Research on the Impact of Digital Literacy on the Overall Income of Rural Households: A Case Study of 410 Questionnaires in Pucheng County, Shaanxi Province

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Abstract. To increase the income of farmers is an important goal of rural revitalization. Based on 410 questionnaires in Pucheng County, Shaanxi Province, this paper empirically tested the positive impact of rural households' digital literacy on income growth. The results show that digital literacy has a promoting effect on the income accumulation of farmers, and this effect shows a marginal decreasing feature in the structure of multiple income sources. The use of digital infrastructure can promote the improvement of digital literacy, but the use of Internet for the purpose of social life has no obvious effect on the improvement of household income. Digital activities such as working and learning can promote the increase of household wealth. Digital literacy enables low-cost access to relevant production information, which is conducive to cultivating awareness of the digital economy, transforming wealth into more valuable assets and increasing overall income.

Keywords: Digital Literacy; Household Income; Digital Economy.

1. First, The Raising of the Problem

The Fifth Plenary Session of the 19th CPC Central Committee set a long-term goal of basically realizing socialist modernization by 2035. The meeting proposed that "per capita GDP should reach the level of moderately developed countries, the middle-income group should expand significantly, basic public services should be given equal access, and the gap between urban and rural development, regional development and people's living standards should be significantly narrowed." China's rural population is 509.79 million, accounting for 36.11% of the total population. The continuous increase of farmers' income is one of the important goals of realizing socialist modernization and carrying out the strategy of rural revitalization. Since 2004, with the continuous attention to "agriculture, rural areas and farmers" in the No. 1 Central document, the per capita net income of farmers has rapidly exceeded the mark of 5,000 yuan (2009) and 10,000 yuan (2014) from 2,936.4 yuan in 2004, realizing "16 consecutive increases" with an average annual growth rate of 11.75%. [1]

It has become a global consensus to develop the digital economy, promote economic and social transformation, and foster new drivers of economic growth. With the rapid development of China's digital economy, the construction of digital countryside has been promoted, and a digital-driven modern rural economic system, social governance system and support system for economic and social development have been established. It has become the strategic direction and important content of rural revitalization and agricultural and rural modernization development. The size of Internet users and lax regulatory policies have contributed to the rapid development and wide application of digital finance in China. In rural areas, the use of digital finance has increased dramatically with the growing popularity of the Internet. The 2017 China Household Finance Survey (CHFS) data showed that the proportion of households using digital payment in rural areas of China was 13.6%[2] after the national deployment and implementation of digital rural pilot in 2020, the Number one central document in 2021 clearly proposed to start the construction and development of digital rural project. It marks a new stage of exploration and implementation of digital rural construction strategy planning. The comprehensive development of digital countryside objectively requires the comprehensive integration of digital technology and rural production, life, ecology, governance and other fields. This depends on the breadth and depth of farmers' participation in digital practices in various fields, thus placing increasingly high demands on farmers' digital literacy. [2]

However, in most rural areas, relying on information education to improve residents' information literacy, the development of rural digital literacy education system lags behind, which restricts the improvement of farmers' digital literacy level and the cultivation of rural digital talents [3]. The application of digital technology provides equal opportunities for rural residents to benefit, but it does not mean that every rural resident can equally reap the fruits of digital development in the "reservoir" of digital economy. Due to the difference of digital technology application ability, namely digital literacy, rural residents' participation and benefit level in the process of digital empowerment will be quite different. Therefore, under the premise of limited digital literacy, the ability of farmers to use digital finance will also be limited, and the income of farmers will be different. So is there a close relationship between the digital literacy of farmers and the income of rural residents? What is the impact of digital literacy on the increase in farmers' incomes? The discussion of this problem is helpful to perfect the construction of digital countryside and improve the income level of rural residents.

2. Second, Literature Review

Bawden[4] systematically summarized the definition and sources of digital literacy, which originally referred to the ability to read and understand multimedia and web texts in the 1990s. The current context of digital literacy is often referred to as reading, writing and information processing abilities based on new technologies. Gilster[5] argues that, first of all, he believes that digital literacy should be based on the critical thinking and integration ability of citizens in the context of digital economy, that is, digital literacy is about "mind control, not keyboard". Eset-alkali [6] believes that digital literacy is the thinking ability to understand and correctly use computers to store digital resources and information, and Summey[7] believes that digital literacy refers to people's data ability, digital creation ability and digital learning ability. Prema and Rajani et al. [8] propose six inclusive digital literacy frameworks for rural residents: information, health, finance, digital government, digital security and online education.

Combined with previous studies, we can find the following deficiencies: first, the existing definition of digital literacy can not meet the urgent need to strengthen the digital literacy of farmers in China; Second, only a few studies have explored the economic effects of digital literacy in the area of income. This paper defines digital literacy as a comprehensive scientific skill and cultural literacy based on digital life, digital learning, digital work and other practical scenarios, which can quickly and effectively discover and obtain information, evaluate information, integrate information and exchange information. On this basis, using 410 questionnaires in Pucheng County, Shaanxi Province, this study exploratively constructed an evaluation index system for rural residents' digital literacy, and further explained the relevant impact and theoretical mechanism of digital literacy on farmers' income.

3. Third, Data Sources, Variable Selection and Model Design

(I) Data sources

The data of this paper are based on 436 valid questionnaires from a survey of farmers in Pucheng County, Shaanxi Province. After data reduction, 410 valid questionnaires were obtained. To support subsequent analytical validation and interpretation.

(2) Variable selection and statistical description

Explained variable: the overall income of farmers. In the process of investigation, the total income of the peasant household sample mainly includes agricultural income, income of working part time, income of self-employed, wage income of enterprises and public institutions, transfer income and other income. In this paper, 410 questionnaires were collected and summarized, the six types of income were classified as the total income sources of farmers, and the overall income of farmers was measured. In order to eliminate the influence of heteroscedastic on the empirical analysis, and to

eliminate the inaccurate influence caused by the large income difference between samples. In this paper, after taking logarithm of six types of income and total income of farmer samples, regression equation is studied.

Core explanatory variable: Digital literacy. Based on the theoretical analysis and experience summary above, this paper starts from the daily life where farmers are most likely to have access to digital technology, and refers to the measurement method of digital literacy by Shan Depeng et al. [9]. The actual digital literacy level of farmers was measured from four dimensions: "weekly frequency of using the Internet for learning", "weekly frequency of using the Internet for entertainment", "weekly frequency of using the Internet for social networking" and "weekly frequency of using the Internet for business". "Using the Internet for learning" and "using the Internet for business" belong to the actual situation of rural households using digital finance; "Internet entertainment" and "using the Internet to socialize" can be attributed to farmers' mastery of digital technology. In this paper, the four measured literacy values obtained in the sample were respectively summed up, and then weighted with equal amount, and finally calculated the actual digital literacy of individual farmers.

Control variables: In this paper, gender, age, marital status, education level, health status, Party member or cadre, risk preference degree and network usage of farmers are set as control variables. Internet usage includes: whether there is a network at home, whether the network is 3G/4G/5G, whether the use of mobile phones or computers to transfer money, whether the use of mobile phones or computers to pay online (consumption), whether the use of digital financial services to understand the solution to the loss of rights and interests, whether they know how to identify the legality of various online lending channels; The control variables were summarized into three aspects: individual characteristics, household characteristics, and Internet usage, in order to minimize the regression bias of the impact of digital literacy on farmers' income caused by the interference of other variables. The degree of risk preference is risk preference test; The family level includes family size and population composition;

Table 1. Descriptive statistics of the explained variables

variable	observations	The mean	The standard deviation	The minimum	The maximum
Total peasant income	410	11.2369	0.8610	8.1605	13.2787
Agricultural income	408	9.5471	0.7709	7.0901	12.5189
Work income	295	11.0903	0.7699	6.1527	12.2830
Income from individual business	34	11.2120	0.9176	8.5172	12.6115
Wage income of enterprises and institutions	55	11.0297	0.9045	7.2930	12.1007
Transfer of income	400	7.0829	0.9945	4.3820	10.5966
Other income	33	9.2318	1.0107	6.8024	10.5966

According to the descriptive statistical characteristics of household income: Among the 410 survey samples, the agricultural income of the surveyed households accounted for 99.5121% of the total number of people surveyed, but the overall mean of the agricultural income of the households was 20,000 yuan per year. After taking the logarithm, the agricultural income value was 9.5471, which accounted for a low proportion, reflecting the inadequate characteristics of household income. Although the number of agricultural income is absolutely dominant, the level of income obtained ranks low in the average of the six income sources, only higher than other income. And the difference of agricultural income between farmers and farmers is small, and most farmers rely on farming to obtain agricultural income. In the survey sample, the average income from self-employment of farmers is the highest among the six income sources. However, the proportion is small in the survey sample, only 8.2923% of farmers have self-employed income, which reflects the status quo of undeveloped individual industry and commerce in Pucheng County, Shaanxi Province. Transfer income accounts for the highest proportion, and 97.5610% of the total respondents have transfer income. Therefore, to improve the digital literacy of farmers, promote farmers to enjoy the substantial

utility brought by science and technology, and then improve the overall income of farmers is indeed an important task to study digital economy and construct digital countryside.

Table 2. Descriptive statistics of control variables

variable	observations	The mean	The standard deviation	The minimum	The maximum
Digital literacy	410.000	1.729	1.025	1.000	4.000
Age (1 year)	410.000	59.956	10.528	30.000	86.000
Gender (male =1)	410.000	0.500	0.485	0.000	1.000
Marital status (married =1)	410.000	0.821	0.349	0.000	1.000
Level of education (1= illiteracy)	410.000	2.637	0.866	1.000	5.000
Physical health (very health =5)	410.000	4.115	0.856	1.000	5.000
Risk testing (High risk =1)	410.000	3.372	0.828	1.000	4.000
Party Member or not (yes =1)	410.000	0.049	0.216	0.000	1.000
Owning information equipment (yes =1)	410.000	0.990	0.120	0.000	1.000
Network used or not (yes =1)	410.000	0.910	0.290	0.000	1.000
Whether 3G/4G/5G is used (yes =1)	410.000	0.770	0.423	0.000	1.000
Whether to use mobile phone or computer to transfer money (yes =1)	410.000	0.510	0.501	0.000	1.000
Whether to use mobile phone or computer for online payment (consumption) (yes =1)	410.000	0.517	0.500	0.000	1.000
Digital literacy	410.000	1.700	1.016	1.000	4.000
Age (1 year)	410.000	1.670	1.002	1.000	4.000
Gender (male =1)	410.000	3.370	0.828	1.000	4.000

According to the descriptive statistics of the individual characteristics, family characteristics and network usage characteristics of the surveyed farmers, the average value of the actual digital literacy of the sample farmers is 1.729. According to the practice of Rooij and Lusardi et al. [10], we divided the digital literacy into four intervals, from 1 to 4, representing the real level of the actual digital literacy of the farmers from low to high. The mean value of the respondents is less than the median value of the measurement interval, which reflects that the development of digital economy in Pucheng County, Shaanxi Province is relatively backward, and the farmers' understanding of digital finance and digital technology is not high, which restricts the digital literacy level of farmers in Shaanxi Province. As described above for transfer income, farmers in the survey area are generally around 60 years old, poorly educated and more risk averse. In this case, farmers have a low acceptance of new digital technologies and digital finance, and some residents have a great misunderstanding of the emerging digital technologies, which seriously limits the digital literacy level of farmers. The Internet usage of the survey sample shows that smart phones and computers only exist in daily life, and few farmers use Internet resources to obtain digital financial services or digital credit services. It reflects that the digital literacy level of rural households in Shaanxi Province is low, the degree of digital financial inclusion is relatively backward, and the income sources of residents are mostly traditional income methods. Therefore, to reverse the stereotype of farmers on digital technology and improve their digital literacy level is the top priority to promote the development and industrial upgrading of the national agricultural industry.

As above, digital literacy is divided into four intervals, ranging from 1 to 4, which represents the actual digital literacy level of the surveyed farmers. Accordingly, we statistically describe the total income of farmers and their digital literacy value. As shown in Table 3, with the increase of the digital literacy level of the farmers, the number and proportion of the population with the total income above the mean of the farmers also gradually increased. Digital literacy plays a positive role in promoting the overall income of farmers, but what is the mechanism of the positive effect of digital literacy on

the income of farmers? Does digital literacy have a positive effect on the six aspects of income of farmers? To answer these questions, it is necessary to test the relationship between digital literacy and household income after controlling for other relevant variables.

Table 3. Statistical description of digital literacy

variable	observations	The mean	The standard deviation	The minimum
Below the mean of total income	56.00	81.00	34.00	5.00
Above the mean of total income	68.00	108.00	49.00	9.00
Average overall income in the following proportion	0.45	0.43	0.41	0.36
Average overall income in the above proportion	0.55	0.57	0.59	0.64
A total of	124.00	189.00	83.00	14.00

(3) Model design

The estimated equation of the impact of digital literacy on the total income of farmers is as follows:

$$Income=\alpha+\beta Literacy+\gamma X+\varepsilon$$

Income represents the income of farmers, where represents the total income of farmers, agricultural income, working income, self-employed income, wage income of enterprises and public institutions, transfer income and other income. Literacy represents the digital literacy value of farmers, X represents other control variables affecting farmers' income, and ε is a random disturbance term. β is the coefficient of the influence level of digital literacy on farmers' income. This paper mainly studies the coefficient of the influence of farmers' digital literacy on farmers' income sources. If β is significant and positive, it indicates that digital literacy can effectively promote the income of farmers in this aspect. If it is significantly negative, it means that digital literacy has a significant impact on the income of farmers, but it has a inhibitory effect.

4. Fourth, Empirical Analysis

(I)OLS regression analysis

This paper uses OLS regression to estimate the relationship between digital literacy and household income. Columns (1) to (3) of Table 4 indicate that the regression results of ordinary least squares method are obtained by only introducing the core variables of farmer's income and digital literacy value, adding the variables of farmer's personal characteristics and household variables in the function model. In the regression process, there are farmers' income from one side. For example, the survey result of transfer income is 0, and the number is large. In order to ensure the accuracy of the research conclusions in this paper, Tobit model is introduced for one-step analysis and demonstration. The regression results in Table 4 show that even if the variables of individual characteristics of farmers and household characteristics are introduced into the model for regression, the influence coefficient of digital literacy on the total income of farmers is still significant and positive. In addition, compared with OLS regression model, the coefficient of Tobit model is more significant, indicating that no matter what form and method is used for analysis, digital literacy can significantly improve the total income of farmers, and the verification conclusion is relatively robust. The improvement of digital literacy level plays an important role in the construction of digital countryside and the rapid digital transformation of rural foundation. The low level of digital literacy limits the digital transformation of rural areas. We should actively build a digital scene closely related to the production and life of farmers, improve the popularization of digital literacy, increase the effect of digital literacy on the income increase of farmers using digital infrastructure, and continue to promote the overall income increase of farmers.

Table 4. Regression analysis results

	1	2	3	4	5	6
Digital literacy	1.572***	1.521**	1.524***	1.572***	5.451**	6.527**
	-2.88	-2.55	-2.69	-2.88	-2.17	-2.28
age		0.053*	0.054**		0.396*	0.412**
		-1.93	-2.12		-1.91	-2.1
Age square		0	0		-0.003	-0.003
		(-1.37)	(-1.44)		(-1.38)	(-1.46)
gender		-0.054	-0.0631		-0.371	-0.402
		(-0.67)	(-0.72)		(-0.62)	(-0.67)
Marital status		-0.041	-0.149		-0.261	-0.941
		(-0.24)	(-1.05)		(-0.31)	(-1.02)
Years of education		0.051***	0.051***		0.384***	0.385***
		-4.71	-4.76		-4.78	-4.82
Degree of physical fitness		-0.068*	-0.067*		-0.5036*	-0.492*
		(-1.77)	(-1.73)		(-1.86)	(-1.82)
Risk assessment		-0.013	-0.007		-0.217	-0.211
observations	410	410	410	410	410	410

(2) Robustness test and endogeneity treatment

In order to enhance the scientific nature of the research conclusions, it is necessary to consider the issues of robustness and endogeneity when using micro data for empirical test. The test ideas of this paper are as follows: First, try to replace the core variables. The value of farmers' income was divided according to 0-1, and the value greater than 0 was attributed to 1. Probit framework was used for a new round of analysis, and the results are shown in Model (1) in Table 6. In this paper, the digital literacy variables mentioned above are reassigned. Those who do not participate in Internet activities are assigned 0, and the rest are assigned 1. Then the regression is performed again, and the results are shown in model (2) in Table 6. Considering that the relationship between digital literacy and household income may be plagued by endogeneity problems, this paper uses the data of "average Internet usage frequency" as an instrumental variable to test the relationship between the two. The regression results are shown in Model (3) and Model (4) in Table 6.

Table 5. Robustness test

	-1	-2	-3	-4
	Total revenue	Total revenue	Digital literacy	Total revenue
Digital literacy	0.652*			46.570***
	-1.75			-5.21
Digital Literacy substitution		0.931**		
		-2.31		
Instrumental variable The F value			0.099*** -6.67	
Control variables			20.34	
observations	Yes	Yes	Yes	Yes
Digital literacy	410	410	410	410

According to the regression results in Table 6, after replacing variables, digital literacy still has a significant positive effect on farmers' income, indicating that the income increasing effect of digital literacy is supported again. From the point of endogenous processing, model (3) the regression results show that F statistics is more than 10, according to the selected tool variable satisfied efficacy, Internet

penetration is higher, the infrastructure is perfect, farmers increase probability of digital literacy, both can influence each other, the promotion of farmers digital literacy can, in turn, drive the local infrastructure is perfect. The regression results of model (4) show that the coefficient of digital literacy is significantly positive, and the coefficient is much higher than the benchmark regression coefficient. This means that if endogeneity is not considered, it is likely to reduce the positive effect of digital literacy on household income. Through the promotion of practical cases, farmers' purchase of digital equipment and digital services to provide significant support, to promote farmers to understand and use the Internet to engage in creative and productive activities, cultivate and develop low-income farmers' awareness of digital enrichment, and strive to increase farmers' income and expand their income sources.

Table 6. Endogeneity test

	-1	-2	-3	-4
Digital literacy	1.049	3.5.4**	7.207***	1.573**
	-1.62	-2.53	-3.25	-2.77
Control variables	Yes	Yes	Yes	Yes
observations	233	233	233	233

5. Research Conclusion and Policy Recommendations

(I) Research conclusions

Increasing household income is the key to rural revitalization. Based on 410 questionnaires in Pucheng County, Shaanxi Province, this paper empirically tested the positive impact of household digital literacy on income increase, and studied the role and mechanism of household digital literacy on income improvement. The main research conclusions are as follows:

First, digital literacy has a promoting effect on the income accumulation of farmers, and this effect shows a marginal decreasing feature in the structure of multiple income sources.

Secondly, the use of digital infrastructure can promote the improvement of digital literacy, but the use of Internet for social life has no obvious effect on the improvement of farmers' income. Digital activities like work and study can promote farmers' wealth more. Digital business, digital learning and digital work have the greatest positive impact on income growth. Digital entertainment is also an effective means to acquire knowledge and information, but digital social interaction is more about skill locking caused by the pressure of conformity.

Third, digital literacy enables low-cost access to relevant production information, which is conducive to cultivating awareness of the digital economy, transforming wealth into more valuable assets and increasing overall income.

(2) Policy recommendations

Digital literacy can effectively improve farmers' incomes. It is an important part of the construction of digital countryside and an important social foundation for the development of China's digital economy. In order to better play the positive role of digital literacy in promoting rural revitalization, the policy recommendations of this paper are as follows:

While improving digital literacy, it is also necessary to strengthen the construction of rural financial system, land system reform and the cultivation of village collective economy. The role of digital literacy is not only to optimize capital stock, but more importantly to help each other in capital appreciation, which mainly comes from capital, land and village collective economies. Rural areas should improve digital communication infrastructure, build a common digital economy application scenario, and provide digital background support; Financial institutions should use digital means to improve the rural financial system and provide financial products and services at reasonable prices. Provide vouchers and channel support for equity conversion based on digital platform; Village collective economic organizations should rely on digital application scenarios, provide the support of

characteristic industry development platform, and finally realize two-way empowerment through the promotion of digital literacy.

References

[1] WANG Y C. Research on the threshold effect of digital financial inclusion on farmers' income growth [J]. Finance Theory and Practice,2021, (06):94-109.

[2] Data from 2017 China Household Financial Survey (CHFS).

[3] Su Lanlan, Zhang Hangyu, Peng Yanling. Research on the mechanism of farmers' digital literacy driving the development of digital countryside [J]. E-government,2021,(10):42-56.

[4] BAWDEN, D. Origins and concepts of digital literacy[R]. Digital literacies: Concepts, policies and practices and practices, New-York: Peter Lang.

[5] GILSTER conviction yourself digital Literacy [J]. Journal of Scientific American, 1995273 (3) : 198-199.

[6] ESHET-ALKALAI Y. Digital Literacy: A conceptual framework for survival skills in the digital era[J]. Journal of Educational Multimedia and Hypermedia, 2004, 13 (01); 93-106.

[7] SUMMEY D C. Developing digital Literacies: A Framework for professional learning[M]. Corwin press, 2013.

[8] Prema P. Nedungadi et al. Towards an inclusive digital literacy framework for digital India[J]. Education + Training, 2018, 60 (6) : 516-528.

[9] Depeng Shan, Yongqi Zhang, Ying Wang. Rural household Digital literacy, Property Income and Common prosperity [J]. Journal of Minzu University of China (Philosophy and Social Sciences Edition), 202,49 (03):143-153.

[10] Wu Weixing, Zhang Linwan. Household Income Structure and Wealth distribution: An empirical analysis based on the micro-survey of Chinese households [J]. Journal of northeast normal university (philosophy and social sciences edition), 2015 (01) : 62-69. The DOI: 10.16164 / j.carol carroll nki. 22-1062 / c. 2015. 01.013.