Analysis of Factors Influencing Farmers' Willingness to Transfer Farmland in Shouguang City, Shandong Province

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Abstract Based on questionnaire data from Niutouzhen Village Units 1 - 7 in Shuangwangcheng Economic Zone, Shouguang City, Shandong Province, this study employs a binary logistic regression model to explore the factors influencing farmers' willingness to transfer farmland, and uses SPSS 27.0 software to perform regression analysis on the data. The results indicate that farmers' educational level, age of the household head, and contracted land area have a positive influence on farmers' willingness to transfer farmland at the 0.05 significance level, while annual household income has a positive influence at the 0.10 significance level. Furthermore, based on the regression analysis results, measures are proposed, including establishing and improving the rural land transfer compensation mechanism, enhancing publicity for land transfer, refining land transfer laws and regulations, optimizing the rural social security system, and actively expanding non-agricultural employment channels. These measures are intended to provide references for promoting farmland transfer work in Shouguang City.

Key words Farmland transfer, Binary logistic regression, Influencing factors

0 Introduction

As the world's most populous country, China faces the fundamental national condition of having a large population but limited land. Implementing farmland transfer for large-scale farming plays a crucial role in maximizing agricultural planting efficiency on limited arable land. Farmland transfer, as a vital part of rural economic system reform, is key to achieving large-scale rural economies and increasing land returns[1]. Since the amendment of the *Constitution* in 1988, farmland in China has undergone a process from being prohibited from transfer, to being permitted, and finally to being opened up for transfer. Since the 18th National Congress of the Communist Party of China, resolving issues relating to agriculture, rural areas, and farmers (the "Three Rural Issues") has been consistently prioritized as the most critical task for the entire Party. The report of the 19th National Congress of the Communist Party of China pointed out that rural revitalization is the overarching strategy for addressing the "Three Rural Issues" in the new era, and rural land issues serve as a crucial vehicle for realizing the rural revitalization strategy. In recent years, with the accelerated pace of urbanization, problems such as farmland idleness, abandonment, and non-grain conversion have become increasingly prominent.

Farmland transfer has thus emerged as an effective pathway to address this series of issues. As a means of optimizing the allocation of agricultural resources, farmland transfer is conducive to enhancing agricultural production efficiency[2]. Farmland transfer facilitates the consolidation of originally fragmented plots into centralized operation, promoting mechanization and scale in agricultural production. This not only improves agricultural production efficiency but also reduces production costs and increases agricultural output. However, rural land transfer diversifies farmers' income sources, helps reduce conflicts and disputes arising from land issues, promotes harmony and stability in rural society, and is conducive to stimulating endogenous development momentum in rural areas, thereby supporting high-quality economic development[3]. Moreover, through land transfer, farmers can obtain stable rental income from their land. Some farmers are liberated from contracted land and can engage in production in other industries, thereby gaining more economic benefits[4]. Therefore, it is highly necessary to study farmers' willingness to transfer farmland. Delving into the factors influencing the willingness of farmers in Niutouzhen Village Units 1 - 7 of Shouguang City to transfer farmland will enrich research cases where village collectives undertake unified farmland transfer-out efforts. This aims to tangibly improve agricultural production efficiency, develop large-scale agricultural operations, enhance farmers' living standards, and strengthen their sense of fulfillment and happiness.

Research on the factors influencing farmers' land transfer has been a key topic of academic focus in recent years. Liu Ye *et al.*[5] used a binary logistic regression model to analyze factors influencing farmers' willingness to transfer farmland, indicating that eight factors, including age, educational level, and the presence of idle land, had a significant impact on farmers' willingness to transfer farmland. Cao Yuling *et al.*[6], based on survey data, employed a Logistic model to analyze the impact of relevant policy tools on farmers' willingness to transfer farmland. The results showed that public policy directly influences farmers' willingness to transfer farmland. Zhou Nidi *et al.*[7] used a binary logistic model to explore the main factors influencing the land transfer willingness of suburban farmers. Their results indicated that factors such as the educational level of the household head and the transfer price had a positive influence on farmers' willingness to transfer land, while factors like the age of the household head and the number of family laborers had a negative influence. Li Zhenjie *et al.*[8] selected five provinces nationwide as sample areas for investigation. Using a Logistic regression model to analyze and com-

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pare factors affecting farmland transfer willingness, their results showed that factors such as age, educational attainment, occupation, and family income influence farmland transfer. Zhao Panpan[9], based on a field survey of 292 households regarding farmland rights confirmation and land transfer in Zalaite Banner, Xing'an League, used a Logistic model to explore the factors influencing farmland transfer willingness. The results showed that farmers' willingness to participate in land transfer was influenced by eight factors, including per capita land area, land transfer price, and annual household income, while three factors such as farmers' age and educational level had no significant impact on land transfer willingness. Mu Anping *et al.*[10], based on field survey data from 260 households in 15 townships of Liulin County, Shanxi Province, used a binary logistic model to study the factors influencing farmers' willingness to transfer farmland. Their research results showed that five factors, including the number of family members engaged in off-farm work, laborer age, and household agricultural income, significantly affected farmers' land transfer willingness. Yi Qing *et al.*[11] used the Heckman two-stage model to explore factors influencing farmers' farmland transfer decisions. Their results indicated that factors such as family income and the amount of land transferred out constrain farmers' farmland transfer. Zhang Huiping *et al.*[12], using field survey data from Pingluo County in the Yinbei region of Ningxia and employing a Probit model, analyzed the factors influencing farmers' land transfer from both land transfer-in and transfer-out perspectives. Their results showed that the contiguity of land plots and the locational factors of the village constrain farmers' land transfer behavior.

In summary, most scholars use Logistic and Probit models to study the factors influencing farmers' farmland transfer. Farmers' willingness to transfer farmland is primarily influenced by household characteristics, external environment, and policy factors. Specific circumstances need to be analyzed according to local conditions. This paper, referencing relevant literature and combining the actual situation of Niutouzhen Village Units 1 – 7 in Shuangwangcheng Economic Zone, Shouguang City, employs a binary logistic regression model to explore the factors influencing farmers' willingness to transfer farmland. Based on the research findings, targeted policy recommendations are proposed to improve the efficiency of farmland transfer-out work.

1 Overview of the study area and research methods

1.1 Overview of the study area Shouguang City is located in the central-northern part of Shandong Province, and its vegetable production scale ranks first in the country. Shouguang City has flat terrain and a warm temperate monsoon climate with temperate continental characteristics, suitable for crop growth. By 2022, the grain planting area in Shouguang City reached 83 300 ha, with over 56 000 farming households, among which 2 138 were large-scale farming households with plots above 3.33 ha. In recent years, with the transfer of rural labor and changes in agricultural production methods, the land transfer area in Shouguang City has shown a trend of year-on-year growth. By 2021, approximately 56.9% of rural agricultural land had been transferred[13]. Niutou Town is located in the northwest of Shouguang City, close to the Laizhou Bay of the Bohai Sea. It is a coastal township with a current population of 9 160 people, 2 460 households, and 1 666.67 ha of cultivated land. The village Party general branch led farmers in carrying out large-scale farmland transfer work. The agricultural production model shifted from small-scale peasant farming to large-scale operation. After the transfer, per capita income increased by over 1 000 yuan, indirectly contributing to an increase of about 20 000 yuan in the annual income of farmers engaged in off-farm work.

1.2 Research methods

1.2.1 Data sources. Data related to farmland transfer in the 7 units of Niutouzhen Village, Shuangwangcheng, Shouguang City, were obtained through household questionnaire surveys. The data specifically included: household characteristics (age, number of laborers, education level, sources of household income, proportion of agricultural income to total household income, *etc.*), characteristics of contracted land (quality of contracted land, area of contracted land, production cost per unit area, profit per unit area, *etc.*), farmland transfer status (area transferred out, transferee, transfer method, reasons for transfer, *etc.*), and farmers' understanding of land transfer policies. The survey was conducted from July to September 2024. A total of 240 questionnaires were distributed. After excluding incomplete and casually answered questionnaires, 221 valid questionnaires were recovered, resulting in an effective questionnaire recovery rate of 92%. The collected questionnaire data were entered into Excel spreadsheets for organization, and a specialized database for farmland transfer-out was established for subsequent analysis.

1.2.2 Model construction. A binary logistic model was used to empirically analyze the factors influencing farmers' willingness to transfer farmland. The study set that farmers face two choices: willing to transfer contracted land or unwilling to transfer contracted land, represented by 1 and 0, respectively. Therefore, the dependent variable is a binary variable. Using SPSS 27.0 software, variables were processed, factors influencing farmers' willingness to transfer land were screened, and the analysis was conducted using the binary logistic regression model. A total of 221 samples participated in the analysis, with no missing data.

The Logistic model formula is as follows:

$$\text{Logistic}Y = \ln\left(\frac{p}{1-p}\right) = A + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 \cdots \alpha_n X_n$$

where Y represents the probability of a farmer being willing to transfer land; A represents the constant term; α represents the regression coefficients of each influencing factor; X_n represents the factors influencing farmers' willingness to transfer land.

1.2.3 Variable description. Dependent variable: To more precisely analyze the influencing factors of different transfer types, the dependent variable for the overall model (which only distinguishes whether land transfer-out behavior occurs) needs to be defined. Variable Y is assigned a value of 1 if the farmer is willing to

transfer farmland, and 0 if unwilling.

Independent variables: Based on field surveys and references to relevant literature such as Hu Chencheng *et al.*[14], Yang Haopeng *et al.*[15], and Ma Zhenhua[16], this study intends to analyze the factors influencing farmers' farmland transfer-out from eight aspects: number of household members (X_1), farmer's education level (X_2), age of household head (X_3), contracted land area (X_4), quality of contracted land (X_5), production cost per unit area (X_6), proportion of agricultural income to total household income (X_7), and annual household income (X_8) (Table 1).

Table 1 Independent variables and statistical analysis

Statistical variables	Assignment description	Mean	Standard deviation
Willingness to transfer farmland (Y)	1 = yes; 0 = no	–	–
Number of household members (X_1)	1 = 2 persons or less; 2 = 3 persons; 3 = 4 persons; 4 = 5 persons or more	2.61	1.169
Farmer's education level (X_2)	1 = primary school or below; 2 = junior high school; 3 = senior high school or technical secondary school; 4 = college and above	1.94	0.859
Age of household head (X_3)	1 = 30 years old or younger; 2 = 30 – 40 years old; 3 = 40 – 50 years old; 4 = 51 years old or older	3.59	0.601
Contracted land area (X_4)	1 = 666.67 m^2 or less; 2 = 1 333.33 d; 3 = 2 000 m^2; 4 = 2 666.67 m^2 or more	3.28	0.991
Contracted land quality (X_5)	1 = poor; 2 = average; 3 = good; 4 = very good	2.84	0.675
Production cost per unit area (X_6)	1 = relatively high; 2 = average; 3 = relatively low; 4 = very low	2.47	0.806
Proportion of agricultural income to total household income (X_7)	1 = less than 20%; 2 = 20% – 50%; 3 = 50% – 70%; 4 = more than 70%	2.17	1.181
Annual household income (X_8)	1 = less than 10 000 yuan; 2 = 10 000 – 20 000 yuan; 3 = 20 000 – 30 000 yuan; 4 = more than 40 000 yuan	3.36	0.856

1.3 Data quality analysis

1.3.1 Multicollinearity of independent variables. To ensure the accuracy of the binary logistic regression model results and prevent severe multicollinearity among the variables from affecting the regression outcomes, a Variance Inflation Factor (*VIF*) test was conducted on the aforementioned eight independent variables. A $VIF \geqslant 5$ indicates the presence of multicollinearity among variables, while a $VIF \geqslant 10$ indicates strong multicollinearity. The multicollinearity test results for the independent variables in this study are shown in Table 2. The variance inflation factors for independent variables $X_1 - X_8$ are all less than 5, indicating that there is no multicollinearity among the eight variables: number of household members, farmer's education level, age of household head, sources of household income, contracted land area, quality of contracted land, production cost per unit area, proportion of agricultural income to total household income, and annual household income. Therefore, empirical analysis can be performed on the data.

Table 2 Multicollinearity test results

Model	t	Significance	Collinearity statistics	
			Tolerance	*VIF*
(Constant)	–1.728	0.085	–	–
Number of household members	0.471	0.638	0.944	1.059
Farmer's education level	2.283	0.023	0.614	1.629
Age of household head	2.563	0.011	0.686	1.458
Contracted land area	2.654	0.009	0.873	1.146
Contracted land quality	–0.137	0.891	0.896	1.116
Production cost per unit area	–1.029	0.305	0.927	1.079
Proportion of agricultural income to total household income	0.430	0.667	0.726	1.378
Annual household income	1.717	0.087	0.684	1.463

1.3.2 Hosmer – Lemeshow test. The Hosmer – Lemeshow test results are: *Chi*-square 8.741, *df* 8, *Sig.* 0.365. This test is the most common method for testing the goodness-of-fit of a binary logistic regression model. The model's significance level is 0.365, which is greater than the 0.05 significance level, indicating that the model has a good goodness-of-fit, the regression results are credible, and the construction and study of this model are meaningful.

2 Results and analysis

2.1 Analysis of basic characteristics of sample farmers

2.1.1 Household situation. Among the 221 valid samples, the proportions of male and female household heads accounted for 82.4% and 17.6% of the surveyed farmers, respectively. Among the surveyed farmers, the proportion of household heads aged 51 and above was 65.1%, those aged 40 – 50 accounted for 29%, and those aged 30 – 40 accounted for 5.9%. Regarding farmers' education levels, primary school, junior high school, high school/vocational school, and college/vocational college or above accounted for 36.7%, 35.7%, 24.4%, and 3.2%, respectively. In terms of household income sources, farmers for whom agriculture was the primary income source (*i.e.*, agricultural income accounted for more than 50% of annual household income) constituted 42.1%, while those for whom business or salaried employment was the primary income source accounted for 10.9% and 47%, respectively. Regarding the transportation conditions in the farmers' villages, 99.5% reported convenient transportation. In terms of annual household income, 57.9% of the farmers had an income above 40 000 yuan, while only 3.2% had an annual household income below 10 000 yuan. Regarding the number of household members, 2 or fewer accounted for 25.8%, and 5 or more accounted for 30.3%. Regarding the number of laborers in the household, 2 or fewer accounted for 71.9%, and 3 – 4 accounted for 28.1%. In the survey on current land cultivation practices, fully manual cultivation accounted for 23.5%, semi-manual and semi-

mechanized cultivation accounted for 67.4%, and fully mechanized cultivation accounted for 9%.

2.1.2 Social conditions. Regarding the question of whether they understand agricultural subsidy policies, 55.7% of farmers stated that they have a relatively good understanding of these policies. Agricultural subsidy policies are primarily publicized through village committee broadcasts and television publicity, indicating that the government places considerable emphasis on promoting agricultural subsidies, but the impact still needs improvement. Regarding the question of whether agricultural policies help agricultural development, 13.6% believed they were not helpful, and 14.5% were uncertain, indicating a need to further deepen farmers' understanding and awareness of farmland transfer policies. 81.9% of farmers expressed satisfaction with the farmland transfer policy, while 18.1% were less satisfied with the current policy.

2.1.3 Farmland transfer by farmers. The survey revealed that farmers in Units 1 – 7 of Niutouzhen Village, Shouguang City, who engaged in farmland transfer, all transferred their land to large-scale growers through leasing, and signed farmland transfer contracts with a duration of 10 years and a transfer price of 18 000 yuan per hectare.

2.1.4 Situation of farmers' contracted land. The cultivated land of Units 1 – 7 in Niutouzhen Village is mostly distributed in areas such as Damailing, Dongling, Donglingerhaofang, Donglingba, Damaiwahegou, Lijiadawa, Yujiawazi, and Muxuchang. Among the surveyed households, 149 had one contracted plot, 61 had two contracted plots, and 11 had three contracted plots. The average number of contracted plots per household was 1.37. The largest contracted land area was 1.28 ha per household, and the smallest was 448.67 m^2 per household. The average contracted land area (total household contracted land area/number of household contracted plots) was 0.369 ha per household. Farmers' contracted land area was divided into three levels: 0 – 3 333.33 m^2, 3 333.33 – 6 666.67 m^2, and above 6 666.67 m^2. Statistics show that there were 110 households with 0 – 3 333.33 m^2, accounting for 49.7% of the total surveyed; 91 households had 3 333.33 – 6 666.67 m^2, accounting for 41.1%; 20 households had above 6 666.67 m^2, accounting for 9.2%. The contracted land was mainly planted with corn, wheat, spinach, and cotton.

2.1.5 Willingness of sample farmers to transfer farmland. Regarding the question of whether farmers are willing to transfer farmland, 144 households expressed willingness to transfer farmland, accounting for 65.2%, while 77 households were unwilling, accounting for 38.4%.

2.2 Factors influencing farmland transfer by farmers in Units 1 – 7 of Niutouzhen Village Binary logistic regression was performed on the 221 samples using SPSS 27.0 software, and the results are shown in Table 3. According to the calculation results, farmers' education level, age of household head, and contracted land area significantly influenced farmers' willingness to transfer farmland at the 0.05 significance level; annual household income significantly influenced farmers' willingness to transfer farmland at the 0.10 significance level.

Table 3 Binary logistic model regression results

Factors	*B*	*S.E*	*Wals*	*df*	*Sig.*	*Exp* (*B*)	95% confidence interval for *EXP* (*B*)	
							Lower limit	Upper limit
Number of household members	0.066	0.132	0.252	1	0.615	1.068	0.825	1.383
Farmer's education level	0.527	0.230	5.243	1	0.022*	1.694	1.079	2.661
Age of household head	0.791	0.309	6.574	1	0.010*	2.206	1.205	4.040
Contracted land area	0.410	0.157	6.810	1	0.009**	1.506	1.107	2.049
Contracted land quality	−0.046	0.237	0.038	1	0.846	0.955	0.599	1.521
Production cost per unit area	−0.215	0.198	1.180	1	0.277	0.807	0.548	1.188
Proportion of agricultural income to total household income	0.063	0.149	0.177	1	0.674	1.065	0.795	1.426
Annual household income	0.350	0.205	2.910	1	0.088*	1.419	0.949	2.122
Constant	−5.339	1.760	9.206	1	0.002	0.005	–	–

NOTE *, **, and *** indicate significance at the 10%, 5%, and 1% confidence levels, respectively.

2.2.1 Education level. Farmers' education level showed a positive correlation with their willingness to transfer farmland, meaning that farmers with higher education levels had a stronger willingness to transfer farmland. Many farmers have low cultural literacy, outdated farming mindsets, lack modern farming concepts and new technologies, and are influenced by traditional beliefs that transferring out farmland equates to losing the land, hence they are reluctant to participate in farmland transfer. In contrast, farmers with higher knowledge levels find it easier to understand and accept various national farmland transfer policy subsidies, have broader access to information, and possess a stronger ability to comprehend and accept new concepts. Farmers with higher knowledge levels have advantages in management knowledge reserves, enabling them to engage in work in other fields after participating in farmland transfer, thereby broadening their income sources and ensuring income stability[17].

2.2.2 Age of household head. The older the household head, the stronger their willingness to participate in farmland transfer. Based on one-on-one survey interviews, farmers stated that due to their older age and lack of labor, they are more willing to transfer their land to obtain additional income and avoid leaving the land idle.

2.2.3 Annual household income. Farmers' annual household income is positively correlated with their willingness to transfer farm-

land, indicating that the higher the annual household income, the stronger the farmers' willingness to transfer farmland. Most high-income earners are primarily engaged in non-agricultural businesses, leading to a simultaneous decrease in their families' emotional and economic dependence on the land. The larger the proportion of non-agricultural income in total income, the smaller the dependence on farmland; therefore, farmers with higher annual household incomes are more willing to transfer farmland. According to the analysis of relevant questionnaire data, 64.2% of farmers willing to transfer farmland had an income greater than 10 000 yuan, while among farmers unwilling to transfer farmland, 32.5% had an annual income greater than 10 000 yuan.

2.2.4 Contracted land area. The contracted land area shows a positive correlation with farmers' willingness to transfer farmland. This indicates that farmers in Niutouzhen Village with larger cultivated land areas have a stronger willingness to transfer land. The *EXP* (B) value indicates that, while holding other variables constant, for every increase of 667 m^2 in a farmer's contracted land scale, the probability of their transfer willingness increases to 1.5 times the original. The larger the farmer's cultivated land area, the more they benefit from economies of scale, which can reduce transaction costs and make transfer easier to achieve[18].

The four variables of contracted land quality, production cost per unit area, proportion of agricultural income to total household income, and number of household members had no significant impact on farmers' willingness to transfer farmland. In Table 3, the coefficient for contracted land quality is negative, indicating that farmers with poorer quality contracted land have a stronger willingness to transfer farmland. This is because the poorer the quality of the contracted land, the lower the output efficiency of the farmland, thus increasing the likelihood of farmland being transferred out. The coefficient for farmland production cost per unit area is negative, indicating that farmland with relatively higher production returns is more easily transferred out and more readily accepted by farmland transferees. The coefficient for the number of household members is positive, indicating that the more members in a household, the stronger the farmer's willingness to transfer farmland. For households with more members, relying solely on farmland income is insufficient to cover daily household expenses; moreover, the comparative returns from agricultural products are relatively low, and prices fluctuate significantly due to weather, making it difficult to meet daily living costs. Thus, they need to seek off-farm employment to obtain more substantial income.

2.3 Reasons for farmers' farmland transfer behavior Based on field survey results regarding the "reasons for farmland transfer" among farmers in Units 1 – 7 of Niutouzhen Village, Shouguang City, descriptive analysis using SPSS 27.0 showed the following results. The reasons for farmland transfer and their respective proportions were: labor shortage (25.8%), increasing income (30%), avoiding land idleness (24%), high cultivation costs and low returns (9.7%), and fragmented land making cultivation difficult (10.6%). This indicates that farmers participating in farmland transfer primarily chose to lease their farmland due to low farming profitability and labor shortages. Therefore, given the current low agricultural returns (especially from agricultural product income), farmers have a high willingness to transfer farmland to improve their quality of life, and household resource allocation tends to shift towards non-agricultural sectors.

2.4 Farmers' income after farmland transfer After farmland transfer, the proportion of farmers with a total income below 10 000 yuan decreased from 25.8% to 20.8%, while the proportion with an annual total income above 50 000 yuan increased from 24.9% to 29%. After land transfer, the proportion of sample farmers for whom agricultural income accounted for more than 50% of total household income decreased from 42.1% to 33.5%. If the income farmers earn from agricultural production exceeds that from non-agricultural activities, they would choose to continue agricultural production and might even expand the scale of agricultural production to increase income. For farmers in Units 1 – 7 of Niutouzhen Village, after transferring out farmland, the proportion of agricultural income decreased while total income increased. This indicates that farmland transfer can raise farmers' income and help further enhance their enthusiasm for farmland transfer.

3 Recommendations

Based on the characteristics and influencing factors of farmland transfer willingness among farmers in Units 1 – 7 of Niutouzhen Village, Shouguang City, the following key areas can be focused on to promote farmland transfer work in Shouguang City.

3.1 Establishing and improving the rural land transfer compensation mechanism Reasonable compensation for farmers' interests helps enhance their incentives for current investment in the land, thereby increasing opportunities for land transfer[19]. Only by safeguarding the vital interests of farmers can their expectations in land transfer be raised. Establishing and improving a land transfer compensation mechanism helps create a favorable market atmosphere for transfers. Providing certain economic compensation to farmers participating in land transfer work will increase their enthusiasm for participation, thereby expanding the scope of land transfer, achieving scaled operation of land resources, and optimizing the allocation of land resources. It is necessary to encourage farmers to actively purchase agricultural insurance and provide economic compensation to those who suffer reduced yields due to natural disasters. This will reduce farmers' agricultural production and operation risks and alleviate their concerns about potential decreases in expected income due to external factors after land transfer.

3.2 Enhancing publicity efforts for land transfer Given that the overall implementation of land transfer is not yet mature, the Shouguang municipal government should strengthen publicity and guidance efforts, establish an information consultation platform to provide farmers with transfer information consultation services, conduct effective publicity to ensure local farmers fully understand land transfer policies and compensation related to their rights and interests before and after the transfer, thereby increasing farmers' awareness and participation rates in the policies. Providing information guidance to farmers can help avoid non-standard land transfer contract forms. At the same time, promote land transfer work

through means such as village collective broadcasts and household interviews, enabling farmers to gain a comprehensive understanding of land transfer and enhancing their sense of identification with the land transfer-out process, making them genuinely feel the significance of farmland transfer-out for increasing their income, so that they are mentally willing to engage in land transfer and cooperate with and support the transfer work.

3.3 Improving land transfer laws and regulations A key task in conducting land transfer work is to improve relevant laws and regulations. Relevant government departments should, according to the needs of rural revitalization, provide detailed stipulations on the procedures, standards, and norms for land transfer, and supervise and manage the land transfer market to protect farmers' land rights and interests[20]. Simultaneously, the *Land Administration Law* should be promptly updated and improved to enhance its coverage and rationality, and illegal activities during the land transfer process should be restrained to ensure the openness and transparency of the land transfer market.

3.4 Optimizing the rural social security system Optimizing the rural social security system is a crucial link in facilitating the smooth progress of rural land transfer. It can not only guarantee the minimum income for farmers engaging in land transfer but also reduce their dependence on land and promote land transfer[21]. First, it is necessary to increase fiscal investment in social security. Fiscal investment serves as the economic foundation for establishing the rural social security system. We should expand the coverage of social insurance to alleviate the economic burden on farmers. Second, it is necessary to improve a rural-specific social security system. A robust social security system can not only safeguard farmers' basic livelihoods but also further incentivize them to actively participate in land transfer[22]. After land transfer, farmers who rely on farming for their livelihood may feel insecure about their future life security. Therefore, the state must improve the security system to ensure farmers receive adequate old-age security after participating in land transfer, improve the medical security system, enhance the level of medical security for farmers, prevent them from falling into hardship due to illness, and reduce the pressure of medical costs. Simultaneously, it is necessary to build an employment security system to ensure farmers gain new employment opportunities after land transfer.

3.5 Actively broadening non-agricultural employment channels It is necessary to provide professional training to farmers to broaden their non-agricultural employment channels, collaborate with local Shouguang enterprises, such as vegetable processing factories, logistics companies, and packaging companies, to conduct targeted recruitment of farmers who have transferred out their farmland, and teach them specialized skills such as vegetable packaging and forklift operation. Besides, it is necessary to encourage farmers to participate in various segments of the agricultural industry chain, such as e-commerce sales and logistics transportation, to increase their wage income, and provide public welfare positions, such as village sanitation and facility maintenance, for older farmers or those lacking skills.

4 Conclusion

This study took 221 farmer households in Units 1 – 7 of Niutouzhen Village, Shuangwangcheng Economic Zone, Shouguang City, as the research subjects. Using a binary logistic regression model, it explored the factors influencing farmers' willingness to transfer farmland. This further enriches relevant cases of unified land transfer-out conducted by village collectives. The research results show that farmers' personal characteristics and family situations can influence farmland transfer willingness to varying degrees. According to the regression results, the main significant factors currently influencing farmers' farmland transfer willingness are farmers' education level, age of household head, contracted land area, and annual household income. The older the farmer, the higher the education level, the larger the contracted land area, and the higher the annual household income, the stronger the willingness to transfer farmland. Based on the regression analysis results, measures were proposed: establishing and improving a rural land transfer compensation mechanism, enhancing publicity for land transfer, improving land transfer laws and regulations, optimizing the rural social security system, and actively broadening non-agricultural employment channels. This provides references for promoting farmland transfer work in Shouguang City.

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tions. An industrial integration demonstration park should be constructed, with the Tomato Seed Industry Smart Valley as the core, coordinating with surrounding streets to build a 66 700-ha standardized seed production base, developing deep-processed products such as tomato vinegar and tomato wine, and extending the industrial chain.

5.5 Strengthening intellectual property protection and talent cultivation A patent protection mechanism should be established, working with market supervision departments to severely crack down on infringement and counterfeiting, and supporting enterprises in applying for new variety rights patents. Professional farmers and expert teams should be cultivated, establishing workstations relying on Northwest A&F University and the Xi'an Tomato Research Institute, hiring agricultural experts to solve problems in tomato production such as disaster prevention and control, yield increase, and efficiency enhancement; thematic training sessions should be organized regularly, conducting seed production technology training, and enhancing farmers' capabilities in facility seed production and smart management levels.

5.6 Expanding sales channels, promoting industrial transformation and upgrading Diversified sales channels should be expanded, covering models such as direct-to-consumer sales, cooperative sales, and agricultural product e-commerce. Enterprises need to enhance their informatization level to more accurately grasp market demand and explore emerging sales channels. They should actively connect with national large-scale sales enterprise service platforms, promptly release sales information, expand online sales channels, and achieve seamless production-sales linkage. By participating in agricultural exhibitions such as the China Modern Agriculture Expo, Yangling Agricultural High-tech Fair (Yangling Agri-Hi-Tech Fair), and China International Agricultural Trade Fair, we should gather resources from various fields of "industry-university-research", which can not only broaden tomato seed sales channels but also help find partners and establish stable long-term cooperative relationships.

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