.0126)		(0.2152)		(0.0276)
Control variable	control	Control	control	control	control	Control	control	control
constant term	−5.7822 ***	−5.6721 ***	−7.2938 ***	−7.0263 ***	−6.9203 ***	−6.2873 ***	−7.0293 ***	−6.7718 ***
	(0.1552)	(0.1441)	(0.2617)	(0.2116)	(0.1927)	(0.1783)	(0.2288)	(0.1673)
Wald statistic	18,932.178	17,902.776	7821.883	7903.672	7628.192.	7554.273	7833.273	7564.292
Sample size	9345	9345	3115	3115	3115	3115	3115	3115

Note: standard errors in parentheses, *** indicates significance at the 1% levels.

6. Conclusions and Insights

6.1. Findings of the Study

For a long time, to better support the development of the "three rural areas", the financial market has been attempting various reforms aiming to upgrade the rural financial ecology and financial services. China's rural areas are now in a new agricultural and rural modernization stage, involving urban–rural integration and rural revitalization development. Under the trend of the rapid development of information and the internet, it is indisputable that there is a need to integrate the advantages of internet financial services, improve the rural financial market to build a modern financial system, and improve the quality and efficiency of rural financial services for the agricultural economy. This is the driving force required to promote the high-quality development of the agricultural economy through the rural revitalization strategy and the rightful meaning of rural finance, which aims to support the economy of the "three rural areas" under the new pattern of the "double cycle." Therefore, does the coexistence of internet finance in rural areas and traditional rural financial institutions help the growth of the agricultural economy? Based on the perspective of the "complementary–substitution" effect, this paper empirically examines the relationship between internet finance and rural finance in terms of agricultural economic growth. The main research findings are as follows.

As stated in Hypothesis 1, the overall rural financial development contributes to rural economic growth. Sub-dimensionally, the rural financial scale and rural financial efficiency have a positive effect on the rural economy, but the rural financial structure has a negative effect on the rural economy. The higher the monopoly of the credit unions in rural financial markets is, the more detrimental this will be to rural economic growth. For counties of different economic levels, the impact of rural financial development on rural economic growth on counties of high, medium and low economic levels is significantly positive, and the degree of the impact decreases in the order of high, medium and low.

Secondly, according to Hypothesis 2, internet financial development contributes to rural economic growth. For counties of different economic levels, internet financial development helps rural economic growth in counties of high economic levels but has a suppressive effect on rural economic growth in counties of medium and low economic levels.

Thirdly, Hypothesis 3 stated that internet finance and rural finance exhibit substitution effects on rural economic growth. Sub-dimensionally, the development of internet finance weakens the marginal contribution of the financial scale and financial efficiency to the rural economy, while reducing the negative effect of the financial structure on the rural

economy. Thus, Hypothesis 4 is verified. There is a substitution effect of the relationship between the development of internet finance and the financial scale and financial efficiency on rural economic growth in different financial dimensions, and a complementary effect between internet finance and the financial structure. For counties of different economic levels, internet financial development enhances the development capacity of rural financial services for the rural economy in high-economic-level counties, but it weakens the marginal contribution of rural finance to rural economic growth in medium- and low-economic-level counties, which verifies Hypothesis 5.

6.2. Policy Recommendations

Based on the above analysis, the following policy insights are proposed. Firstly, we must strengthen innovation and vigorously improve the operational level of rural financial institutions. On the one hand, rural financial institutions should be based on credit business, reduce service costs, reduce service processes and improve their service capability by developing electronic banking business platforms, such as online banking, WeChat banking and direct marketing banking. At the same time, they should fully combine the current development characteristics of the rural economy to develop business types, such as the provision of financial services to new agricultural business entities, agricultural products, e-commerce and other objects, seeking profit growth points and coping with the internet financial enterprises' erosion of their profits. On the other hand, rural financial institutions should strengthen their cooperation with internet financial enterprises. In fact, rural financial institutions have abundant customer resources and a large number of physical outlets, while internet financial enterprises have certain advantages in terms of IT technology, platform construction, etc. There is a basis for cooperation between the two, which promotes common development through cooperation.

Secondly, we must strengthen regulation and effectively engage with the competitive effect of internet finance. As new entrants in the rural financial market, internet financial enterprises have broken the monopoly of traditional rural financial institutions, but at the same time, they also have a certain negative impact on the original market. As "three rural" customers have strong credit needs but limited financial knowledge, they are prone to financial rejection. We should strengthen the constraints on the access, business operation and supervision of internet finance in rural areas to reduce the self-exclusion of internet finance and enhance the awareness and financial literacy of small- and medium-sized agricultural enterprises and farmers with regard to internet finance. Internet finance platforms should design more inclusive products, and the reasonable and effective promotion of their own products can be enhanced at the same time so as to popularize the financial knowledge of customers in order to improve their acceptance of the products. By giving full recognition to the advantages of internet finance, the scope of financial services and service quality in rural areas can be improved, and the risk control system for financial products can be perfected. Based on the natural weakness of "three rural" customers, the government should set higher entry thresholds for the internet financial platforms entering rural areas, while the platforms themselves should pay great attention to the possible risks of various kinds and ensure the normal operation of the platforms by improving the risk control system and effectively controlling the credit information of customers.

Thirdly, we must optimize the structure and overcome the monopoly pattern of agricultural credit cooperatives in the rural financial market. The flexible policy regulatory system should be set up under conditions that can gradually strengthen the degree of openness and competition in the rural financial market. We must improve the service system of "commercial finance–development finance–policy finance–cooperative finance" in the rural financial market with a reasonable division of labor and mutual complementarity and provide a diversified financial supply to rural areas. Traditional rural financial institutions should learn the essence of internet financial business, overcome the disadvantages of traditional financial institutions and apply internet technology to improve financial services on the basis of a stable customer base and credibility brand. Rural financial institutions

should accelerate the sinking of businesses, promote the construction of an inclusive financial service system, explore the value of "long-tail" customers, pinch the "long-tail" market fragments, and cease from focusing on only the middle- and high-end customers. By enhancing the ability of rural financial institutions to cope with the impact of internet finance, rural financial institutions can alleviate the mismatch of financial resources for a stable business performance and bring into play the promotion effect of the rational allocation of financial market resources for the rural economy.

Author Contributions: Conceptualization, B.M.; methodology, B.M. and A.A.K.; software, B.M. and A.A.K.; validation, B.M. and J.L.; formal analysis, B.M. and J.L.; investigation, B.M., S.U.K. and J.L.; resources, J.L.; data curation, B.M.; writing—original draft preparation, B.M.; writing—review and editing, B.M., S.U.K., M.A.S.A. and J.L.; visualization, B.M.; supervision, J.L.; project administration, B.M.; funding acquisition, J.L. All authors have read and agreed to the published version of the manuscript.

Funding: This paper is supported by "Research on the Dynamic Value Evaluation of Agricultural Biological Assets, Mortgage Financing Model and Risk Management Policy", National Natural Science Foundation of China (NSFC), Jan 2023-Dec 2026, No. 72273105. Sponsor and Host: Jianchao Luo. This paper is also supported by "Research on the Effectiveness Evaluation, Risk Control and System Construction of the Agricultural Credit Guarantee Policy", National Natural Science Foundation of China (NSFC), Jan 2019-Dec 2022, No. 71873100. Sponsor and Host: Jianchao Luo. This paper is also supported by "Rural revitalization financial policy innovation team", Chinese Universities Scientific Fund, Jan 2022-Dec 2023, No. 2452022074. Sponsor and Host: Jianchao Luo. This paper is also supported by "Research on the Policy Orientation and Implementation Path of Financial Empowerment of Rural Revitalization", the Soft Science Project of the Central Agricultural Office and the Rural Revitalization Expert Advisory Committee of the Ministry of Agriculture and Rural Affairs, 2022.5.31-2023.5.31, No. rkx20221801, Sponsor and host: Jianchao Luo.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to data management reasons.

Conflicts of Interest: The authors declare no conflict of interest.

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