

Research Article

Research on the Influencing Mechanism of Data Capital on Farmers' Income

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Based on the 2018 China Family Panel Studies data, this paper uses the OLS model, threshold regression model, and mediation effect model to analyze the influencing mechanism and degree of data capital on farmers' income. The study found that data capital has a significant positive impact on farmers' income, which can effectively promote farmers' income. There is a nonlinear relationship between data capital and farmers' income, and its marginal return increases with farmers' human capital increasing. Social network plays a partial intermediary role between data capital and farmers' income, that is, social network is an important channel for data capital to affect farmers' income improvement. Based on the above conclusions, some reference suggestions are put forward.

1. Introduction

At present, China's farmers are facing a severe situation in increasing their income and other problems such as the rapid aging of the rural population, the structural unemployment of the rural labor force, and the lack of traditional kinetic energy. How to quickly promote the continuable and stable income increase of farmers has become one of the most urgent problems [1]. The quiet rise of the digital economy has brought new opportunities and vitality for farmers to increase their income. The digital economy which is based on digital technologies such as big data and 5G has deepened the integration of agricultural production and management, giving birth to many new ways and channels of increasing income and injecting fresh blood into farmers' income. By the end of 2020, the number of rural dwellers in our country has reached 309 million and the Internet penetration rate in rural areas has reached 55.9%. In December 2021, the State Council issued the 14th Five-Year Plan for the Development of the Digital Economy which proposed that the digital economy is the new engine of the economic system in the new era and it is necessary to rapidly promote the construction of digital villages and the digital transformation of agriculture. In January 2022, the opinions

of the central committee of the communist party of China also pointed out that it is necessary to vigorously develop smart agriculture, strengthen farmers' digital ability training and skill training, and use data as a key element resource to empower farmers' income. In the context of this paper, it is of great practical significance to explore the influencing mechanism of data capital on farmers' income. What is the relationship between data capital and farmers' income? In view of it, this paper uses the 2018 China Family Panel Studies data to empirically test the impact mechanism and degree of data capital on farmers' income and further puts forward relevant suggestions, providing useful reference for promoting farmers' income, promoting digital village governance and farmers' income, accelerating agricultural modernization, and improving farmers' income.

The marginal contribution of this paper may lie in the following aspects: first, the data capital level of farmers is measured from the two dimensions of digital technology access and data application ability which enriches the literature on data capital measurement; second, with the gradual advancement of the digital village strategy, data capital is likely to become a breakthrough path for farmers' income improvement during the 14th Five-Year Plan period; this study uses the latest China family panel studies data to

explore the relationship between data capital and farmers' income; third, human capital and social network are included in the same research framework to verify the impact mechanism of data capital on farmers' income from a microperspective and further reveal the threshold effect of farmers' human capital and the mediating effect of social networks. The conclusions provide abundant evidence and also deepen the relevant research on the mechanism of data capital.

2. Literature Review

2.1. Data Capital. For the study of data capital, the term digital capital is used more abroad. Don et al. [2] first proposed the concept of digital capital in the book "Digital Capital-Using the Power of Commercial Websites" published in 2000, namely, the key production resources on developing new products and services in the digital economy. Later, Ragnedda [3] emphasized that digital capital is composed of internal digital application capabilities and external digital technology resources which has been recognized by scholars [4]. Domestic scholars have also begun to pay attention to data capital in recent years. Jiang [5] introduced the characteristics of data capital by proposing the concept of general data and believed that data capital is an abstract data form stored on digital equipment, a product created by general intelligence (cognition, technology, and knowledge) and privately owned. Liu [6] affirmed the possibility of data capital from the two dimensions of Marx's capital logic and capital's civilization and consumption capacity. Xu and Zhao [7] defined data capital as information and data that are fully digitized and production factors based on the Internet and databases. Based on this, Zhang [8] further pointed out that data capital is a new form of capital created by the marriage of capital and digital technology. Meng and Guo [9] believe that data capital is a form of capital built on digital infrastructure. Based on the viewpoints of scholars, data capital should include two categories: one is traditional tangible data capital, which is composed of technologies such as information, computing, communication, and connection, such as servers, routers, online purchasing platforms, and basic Internet software. The second is intangible data capital, that is, the digital capabilities of farmers in terms of information and reading and writing, communication and cooperation, digital content creation, security, and problem solving. In addition to the characteristics of big data such as large volume, reproducibility, and sharability, data capital is also accumulating and transferable, and it is a bridge connecting other forms of capital online and offline [10], which promotes the efficient use of traditional capital use to create more profits. Based on the definition of data capital connotation, many scholars began to conduct practical exploration and measured the data capital level of individuals, enterprises, and websites, respectively. Ragnedda [3] used online research and factor analysis to measure individuals' data capital from both digital exposure and digital application capabilities. Bughin and Manyika [4] selected three cases to evaluate the enterprise data capital level in both terms of digital

investment and application capability. Liu [6] built data application capability indicators from three aspects of relationship, customer, and service and measured data capital of hospital service websites. To sum up, existing scholars should research data capital in concept definition and measurement.

2.2. Data Capital and Farmers' Income Increase. The direct quantitative research on data capital and farmers' income increase is relatively rare and the relevant research focuses on the following: (1) the Internet and farmers' income increase. Some studies have shown that Internet information technology has a significant positive impact on the income of farmers and plays a key role in increasing the income of poor farmers [11, 12]. First, the application and diffusion of Internet information technology make it easier for farmers to obtain market information, reduces the cost of farmers' information search, and is beneficial to farmers to obtain higher market prices of agricultural products [13], which leads to an increase in farmers' income. Zhao [14] found based on the survey data in Peru in 2012 that farmers with ICT access are more inclined to choose foreign sales markets and thus obtain higher incomes. Second, the Internet leads the development of rural e-commerce, broadens employment channels, increases the nonagricultural employment rate [15], and promotes rural labor to achieve employment and get rid of poverty. Furthermore, the Internet increases the level of wage income by improving work efficiency [16]. Camacho and Conover [17] found that Internet information technology has a greater positive effect on farmers' wage income based on macrostatistical data. Finally, the digital information platform provides entrepreneurs with convenient resources, reduces the financing risk of ordinary households, improves farmers' entrepreneurial activity, and promotes farmers' income. There are also some studies that show that Internet information technology has little effect on the income increase of farmers. Based on the data of Columbia international corporation, Tian and Zhang [18] found that Internet information technology does not significantly promote the sales price of agricultural products and farmers' income. (2) Digital economy, digital agriculture, digital literacy, and farmers' income: Shan et al. [19] based on the two-difference model found that the digital economy can significantly promote nonagricultural employment and promote the highly skilled rural labor force to the highly skilled biased digital nonagricultural industry. Qin et al. [20] found that digital literacy had a significant effect on the accumulation of farmers' property income and showed the characteristics of beneficial poverty. Yu [21] verified that the development of e-commerce is beneficial to promoting the level of entrepreneurship and increasing nonagricultural employment, but there is no obvious difference in the role of e-commerce development for farmers with different human capital and social relations. (3) Other factors related to increasing farmers' income: scholars have found that family human capital, material capital, and social relations will promote farmers' income. In terms of human capital, education and health can increase labor income and

thus increase farmers' income. Gao and Yao [22] found that almost all health indicators affected farmers' planting income, but the impact degree varied. The self-rated health impact was the most significant. The body mass and calorie intake showed nonlinear relationships and nonhealth indicators such as age and education had no significant impact on farmers' income. The study by Cheng et al. [23] showed that the return on income of material capital was lower compared with human capital. In terms of social relations, Gloede et al. [24] pointed out that social capital such as political identity plays an important role in the income of farmers. The income of farmers with political identity is significantly higher than that of ordinary farmers, and differences in their characteristics such as population burden rate and employment structure will also significantly affect the income of farmers.

The literature review shows that the existing related research has discussed the concept and characteristics of data capital, data capital measurement, and the influence of the Internet, digital economy, human capital, and social relations on farmers' income, but the influencing mechanism of data capital and farmers' income is relatively scarce and has not been involved in the farmers' human capital indirect influence of investment and social network. In view of it, based on the microlevel sample data of the China Family Panel Studies, this study explores the influencing mechanism of data capital on farmers' income and further builds the bootstrap mediating effect model and threshold regression model to reveal the mediating effect of social network on data capital and farmers' income and threshold effect of farmers' human capital.

3. Theoretical Analysis and Research Hypotheses

3.1. The Impact of Data Capital on Farmers' Income. Data capital is a digital production factor. Different from traditional capital, data capital needs to be based on digital technology and covers digital technology tools and data application capabilities [3, 4]. Based on this, the impact of data capital on farmers' income includes not only the impact of farmers' ownership of digital tools such as mobile phones and computer facilities on income but also the impact of farmers' data application capabilities on income. At the microlevel, the impact mechanism of data capital on farmers' income is mainly reflected in the following aspects.

First, data capital promotes the increase of agricultural income by reducing costs and improving efficiency. On the one hand, farmers can use mobile phones and computers to connect the Internet of Things and the Internet, access digital technology platforms, and integrate into a real-time and efficient information sharing network, thereby reducing information search costs. According to the information search theory, when the cost of information search decreases, farmers will tend to expand information search [25], accelerate the classification and integration of agricultural resources in cyberspace, optimize the planting structure of agricultural products, and maximize profits. On the other hand, various digital platforms reduce the cost of acquiring

educational and commercial resources and provide farmers with convenient learning, shopping, and sales channels. Through online learning, training, and shopping, farmers can not only accumulate rich agricultural production skills but also improve farmers' acceptance of new things and innovation ability [26, 27], so as to independently change the traditional agricultural management concept according to digital platform information, develop digital agricultural production plans, make optimal production decisions, and then promote the increase of agricultural income.

Second, data capital promotes the increase of farmers' nonagricultural income by increasing the employment rate and entrepreneurship rate. Data capital can not only be directly manifested in the improvement of labor productivity but also promote the increase of nonagricultural income by increasing the employment rate and entrepreneurship rate. First, with the accumulation of data capital, farmers can master more employment channels, obtain more extensive employment information, activate the employment potential of rural surplus labor, and then achieve self-employment. Second, the development of new business formats such as e-commerce and online self-media has reduced the dependence on education level, effectively made up for the generally low education level of farmers, and provided entrepreneurs with more opportunities, jobs, and increased nonagricultural employment probability, and promote the increase of nonagricultural income. Furthermore, the attributes of data capital that can be shared, transferred, and replicated [2] are conducive to the formation of a dynamic, real-time, and efficient information sharing mechanism [25], which reduces the cost of information search and risk estimation of farmers, stimulates their entrepreneurial enthusiasm which has an important role in promoting farmer's willingness of potential entrepreneurs. Finally, a convenient information sharing platform is also helpful for entrepreneurs to grasp market dynamics in a timely manner, improve the success rate of entrepreneurship, and then increase the nonagricultural income of farmers. Based on this, the following is proposed:

Hypothesis H1: data capital can significantly promote the income of farmers

3.2. The Mediating Effect of Social Networks. A social network is a network composed of main personal relationships such as family members and friends and belongs to the category of social capital [28, 29]. The characteristics of "face-to-face" communication in traditional social networks make the communication between individuals in social networks limited by spatial distance. The use of digital network terminals has eliminated space barriers, shortened physical distances, and provided farmers with convenient social channels. With the help of digital communication means, farmers can realize instant communication, which significantly enhances the interaction and connection between farmers, improves the timeliness of information exchange, and realizes the full use of social network resources. At the same time, with the help of online communication tools such as WeChat and Weibo, farmers can find groups similar to or identify with each other on the Internet to build online

communities, and by strengthening network relationships, virtual social capital can be transformed into real social networks and improve farmers' social capital.

Furthermore, according to social embedding theory, when making relevant decisions, individual economic behavior is affected by the embedded social network. In the countryside which has the typical characteristic of relationship-based, the social network plays a pivotal role on farmer's behavior decision-making process [30]. Relevant studies also show that social network has a significant positive effect on farmers' income. On the one hand, agricultural production is faced with both natural and social risks, and the social network has the characteristics of high, heterogeneous, and extensive [31], which can not only improve the quantity, quality, and extent of information resources but also expand the market transactions of agricultural products scope and increase the transparency of transactions, thereby effectively reducing the impact of risks and promoting the income of farmers. On the other hand, the labor market is naturally asymmetric. The social network can help farmers obtain jobs and business opportunities under the same conditions, enrich income channels, further increase the employment and entrepreneurship rate and farmer's income [32, 33]. From this viewpoint, the application of data capital can significantly improve the interaction efficiency and social network range, fully releasing the income-increasing potential of social network and become the important driving force on increasing farmer's incomes in digital economy. Based on this, the hypothesis is presented.

Hypothesis H2 : social network plays a significant mediating role between data capital and farmers' income increase

3.3. Threshold Effect of Farmer's Human Capital. The ability of farmers to apply digital technology largely depends on their human capital level. According to the human capital theory, the differences in the ability of individual behaviors to allocate production factors will directly affect the level of income. Based on this, the difference in the ability of farmers to apply data capital will also lead to different characteristics of income. Research shows that health and education are the core elements of human capital, and this is the fundamental mechanism for increasing farmers' knowledge, skills, and income. On the one hand, with the improvement of education level, farmers' cognition, understanding, acceptance, and application ability of digital technology will be improved accordingly and farmers' income sources and realization paths will be greatly expanded [34]. In addition, the health status of farmers will also have an important impact on the application of farmers' data capital. Only farmers with good health can meet the new opportunities and challenges brought by the new generation of digital technology with a positive physical and mental state, better integrate and accept them, and promote income growth. The specific impact is reflected in the following.

When the human capital of farmers is lower than a certain level, the education level and health of farmers are relatively low and the effect of data capital in promoting farmers' income is low. It is manifested in the following aspects: on the one hand, farmers have insufficient knowledge and skills reserves and can only rely on simple digital technology for production, due to their average physical and mental quality, the actual working time is short, and the depth and breadth of farmers' access and application of digital capital are limited. The growth rate of farmers' income is relatively slow [35, 36]; on the other hand, although some farmers have a strong desire to adopt digital technology and apply learning, they do not have the matching ability to learn and accept data, which reduce data capital utilization efficiency and limit farmer's income increase to the certain extent.

When farmer's human capital accumulates to a certain level, their level of education and health is relatively high. Accordingly, the impact of data capital on farmer's income will increase. Firstly, farmers can actively use digital platform resources, quickly identify and acquire big data knowledge, master certain digital technology resources, promote farmer's production skills optimization, improve labor production efficiency [37]. Secondly, when the level of farmer's human capital is high, they have stronger risk aversion ability, high self-confidence and enthusiasm for adopting new technologies, then improve utilization efficiency of data capital and increase income level [38]. Finally, with the improvement of human capital, farmer's dependence on traditional agricultural business income has gradually weakened and they are more inclined to fully search for Internet platform information to gain non-agricultural employment and entrepreneurship, which promote the ability to increase farmer's income [38–40].

To sum up, the relationship between data capital and farmers' income is not a simple linear relationship, but shows obvious differences with the changes in the level of farmers' human capital. Based on this, the following is proposed:

Hypothesis H3: farmer human capital is a significant threshold variable between data capital and farmer income

4. Research Design

4.1. Definition of Variables. Explained variable-farmer household income (*lnincome*): drawing on the research of Cheng and Shi [33] and Liu and Han [32], using the sum of family agricultural income and nonagricultural income to express, the agricultural income of farmers is defined as the difference between the market value of agricultural products and the input cost of agricultural products, and the non-agricultural income of farmers is determined by family management. The sum of sex income and wage income is measured. In order to reduce the influence of heteroscedasticity, we further take the logarithmic form of farm household income and record it as *lnincome*.

Explanatory variables—Data Capital (DC): based on the definition of data capital by predecessors and referring to the measurement method of personal digital capital by Cheng and Shi [33], data capital is defined as two dimensions of digital technology contact and data application ability. Digital technology contact includes digital equipment, connectivity, online time, support, and training; data application capabilities are information and literacy, communication and cooperation, digital content creation, etc. Data application capabilities include whether to use the Internet, the frequency of using the Internet to measure exposure to digital technologies, the importance of using the Internet to obtain information, online communication and cooperation, and awareness of active learning. Among them, whether to use the Internet and the frequency of using the Internet to work are farmers' identification of data capital from their behavioral methods and are a direct reflection of farmers' adoption and acceptance of data capital. The importance of using the Internet to obtain information, the awareness of online communication and cooperation, and active learning are farmers' recognition of data capital from the way of thinking and a deep reflection of farmers' data capital application ability. The specific measurement index system is shown in Table 1.

Mediating variable—Social Network (SN): Most of China's rural areas rely on the exchange of gifts to maintain traditional social relations. The more spending on gifts, the larger the scale of social networks. Therefore, referring to the previous research results [31–33], farmer's social network is measured by the expenditure on family favors and rituals.

Threshold variable—Human Capital (HC): considering that education and health are the core elements of farmers' human capital, combined with the existing common treatments [34, 36], two items of “education and training expenditure” and “health care expenditure” in the CFPS questionnaire were selected to construct the farmers' human capital indicators. Drawing on the practice of Wen and Ye [36], it is further measured by the per capita human capital of farmers, which is recorded as HC.

Control variables: in order to avoid the interference of other factors affecting the income of farmers in the regression process, this paper refers to the existing research [32–36] and adds the characteristics of the head of household and the characteristics of the family as control variables, including the age, gender, work nature, and perception of relative income of the head of the household, family size, and marital status. The relevant variables are defined in Table 2.

4.2. Model Design. In order to verify the existence of hypothesis H1, that is, data capital can promote the income of farmers, the following linear regression model 1 is constructed by referring to the existing treatment [2]:

$$\ln \text{ income}_i = \alpha_0 + \alpha_1 DC_i + \alpha_x X_i + \varepsilon_i. \quad (1)$$

In order to verify the existence of H2, that is, the mediating effect of social network in the process of data capital affecting farmers' income, the following mediation effect

regression models (2)–(4) were established by referring to the practice of Liu and Chen [37]:

$$\ln \text{ income}_i = \alpha_0 + \alpha_1 DC_i + \alpha_x X_i + \varepsilon_i, \quad (2)$$

$$SN_i = \beta_0 + \beta_1 DC_i + \beta_x X_i + \mu_i, \quad (3)$$

$$\ln \text{ income}_i = \alpha_0 + \alpha_1 DC_i + \alpha_2 SN_i + \alpha_x X_i + \varepsilon_i. \quad (4)$$

In order to verify the existence of hypothesis H3, that is, the threshold effect of farmer households' human capital, the following threshold regression models (5) and (6) are constructed:

$$\ln \text{ income}_i = \alpha_0 + \alpha_1 DC_i + \alpha_x X_i + \varepsilon_i, HC_i \leq \gamma, \quad (5)$$

$$\ln \text{ income}_i = \alpha_0 + \alpha_1 DC_i + \alpha_x X_i + \varepsilon_i, HC_i > \gamma. \quad (6)$$

In the above model, $\ln \text{ income}_i$ represents the logarithm of the total household income of farmer i , DC_i represents the data capital of farmer i , HC_i represents the threshold variable: the human capital of farmer i , γ represents the threshold value to be estimated, SN_i represents the intermediary variable social network, X_i represents the set of all control variables that affect the income of farmers, α represents the coefficient to be estimated, and ε_i represents the random error term. Regarding the setting of the mediation effect model, if at least one of the coefficients β_1 of DC in model (3) and the coefficient α_2 of SN in model (4) is not significant, the Bootstrap test H_0 is required: $\beta_1 \times \alpha_2$ equals 0. This paper uses the nonparametric percentile Bootstrap method based on bias correction. This method does not involve the overall distribution and parameters and uses the empirical distribution derived from the sample instead. If the confidence interval does not contain 0, the coefficient product is significant. α_1 in the threshold models (5) and (6), respectively, represents the influence coefficient of data capital on farmers' income when $HC \leq \gamma$ and $HC > \gamma$. If the two are equal, it proves that there is a threshold effect; otherwise, there is no threshold effect.

4.3. Data Sources. The data used in this article come from the China Family Panel Studies (CFPS) microdatabase. The database is updated every two years and can better reflect the income growth characteristics of Chinese farmers. Since the 2020 data have not yet been fully released, based on the issues and background of this paper, the 2018 database was finally selected as the research object, and the samples with “unknown,” “not applicable,” and related variables less than 0 in the relevant variables of the original data were excluded. After screening, merging, and sorting of relevant data, 14,215 valid samples were finally obtained.

Table 2 shows the basic characteristics of the sample farmers. From the perspective of household head characteristics, the average age is about 50 years old, showing aging characteristics, mainly male, with low education level, average primary school education level, mainly engaged in agricultural work, general health, and poor evaluation of their own income level optimism. From the perspective of family

TABLE 1: Description of the digital capital index measurement system.

| Dimension | Item | Assign | Mean | Standard deviation |
|----------------------------|---|---|------|--------------------|
| Digital technology contact | Whether to use the Internet | Use the Internet = 1, Do not use the Internet = 0 | 0.43 | 0.495 |
| | How often you use the Internet for work? | Including the intranet of the user unit, 1-7 continue to rise | 2.33 | 1.619 |
| | Frequency of Internet learning | 1-7 keep rising | 2.04 | 1.237 |
| Data application ability | Importance of Internet access to information | 1-5 keep increasing | 2.99 | 1.190 |
| | Respondents' social interactions with their relatives, friends, and acquaintances | 1-7 keep rising | 3.78 | 1.479 |
| | Active learning awareness | Do you usually read? yes = 1, no = 0 | 0.16 | 0.370 |

TABLE 2: Variable definitions and descriptive statistical analysis.

| Variable name | Variable definitions | Average | Standard deviation | Maximum value | Minimum value |
|---------------------------------|---|---------|--------------------|---------------|---------------|
| Age | Age squared | 2596.28 | 1322.78 | 400 | 8100 |
| Gender | Male = 1, female = 0 | 0.73 | 0.50 | 1 | 0 |
| Education level | 1-7 keep rising | 2.41 | 1.98 | 6 | 1 |
| Nature of the work | Agricultural jobs = 1, nonfarm jobs = 0 | 0.62 | 0.49 | 1 | 0 |
| Subjective health assessment | 1-5 keep increasing | 2.69 | 1.56 | 5 | 1 |
| Perceived relative income level | 1-5 keep increasing | 3.05 | 0.92 | 5 | 1 |
| Family size | Total family size | 4.65 | 2.89 | 2 | 9 |
| Marital status | 1-5 keep increasing | 2.07 | 0.81 | 5 | 1 |
| Farmer's income | The logarithm of the sum of farm income, household business income, and wage income | 10.80 | 2.22 | 12.60 | 0 |
| Education and training spending | The logarithm of all education-related expenditures | 4743.62 | 10277.03 | 300000 | 0 |
| Healthcare spending | The logarithm of the sum of medical expenses and healthcare expenses | 6186.44 | 15758.96 | 389000 | 0 |
| Social network | Logarithm of family favors spending | 7.45 | 2.441 | 10.37 | 0 |

characteristics, the family labor force is sufficient, the average family size is 4.65, and the average marital status is married.

5. Analysis of Empirical Results

Table 3 presents the benchmark regression estimation results of data capital and farmers' income. The first column only shows the independent effect of data capital on farmers' income. The second column is the regression result of data capital and farmers' income with the addition of control variables. The third column is the regression result of the relationship between data capital and social network. The fourth column is the joint regression result of data capital, social network relationship, and farmers' income.

5.1. Data Capital and Farmers' Income. The first column of Table 3 shows that the estimated coefficient of data capital for farmers' income is 0.023, which is significantly positive at the 1% statistical level, indicating that for every 1% increase in data capital input, farmers' income increases by 0.023%, which supports the existence of H1. Furthermore, the second column shows the regression results after introducing

control variables such as head of household and family characteristics. At this time, the data capital estimation coefficient is 0.017, a slight decrease, but it still reaches the significance of 1%. For every 1% increase in data capital, the income of farmers increased by 0.017%, once again verifying the existence of H1, fully demonstrating that farmers can increase farmers' income by driving agricultural and non-agricultural incomes by accessing digital technology resources, actively using Internet platforms, and strengthening data application capabilities.

In addition to the negative impact of age on the income of farmers, the gender of the head of the household, the nature of work, the perception of relative income, family size, and marital status all have a significant positive impact on the income of farmers, to a certain extent, revealing that men in rural households are better at capturing market dynamics and are more able to increase farmers' income; farmers with a higher sense of relative income are more able to take the risk of adopting data capital and are more willing to invest manpower and material resources to use data capital to increase income; the larger the population size, the more likely they are. Larger farmers have more labor, save production costs, and are more likely to accept more new

TABLE 3: Regression results of digital capital on farmers' income.

| Variable | Farmer's income First row | Farmer's income The second list | Social network Third column | Farmer's income Fourth column |
|-----------------------|------------------------------|------------------------------------|--------------------------------|----------------------------------|
| Data capital | 0.023*** (6.32) | 0.017*** (2.63) | 0.028*** (6.76) | 0.022*** (2.63) |
| Social network | | | | 0.143 |
| Gender | | 0.0423*** | 0.0192** | 0.0434** |
| Age | | -0.0433* | -0.0947** | -0.0315*** |
| Nature of the work | | -0.04769** | 0.0337** | 0.0423*** |
| Relative income level | | 0.0285*** | 0.0636*** | 0.0293*** |
| Family size | | 0.0314* | 0.0162*** | 0.1242** |
| Marital status | | 0.0252* | 0.0413*** | 0.0285** |
| Constant term | 4.73 | 2.34 | 0.81 | 1.15 |
| Sample size | 14031 | 14031 | 14031 | 14031 |
| R ² | 0.0141 | 0.0809 | 0.0450 | 0.0809 |
| F | 39.97 | 27.28 | 24.62 | 29.21 |

Symbols ***, **, and * are significant at the 1%, 5%, and 10% statistical levels, respectively, similarly hereinafter.

ways to increase their income; the more stable the marriage status of farmers, the stronger the sense of family responsibility and the more family income they can create; age has a significant negative impact on farmers' income increase. It shows that the older the respondents are, the more difficult it is to accept and learn digital technology resources, the ability to quickly adapt and utilize data resources is weaker, and they rely more on traditional production methods to obtain income, and the way to increase income is hindered.

5.2. The Mediating Effect Test of Social Network. The aforementioned analysis has confirmed the promotion relationship between data capital and farmers' income. The third and fourth columns of Table 3, respectively, give the regression results of array capital on the relationship of social network and the regression results of data capital and social network on farmers' income.

Among them, the estimated coefficient of data capital to social network is 0.028 (significant at 1% level), and the coefficient of social network to farmers' income is 0.143 but not significant, and the Bootstrap test is needed. This paper uses bias-corrected nonparametric percentile Bootstrap testing method, specifically referring to Hayes' plug-in PROCESSv3.5. Bootstrap was performed in SPSS26.0 software, and the sample size was set to repeat 5000 times. Under the 95% confidence interval, percentile and bias-corrected were used. The confidence interval estimation method is used to test the mediating role of social network in the path of data capital affecting farmers' income increase. The results of the mediation effect test are shown in Table 4. The lower and upper limits of the confidence interval of the mediation effect are 0.022 and 0.267, respectively, excluding the 0 value. The indirect mediating effect of capital on farmers' income increase is significant. According to the mediation effect test steps, this shows that the mediating effect of social network is established. The mediation effect and direct effect account for 22.73% and 77.27% of the total effect, respectively. The influence of income plays a part of the mediating effect, accounting for 22.73% of the total effect. 22.73% of the impact of data capital on farmers' income comes from social networks, which well supports the existence of H2.

5.3. Threshold Effect of Farmer's Human Capital.

Threshold existence test: in order to verify the existence of the threshold of human capital for farmers, this paper uses stataSE15.1 software, draws on Hansen's research processing, and uses the self-sampling method to repeatedly sample 300 times to determine the number of thresholds and test their significance. The estimated results are shown in Table 5. When taking lnincome as the explained variable and DC as the core explanatory variable, the F value of the single threshold test of the human capital HC of farmers is 34.67 and the P value is 0.017. At the 5% significant level, the hypothesis that there is no threshold effect is rejected and the first threshold exists. The F value of the double threshold test is 9.51, the P value is 0.617, and there is no second threshold.

Threshold authenticity test: construct the confidence interval of the threshold estimated value and use the grid search method to determine the threshold estimated value and its 95% confidence interval table; the LM value and P value of human capital as the threshold variable are 26.700 and 0.0015, respectively, indicating that human capital affects farmers in data capital. There is a significant threshold effect in the process of increasing income. The estimated threshold value is 19.479, which is within the 95% confidence interval. The estimated threshold value is equal to the true threshold value. The P value of the heteroskedasticity test is 0.0007, which cannot be rejected at the 1% significant level. The null hypothesis of homoscedasticity is that there is no heteroscedasticity.

Threshold regression results analysis: further, divide the low human capital farmers ($HC \leq 19.479$) and high human capital farmers ($HC > 19.479$) into two sample intervals for threshold regression. The estimated results are shown in Table 6. The table shows that the impact of data capital on farmers' income reaches a significant level of 1% in both sample intervals, but there are significant differences in the degree of impact. When the human capital level is in the first range, the estimated coefficient is 0.008, reaching a significant level of 1%, indicating that when the human capital level of farmers is low, data capital can promote farmers' income, but it is limited by farmers' poor digital acceptability, the role coefficient of data capital is small, but at this time, data capital investment still helps to make up for the

TABLE 4: Mediating role of social network.

| Mediation test | Observation coefficient | Deviation | Standard deviation | Bootstrapping | | |
|------------------|-------------------------|-----------|--------------------|---------------|-------------|----------------------|
| | | | | BOOTCI | | Relative effect size |
| | | | | Lower limit | Upper limit | |
| Direct effect | 0.017*** | 0.04 | 2.2094 | 0.160 | 1.452 | 0.001 |
| Mediation effect | 0.005*** | 0.01 | — | 0.022 | 0.267 | 0.000 |
| Total effect | 0.022*** | 0.04 | 2.6308 | 0.013 | 0.135 | 0.003 |

TABLE 5: Correlation test of human capital as a threshold variable.

| Explained variable | Cocore explanatory variable | Model | <i>F</i> value | <i>P</i> value | Threshold estimate | 95% confidence interval |
|--------------------|-----------------------------|------------------|----------------|----------------|--------------------|-------------------------|
| Lnincome | DC | Single threshold | 34.67** | 0.017 | 19.479 | 19.497, 90.094 |
| | | Double threshold | 9.51 | 0.617 | | |

TABLE 6: Threshold regression estimation results.

| Variable | Farmer's income | |
|------------------|------------------|-----------------|
| | HC \leq 19.479 | HC > 19.479 |
| Digital capital | 0.008*** (6.87) | 0.023*** (3.09) |
| Control variable | Yes | Yes |
| Sample size | 8103 | 6112 |
| R^2 | 0.052 | 0.098 |

low level of education of the rural labor population and the serious aging of the rural households. When the human capital level is in the second interval, the estimated coefficient of data capital on farmers' income increases to 0.023, indicating that with the improvement of farmers' human capital level, the impact of data capital on farmers' income is more significant, which fully reflects farmers' income. Human capital factors such as education level and health status can better promote the effect of data capital on farmers' income. Data capital and farmers' income are not simple linear relationships. Human capital is an important threshold which supports the existence of H3, namely the marginal contribution of data capital on farmer's income shows an increasing trend with the improvement of farmer's human capital level.

5.4. Robustness Test. In order to enhance the reliability of benchmark regression results, the following methods are used for testing. Referring to Zhang [12], select whether to surface the Internet to replace the important factor whether to use Internet, recalculate the model estimation results and still support original assumption. Referring to Gloede [36], 25-55 household head age is selected as the analysis sample. Physical quality and education level are higher, farmer's digital technology contact and data application ability are stronger, which is of good representativeness. The regression results are shown in table 7, the effect of data capital on farmer's income is significantly positive at 1% level, again supporting the results of benchmark regression.

Furthermore, considering that there may be a causal relationship between the mediating variable and the increase

of farmers' income, "trust in strangers" in the CFPS questionnaire was selected as the instrumental variable of the social network and 2SLS estimation was carried out to test the endogeneity and instrumentality of the mediating variable. The regression results of the validity of the variables are shown in Table 8. The *F* value of the first stage is 64.08, which is far more than 10, indicating that the instrumental variables do not have the problem of weak instrumental variables. The *P* value of the second-stage Hausman test was 0.002, indicating that the social network was an endogenous variable. Therefore, after considering the possible endogeneity of the model, the social network still plays an intermediary role in the promotion of farmers' income by data capital.

6. Conclusions and Implications

Based on the context of digital rural construction, this study uses the 2018 China Family Panel Studies data to empirically test the impact mechanism of data capital on farmers' income. The study found that, first, data capital has a significant positive impact on farmers' income, providing rich direct evidence for the influence mechanism of farmers' income increase, the measure and action mechanism of data capital; second, data capital has a significant threshold effect on farmers' income, which is not a simple linear relationship and the marginal return gradually increases with the level of human capital, enriching the human capital theory; third, data capital indirectly promotes the income of farmers by improving the interaction efficiency of social networks and the mediating effect accounts for 22.73%, *t* expanding the research horizon of social capital theory. After using the instrumental variable method to overcome the endogeneity, the results of the hypothesis verification have not changed substantially.

Based on the above conclusions, the following suggestions are put forward: first, on the basis of steadily advancing the construction of rural digital infrastructure, resources should be allocated to poor and remote areas and "digital village construction" should improve farmers' digital access opportunities and support the rural revitalization strategy; second, strengthen farmers' modern production technology and online sales training, make full use of the advantages and resources of digital information platforms, improve farmers'

TABLE 7: Robustness test.

| Variable | Substitution variable | | Narrow the sample | |
|-----------------------|-----------------------|-----------------|-------------------|-----------------|
| | (1) | (2) | (3) | (4) |
| Data capital | 0.026*** (6.87) | 0.012*** (3.09) | 0.028*** (6.55) | 0.021*** (4.57) |
| Gender | | 0.0417** | | 0.0423* |
| Age | | -0.0416* | | -0.0829*** |
| Nature of the work | | -0.0464** | | -0.0582** |
| Relative income level | | 0.0287*** | | 0.0250*** |
| Family size | | 0.0317* | | 0.0235* |
| Marital status | | 0.0111** | | 0.0135* |
| Constant term | 4.77*** | 2.22*** | 0.0198*** | 0.0253*** |
| Sample size | 14215 | 14215 | 9239 | 9239 |
| R ² | 0.0166 | 0.0818 | 0.0229 | 0.0699 |
| F | 47.25 | 27.6 | 42.95 | 15.23 |

TABLE 8: Regression of instrumental variables.

| First-stage return | | Second-stage return | |
|------------------------------------|-----------|-------------------------------------|-----------|
| Dependent variable: social network | | Dependent variable: farmer's income | |
| Instrumental variable | 0.1049*** | Mediating variable | 0.6483*** |
| Control variable | Yes | Control variable | Yes |
| Wald exogeneity test | — | Wald exogeneity test | 19.57 |
| P value | — | P value | 0.002 |
| One-stage F statistic | 64.08 | One-stage F statistic | — |
| Observation N | 14215 | Observation N | 14215 |

data application capabilities, and further expand the dividend effect of data capital; third, deepen the relationship strength of the social network vertically, improve the communication efficiency of the social network, give full play to the demonstration and leading effect of the social network and drive more farmers to increase their income; fourth, improve the medical and healthcare awareness of the rural population, strengthen the preferential treatment of the elderly population for regular physical examinations, improve the medical level and sanitation conditions in rural areas, effectively ensure the health of the rural population, and make up for the shortcomings of age with physical advantages; fifth, continue to strengthen rural areas basic education, increase talent training, release preferential policy dividends to encourage talent backflow, promote the flow of talent resources between urban and rural areas, and optimize the structure of rural human capital; sixth, while striving to improve the digital level of farmers, it is also necessary to increase human capital investment in education and physical and mental health so that more farmers can stride over the threshold value of human capital investment as soon as possible and release the income increase potential of data capital to the greatest extent.

During the course of research, Limited by time, energy, and sample data, this article still has the following deficiencies to be further deepened. This paper uses a single annual data, cannot reflect the longitudinal temporal changes of data capital and farmer's income level, to be combined with official statistics or existing databases, use the dynamic panel model to explore the change trajectory,

evolution characteristics and lag effect in multiple years. Furthermore, in addition to intermediary and threshold factors mentioned in the article, the relationship between data capital and farmer's income may also be influenced by other factors such as digital policy, household owner characteristics, regional marketization degree, and manpower structure, which still needs to be further explored.

Data Availability

The data used in this article come from the China Family Panel Studies (CFPS) microdatabase. The database is updated every two years and can better reflect the income growth characteristics of Chinese farmers.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Xu Xiumei is responsible for data analysis and paper writing; Zhai Xiaoxuan is responsible for data collection and collation; Wang Hui is responsible for language modification and robust testing.

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