

Article

Operation Scale, Transfer Experience, and Farmers' Willingness toward Farmland Transfer-In: A Case Study of Rice–Crayfish Cultivating Regions in China

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Abstract: Most arable land in rural areas of China is highly fragmented, and promoting large-scale operation by means of farmland transfer is of great significance to both increase farm income and improve the ecological stability of farmland. At present, crayfish are widely popular with the consumer market, and the rice–crayfish cultivation pattern has considerable industrial advantages for water-rich plain areas. However, farmers do not have a sufficient understanding of the new model, and its application is not common enough, failing to realize the advantages of the region's special industries. The purpose of this paper is to analyze the current situation of farmland transfer in rice–crayfish cultivating regions of Hunan and Hubei, China, and employ the logistic regression model to explore the impacts of operation scale and transfer experience on farmers' willingness toward farmland transfer-in, in order to promote the sustainable development of rice–crayfish cultivating. The results showed that: Firstly, both operation scale and transfer experience have a significant positive relevance with farmers' willingness toward farmland transfer-in. Secondly, there are obvious differences in the impact path among large-scale, medium-scale, and small-scale rice or rice–crayfish farmers. Thirdly, the transfer-out experience is inhibitory or not significantly associated with the willingness toward farmland transfer-in. Fourthly, the transfer experience intensifies the positive influence of the expansion of operation scale on the farmers' willingness toward farmland transfer-in. This study can provide some reference and basis for the local government to make differentiated measures according to the farmland transfer preferences of farmers with different scales and operation types, so as to promote farmers' willingness to operate at a large scale and realize the sustainable development of the regional rice–crayfish cultivating model.

Keywords: operation scale of farmland; farmland transfer experience; willingness toward farmland transfer-in; rice–crayfish cultivating; Hunan and Hubei provinces



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1. Introduction

Farmland transfer plays an important role in addressing land fragmentation, realizing appropriate operation scale, improving the allocation of farmland resources, and increasing the agricultural income of rural households [1–3]. In 2014, the policy document titled “Opinions on Guiding the Orderly Transfer of Farmland Management Rights to Develop Agricultural Appropriate Operation Scale” was released by the General Office of the State Council. Thus, encouraging and guiding farmland transfers to promote appropriate operation scale has become the mainstream of public policy [4]. Farmland transfer is subdivided into transfer-in and transfer-out. For farmers, transfer-in can not only centralize the fragmented land but also reduce production costs, improve land-use efficiency, and increase incomes [5]. Regulated transfer motivates farmers to invest in the medium and long term, resulting in a reduction of chemical persecution and a change in the pattern of high-intensity unreasonable inputs, maintaining the ecological stability of farmland [6,7]. Consequently, it is widely utilized for industrialized operations, especially for innovative

cultivation patterns. “Rice–crayfish cultivation” is a breeding pattern of crayfish stocking in paddy fields that makes full use of light, heat, water, and biological resources to form a compound cycle ecological farming pattern. It is supposed to improve the water and soil utilization rate and achieve high-quality and high-yield rice and crayfish [8]. With the soaring consumption demand for crayfish throughout China, rice–crayfish cultivation is becoming more and more promising. In this case, it is extremely necessary to expand the scale of cultivation to support the development of the rice–crayfish industry and the local economy.

In recent years, many scholars have explored the influencing factors of farmland transfer. Among them, personal characteristics [6,9], household characteristics [10,11], farmers’ perceptions [12,13], property rights and institutional factors [14,15], and social security [16,17] have received extensive attention from scholars. Zhong et al. [12] studied farmers’ willingness to transfer farmland from the perspective of farmers’ cognition, and Xu et al. [18] found that the degree of cognition and farmers’ occupational and economic differentiation would cause differences in farmers’ willingness to transfer farmland. The empirical study by Xu [19] pointed out that farmers in less developed areas showed a weaker willingness to transfer farmland due to the intensity of land production and social security functions. However, current research has shown that there are some differences in farmers’ willingness preferences. The empirical study by Wang et al. [20] compared the difference between farmers’ willingness to transfer-in and out of cultivated land based on the theory of planned behavior. The research results revealed that behavioral attitudes and perceptual behavior control had a positive contribution to farmers’ willingness to transfer-in and out, while subjective attitudes differed in the direction of their influence paths. Zou et al. [21] argued that the existence of family farms would promote traditional farmers’ willingness to transfer farmland out and inhibit willingness to transfer farmland in. The study by Zhang and Qian [22] uncovered that the willingness toward farmland transfer-in was weaker, but transfer-out was stronger for part-time farmers compared with the pure farmers. Besides, Cui and Wu [23] examined the main factors of farmland transfer from the viewpoint of farmers and pastoralists in the intersection of agriculture and livestock. These studies mentioned above analyzed the factors influencing farmers’ willingness to transfer-in and out from different perspectives, which provide a solid basis for future research.

According to Han et al. [24] and Yan et al. [25], there is a particular relationship between the scale of operation and transfer experience. However, little of the literature [26–28] studies their impact on farmers’ willingness. Most research ignored the fact that transfer experience may lead to differences in operation scale, resulting in the bias of econometrical results. In the context of rural industry’s development in China, the willingness of rice and rice–crayfish farmers toward farmland transfer-in needs to be further explored. This study considers both the operation scale and transfers experience and conducts a comparative analysis of the willingness between rice and rice–crayfish farmers to help policy-makers to understand more about the differences between the two so that they can formulate differentiated farmland transfer policies for different farmers to enhance farmers’ willingness toward farmland transfer-in, and promote the economic development of rice–crayfish cultivating areas.

Hunan and Hubei provinces, located in the middle and lower reaches of the Yangtze River plain, are the main area of rice–crayfish cultivation in China. Based on the field survey, this paper regards farmers in rice–crayfish cultivating regions areas in Hunan and Hubei provinces as research objects, and uses the logistic regression model to propose an analytical framework in which operation scale and transfer experience jointly affect farmers’ willingness toward farmland transfer-in. This framework is employed to explain the influence mechanism of operation scale and transfer experience on different types of farmers, and afterward, explores whether transfer experience intensifies the influence of farmland expansion on farmers’ willingness toward farmland transfer-in, in order to provide a basis for relevant departments to formulate industrial development policies.

2. Research Hypothesis

2.1. Scale of Operation and Willingness to Transfer-In

According to the theory of economies of scale, the average cost of products decreases as the scale of operation gradually expands before it reaches a critical point [29,30]. An appropriate operation scale is preferable for farmers, and farmland transfer is a useful way to achieve that goal [26,30]. In general, farmers make decisions to transfer farmland at the stage of increasing economies of scale. They prefer to expand the operation scale of farmland, increase the number of factor inputs, and reduce the average cost of production. Existing research shows that scattered small-scale operations result in a large amount of labor time consumed in traveling between plots, boundaries, and ridges of plots cause inefficient land use, and missing elements in the transportation system also lead to waste of resources [26,31]. The empirical studies argued that farmers with larger operation scales have more robust economic advantages and the ability to bear risks, and are more willing to transfer farmland in to expand their operation scale than small-scale farmers [32,33]. However, the study by Xia [34] showed that the larger the operation scale of farmland, the lower the farmland output rate. Accordingly, the amount of labor and capital per unit area is decreased, affecting farmers' willingness to transfer farmland. Moreover, some scholars revealed that the willingness of medium-scale farmers was much stronger than small-scale and large-scale farmers when comparing different farmland scales [35]. Therefore, it is necessary to consider the operation scale as one important factor in farmland transfer. Based on the above analysis, Hypothesis H1 of this paper is proposed:

Hypothesis 1 (H1). *The scale of operation affects the willingness of farmers to transfer farmland in.*

2.2. Transfer Experience and Willingness to Transfer-In

Farmland transfer is divided into transfer-in and transfer-out, where transfer-in is to increase the farmland operation scale through subcontracting, leasing, and swapping, and transfer-out is also to transfer farmland to other farmers through these ways, so as to reduce the operation scale of their own. Transfer experience refers to the fact that farmers have transferred their contracted farmland in or out at least once [36]. In the background of the incomplete farmland transfer market, several risk factors such as the uncertainty of cost and return of growing grain and farmers' own capabilities will directly affect the final decision of farmers [37,38]. Farmers with transfer experience have a higher risk perception and deeper understanding of policy, market, and production information on farmland transfer, which reduces the uncertainty to a certain extent.

The transfer experience includes transfer-in and transfer-out experiences, both of which affect farmers' willingness. For one thing, farmers with transfer experience have lower transaction and production costs because of their rich experience in transfer channels choosing and farming skills, leaving them willing to transfer more farmland in. For another thing, farmers with transfer-out experience often have little intention to engage in agricultural production, which results in lower reliance on farmland for livelihood and lower willingness to transfer farmland in [15]. Peng et al. [39], based on the survey data of 645 farmers in 10 counties in Hubei, concluded that most farmers with transfer experience are still willing to transfer farmland, while those without are not willing. Zheng et al. [28] explained that farmers with sufficient experience are more familiar with channels, methods, processes, and benefits of farmland transfer, which strengthens their willingness. In addition, studies have shown that there is a relationship between "path dependence" and farmers' willingness toward farmland transfer-in. This concept was introduced by David and Arthur in their study of technological change, emphasizing the increasing rewards of technology and self-reinforcing mechanisms [40–43]. On this basis, Douglas argued that incomplete markets caused by significant transaction costs could also cause "path dependence", and the concept has been applied and developed in legal systems and economics [44–46]. Therefore, drawing on this concept, transfer experience is considered a kind of cognitive inertia in this paper. Farmers choose to rely on and reinforce their

original cognition after farmland transfer due to a series of factors such as economies of scale, adaptive expectations, and vested interest constraints. Considering increasing returns and sunk costs, farmers will continue to follow the existing path to maintain their current interests. Liu et al. [47] studied the relationship between path dependence and conversion of farmland from the perspective of land property rights, indicating that path dependence significantly impacts farmers' expectations. Additionally, the relationship between path dependence and farmers' willingness is examined [48]. Based on the above analysis, Hypothesis H2 is as follows:

Hypothesis 2 (H2). *Farmers' experience of transfer-in can enhance their willingness to transfer farmland in, and the experience of transferring-out may inhibit their willingness.*

2.3. Operation Scale, Transfer Experience, and Willingness toward Farmland Transfer-In

Following the above analysis, farmers' willingness toward farmland transfer-in varies with farmland operation scale and transfer experience. Notwithstanding, transfer experience means farmers have experienced farmland transferred in or out, which directly changes the operation scale. Particularly, transfer-in experience expands the farmland operation scale, while the transfer-out experience reduces the farmland operation scale [25]. For the transferred-in farmers, the operation scale expands which reduces the unit production cost of farmland and improves economic efficiency. Those farmers who have rich experience in transferring farmland, completing farmland transfer channels, and intuitively perceive earnings, are generally willing to continue transferring farmland to obtain greater scale benefits. For the transferred-out farmers, their operation scale is decreasing, parts of agricultural laborers are converting to non-agriculture, the dependence on agriculture is lowered. In consideration of comparative profits, those farmers who have experienced farmland transfer out and more profound recognition of operation scale, earn a higher income from other jobs, and are usually unwilling to transfer farmland in again. In a word, there is a tight interrelationship between farmland operation scale and transfer experience, and they both affect farmers' willingness toward farmland transfer-in. Thus, Hypothesis H3 is proposed as above:

Hypothesis 3 (H3). *Transfer experience will intensify the impact of the operation scale on the willingness of farmers to transfer farmland in.*

3. Materials and Methods

3.1. Data Sources

In this paper, Yueyang and Qianjiang were selected as the study areas of two provinces, Hunan and Hubei, which are the main grain-producing provinces in China (Figure 1). They are featured with excellent quality irrigated paddy fields, a suitable environment for rice–crayfish cultivation, and strong policy support from local governments.

The data was collected from a survey of farmers from 22 April to 3 May 2018. In this study, a stratified random sampling method was adopted. Farmers were randomly selected during the field survey in Yueyang and Qianjiang. A total of 530 samples were obtained, including 253 from Yueyang and 277 from Qianjiang, 301 rice farmers who grow rice only, and 229 rice–crayfish farmers. The investigated farmers over 50 years old account for 82.83%, and 86.60% have junior high school education or less. Regarding the scales of farmland operation, 39.81% of them are less than 0.33 ha, 34.34% are between 0.33 and 0.67 ha, 13.77% are between 0.67 and 1 ha, and 12.08% are larger than 1 ha. Farmers with experience in transferring account for 34.34%, including 44.98% of rice farmers and 26.25% of rice–crayfish farmers.

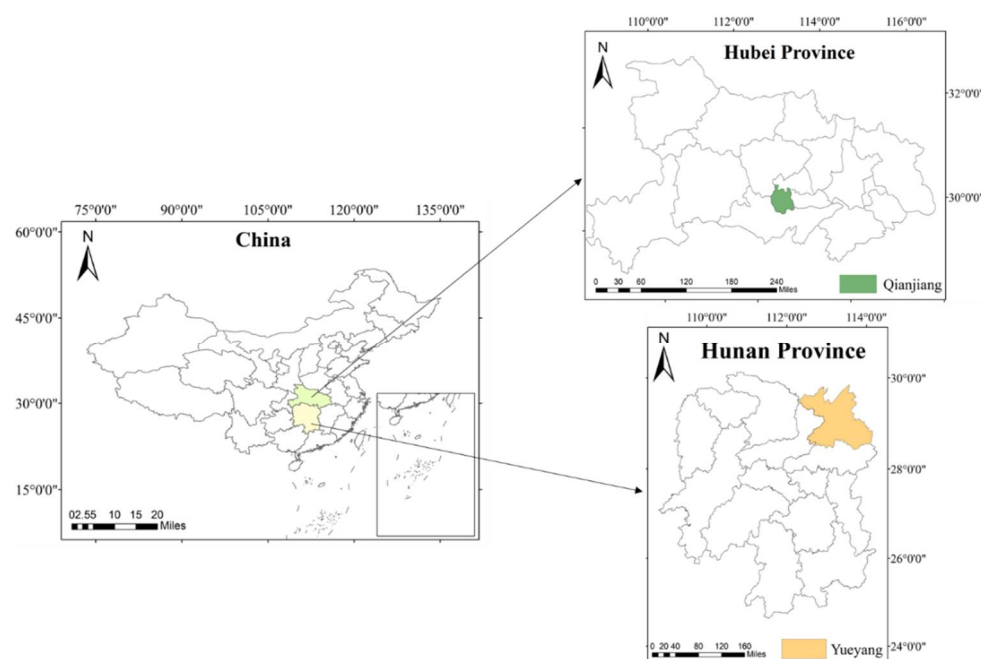


Figure 1. Location of the study area in China.

3.2. Research Methods

The willingness toward farmland transfer-in studied in this paper is divided into “willing” and “unwilling”, which is a typical binary choice model, and the logistic regression model can be used to analyze such qualitative variable, where “1” indicates a willingness to transfer farmland in, and “0” indicates an unwillingness to transfer-in. Thus, the binary logistic regression model is employed to conduct the factors associated with farmers’ willingness toward farmland transfer-in in rice–crayfish cultivating areas. The regression equation is denoted as:

$$\ln p_i / (1 - p_i) = \alpha_0 + \alpha_1 X_{1i} + \alpha_2 X_{2i} + \dots + \alpha_k X_{ki} + \mu_i \quad (1)$$

where $p_i / (1 - p_i)$ represents the odds ratio of willingness to transfer-in for farmer “ i ”, p_i represents the probability of the willingness to transfer-in for farmer “ i ”, X_{ki} represents the variable that affects this farmer’s willingness to transfer-in, α_k represents the estimated parameter of explanatory variables, $k = 1, 2, 3, \dots, 10$, and μ_i represents the random disturbance term.

Based on the analytical framework proposed above, the core independent variables that this paper focuses on are operation scale and transfer experience. In general, the larger the operation scale, the greater the expected moderate operation scale of farmers, and the stronger the willingness toward farmland transfer-in. The transfer experience is divided into transfer-in and transfer-out experience. The transfer-in farmers are more familiar with the channels, methods, processes, and benefits of farmland transfer, so they have a stronger willingness to continue transferring farmland in; the transfer-out farmers often show a willingness to engage in non-agricultural production, and a lower willingness to transfer farmland for farming instead. In addition, referring to the existing literature and the actual situation in the study area, the selected control variables include household characteristics, farmland resource endowment, and farmland transfer characteristics. With regard to household characteristics, generally speaking, the older farmers are, the weaker their physical and labor capacity, and the lower their willingness toward farmland transfer-in; highly educated farmers, who are more capable of accepting knowledge and new things, and have more ability to master the technology and management skills needed for a large-scale operation, show a stronger willingness to transfer farmland; farmers with a large number of agricultural laborers from their family are rich in labor resources and have

a stronger willingness toward farmland transfer-in; the higher the share of agricultural income, the greater the willingness to engage in agricultural production, and the greater the willingness to transfer-in. As for the farmland resource endowment, the flatter the farmland and the better the farmland quality, the more favorable it is to expand the operation scale and carry out mechanical production in order to improve income. In terms of farmland transfer characteristics, if the price per unit area of farmland transfer is high, farmers' willingness toward farmland transfer-in is relatively low; the standardized contract form will make the perception that the transfer of farmland is guaranteed and ensure a stronger willingness toward farmland transfer-in.

Moreover, depending on the available studies, the transfer experience may influence the relationship between differential operation scale expansion and farmers' willingness toward farmland transfer. To further explore the interrelationship among operation scale, transfer experience, and farmers' willingness toward farmland transfer-in, the interaction term is added [49]. The product of operation scale and transfer experience is taken as the interaction term in the model, which is supposed to clarify the interactive impact of the combination of the two variables. If the interaction term has a significant and positive impact, it means that the expansion of the operation scale of the farmers with the transfer experience has a greater impact on the farmers' willingness toward farmland transfer-in than the farmers without that. If it is significant but negative, it means that the expansion of the operation scale of the farmers with the transfer experience has a smaller impact on the farmers' willingness than the farmers without that.

$$\ln p_i / (1 - p_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta(X_{1i} \times X_{2i}) + \dots + \beta_k X_{ki} + \omega_i \quad (2)$$

where $X_{1i} \times X_{2i}$ represents the interaction term of farmer "i", β_k represents the estimated parameter of explanatory variables after adding the interaction term, $k = 1, 2, 3, \dots, 10$, and ω_i represents the random disturbance term. The variables are listed in Table 1.

Table 1. Descriptive statistics of variables.

Variable Type	Variable Name	Variable Definition	References	Average	Standard Deviation
Dependent Variable	willingness of transfer-in (Y)	0 = "unwilling to transfer-in", 1 = "willing to transfer-in"	[12]	0.134	0.341
Independent Variables	operation scale (X_1)	area of farmland, ha 0 = "no", 1 = "Yes"	[31,32] [28,38]	8.773 0.343	7.293 0.475
	transfer experience (X_2)				
Control Variables	age (X_3)	years 1 = "elementary school and below", 2 = "junior high school degree", 3 = "high school or junior college", 4 = "college degree or above"	[33] [33,50]	57.811 1.772	9.494 0.744
	education level (X_4)				
	share of agricultural income (X_5)	share of agricultural income in family income	[33]	0.581	0.361
	agricultural laborers (X_6)	number of family agricultural laborers	[51]	2.066	0.827
	farmland quality (X_7)	evaluation of the quality of farmland (1 = "Very bad", 2 = "Bad", 3 = "Fair", 4 = "Better", 5 = "Very good")	[52]	3.470	0.806
	levelness of field (X_8)	evaluation of the levelness of the field surface (1 = "Very uneven", 2 = "Less flat", 3 = "Fair", 4 = "Flatter", 5 = "Very flat")	[15]	3.770	1.020
	transfer prices (X_9)	Transfer prices of farmland per unit area, yuan/ha	[53,54]	133.181	264.365
	contract forms (X_{10})	contractual forms of farmland transfer (1 = "Oral agreement", 2 = "Part oral agreement, part paper deed", 3 = "Paper deed")	[18,55]	1.425	0.721

4. Empirical Results and Analysis

4.1. Regression Results

The regression results for the baseline model are shown as Model 1 in Table 2, and Model 3 and Model 5 are the regression results of different subsamples, rice farmers,

and rice–crayfish farmers, respectively. Additionally, Model 2, Model 4, and Model 6 are the corresponding results after the interaction term is added. By econometric analysis, the Pseudo R² is about 0.16, corresponding to a *p*-value of 0.00, indicating that the joint significance of the equation coefficients is high and the fit is relatively good.

Table 2. Factors influencing farmers’ willingness to transfer farmland in.

Variables	All Farmers (N = 530)		Rice Farmers (N = 301)		Rice–Crayfish Farmers (N = 229)	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
operation scale (X ₁)	0.010 *** (0.002)	0.007 * (3.170)	0.012 *** (0.002)	0.009 * (0.003)	0.008 *** (0.002)	0.004 (0.003)
transfer experience (X ₂)	0.113 *** (0.035)	0.025 (0.480)	0.114 ** (0.046)	0.046 (0.071)	0.118 ** (0.056)	0.004 (0.083)
X ₁ × X ₂		0.008 ** (2.200)	-	0.006 (0.005)		0.010 * (0.006)
age (X ₃)	−0.002 * (0.001)	−0.002 (−1.530)	−0.002 (0.002)	−0.001 (0.002)	−0.004 * (0.002)	−0.004 * (0.002)
education level (X ₄)	0.013 (0.022)	0.015 (0.680)	0.007 (0.030)	0.006 (0.030)	0.016 (0.032)	0.020 (0.031)
share of agricultural income (X ₅)	0.043 (0.040)	0.044 (1.110)	0.060 (0.050)	0.056 (0.049)	0.018 (0.066)	0.022 (0.065)
agricultural laborers (X ₆)	−0.003 (0.016)	−0.006 (−0.360)	−0.002 (0.021)	−0.004 (0.021)	−0.011 (0.028)	−0.011 (0.029)
farmland quality (X ₇)	0.003 (0.019)	0.005 (0.260)	0.008 (0.024)	0.006 (0.024)	−0.004 (0.030)	0.005 (0.030)
levelness of field (X ₈)	0.006 (0.015)	0.004 (0.250)	0.005 (0.020)	0.003 (0.020)	0.009 (0.022)	0.004 (0.022)
transfer prices (X ₉)	0.000 (0.000)	0.000 (−1.320)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
contract forms (X ₁₀)	−0.019 (0.020)	−0.018 (−0.880)	−0.035 (0.028)	−0.037 (0.028)	0.000 (0.033)	0.007 (0.032)

Notes: The above regression results are marginal effects; standard errors are in parentheses; ***, **, and * are significant at 1%, 5%, and 10% levels, respectively; the VIF results show that variance inflation factors of all variables are less than 10, which indicates a low covariance between variables.

From the baseline model results and its extensions, operation scale and transfer experience are significantly positively correlated with farmers’ willingness toward farmland transfer-in, whether for the total sample (Model 1) or subsample (Model 3 and Model 5). After the interaction term is introduced, the results of Model 2, Model 4, and Model 6 indicate that the correlation between transfer experience and willingness turns insignificant. Still, the interaction term’s impact is positive and partially significant (Model 2 and Model 6), implying that the relevant mechanism may vary for different groups of farmers.

Rice farmers are traditional and dominating farmers in Hunan and Hubei, even in most main grain-producing provinces in China. For them, the scale of operation is positively associated with their willingness to transfer farmland in, and the marginal effect is 0.012. According to existing research carried out in Jiangnan Plain, the current farmland operations in Hubei are in most cases smaller than the appropriate operation scale [56]. Before reaching the critical point, rice farmers are often willing to transfer farmland in to expand the scale. Moreover, the results of the marginal effects of the transfer experience will increase the probability of farmers’ willingness toward farmland transfer-in by about 11.40 percentage points. Rice farmers with enough experience have a better understanding of policies, information sources, main procedures, market prices, contract forms, and economic benefits of farmland transfer, which in turn promotes rice farmers’ willingness to transfer more farmland in. The coefficient of the interaction term is positive and insignificant, indicating that the positive correlation between operation scale expansion and willingness toward farmland transfer is greater for rice farmers with transfer experience. The main reason may be that rice farmers have a deeper perception of the uncertainty and benefits of growing rice after the transfer, and operation scale expansion helps them to increase operational efficiency and resist agricultural risks in a much easier way.

As crayfish have been widely popular by consumers around China in recent years, rice–crayfish farmers are soaring and becoming more promising. Their willingness toward

farmland transfer-in is inspired by increased benefits from operation scale expansion, and the marginal effect is 0.008. The fields survey in Qianjiang and Yueyang of this study indicates that the average net income for rice–crayfish farmers is about 9.5 times that of rice farmers when they own the same area of farmland [57]. Considering factors such as employment opportunities, mechanical farming, and production efficiency, expanding farmland scale and increasing factor inputs become the preferred operation strategy for rice–crayfish farmers. Rice–crayfish farmers with transfer experience are more likely to benefit from policy support, and the probability of their willingness toward farmland transfer-in is raised by about 0.118. After adding the interaction term (Model 6), the result is significant and positive, the marginal effect is higher than that of the operation scale when other factors are held constant, indicating that the expansion of the operation scale has a greater association with the willingness of the rice–crayfish farmers with transfer experience than those without transfer experience. The possible explanation may be that the transfer experience of rice–crayfish farmers intensifies the impact of operation scale expansion on their willingness to transfer more farmland in.

Among control variables, the age of farmers needs to be paid more attention. Normally, due to physical strength and health constraints, older farmers are less likely to continue large-scale and high-intensity agrarian work, and the vast majority choose to maintain their current scale of operation to obtain stable production returns [58,59]. Furthermore, due to rice–crayfish cultivating technology’s high requirements, older farmers show less willingness to transfer-in than younger farmers.

4.2. Differences in Transfer Experience

According to the previous analysis, there are some differences in farmers’ willingness toward farmland transfer-in with different transfer experiences, so we divide the transfer experience into transfer-in and transfer-out experiences and also introduce the operation scale and the interaction term in the model respectively to obtain estimation results, as follows in Tables 3 and 4.

Table 3. Regression results of rice farmers after different transfer experiences.

Variables	Rice Farmers (N = 301)		Rice Farmers (N = 301)	
	Model 7	Model 8	Model 9	Model 10
operation scale (X_1)	0.010 *** (0.002)	0.009 *** (0.003)	0.013 *** (0.002)	0.012 *** (0.003)
transfer-in experience	0.175 *** (0.038)	0.155 ** (0.075)	-	-
$X_1 \times$ transfer-in experience	-	0.002 (0.006)	-	-
transfer-out experience	-	-	-0.091 * (0.053)	-0.093 (0.107)
$X_1 \times$ transfer-out experience	-	-	-	0.000 (0.008)
age (X_3)	-0.001 (0.002)	-0.001 (0.002)	0.001 (0.002)	0.001 (0.002)
education level (X_4)	0.001 (0.029)	0.001 (0.029)	0.068 ** (0.028)	0.068 ** (0.028)
share of agricultural income (X_5)	0.052 (0.048)	0.051 (0.048)	-0.052 (0.051)	-0.052 (0.051)
agricultural laborers (X_6)	-0.011 (0.020)	-0.012 (0.020)	-0.002 (0.022)	-0.002 (0.022)
farmland quality (X_7)	0.009 (0.023)	0.008 (0.023)	-0.058 ** (0.024)	-0.058 ** (0.024)
levelness of field (X_8)	0.001 (0.019)	0.001 (0.019)	0.004 (0.019)	0.004 (0.019)
transfer prices (X_9)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
contract forms (X_{10})	-0.016 (0.027)	-0.015 (0.027)	0.005 (0.027)	0.005 (0.027)

Notes: The above regression results are marginal effects; standard errors are in parentheses; ***, **, and * are significant at 1%, 5%, and 10% levels, respectively.

The results show that for rice farmers, there is a significantly positive marginal effect of transfer-in experience on the willingness toward farmland transfer-in, which is consistent with the effect of transfer experience on willingness; while the marginal effect of transfer-out experience is negative (Table 3). It further indicates that the farmers with transfer-in experience are more willing to transfer farmland in. After transferring, the remuneration for rice cultivation increases, the family’s livelihood improves, and farmers gain more familiarity with the process of farmland transfer. All can help promote farmers to continue

to transfer farmland in. The reason for the negative effect of the transfer-out experience may be that generally farmers who choose to transfer out of farmland in the early stage basically have no intention to continue to engage in large-scale agricultural production, thus showing a negative correlation.

Table 4. Regression results of rice–crayfish farmer after different transfer experience.

Variables	Rice–Crayfish Farmers (N = 229)		Rice–Crayfish Farmers (N = 229)	
	Model 11	Model 12	Model 13	Model 14
operation scale (X_1)	0.008 *** (0.002)	0.008 *** (0.003)	0.009 *** (0.002)	0.007 *** (0.002)
transfer-in experience	0.080 (0.053)	0.060 (0.082)		
$X_1 \times$ transfer-in experience		0.002 (0.005)		
transfer-out experience			0.023 (0.053)	−0.286 (0.183)
$X_1 \times$ transfer-out experience				0.032 * (0.017)
age (X_3)	−0.004 (0.002)	−0.004 (0.002)	−0.004 * (0.002)	0.055 (0.035)
education level (X_4)	0.015 (0.032)	0.014 (0.032)	0.048 (0.035)	−0.036 (0.064)
share of agricultural income (X_5)	0.020 (0.067)	0.019 (0.067)	−0.050 (0.065)	0.017 (0.026)
agricultural laborers (X_6)	−0.008 (0.029)	−0.008 (0.029)	0.016 (0.027)	−0.011 (0.028)
farmland quality (X_7)	−0.001 (0.031)	0.001 (0.031)	−0.019 (0.028)	−0.035 (0.023)
levelness of field (X_8)	0.004 (0.023)	0.004 (0.023)	−0.035 (0.023)	0.000 (0.000)
transfer prices (X_9)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.031)
contract forms (X_{10})	−0.001 (0.033)	0.000 (0.033)	−0.008 (0.031)	0.070 (0.338)

Notes: The above regression results are marginal effects; standard errors are in parentheses; *** and * are significant at 1% and 10% levels, respectively.

In terms of rice–crayfish farmers, the marginal effects of transfer-in and transfer-out experience on the willingness toward farmland transfer-in are both positive, which are consistent with the effect of transfer experience on willingness, but not significant (Table 4). It may be that the current market for the transfer of rice–crayfish farmland is still not well developed, and the market supply and demand have some influence on farmland transfer, making some variations in the operational decisions of these farmers.

4.3. Grouping of Farmers

Our study area’s rice and rice–crayfish farmers are further grouped to investigate the factors affecting their willingness to transfer-in. Based on the studies of Yuan et al. [60], Li et al. [61], both rice and rice–crayfish farmers are divided into three parts using the K-means cluster analysis method [62], namely small-scale, medium-scale, and large-scale (Figure 2). It is easy to tell that the medium-scale group makes up the majority of rice and rice–crayfish farmers, accounting for 46.60% of the total farmers with 55.13% of the total farmland. The small-scale group is ranked second, with 44.91% of the total farmers and 19.53% of the total farmland. The large-scale group is the smallest one, only 8.49% of the total farmers but 25.35% of the total farmland.

The estimation results of Model 15, Model 17, and Model 19 demonstrate that: (1) operation scale has a significant positive association with the willingness of large-scale rice farmers to transfer farmland in, but not with small-scale and medium-scale rice farmers, and (2) transfer experience is significantly positively linked to the willingness of medium-scale rice farmers to transfer-in, but not with other groups of rice farmers (Table 5).

The relevance of the operation scale varies considerably with different groups of rice farmers. For example, large-scale rice farmers have a significantly positive effect of operation size on their willingness toward farmland transfer-in, with a marginal effect of 0.029, both higher than that of small- and medium-scale farmers. Driven by external economies of scale, large-scale farmers could be at a lower cost per unit of product than small or medium-sized farmers [30]. Moreover, to the extent that production capacity allows, factors such as agricultural machinery of large-scale rice farmers can be more fully and efficiently utilized in time and space, and the cost apportioned per unit of production could be reduced. Smaller-scale farmers have relatively less incentive for

advanced agricultural technology, which is not conducive to the efficiency improvement of agrarian machinery [63,64]. Therefore, large-scale rice farmers are more willing to transfer more farmland in, which reduces production costs, improves the comparative efficiency of rice cultivation, and raises the income of farmers.

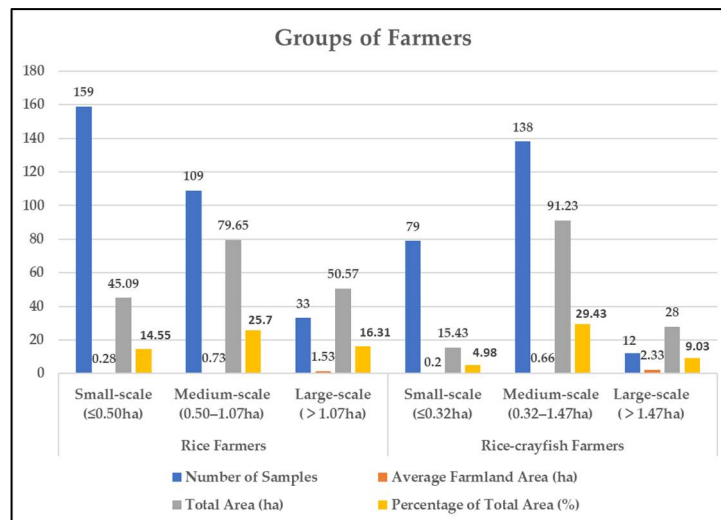


Figure 2. Groups of farmers.

Table 5. Regression results of rice farmer groups.

Variables	Small-Scale Farmers (N = 159)		Medium-Scale Farmers (N = 109)		Large-Scale Farmers (N = 33)	
	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20
operation scale (X_1)	−0.011 (0.012)	−0.011 (0.015)	0.009 (0.013)	0.025 (0.018)	0.029 *** (0.010)	0.031 (0.020)
transfer experience (X_2)	0.011 (0.055)	0.014 (0.114)	0.192 * (0.080)	0.614 * (0.349)	0.514 (0.361)	0.611 (0.933)
$X_1 \times X_2$		−0.001 (0.026)		−0.035 (0.028)		−0.004 (0.034)
age (X_3)	−0.003 (0.002)	−0.003 (0.002)	−0.001 (0.004)	−0.001 (0.004)	0.045 (0.028)	0.046 (0.030)
education level (X_4)	−0.032 (0.036)	−0.032 (0.036)	0.077 (0.056)	0.090 (0.057)	−0.077 (0.102)	−0.074 (0.104)
share of agricultural income (X_5)	0.100 * (0.057)	0.100 * (0.057)	−0.121 (0.092)	−0.124 (0.092)	0.573 ** (0.274)	0.578 ** (0.273)
agricultural laborers (X_6)	−0.017 (0.028)	−0.017 (0.028)	0.074 * (0.042)	0.073 * (0.043)	−0.316 * (0.179)	−0.321 * (0.192)
farmland quality (X_7)	0.051 (0.036)	0.050 (0.036)	−0.049 (0.039)	−0.041 (0.039)	0.169 (0.118)	0.163 (0.127)
levelness of field (X_8)	0.023 (0.025)	0.023 (0.025)	−0.015 (0.039)	−0.006 (0.041)	0.014 (0.086)	0.019 (0.098)
transfer prices (X_9)	0.000 (0.000)	0.001 (0.000)	−0.001 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.001)
contract forms (X_{10})	0.008 (0.030)	0.009 (0.031)	−0.089 * (0.051)	−0.110 ** (0.056)	−0.463 ** (0.215)	−0.458 ** (0.214)

Notes: The above regression results are marginal effects; standard errors are in parentheses; ***, **, and * are significant at 1%, 5%, and 10% levels, respectively.

The transfer experience of rice farmers is another story. Transfer experience increases the probability of medium-scale farmers' willingness toward farmland transfer-in by 0.192 at the 10% significant level. Small-scale or severely fragmented farmland is more challenging and costly to transfer, while larger-scale farmers need to bear greater risks. In comparison, medium-scale farmland is moderately costly and risky to transfer, making it easier to complete transfer-in for them. In addition, small-scale farmers generally aim at self-sufficiency and tend to hold conservative strategies; there may be an obvious bias

between econometrical results and the actual ones of large-scale farmers due to the limited sample size of this study ($N = 33$).

From the estimation results of Models 16, 18, and 20, it is clear that the marginal effect of the interaction term is negatively insignificant for small-scale rice farmers but still higher than that of scale operation with other factors unchanged, which also indicates that compared to non-transferred farmers, transferred farmers show a relatively stronger willingness toward farmland transfer-in when operation scale is expanded. It may be due to the fact that most farmers in this category are those with transfer-out experience, gaining experience in transferring out some remote and fine-grained farmland, and are willing to transfer closer farmland to centralize their operations. For medium-scale and large-scale rice farmers, the negative but insignificant marginal effect of the interaction term implies that the transfer experience inhibits the positive association between expanding operation scale with their willingness. It might be because this group of rice farmers had a strong willingness and an entire experience of transferring farmland before, but they were not satisfied with the outcome of the transfer [2,65]. Thus, the transfer experience rather inhibits the transfer of farmland in the future.

Regarding other control variables, the share of agricultural income and agricultural laborers are two variables worthy of attention. Farmers with a higher proportion of agricultural income tend to be more dependent on agricultural production and more willing to transfer farmland in. Medium- and large-scale farmers show some differences in their willingness toward farmland transfer-in due to the degree of part-time labor.

It is easy to find that the marginal effect of operation scale on small-scale farmers' willingness toward farmland transfer-in is 0.071, but the significance is relatively low (Model 21); while both operation scale and transfer experience are significant on medium-scale rice–crayfish farmers' willingness at the 1% level, with marginal effects of 0.022 and 0.211, respectively (Model 23). This is consistent with the main findings of Zhang et al. [35]. The reason is that rice–crayfish cultivation needs farmland with favorable irrigation and drainage conditions, water conservation, broad and flat land, and fertile soil [66]. Meantime, farmers are required to master the basic skills of rice farming and crayfish cultivation, to be specific, excavation of crayfish trenches and field renovation of transferred farmland, and resistance from farming and market risks. Moreover, the transfer price of farmland suitable for rice–crayfish cultivation is higher than that of rice growing. Small-scale farmers' economic conditions are limited and lack advanced managing capabilities, which may make the significance of their scale-up effect relatively low [67]. The local government is inclined to concentrate fragmented land, and thus, medium-scale rice–crayfish farmers are backed up by the government to expand their operation scale, with the impact of “path dependence” (Table 6). The marginal effect of transfer experience on the willingness toward farmland transfer-in is significant and positive for medium-scale rice–crayfish farmers. This category of farmers accounted for more than 60% of regional rice–crayfish farmers, which is consistent with the results of rice–crayfish farmers in Table 2.

It can be seen from Model 22 and Model 24 that the regression coefficients of the interaction term are positive. This is in accordance with the results of rice–crayfish farmers in Table 2.

4.4. Robustness Test

To test the robustness of the econometrical model, we can compare the results of the models in Tables 2–4, it can be observed that the directions of most variables remain basically consistent, except for the differences in the significance of individual variables. Thus, the regression results based on the model are somewhat robust.

Table 6. Regression results of rice–crayfish farmer groups.

Variables	Small-Scale Farmers (N = 79)		Medium-Scale Farmers (N = 138)	
	Model 21	Model 22	Model 23	Model 24
operation scale (X_1)	0.071 * (0.040)	0.038 (0.065)	0.022 *** (0.005)	0.011 * (0.006)
transfer experience (X_2)	−0.027 (0.098)	−9.419 (0.102)	0.211 *** (0.063)	−0.113 (0.161)
$X_1 \times X_2$		2.376 (0.039)		0.030 ** (0.015)
age (X_3)	−0.007 (0.005)	−0.008 (0.008)	−0.003 (0.003)	−0.004 (0.003)
education level (X_4)	−0.170 ** (0.073)	−0.245 ** (0.165)	0.036 (0.033)	0.047 (0.035)
share of agricultural income (X_5)	−0.088 (0.094)	−0.131 (0.172)	0.099 (0.087)	0.081 (0.086)
agricultural laborers (X_6)	0.029 (0.042)	0.062 (0.080)	−0.037 (0.034)	−0.039 (0.034)
farmland quality (X_7)	0.085 (0.064)	0.114 (0.110)	−0.034 (0.036)	−0.030 (0.035)
levelness of field (X_8)	0.002 (0.039)	0.010 (0.056)	0.029 (0.027)	0.030 (0.027)
transfer prices (X_9)	0.001 (0.000)	0.001 (0.000)	−0.001 ** (0.000)	−0.001 ** (0.000)
contract forms (X_{10})	−0.038 (0.063)	−0.111 (0.117)	0.019 (0.038)	0.017 (0.035)

Notes: The above regression results are marginal effects; standard errors are in parentheses; ***, **, and * are significant at 1%, 5%, and 10% levels, respectively. For large-scale rice–crayfish farmers, the regression results are not given by STATA due to limited samples of only 12.

5. Conclusions and Discussion

5.1. Conclusions

This paper aims to investigate the association mechanism of operation scale and transfer experience with the willingness of farmers to transfer farmland in, using field survey data in Yueyang, Hunan and Qianjiang, Hubei, China. The study shows that 12.96% of rice farmers and 13.97% of rice–crayfish farmers are willing to transfer farmland in and rice–crayfish farmers' willingness is slightly higher than that of rice farmers. However, the overall farmers' willingness is rather low, which is not conducive to the development of the local farmland market. Therefore, a policy-oriented approach should be adhered to effectively guide rice and rice–crayfish farmers to transfer farmland in.

Farmers' willingness toward farmland transfer-in is related to several key factors, including operation scale and transfer experience. Firstly, both operation scale and transfer experience have significant positive relevance to farmers' willingness toward farmland transfer-in. The operation scale has more significant relevance to the rice farmers' willingness, while the transfer experience has significant relevance to that of rice–crayfish farmers. Secondly, the operation scale is significantly positively correlated with the willingness of large-scale rice farmers and small- and medium-scale rice–crayfish farmers, while the transfer experience is significantly positively correlated with the medium-scale farmers' willingness. Thirdly, transfer-out experience has a significant inhibitory relationship with the rice farmers' willingness toward farmland transfer-in but has no significant association with the willingness of rice–crayfish farmers. Lastly, transfer experience intensifies the positive influence of the expansion of operation scale on the farmers' willingness toward farmland transfer-in.

5.2. Discussion

Firstly, based on the important hypothesis, the impacts of operation scale and transfer experience on the willingness toward farmland transfer-in, as well as the interaction term, are examined in this paper. The results show that there are some differences in the impacting path. Thus, sufficient attention must be paid to these differences in rice–crayfish cultivating area. The local government should roundly understand farmers' willingness to transfer farmland based on their own scale and the type of land transferred, adopt differentiated guidance and incentive measures to enhance farmers' willingness, and promote large-scale farmland operation.

Secondly, one of the most interesting findings of this paper is that farmers' willingness to transfer farmland in is closely related to their operation scale. For example, small-scale farmers may show a stronger willingness for farmland transfer-in because they expect to reduce the average cost of production. Although large-scale farmers have stronger

economic advantages, they may also be less willing to transfer farmland in due to the smaller output per unit after expansion of scale. On the contrary, medium-scale farmers are more willing to transfer farmland than small- or large-scale farmers because of their moderate scale [26,34,35]. However, the appropriate operation scale for different groups of farmers needs further discussion.

Thirdly, with respect to transfer experience, transfer-in experience promotes farmers' willingness toward farmland transfer-in, while the transfer-out experience may diminish their willingness [15,28]. Nevertheless, some studies have pointed out that farmers with higher education levels may be more willing to transfer farmland in to establish their own family farms [21]. The number of agricultural laborers is significantly positively correlated with farmers' willingness toward farmland transfer-in [28], which differs from this paper, and more extensive empirical studies need to be carried out.

Fourthly, in this paper, some typical rice–crayfish cultivating regions in Hunan and Hubei provinces in China are selected as study areas, but subsamples of some groups of farmers are limited. It is essential in the next step to increase the survey samples, improve the accuracy of the analysis results, and illustrate the farmers' actual situation in the real world as far as possible.

Lastly, although China's farmland transfer market has been established and developed steadily, farmland transfer in some regions is still in an unregulated state. After farmland transfer, due to poor supervision institutions, transferred-in farmers are more likely to overuse the land for pursuing short-term interests, which destroys the ecological stability of farmland. Therefore, it is necessary to improve farmland management during the post-transfer stage.

6. Policy Implications

Based on the above conclusions and discussion, the following implications are advised.

- (1) A local farmland transfer market should be established to promote land transfer. According to the research results, the operation scale and transfer experience positively affect farmers' willingness to transfer farmland. However, the transferred farmland percentage in the study region is still low. It is necessary to improve market factors for traditional rice growing and rice–crayfish cultivation. In addition, local governments should release incentive policies to help different kinds of farmers to transfer farmland in or out orderly, to meet the needs of rural development and prosperity.
- (2) Fragmented and small-sized farmland should be encouraged to transfer to medium or large-scale farmers. The research results demonstrate that both operation scale and transfer experience significantly affect middle-scale and above farmers. To increase production efficiency, the local government can comprehensively assist them in improving their willingness toward farmland transfer-in and promote the moderate concentration of small-scale farmland. However, it needs to be noted that in fostering medium and large-scale operations, the one-sided pursuit of scale expansion should be avoided without regard for the appropriate scale of operations.
- (3) Farmers with transfer experience can be trained and assisted in a particular way. Research reveals that compared with non-transferred farmers, farmers with transfer experience have a stronger willingness. On the one hand, the government can educate professional workers, employ experts, and technicians, and provide farmers with helpful support. On the other hand, agricultural enterprises or cooperatives can be introduced to connect rice farmers and rice–crayfish farmers.
- (4) Agricultural subsidies and loans can be considered important policy tools. Farmers are always in a relative shortage of capital, and rural financial services need to be enhanced. The government departments and banking institutions can provide financial subsidies and microfinance loans to needed farmers to overcome the phased difficulties and achieve sustainable growth, both in personal income and rice–crayfish cultivation.

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