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Human Capital, Social Capital, and Farmers' Credit Availability in China: Based on the Analysis of the Ordered Probit and PSM Models

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Abstract: Rural credit is very important to the increase of farmers' income and the development of rural economy, and it has attracted wide attention from scholars. Many scholars have paid attention to the impact of social capital on farmers' credit availability, but the research conclusions have not yet been unified. In addition, human capital is also one of the important factors that scholars pay attention to. However, the research mainly focuses on farmer education and pays less attention to their health. Based on the China Household Income Project (CHIP2013) database, we evaluated the impact of human capital (education and health of farmers) and social capital on the credit availability of farmers. To ensure the robustness of our results, we used both the ordered probit model and the propensity score matching (PSM) model to carry out the estimations. Therefore, the study not only improves the research framework of the impact of human capital on farmers' credit availability, but also uses a more accurate method to estimate the net impact of social capital on farmers' credit availability. The results showed that, firstly, in terms of human capital, farmers' educational and health levels have a significant positive impact on their formal credit availability, but no significant impact on their informal credit availability. In particular, farmers with a high school education or above are more likely to obtain a formal loan. Secondly, in terms of social capital, interpersonal relationship capital and political relationship capital are beneficial for farmers obtaining loans from formal and informal channels. Organizational relationship capital only has a more significant positive impact on the informal credit availability of farmers. These results imply that formal financial institutions not only pay attention to farmers' human capital but also their social capital to reduce the risk of lending. However, informal lenders, that is, relatives or friends, pay more attention to the social capital of farmers.

Keywords: human capital; social capital; credit availability; propensity score matching; China

1. Introduction

The development of the rural economy cannot do without the support of rural finance [1]. A relatively perfect rural financial market can significantly improve farmers' technical efficiency and increase their income and consumption [2,3]. However, at present, the credit constraints on farmers are still relatively serious in China, especially the credit constraints from formal financial institutions. Further research also found that the welfare of farmers with credit constraints has been significantly reduced. Kumar et al. [4] found that credit constraints had a negative impact on farmers' health and education expenditures, food consumption, and agricultural investment. Therefore, researchers have

focused on methods to reduce the credit constraints on farmers or improve their credit availability. Among them, the impact of material capital and social capital on the credit availability of farmers has received considerable attention.

Relevant research shows that there are many reasons why farmers are subject to credit constraints, such as the lack of effective mortgages and a perfect rural credit system and the asymmetric information between borrowers and lenders [5]. Material capital has a positive impact on farmers' credit availability because it can be used as an effective mortgage to restrain the potential default behavior of farmers. Furthermore, due to "limited liability", banks often decide whether to lend to farmers and the specific loan amount based on the farmers' wealth owned. Alternatively, they may set a higher credit threshold (e.g., mortgage and guarantee) to ensure that the borrower has a certain ability to repay to reduce their lending risk [6]. Consequently, wealthier families often have more access to bank loans because they have the necessary mortgage for loans [7]. Moreover, farmers who have a higher income always have a higher credit rating, and a bank will treat them as quality customers and lend them more money [8]. Furthermore, Xu and Yuan [9] argued that wealthier farmers have more additional capital to invest in their social networks and expand financing channels. Their study found that, compared with the least wealthy 10% of farmers, the credit availability of the wealthiest 10% of farmers is significantly better.

However, the income of farmers is generally low in China, and the material capital that can be used as an effective mortgage is generally insufficient. Social capital can be used as a substitute or supplement to material capital and can reduce the negative impact of insufficient material capital on farmers' credit availability [10]. Therefore, the impact of social capital on farmers' credit availability is also one of the important factors to which many scholars pay attention. However, studies on farmers' credit availability mostly used a binary variable ("whether to obtain loans?") or specific financing amounts [11,12]. However, with the development of the economy and the improvement of farmers' income and consumption, the borrowing amount of farmers has increased significantly, while the credit constraints felt by farmers have not eased and even increased [8]. This may be because the credit demand of farmers is also increasing. Consequently, it may not be appropriate to use a binary variable (yes or no) or a specific borrowing amount to express farmers' credit availability. The dependent variable selected in this work also considered the credit demands of farmers, which may better express the credit availability of farmers.

In terms of human capital, most studies about the impact of human capital on the credit availability of farmers have focused on their education and less on their health [13,14]. However, human health is also one of the most important components of human capital [15]. Therefore, in this study, we estimated the impact of both farmers' education and health on their credit availability and improved the research framework of the impact of human capital on farmers' credit availability.

Furthermore, there is a lack of consistency among the research conclusions regarding the impact of human and social capitals on farmers' credit availability. To ensure the robustness of our results, we used both the ordered probit model and the propensity score matching (PSM) method to carry out the estimations. For some important human and social capital variables (e.g., participation in cooperative organizations) that are self-selective, we re-estimated their impact with the PSM method to avoid the impact of sample selection bias on the estimation results.

The remainder of this paper is arranged as follows. The second part mainly introduces the credit situation of farmers and the cultural background of China. The third part mainly reviews the literature on human and social capitals and the credit availability of farmers. The fourth part explains the ordered probit and propensity score matching models to analyze the net effect of human and social capitals on the credit availability of farmers. It also explains the data source and the data type used for the estimation. The fifth part empirically analyzes the impact of human and social capitals on the credit availability of farmers. The last part summarizes and discusses the main findings and draws some suggestions to improve the credit availability of farmers.

2. Research Context

China is a large agricultural country. However, China's agricultural production is small-scale and decentralized, with a low production efficiency and rising production costs. Moreover, agricultural production also faces both natural and market risks. Therefore, farmers' agricultural income is low and unstable. In such circumstances, financial institutions are generally unwilling to lend to farmers.

Furthermore, the construction of the rural financial system is not perfect in China. There are few financial institutions and an uneven distribution in rural areas. Financial services are more traditional and single, which cannot effectively meet the needs of farmers. Besides, rural finance also lacks a risk-sharing mechanism. Therefore, the phenomenon of "de-ruralization" of financial institutions is serious [16], and farmers are severely constrained by credit.

However, at present, the credit constraints on farmers are still relatively serious in China, especially the credit constraints from formal financial institutions. Li et al. [17] made a survey of 1773 households in China, and the data shows that among the farmers with a borrowing demand, about 66.92% of the farmers are subject to credit constraints. He et al. [18] also conducted a field survey on the credit constraints of 1730 households in Shandong, Henan, and Guangxi provinces. They found that about 31.21% of the households were subject to credit constraints and could not obtain loans from formal and informal channels. Among the farmers who had received loans, only about 34.02% of them obtained loans from formal channels, and about 53.61% of them could only acquire loans from informal channels. Furthermore, compared with farmers who are not subject to formal credit constraints, the productive income of farmers with partial or complete credit constraints would decrease by 13.0% and 9.8%, respectively. Additionally, the non-basic consumption of farmers with partial or complete credit constraints would decrease by 14.8% and 12.5%, respectively [19].

China's rural residents are collective and closely related based on blood, kinship, and geography. Farmers live in the same place for a long time, forming certain social norms. All farmers will consciously abide by these unwritten norms. In addition, the spatial distance between families is close, and the communication between farmers is frequent. Therefore, the degree of information sharing between farmers is high, and the speed of information transmission is also fast. If someone violates these norms, they will be rejected by others and under the pressure of gossip. As an old Chinese saying goes, "good news never goes out, while bad news has wings". That is, the transmission speed of "bad news" is very fast, such as information that does not comply with the norms. Therefore, under social pressure, farmers may be more likely to comply with the norms. The unique rural culture in China implies the particularity of China's problems.

3. Theoretical Analysis and Research Hypothesis

Farmers' borrowing is a transaction between farmers, or between farmers and financial institutions. Transactions always have costs. Transaction costs include the cost of information search before the transaction, the cost of bargaining during the transaction, and the cost of supervision and execution after the transaction [20]. One of the reasons for the transaction cost is the information asymmetry between the borrowers and lenders. In the case of information asymmetry, borrowers may produce opportunistic behavior. To reduce or prevent the borrowers' opportunistic behavior, lenders need to spend more money to collect more information.

For human capital, farmers with higher education levels tend to have higher comprehensive qualities and a lower probability of opportunistic behavior. For social capital, the collateral function and information transmission function of social capital can reduce transaction costs such as the cost of information search between farmers or between farmers and banks. Therefore, both human capital and social capital can reduce the transaction costs between borrowers and lenders, and help farmers obtain loans.

3.1. Human Capital and the Credit Availability of Farmers

Human capital is formed by workers' investments, which reflect the knowledge, skills, and health level of workers [21]. It is an important factor in promoting economic growth and increasing the income of farmers [22]. Cheng et al. [23] found that human capital contributed 38.57% to the increase in farmers' income, among which the health and education of farmers played an important role. Studies have also shown that, due to "limited liability", lenders such as banks tend to lend more money to wealthier farmers [24]. Therefore, farmers with a higher human capital may be more likely to obtain loans. The measurement of human capital also differs in the literature. It is often measured by an individual's education, training, working seniority, health, and other indicators [25,26]. However, an individual's education and health are the two most important components of human capital [15]. Therefore, we chose farmers' education and health to express the human capital of farmers in this study.

Generally speaking, education can effectively distinguish high-ability from low-ability people [27]. Farmers with a higher level of education always have a higher comprehensive quality, and there are more or better employment and learning opportunities available to them to improve their income [22]. At the same time, Yi and Cai [28] claim that, compared with low-income farmers, high-income farmers tend to have a better repayment willingness and ability. This may reduce the potential default risk that banks and other lenders may bear. Finally, a higher level of education may make it easier for farmers to obtain loans.

As the saying goes in China, the "body is the capital of the revolution". A healthy body is an important carrier of other human capital components [29]. The health of farmers also has a significant impact on farmers' current income, even more so than the education [30]. Furthermore, farmers' health also indicates their future income and repayment ability. Farmers with a better health level can maintain and improve their income and repayment ability [31]. Therefore, the health of householders represents the credit risks of lenders to some extent; the healthier the householder is, the less risk the lender will face [10], and the healthier householders will have a higher probability of obtaining a loan. Yin et al. [31] found that the average health level of family members has a significant positive impact on the formal financing capacity of farmers. Based on this, we hypothesized the following:

Hypothesis 1. *Human capital has a significant impact on farmers' credit availability. The higher the education and health level, the higher the credit availability of farmers.*

3.2. Social Capital and the Credit Availability of Farmers

For social capital, there is currently no universally agreed-upon definition, but the definition described by Putnam is widely used. Putnam [32] points out that social capital is an organizational characteristic that can improve economic efficiency and people's income, which includes trust, norms, and networks. Heikkilä et al. [33] studied the relationship between individual social capital and credit availability in Uganda. They found that the importance of individual social capital to formal banks was significantly reduced because they valued a physical mortgage more greatly. However, social capital has a significant impact on the semi-formal and informal credit availability, especially for poor people, and for those in rural areas or areas with low general trust. These findings support the views of Liang et al. [6], who found that formal financial institutions have not yet taken farmers' social capital as the basis for lending. This results in social capital having no significant impact on the formal financing ability of farmers and only having a significant impact on their informal financing ability. However, van Bastelaer [34] argued that social capital could reduce the cost of incomplete information in financial transactions. Social connections between borrowers allow significant savings in terms of screening, mutual monitoring, and enforcement. This kind of interpersonal relationship is a central factor in ensuring repayment and is one of the important factors that lenders consider. Tan and Hu [24] also found that social capital could significantly improve the formal credit availability of farmers. When

social capital is increased by one unit, the probability of farmers being subject to credit constraints is reduced by about 20%.

There may be three main mechanisms for the impact of social capital on the credit availability of farmers. First, social capital owned by farmers can be used as a social mortgage, and its punishment and reputation mechanism can effectively restrict the behavior of farmers [35]. The countryside is a typical acquaintance society in China. Farmers live in a group for a long time and form some social norms. Once farmers violate the social norms, they come under social pressure from the group (e.g., relatives and friends), which causes a certain loss of their reputation and increases the cost of their default [12]. Moreover, the higher the social capital stock of farmers, the higher the cost of their default. This may give farmers a stronger incentive to repay on time to maintain or further enhance their social capital [36]. The high cost of default may also reduce the concerns of lenders such as banks, and then improve the credit availability of farmers.

Second, social capital also has the function of information transmission, which can reduce the information asymmetry between borrowers and lenders. With the low marketization degree of rural finance in China, the role of social capital becomes particularly important. Villages with higher trust levels and developed social networks have a higher information sharing level. In such a village, farmers' personal information is more fully disclosed [37], such as farmers' risk type, borrowing demand, repayment ability, and other information. To a certain extent, it may alleviate the adverse selection and moral hazard caused by information asymmetry between borrowers and lenders.

Third, social capital can also help farmers acquire more borrowing resources. Dinh et al. [38] argued that building strong ties with people of a higher social status could reduce credit constraints. Li et al. [17] found that one of the important reasons why farmers think they cannot obtain loans from banks was that they had no acquaintances at the banks. Farmers with relatives working in the financial sector tend to have more borrowing resources [39]. In addition, participation in credit cooperatives could significantly reduce farmers' credit constraints. Even for poor farmers, their borrowing opportunities also increase significantly [40]. Therefore, we hypothesized the following:

Hypothesis 2. *Social capital has a positive impact on farmers' credit availability.*

4. Research Methodology

This study mainly aims to answer the following question: "Do human and social capitals have a significant impact on the credit availability of farmers?" We mainly use an empirical analysis to test, including ordered probit and propensity score matching (PSM) models. However, it is worth noting that some variables representing human and social capitals are a kind of self-selection of farmers. These selections may not be random and may be influenced by the characteristics of the farmers themselves. Moreover, these characteristics may also affect the credit availability of farmers. If so, the general regression model cannot completely exclude the influence of other factors and obtain the net impact of these variables on farmers' credit availability. However, the propensity score matching (PSM) model can effectively control this nonrandom bias problem through a counterfactual estimation [41,42]. Therefore, we choose both the ordered probit and PSM models to estimate the impact of human and social capitals on the credit availability of farmers.

4.1. Collection of Data

The data used in this study came from the China Household Income Projects (CHIP2013) database, which was completed by the China Income Distribution Institute of Beijing Normal University and domestic and foreign experts in 2014. The CHIP project team took samples according to stratified random sampling and systematic sampling methods. They stratified the region according to the east, the middle, and the west, and then obtained samples according to the systematic sampling method. Finally, the sample covers the eastern, central, and western parts of China: 15 provinces;

126 cities; 234 counties and districts; and a total of 18,948 household samples, including 11,013 rural household samples, 7175 urban household samples, and 760 migrant household samples. Considering the research topic of this study, we mainly selected farmers who had applied for loans from 11,013 rural household samples. Then, we removed the samples with missing data and finally obtained a total of 3127 effective samples.

The database collects the basic characteristics of householders and family members, including their education, health, trust, family income, and family loans. The database has a large sample size and strong credibility. Based on this database, there have been many good studies.

4.2. Empirical Model

4.2.1. Ordered Probit Model

The data reflecting the credit availability of farmers are ordered variables of classification, and there are three categories, including “weak credit availability”, “general credit availability”, and “strong credit availability”. Therefore, we use an ordered probit model for the estimation. The model is set as follows:

$$Y^* = X'\beta + \varepsilon \quad (1)$$

$$Y = \begin{cases} 1, & Y^* \leq \gamma_0 \\ 2, & \gamma_0 < Y^* \leq \gamma_1 \\ 3, & Y^* > \gamma_1 \end{cases} \quad (2)$$

where Y^* is an unobservable latent variable, and Y is the observation-dependent variable. $Y = 1$ means that the farmer's loan application is rejected; that is, the credit availability of farmers is weak. $Y = 2$ means that the farmer's loan application is accepted but not fully satisfied; that is, the credit availability of farmers is general. $Y = 3$ means that the farmers' loan applications are fully satisfied; that is, the credit availability of farmers is strong. X is the set of explanatory variables, which may affect the credit availability of farmers. γ_0 and γ_1 are unknown cutoff points, and satisfy $\gamma_0 < \gamma_1$. We assume $\varepsilon \sim N(0, 1)$, the probability of variable Y taking each value is:

$$P(Y = 1|X) = P(Y^* \leq \gamma_0|X) = P(X'\beta + \varepsilon \leq \gamma_0|X) = P(\varepsilon \leq \gamma_0 - X'\beta|X) = \phi(\gamma_0 - X'\beta) \quad (3)$$

$$P(Y = 2|X) = P(\gamma_0 < Y^* \leq \gamma_1|X) = P(Y^* \leq \gamma_1|X) - P(Y^* \leq \gamma_0|X) = \phi(\gamma_1 - X'\beta) - \phi(\gamma_0 - X'\beta) \quad (4)$$

$$P(Y = 3|X) = P(Y^* > \gamma_1|X) = 1 - P(Y^* \leq \gamma_1|X) = 1 - \phi(\gamma_1 - X'\beta) \quad (5)$$

Formula (3) refers to the probability that a farmer belongs to the group with a weak credit availability under the influence of factor X . Formula (4) refers to the probability that a farmer belongs to the group with a general credit availability under the influence of factor X . Formula (5) refers to the probability that a farmer belongs to the group with a strong credit availability under the influence of factor X . We use maximum likelihood estimation for testing. It uses a probability model to maximize the probability of the observed sample data. Then, the loglikelihood function will be:

$$\begin{aligned} \ln L(\beta, \gamma_0, \gamma_1) &= \ln[P(Y = 1|X) \bullet P(Y = 2|X) \bullet P(Y = 3|X)] \\ &= \ln \phi(\gamma_0 - X'\beta) + \ln [\phi(\gamma_1 - X'\beta) - \phi(\gamma_0 - X'\beta)] + \ln [1 - \phi(\gamma_1 - X'\beta)] \end{aligned} \quad (6)$$

Using the maximum likelihood estimation method, we can get the parameter β , γ_0 , and γ_1 , that is, the influence of the explanatory variables (X) on the credit availability of farmers (Y).

4.2.2. Propensity Score Matching Model

The ordered probit regression model can only give us a general answer to the impact of human and social capitals on the credit availability of farmers. In particular, variables such as farmers' education, party membership, and cooperative membership, are all farmers' self-selections. These selections may

not be random, which may lead to some errors in the estimation of the ordered probit model. However, the propensity score matching model can effectively control the selection bias problem through a counterfactual estimation [41,42]. Therefore, for these important human and social capital variables, we used the propensity score matching model to test them again to obtain a more accurate result. Its basic principle is:

$$D_i = \begin{cases} 1, & Z_i\alpha + \mu_i > 0 \\ 0, & Z_i\alpha + \mu_i \leq 0 \end{cases} \quad (7)$$

$$Y_i = \begin{cases} Y_{1i}, & \text{If } D_i = 1 \\ Y_{0i}, & \text{If } D_i = 0 \end{cases} \quad (8)$$

where Z ($Z \neq X$) represents the factors affecting the choice of the farmer, $D_i = 1$ represents the treatment group, $D_i = 0$ represents the control group, Y_{1i} represents the credit availability of the treatment group farmer i , and Y_{0i} represents the credit availability of the control group farmer i . The problem of selection bias is that under the influence of certain factors (Z), farmers cannot randomly choose to enter the control group or the treatment group. This leads to the general model estimation results not completely excluding the influence of other factors and provides the net influence ($Y_{1i} - Y_{0i}$) of the variable D .

Taking the cooperative membership of farmers as an example, for a farmer i participating in a cooperative organization (treatment group), Y_{1i} means the credit availability of farmer i , and Y_{0i} means the credit availability of farmer i if he does not participate in the cooperative organization. Then, the difference between the two (Y_{1i} and Y_{0i}) is the net influence of the cooperative membership on the credit availability of farmer i . However, in fact, Y_{0i} is not observable, so an approximate estimate of Y_{0i} needs to be found to obtain the net influence of the cooperative membership.

The basic idea of the propensity score matching estimation is as follows. First, the propensity score of each farmer is obtained according to the logit regression, that is, the probability of a farmer entering the treatment group under the influence of factor Z .

Second, for farmer i in the treatment group, according to a certain matching method (e.g., kernel matching and nearest-neighbor matching), we find a farmer j in the control group whose propensity scores are as equal or close to farmer i as possible. Thus, we can assume that the probability of farmers j and i entering the treatment group are the same or similar. Then, we take the Y_{0j} corresponding to farmer j as the matching estimator of Y_{0i} , that is, $\hat{Y}_{0i} = Y_{0j}$.

Finally, we can get the net influence (treatment effect) of a variable (D) on farmer i : $Y_{1i} - \hat{Y}_{0i} = Y_{1i} - Y_{0j}$. The average treatment effect (ATT) of the treatment group is:

$$ATT = E(Y_{1i} - \hat{Y}_{0i}) = E(Y_{1i} - Y_{0i} | D_i = 1) = E(Y_{1i} | D_i = 1) - E(Y_{0i} | D_i = 1) \quad (9)$$

4.3. Variable Definition and Descriptive Statistical Analysis

Dependent variable. The measurement of the farmers' credit availability was mainly based on the question, "Has there been any situation where your family's borrowing application was rejected or the borrowing amount obtained was less than the amount of the application?" This can reflect the degree of the farmers' credit availability. If the answer was "all borrowing applications were fully satisfied", this means that the farmers' credit availability was strong, and the value was 3. If the answer was "all borrowing applications were accepted, but the loan obtained was less than the requested amount", this means that the farmer's credit availability was general, and the value was 2. If the answer was "one or more borrowing applications were rejected", this means that the farmer's credit availability was weak, and the value was 1. We divided the credit availability of farmers into formal and informal credit availabilities. We referred to farmers' borrowing from banks, rural credit cooperatives, and other formal credit organizations as formal credit. Then, we referred to farmers' borrowing from relatives or friends as informal credit.

Independent variables. The independent variables selected in this study mainly included the characteristics of farmers' human and social capitals, as well as the personal and family characteristics of the householders.

Human capital. We mainly selected two variables to reflect the human capital of farmers: the education and health of householders. Based on the division method of the agricultural census in China, we divided the education level into values of 1–5, representing “never attended school,” “primary school,” “middle school,” “high school,” and “university”, respectively. The measurement of the farmers' health was mainly based on the self-evaluation of farmers. The value was 1–5, representing “worse health”, “bad health”, “general health”, “good health”, and “better health”, respectively.

Social capital. We divided the social capital of farmers into political relationship capital, organizational relationship capital, interpersonal relationship capital, and financial relationship capital. Among them, political relationship capital is mainly expressed by the political status of farmers, including the party membership and cadre status of farmers. Interpersonal relationship capital mainly used three questions: “How many brothers and sisters do you have?” “Do you think relatives and friends can be trusted?” and “Do you think anyone other than relatives and friends can be trusted?” The options of the latter two questions included “very untrusted”, “not very trusted”, “generally trusted”, “relatively trusted”, and “very trusted”, which were assigned values of 1–5 respectively. Organizational relationship capital was mainly expressed by participation in cooperative economic organizations. Financial relationship capital was mainly expressed by the work industry of family members. If there were family members working in the financial industry, then the value was 1. If there were no family members working in the financial industry, then the value was 0.

Personal and family characteristics of householders. Referring to previous research, we selected householders' age, gender, marital status, outside working experience, family size, family per-capita income, and family wealth as the control variables.

In the estimation, the direct introduction of categorical variables may result in an inaccurate coefficient estimation and economic meaning. Therefore, for the four categorical variables—education, health, the trust of relatives and friends, and the trust of other people—we set eight dummy variables to make the estimation results more accurate, including “education1”, “education2”, “health1”, “health2”, “rela_trust1”, “rela_trust2”, “others_trust1”, and “others_trust2”. The definitions and descriptive statistics for each variable are shown in Table 1.

Table 1. Descriptive statistics of the selected variables.

Variables		Definition and Value	Mean	Standard Deviation
Dependent variables	Formal credit availability	Order variable: 1 if one or more formal borrowing applications are requested; 2 if all formal borrowing applications are accepted but not fully satisfied; 3 if all formal borrowing applications are fully satisfied.	2.57	0.73
	Informal credit availability	Order variable: 1 if one or more informal borrowing applications are requested; 2 if all informal borrowing applications are accepted but not fully satisfied; 3 if all informal borrowing applications are fully satisfied.	2.59	0.70
Human capital	Education1	Dummy variable: 1 if the farmer's maximal education level is middle school, and 0 otherwise.	0.48	0.50
	Education2	Dummy variable: 1 if the farmer's maximal education level is high school or above, and 0 otherwise.	0.14	0.34
	Health1	Dummy variable: 1 if the farmer's health is "general health", and 0 otherwise.	0.24	0.43
	Health2	Dummy variable: 1 if the farmer's health is "good health" or "better health", and 0 otherwise.	0.64	0.48
Social capital	Party membership	Dummy variable: 1 if the householder is a party member, and 0 otherwise.	0.11	0.31
	Cadre	Dummy variable: 1 if the householder is a village cadre, and 0 otherwise.	0.06	0.23
	Cooperative membership	Dummy variable: 1 if the householder is a cooperative member, and 0 otherwise.	0.03	0.18
	Siblings	Dummy variable: Number of brothers and sisters of the householder.	3.21	1.77
	Rela_trust1	Dummy variable: 1 if farmers think their relatives and friends are "generally trusted", and 0 otherwise.	0.24	0.43
	Rela_trust2	Dummy variable: 1 if farmers think their relatives and friends are "relatively trusted" or "very trusted", and 0 otherwise.	0.71	0.45
	Others_trust1	Dummy variable: 1 if farmers think other people are "generally trusted", and 0 otherwise.	0.47	0.50
	Others_trust2	Dummy variable: 1 if farmers think other people are "relatively trusted" or "very trusted", and 0 otherwise.	0.35	0.48
	Bank relatives	Dummy variable: 1 if the family has relatives working in the bank, and 0 otherwise.	0.01	0.09
Control variables	Age	Continuous variable: Age of household head (years).	53.39	10.65
	Male	Dummy variable: 1 if the householder is a male, and 0 otherwise.	0.92	0.28
	Married	Dummy variable: 1 if the householder is married, and 0 otherwise.	0.97	0.17
	Experience	Dummy variable: 1 if the farmer has working experience outside, and 0 otherwise.	0.30	0.46
	Family size	Continuous variable: Number of people residing in the household.	3.95	1.37
	Income	Continuous variable: Annual household income per capita(log).	9.01	0.75
	In-Ex ratio	Continuous variable: Household income/expenditure ratio.	0.77	1.33
	Wealth	Continuous variable: Household wealth(log).	10.44	1.27

5. Empirical Analysis

First, we used the ordered probit model to estimate the impact of human and social capitals on the formal and informal credit availability of farmers (see Table 4). Second, for some human and social capital variables with obvious self-selectivity, we made a counterfactual estimation with the propensity score matching model—a bias-corrected matching estimation. This could reduce the sample selection bias and provide the average treatment effect on the formal and informal credit availability of farmers. The results are shown in Table 5.

5.1. Sample Basic Characterization

The basic characteristics of sample farmers are shown in Table 2. The gender of householders is mainly male, accounting for 91.6% of the total sample. The age of the householders is between 21 and 101 years. Householders aged 40–60 years old account for 64.3% of the total sample. Most of the householders have a low education level; about 80.5% of these farmers have a primary or middle-high-school education level. The per capita income of most households (80.9%) is below CN¥ 15,000. These statistical characteristics (e.g., low education and low income) are roughly consistent with the basic situation of rural households in China. Consequently, the sample selection had a certain credibility.

Table 2. The basic characteristics of the surveyed farmers.

Variables	Options	N	Proportion (%)
Gender of householders	Male	2864	91.6
	Female	263	8.4
Age of householders	<30	40	1.3
	30–40	266	8.5
	40–50	970	31.0
	50–60	1041	33.3
	>60	810	25.9
Education of householders	None	182	5.8
	Primary school	1016	32.5
	Middle school	1500	48.0
	High school	389	12.4
	College or above	40	1.3
Household income per capita (¥)	<5000	769	24.6
	5000–10,000	1131	36.2
	10,000–15,000	630	20.1
	15,000–20,000	264	8.4
	>20,000	333	10.6

Table 3 shows that about 2792 sample farmers chose informal borrowing channels; the total rate was 89.3%. About 1036 sample farmers chose formal borrowing channels; the total rate was 33.1%. This indicates that farmers prefer to choose informal borrowing channels. The sum of farmers using formal and informal credit channels is greater than the total sample, because some farmers applied for both formal and informal borrowing (about 701 farmers).

Table 3. The credit situation of the surveyed farmers.

		Formal Channels		Informal Channels	
		N	Proportion (%)	N	Proportion (%)
Credit availability	Apply for borrowing	1036	33.1	2792	89.3
	All applications are fully met.	745	71.7	2008	71.9
	All applications are accepted, but not fully met.	138	13.3	427	15.3
	One or more applications are rejected.	153	14.7	357	12.8

Table 3 also shows the credit availability of farmers. About 69% of the sample farmers' borrowing applications were fully satisfied, about 16% of the sample farmers' borrowing applications were accepted but not fully met, and about 15% of the sample farmers' applications were rejected one or more times. This means that about 31% of the sample farmers' applications could not be fully met. There is still room for improvement in rural financial development in China. Furthermore, compared with informal credit, the probability of farmers being rejected by formal financial institutions increased significantly ($14.7\% > 12.8\%$).

5.2. Estimation Results

5.2.1. Ordered Probit Model Estimation Results

Some studies show that social capital had a significant impact on the health of residents [43]. In order to reduce the impact of multicollinearity between human and social capitals on the estimation results, we referred to the treatment of Ding et al. [44]. In the estimation, the model (2) and (5) only included human capital variables and control variables, and the models (3) and (6) only included the social capital variables and control variables. The estimation results are shown in Table 4. We can see from this result that R^2 is very low. An important reason for the lower R^2 is missing variables. The credit availability of farmers is not only related to the characteristics of the farmers themselves, but also to the characteristics of the lenders. In the model, we mainly examine the characteristics of the farmers themselves, and lack the characteristic data of the corresponding lenders. This may result in a lower R^2 in our model. In addition, there are generally two purposes for using regression models. One is explanation, and the other is prediction. If you need accurate predictions, a lower R^2 is not feasible. However, if you want to analyze the significance of the explanatory variables, a lower R^2 is feasible. The purpose of our model is mainly to explain, not to predict. However, the R^2 of the ordered probit model is low, and there may be some deviation in the parameter estimation. Thus, we used the PSM model to estimate again. We discussed the same conclusions of the two models in the result section of the ordered probit model. We discussed different conclusions after the PSM estimate.

The results showed that human capital had a positive impact on the formal credit availability of farmers, but that it had no significant impact on the informal credit availability of farmers (Table 4). Specifically, for formal credit, compared with farmers with bad or worse health (the control group), the dummy variables "health1" and "health2" had a significant positive impact on the formal credit availability of farmers. This indicates that improving farmers' health will play an important role in increasing the formal credit availability of farmers. This is consistent with our hypothesis. Healthier farmers have higher incomes and a stronger ability to make continuous payments, reducing the loan risk of banks. Compared with farmers with a primary or lower education level, the dummy variables "education1" and "education2" had a positive but insignificant impact on the formal credit availability of farmers. This is inconsistent with our hypothesis and the results of most scholars. It may be because the investment of farmers in education is influenced by many factors, such as family income. Some scholars believe that education is also related to the credit situation of families, and farmers with credit constraints always have a lower investment in education [45]. Therefore, there may be a degree of causality between education and family credit, causing endogenous problems. We will use the more accurate method of PSM for testing before discussing this further. For informal credit, only the dummy variable "health2" had a significant impact on the informal credit availability of farmers at the level of 10%, and the dummy variables "health1", "education1", and "education2" had no significant impact on the informal credit availability of farmers. As the saying goes, "birds of a feather flock together". People within the group have some similarities. Therefore, there may be little difference in the education level between friends. Borrowing between relatives and friends is based more on the social relationship formed by geographical and blood ties. However, the human capital of farmers is not particularly important to their relatives and friends.

Table 4. The estimation results of the ordered probit model.

Variables	Formal Credit Availability			Informal Credit Availability		
	(1)	(2)	(3)	(4)	(5)	(6)
Education1	0.037 (0.102)	0.055 (0.100)		−0.004 (0.059)	0.017 (0.057)	
Education2	0.017 (0.141)	0.130 (0.131)		−0.021 (0.085)	0.038 (0.081)	
Health1	0.408 *** (0.154)	0.418 *** (0.153)		0.068 (0.091)	0.075 (0.089)	
Health2	0.303 ** (0.144)	0.363 *** (0.141)		0.077 (0.086)	0.159 * (0.083)	
Party membership	0.063 (0.140)		0.079 (0.135)	−0.056 (0.100)		−0.057 (0.098)
Cadre	0.388 ** (0.172)		0.372 ** (0.172)	0.188 (0.128)		0.187 (0.128)
Cooperative membership	0.050 (0.195)		0.044 (0.197)	0.559 *** (0.187)		0.556 *** (0.187)
Siblings	0.069 ** (0.024)		0.066 *** (0.024)	0.033 ** (0.015)		0.033 ** (0.015)
Rela_trust1	0.177 (0.202)		0.186 (0.202)	−0.001 (0.125)		−0.003 (0.125)
Rela_trust2	0.283 (0.194)		0.299 (0.194)	0.407 *** (0.120)		0.407 *** (0.120)
Others_trust1	0.121 (0.123)		0.145 (0.123)	0.172 ** (0.072)		0.179 ** (0.071)
Others_trust2	0.393 *** (0.135)		0.415 *** (0.135)	0.345 *** (0.080)		0.352 *** (0.079)
Bank relatives	0.327 (0.419)		0.340 (0.422)	0.388 (0.348)		0.391 (0.346)
Age	0.002 (0.004)	0.006 (0.004)	0.000 (0.004)	−0.001 (0.003)	0.001 (0.003)	−0.002 (0.002)
Male	−0.227 (0.160)	−0.202 (0.158)	−0.172 (0.161)	0.079 (0.091)	0.085 (0.089)	0.082 (0.091)
Married	0.043 (0.251)	0.083 (0.265)	0.050 (0.253)	0.191 (0.152)	0.230 (0.146)	0.194 (0.151)
Experience	0.027 (0.095)	0.036 (0.092)	0.036 (0.095)	0.048 (0.058)	0.030 (0.057)	0.051 (0.058)
Family size	0.046 (0.033)	0.060 * (0.033)	0.043 (0.033)	−0.004 (0.019)	0.007 (0.019)	−0.003 (0.019)
Income	0.171 *** (0.058)	0.172 *** (0.058)	0.183 *** (0.057)	−0.010 (0.039)	0.002 (0.038)	−0.005 (0.038)
In_Ex ratio	0.106 (0.090)	0.134 (0.088)	0.108 (0.089)	0.034 (0.042)	0.038 (0.042)	0.034 (0.042)
Wealth	0.041 (0.035)	0.034 (0.035)	0.045 (0.035)	−0.006 (0.020)	−0.008 (0.020)	−0.006 (0.020)
No. of observ.	1021	1021	1021	2694	2694	2694
Pseudo R2	0.0392	0.0173	0.0344	0.0329	0.0030	0.0327
Wald chi2	68.30 ***	30.21 ***	60.75 ***	133.97 ***	11.72	132.30 ***

Notes: (1) Standard errors in brackets, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (2) In the estimation, we removed the samples that answered “unclear” when measuring the trust of family and friends and of other people, so the number of observation values in the regression is not consistent with the observation values in the descriptive statistical analysis above.

The results also showed that social capital had a significant impact on the credit availability of farmers. Among them, interpersonal relationship capital had a significant impact on the formal and informal credit availability of farmers. This is consistent with our hypothesis. However, the impacts of financial relationship capital on the formal and informal credit availability of farmers were all non-significant. This is inconsistent with our hypothesis and the conclusions of most previous authors. It may be because the financial relationship capital of our sample farmers is generally weak, and only a few farmers have relatives working in banks, resulting in the estimated results not being statistically significant.

Specifically, for formal credit, the estimation results of models (1)–(3) were relatively consistent. For political relationship capital, the variable “cadre” had a significant positive impact on the formal credit availability of farmers, while the variable “party membership” had a positive but insignificant impact on the formal credit availability of farmers. These results also support the findings of Xu and Yang [46]. This shows that political relationship capital has a positive impact on farmers’ formal credit availability. For interpersonal relationship capital, the variables “siblings” and “others_trust2” had a significant positive impact on the formal credit availability of farmers, while the variables “rela_trust1” and “rela_trust2” had a positive but insignificant impact on the formal credit availability of farmers. For organizational relationship capital, the impact of the variable “cooperative membership” on the formal credit availability of farmers was not significant. This may be because the development of farmer cooperative organizations is still not perfect in China. Many cooperative organizations are just in the form of cooperatives and have no substantive operations, which reduces the trust of formal financial institutions in cooperatives. Therefore, whether farmers participate in cooperative organizations or not has no significant impact on the formal credit availability of farmers [8].

For informal credit, the estimation results of models (4)–(6) were also relatively consistent. The variables “cooperative membership”, “siblings”, “rela_trust2”, “others_trust1,” and “others_trust2” all had a significant positive impact on the informal credit availability of farmers. This shows that farmers with better organizational relationship capital and interpersonal relationship capital are more likely to obtain loans from their relatives and friends. However, the impact of political relationship capital on the informal credit availability of farmers was not significant. This is inconsistent with our hypothesis, and we will use the more accurate method of PSM for testing before discussing this further.

5.2.2. Propensity Score Matching Estimation Results

The propensity score matching model can only deal with binary variables in general. However, the variables of farmers’ education, trust in relatives and friends, and trust in other people are not binary variables. For such variables, some scholars point out that we can perform pairwise matching between groups, select one group at a time, and match with the rest of the groups one by one [47,48]. For the education variable, we took farmers with primary school or lower education as the control group, farmers with middle school education as one treatment group, and farmers with high school or above education as another treatment group. Then, we matched the two treatment groups with the control group one by one. Similarly, for the two trust variables, we took farmers who selected “very untrusted” and “not very trusted” as the control group, farmers who selected “generally trusted” as one treatment group, and farmers who selected “relatively trusted” and “very trusted” as another treatment group. Then, we also matched the two treatment groups with the control group one by one. There are many methods for propensity score matching. We used the bias-corrected matching estimator to measure the average treatment effect on the treated (SATT) variables of human and social capitals. The estimated results are shown in Table 5.

Table 5. The estimation results of the propensity score matching model.

Variables	Formal Credit Availability			Informal Credit Availability		
	SATT	S.E.	Z value	SATT	S.E.	Z value
Education: middle school	0.114	0.072	1.58	−0.004	0.036	−0.11
Education: high school or above	0.210	0.081	2.58 ***	0.022	0.060	0.37
Party membership	0.031	0.075	0.41	−0.012	0.058	−0.20
Cadre	0.224	0.099	2.25 **	0.127	0.075	1.70 *
Cooperative membership	−0.031	0.109	−0.29	0.265	0.078	3.41 ***
Trust of relatives or friends: general trust	0.024	0.109	0.22	0.005	0.101	0.05
Trust of relatives or friends: more trust	0.313	0.112	2.79 ***	0.220	0.095	2.32 **
Trust of other people: general trust	0.136	0.089	1.52	0.155	0.053	2.94 ***
Trust of other people: more trust	0.296	0.098	3.03 ***	0.168	0.056	2.98 ***

Notes: In the matching of farmers' education, we took farmers with primary school or lower education as the control group. In the matching of the trust between relatives or friends, we took farmers who thought their relatives or friends were not trustworthy as the control group. Additionally, in the matching of the trust of other people, we took farmers who thought other people were not trustworthy as the control group. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In terms of human capital, unlike the estimation results of the ordered probit model, the education level of farmers (“high school or above”) had a significant positive impact on their formal credit availability. This indicates that, compared with farmers with primary school or lower education, farmers with high school or above education are more likely to obtain loans from formal financial institutions. This is inconsistent with the results of the ordered probit model but more consistent with our hypothesis. This may be because the PSM estimate excluded the effects of other factors and obtained the net impact of education on the credit availability of farmers. Our analysis is also mainly based on the estimated results of PSM. Farmers with higher education levels have a stronger credit consciousness, repayment ability, and willingness. They are more able to gain the trust of formal financial institutions. Other estimation results were consistent with the ordered probit model. Overall, based on the estimation results of the ordered probit and PSM models, human capital had a significant positive impact on the formal credit availability of farmers. However, its impact on the informal credit availability of farmers was not significant.

In terms of social capital, unlike the estimation results of the ordered probit model, the cadre status of farmers also had a significant positive impact on their informal credit availability at a 10% level. This indicates that the cadre status of farmers is also beneficial to them for obtaining loans from relatives and friends. This may be because rural cadres are generally elected by farmers and usually have a high prestige and credibility in the rural group. Other estimation results were consistent with the ordered probit model. Overall, based on the estimation results of the ordered probit and PSM models, the interpersonal relationship capital and political relationship capital of farmers had a significant positive impact on the formal and informal credit availability of farmers. The organizational relationship capital only had a significant positive impact on the informal credit availability of farmers. However, the impacts of financial relationship capital on the formal and informal credit availability of farmers were all insignificant, which may be related to our sample selection. Only a few farmers had relatives working in the financial sector. Therefore, the sample matching results may not have been ideal, and we do not comment on this here.

6. Conclusions and Suggestions

Based on the CHIP2013 database, we estimated the impact of human and social capitals on the formal and informal credit availability of farmers with the ordered probit model and the PSM model. The basic conclusions are as follows.

First, for the borrowing channels, farmers preferred to choose an informal channel. For the credit availability of farmers, about 31% of the sample farmers did not receive full loans, which is similar to the findings of Yu and Zhou (25.8%) [49]. This indicates that there is still room for further improvement of rural finance in China.

Second, human and social capitals both had a certain positive impact on the formal credit availability of farmers, while for informal credit the impact of social capital was more significant. The hypothesis that social capital has a significant positive effect on the formal and informal credit availability of farmers has been confirmed, but the hypothesis that human capital has a positive effect on the informal credit availability of farmers has not been confirmed. This may be because the informal borrowing we studied was mainly between relatives and friends, which is mainly based on the social relationship between them. The trust and prestige formed by the social relationship based on blood, kinship, and geography have a great influence on farmers' borrowing. In such a relationship, the impact of farmers' education or health is relatively weak. This shows that formal financial institutions not only pay attention to the human capital of farmers but also to their social capital to reduce the risk of lending, while informal lenders, that is, their relatives and friends, pay more attention to the social capital of farmers.

Third, specifically for human capital, the education and health level of farmers had a positive and significant impact on their formal credit availability. Farmers with a higher education level, especially with a high school or above education level, were more likely to obtain loans from formal financial institutions. For social capital, interpersonal relationship capital had a positive impact on the formal and informal credit availability of farmers. This indicates that more siblings and a higher trust among relatives, friends, and others can greatly help farmers obtain loans. Organizational relationship capital only had a significant positive impact on the informal credit availability of farmers. This may be because the mutual assistance and supervision of cooperatives make it easier for farmers to obtain loans from cooperative members, including relatives and friends. However, cooperative organizations are not fully recognized by formal financial institutions, and this has no significant impact on the formal credit availability of farmers. For political relationship capital, compared with the party membership of farmers, farmers' cadre status can give farmers greater prestige and better help them obtain loans. This may be because the cadre identity information of farmers is a kind of explicit information, while the party membership information of farmers is a kind of relatively implicit information. The behavior of village cadres is more constrained, and the cost of default is higher. However, the hypothesis that financial relationship capital has a positive impact on the formal and informal credit availability of farmers has not been confirmed. This may be because the financial relationship capital of farmers is generally weak. Fewer farmers have relatives working in banks. In other words, in the estimation process, the difference in independent variables is small, difficult to render statistically significant. Based on this, we do not overly discuss the impact of financial relationship capital on the credit availability of farmers.

Based on the above conclusions, we can state the following recommendations. For farmers, improving their human capital and social capital has a positive effect on their access to credit. For example, improving farmers' education level, health level, and their prestige, joining cooperative economic organizations, and strengthening a close relationship with relatives and friends have important positive effects on improving the credit availability of farmers. For the government, first, in rural finance more farmers prefer to choose informal borrowing channels, and the role of formal financial institutions needs to be further improved. Second, in terms of human capital, improving the health and education of farmers can help them obtain formal loans. In particular, popularizing high school or above education levels can enhance the formal credit availability of farmers. Third, regarding social capital, Dinh et al. [35] argued that it is difficult to put forward an effective policy recommendation to the government or banks that generally fosters social capital. Moreover, such policy measures may have some unexpected and unnecessary side effects. However, we contend that improving the participation of farmer cooperative organizations and their social recognition may be an important and effective way to improve the credit availability of farmers. Only through the joint efforts of the government and farmers themselves, can we effectively improve the credit availability of farmers.

We have studied the impact of farmers' education and health (especially health) on the credit availability of farmers. Our study improved the research framework of human capital on farmers' credit availability to a certain extent. However, whether there is an interaction between human capital and social capital, and how the interaction between them affects the credit availability of farmers, also has some research value.

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