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Land Transfer Contract and Farmers' Straw-Returning Behavior: Evidence from Rural China

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Abstract: Straw return is a crucial method for utilizing agricultural waste as a resource. Against the backdrop of increasing straw production in China, most scholars focus only on the behavioral decision of whether farmers choose to transfer land. However, few studies have touched on the specific content of the land transfer contract and its impact on farmers' behavior. This paper innovatively starts from the perspective of land transfer contracts to explore the impact of land transfer contracts on straw return in terms of standardization, stability, and profitability and to make theoretical contributions to the rational use of straw and the protection of arable land resources. Using data from the 2020 China Rural Revitalization Survey (CRRS) database, this study empirically analyzed the effects of different elements of land transfer contracts on straw returns to the field. The results show that: (1) Written transfer contracts are more effective than verbal contracts in encouraging farmers to adopt the straw return behavior. (2) Fixed-term contracts are more stable and can effectively promote farmers' adoption of straw return technology. (3) The remunerative transfer method is more profitable and can effectively encourage farmers to adopt straw return technology compared to the non-remunerative transfer method. (4) Farmers in mountainous areas or with smaller areas of farmland have a lower probability of adopting straw return technology. Therefore, the important role of remunerative, fixed-term, written land transfer contracts in the process of straw return should be emphasized, and the adoption rate of straw return should be increased through differentiated policy guidance and comprehensively promoting the sustainable development of agriculture.

Keywords: straw returning; land transfer; written contract; fixed-term contract; remunerative transfer

Citation: Li, R.; Huang, B.; Liu, S.; Xu, D. Land Transfer Contract and Farmers' Straw-Returning Behavior: Evidence from Rural China. *Land* **2024**, *13*, 905. https://doi.org/10.3390/land13070905

Received: 27 May 2024
Revised: 20 June 2024
Accepted: 20 June 2024
Published: 21 June 2024

1. Introduction

China has a high and widespread production of straw, with the annual production of major crop straw reaching 800 million tons. For a long time, crop straw has been a primary resource for household cooking and heating in rural areas [1]. Although straw is rich in organic matter that is beneficial to plants and animals, its importance in rural production and people's livelihoods is gradually decreasing due to the optimization of agricultural structures and changes in rural lifestyles [2]. Straw is now primarily used for livestock feed or even to be burned and landfilled [3]. Straw burning not only wastes agricultural resources but also contributes to global climate degradation [4]. This has serious impacts on rural residents' livelihoods, public transportation, and the ecological environment, hindering the realization of sustainable development.

Straw returning (SR) is one of the main methods of agricultural waste resource utilization, which can save resources, control arable land degradation, increase crop yield,

improve air quality, and reduce fire risk [5–7]. SR is cheaper and easier than other agricultural straw usage processes. In the 1970s, China popularized conservation tillage practices like SR in the field, but economic and technical restrictions limited its impact. Since the start of the 21st century, supporting technologies have developed, and local governments have noticed SR technology. National direct SR reached 402 million tons in 2021, and the rate of SR reached 54.7% [8], but there is still a big gap between the developed countries. China's straw output will rise as grain production improves. Resourceful and environmentally friendly utilization of crop straws will be paid more and more attention from all walks of society.

At present, the existing academic research on the promotion of SR and its influencing factors focuses mainly on two perspectives. One is from the farmer's perspective. Since farmers must bear the risks, including costs, to adopt SR technology and SR's effect is affected by climatic conditions, the technical environment, and the straw production process, many scholars have investigated whether farmers' behaviors will affect SR initiatives, such as farmers' social trust, environmental awareness, and internet use, among others [6,9,10]. Some studies think economic subsidies, technological assistance, or government control directly alter farmers' SR practices [11–16]. From the land side, it is crucial to consider the influence of the characteristics of the farmers' land transfer operation on SR. In terms of the scale of operation, in 2019, the per capita area of arable land nationwide was still less than 2 mu (1 hectare = 15 mu), and there were still 210 million farm households operating arable land of less than 10 mu on average. Some experts believe that standardized agricultural production and operation modes may greatly increase farmland protection's environmental advantages and farmers' SR behavior [2,17]. Some experts believe farmers' operation plots and SR behaviors have an inverted U-shaped connection. Long-term land rights and interests impact farmers' willingness to embrace green production technology, and clear land tenure rights may avoid "planting but not raising" [18–20]. According to data, by 2017, 37% of China's arable land had been transferred. The strict long-term implementation of land transfer contracts allows farmers to reorganize their cultivated land for large-scale mechanization and resource-saving production technology [21,22]. Some studies have found differences in property rights, terms, and stability between transferred farmland and farmers' original contracted farmland, which may make it more uncertain that farmers on transferred farmland will adopt related agricultural production technologies [23,24].

Unlike other agricultural technologies, SR provides short-term returns and future returns by improving and protecting soil quality. Therefore, farmers make reasonable decisions based on dependable future rewards. In reality, land transfer separates the right to manage land from the right to contract. The cultivated land that farmers transfer to is significantly different from their own cultivated land in terms of the nature of property rights, the duration of the management right, and the stability of the management right, which will affect the uncertainty of the future benefits of intertemporal agricultural production technologies such as SR and then affect the behavioral decisions of farmers. In fact, the rural land transfer market in China has developed, resulting in diverse farmer land transfer contracts. Contracts establish land transfer legality, timing, rent, and a large number of other contents closely related to land property rights. As a market-oriented transaction, the standardization, stability, and profitability of these contracts will directly affect the rights and obligations of both parties. How will various factors in the land transfer contract affect SR behavior?

The standardization of the land transfer market and the enhancement of agricultural production efficiency are contingent upon the security and stability of land property rights. The standardization of land transfer contracts is mainly characterized by whether farmers define their rights and interests in the land transfer process by signing a written contract. A written real land transfer contract may clearly establish both parties' rights and obligations, enabling the construction of an effective system to support the standardized transfer of land management rights. However, by 2017, less than 70% of land circulation in China had been signed via written contracts, and there were still many informal contracts with local customs

in rural areas. Farming families in rural China employ trust, family, and morality to manage their conduct, leading to informal contracts. Due to social links, land transfer contracts are verbal. The stability of the land transfer contract is mainly determined by whether or not the two parties agree on the duration of the contract in the process of land transfer by farmers. If there is no clear contract duration, it is difficult for agricultural management subjects to make reasonable production plans to form stable business expectations or anticipations, and there is greater investment risk [25].

SR demands initial investments like machinery and personnel as a long-term agriculture preservation measure. Thus, whether the land transfer contract specifies a clear contract duration will determine whether the farming family may recoup their SR investment. Profitability, on the other hand, is mainly characterized as the ability of farmers to obtain land transfer rents by signing contracts. According to the 2015 CHFS data, 40.8 percent of China's land sale market has a term of less than one year, and 50 percent of the transactions are free [26]. In non-marketable land transfers without compensation, the true value of agricultural land is underestimated, and the relative price to other factors does not reflect the degree of land scarcity.

In rural China, the land transfer market is becoming increasingly active. However, under the influence of human relationships and local customs, the land transfer market is filled with a large number of non-remunerative, verbal, and non-fixed-term contractual relationships [27]. This unique market phenomenon provides a new direction for land transfer research. However, in some studies on land transfer [18,21,22], most scholars focus only on the behavioral decision of whether farmers choose to transfer land, but few studies have touched on the specific content of the land transfer contract and its impact on farmers' behavior. It is worth noting that the relationship between the standardization, stability, and profitability of land transfer contracts, which may affect farmers' SR intentions, has not yet been clarified.

In order to understand the above effects, this paper combines empirical tests based on the 2020 China Rural Revitalization Survey (CRRS) database to explore the impact of key factors in land transfer contracts on farmers' willingness to return straw to the fields. Building on existing studies [24,27,28], this paper not only examines the behavior of land transfer itself but also delves deeper into the contract level to investigate the influence of contract characteristics on the behavioral decisions of farmers. The main contributions of this paper are: (1) innovatively analyzing the standardization, stability, and profitability of land transfer contracts and constructing a theoretical framework of how these elements affect farmers' SR willingness. This fills the gaps in existing research and provides new ideas for subsequent research. (2) Using large-scale survey data, the specific effects of land transfer contract standardization, stability, and profitability on farmers' SR willingness and their heterogeneity are verified through empirical analysis. This approach ensures that the research results are highly credible and practical. Overall, this study not only breaks through the limitations of existing studies but also provides new perspectives for understanding the relationship between land transfer and SR through unique perspectives and appropriate analytical methods [19,21,25]. These findings will have far-reaching implications for optimizing land transfer policies, improving the utilization rate of straw resources, and even promoting sustainable agricultural development.

2. Theoretical Analysis

China's household contract responsibility system started with clear property rights incentives that boosted agricultural productivity and farmer efficiency [28]. However, fragmentation of farmland acreage, unequal factor distribution, and other issues limited agriculture's marginal yield, hindering its growth [29]. Land transfer may help farmers rationalize agricultural production resources with the minimum effect. It's essential for large-scale agricultural production. However, throughout China's rural areas, influenced by human relations, land transfer contracts are affected by geographic location, blood ties, and human feelings [18], resulting in differences in the form of the contract, the duration of

the lease, the transfer rent, and other characteristics [30], which affect the standardization and marketization of agricultural land in China.

In 1991, Ronald H. Coase proposed "Property Rights Points," emphasizing the role of property rights in transactions by exploring the impact of different property rights structures on resource allocation [31,32]. However, in China's rural society, land transfer relies on the stability and clarity of agricultural land property rights, which impact farmers' land transfer choices and land transfer's efficiency and economic advantages. Generally speaking, in China, the transfer of farmland management rights is mainly realized through various transfer contracts between farmers. Compared with verbal contracts, written contracts usually explain the transfer contracts in more detail so that the rights and obligations of both parties are guaranteed and bound [33], and they avoid the phenomenon of information asymmetry. On the one hand, the written contract can improve the binding force and guarantee of the contract to a certain extent and inhibit the opportunistic behaviors of the transferring parties [34,35], such as the circumstance that the wantonly destroys the land and the circumstance that the arbitrarily raises the rent and takes back the land.

On the other hand, a standardized and legally written contract can avoid the risk of changes and damages in the process of land property rights transfer, help attract large farmers, agricultural enterprises, family farms, and other businesses subject to participation in the transfer process, form relatively stable transfer relationships, and promote the application of resource-saving production modes. It is evident that verbal transfer contracts do not guarantee the tenant's right to stable operation, and there is a risk of agricultural production being interrupted at any time. This can hinder farmers from investing in and protecting arable land. The written transfer contract provides greater legal security and risk-avoidance capabilities. This effectively promotes the legitimacy and scale of agricultural production, incentivizing farmers to engage in sustainable resource management and other practices that protect arable land. Thus, H1 can be proposed.

H1: *Compared to the verbal type of transfer contract, the adoption rate of SR is higher among farmers who sign written contracts to transfer land.*

Whether or not the transferred land can be operated stably in the long term is a key factor for agricultural production entities to decide whether they invest in the land in the long term. According to the theories of "rational man" and "economic man," farmers will always adopt the most reasonable economic behavior in the current environment to pursue the maximization of profits. Based on the long-term cyclical characteristics of agricultural production, the land transferee will be very concerned about the stability of the management rights of agricultural land, the risk of agricultural investment, the return cycle, and other important factors when signing the contract [18,25,36]. However, in the case of households' land transfers, land has been the survival and income security of rural households, and the uncertainty of future life makes some farmers prefer non-fixed-term contracts and facilitate their interruption of the transfer at any time. If the transferor does not reach a specific contract on the land transfer period, it means that the land may be recovered at any time, and agricultural operators will face the risk of being unable to recover their investment [37], which ultimately makes the transferring party reluctant to have a long-term investment and protection on the land, which in turn increases the probability that it will adopt the behavior of overdrawing the cultivated land in a short period of time. Only if the land transfer contract stipulates a clear period of time can the management subject's expectation of land management be increased, and the willingness to rationalize production and long-term investment be stimulated [38–40], such as the SR and the purchase of agricultural equipment. Overall, fixed-term contracts can provide farmers with confidence in stabilizing production and ensuring smooth, long-term agricultural production. This can encourage farmers to protect and invest in land for the future. Accordingly, H2 is proposed.

H2: *Compared with the transfer contract of non-fixed duration, the transfer contract of definite duration can motivate farmers to adopt SR.*

As an expansion of property rights theory, property rights risk theory suggests that changes in land use rights create property rights risks [41,42]. This risk can be divided into two parts: policy risk and economic risk. Policy risk refers to the inadequacy of legal policies as a formal system, which threatens the security of property rights in land transfers. Economic risk refers to the tendency of transferring households to act opportunistically after the fact, and it is difficult for the formal system to constrain such opportunistic behavior. Therefore, farmers tend to focus more on the income from farmland transfers and the security of property rights when they transfer the use rights of farmland. Due to human relations in China's rural society [27], farmers often adopt gratuitous land transfers among friends and acquaintances to save transfer costs, avoid transaction risks, and consider human interaction [43–45].

However, the existence of "non-remunerative transfer" makes it difficult for the transferring party to impose constraints on the production behaviors of the transferring party due to family and friends and interpersonal relationships. The transferring party does not need to consider the transferring cost in the process of operation, does not need to pursue long-term returns, and often transfers arable land exceeding its own operating capacity and productivity, according to its past experience, which hinders the recycling of agricultural resources and the improvement of production technology. On the other hand, a paid transfer often exists between strangers or agricultural institutions, and both parties abide by the rules of market transactions. Farmers must use the marginal cost of production inputs and products to decide whether to move or not because of transfer costs. Therefore, farmers will not blindly transfer farmland and will rationally arrange the production decisions according to the scale of the operation to maintain the sustainability of agricultural resources so much so that it can obtain long-term returns.

In short, in the context of non-remunerative transfer, with the suppressed land cost, the willingness of farmers to rationally cultivate and protect their land may be insufficient. Due to the increase in land transfer rent, the land transfer households need to increase their agricultural income to compensate for the transfer cost. SR, as one of the important measures for arable land protection and agricultural production increase, tends to be adopted by more farmers who have transferred their land with compensation. Accordingly, H3 is proposed.

H3: *Compared with non-remunerative transfer, remunerative transfer households are more willing to adopt SR technology.*

The technology acceptance model suggests that farmers' behavioral decision-making tendencies are influenced by both perceived usefulness and perceived ease of use. Agriculture's most fundamental and crucial aspect is land and land resources determine whether agricultural operators can use land efficiently for production and management. Farmers will assess land resource endowment, SR feasibility, and convenience before taking action [10]. In general, if farmers believe that the difficulty of their SR behavior is less, then the incidence of farmers' SR behavior is higher. In terms of land topography, plains are characterized by their flatness, in contrast to mountainous or hilly terrain. This flatness results in reduced fragmentation of land parcels, which facilitates various agricultural activities. In addition, farmers' perceived ease of use of the act of SR is also higher.

In terms of land scale, agricultural scale management depends to a certain extent on land scale management, and the long-term production cost of farmers will decrease with the increase in land scale [46]. With the expansion of planting areas, the convenience of using machinery to carry out operations will also increase [47], and the cost of adopting SR will also be lower. In addition, farmers with a larger-scale operation also have a stronger

dependence on the value of farmland and a stronger perceived usefulness of crop SR; therefore, they are relatively more active in adopting SR [48,49].

Analyzing the above perspectives of farmland topography and land scale, H4 and H5 can be proposed (Figure 1).

H4: *The presence of land transfer contracts has a significantly more positive impact on adopting SR in plains regions than hilly and mountainous areas.*

H5: *The presence of land transfer contracts has a significantly more positive impact on the adoption of SR on larger farms.*

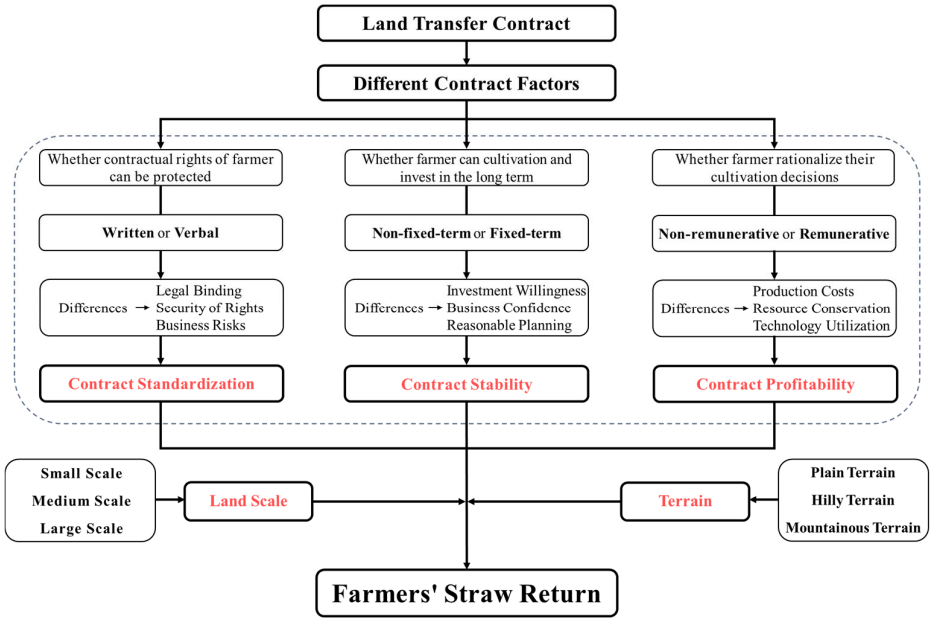

Figure 1. Theoretical framework diagram.

3. Materials and Methods

3.1. Data Source

This paper mainly uses data from the 2020 China Rural Revitalization Survey (CRRS) to develop an empirical study of the above theoretical analysis. CRRS is a Chinese rural micro-survey project organized and initiated by the Chinese Academy of Social Sciences. In the selection of survey areas, the group finally took 1/3 of the provinces (10 in total) in the country by comprehensively considering the geographical location, agricultural characteristics, economic development, human customs, and other characteristics of each region (Figure 2). Then, in order to make the research results show the development of China's rural areas in a more real, comprehensive, and reasonable way, the group took different types of areas within the provinces to conduct a wide-ranging rural survey. All counties were ranked according to the per capita GDP of each province, five counties were drawn equidistant from each province according to the ranking, and towns and villages were drawn in the same way. In the end, a total of 50 counties, 150 towns, and 300 villages were sampled. In the selection of the research farmers, the group contacted the village cadres before the research and got permission from the village cadres to enter the village. According to the list of village members, different types of farm households were selected based on a variety of characteristics, such as living location and working status. Before interviewing the farmers, the research group staff introduced the purpose of the interview and the content of the interview to the farmers, obtained their agreement and recognition, and then conducted a detailed interview for one to two hours. Eventually, after collection and collation, data from 3830 farm households were obtained.

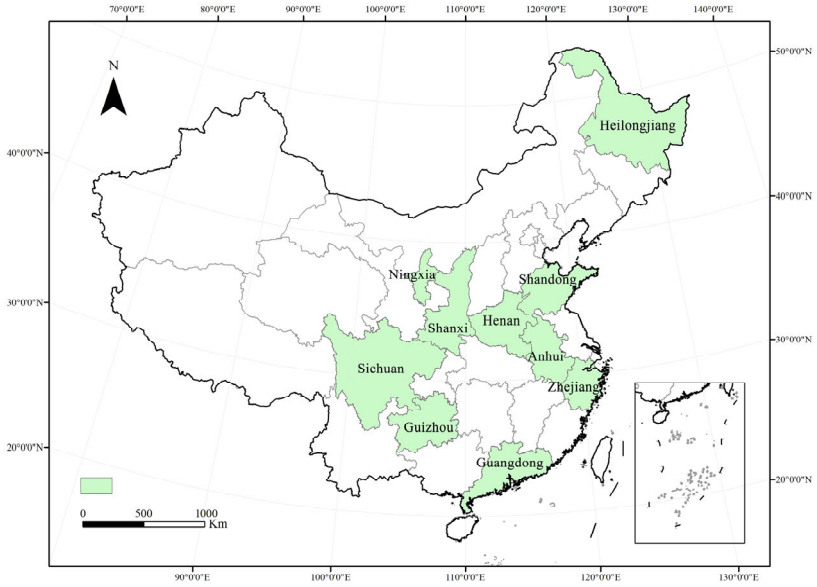

Figure 2. Map of the study area.

3.2. Selection of Model Variables

Since the explanatory variables are 0–1 variables, this paper uses a binary Probit model for regression with the following expression:

$$Probit(Y_i) = \alpha_0 + \alpha_1 Contract_i + \alpha_2 Tenancy_i + \alpha_3 Rent_i + \sum_{k=1} \alpha_4 Control_i + \mu_i \quad (1)$$

In Formula (1), Y_i indicates whether the ith farmer adopts the behavior of SR technology, 0 indicates that the farmer does not conduct SR behavior; 1 indicates that the farmer is willing to adopt the behavior of SR technology. $Contract_i$ denotes the standardization of the land transfer contract of the ith farmer, including written contract and verbal contract; 0 means that the farmer adopts a verbal contract when transferring land; 1 means that the farmer adopts a written contract. $Tenancy_i$ is the stability of the contract of the *i*th farmer, including fixed tenancy period and unspecified tenancy period, 0 means that the farmer did not specify the tenancy period when transferring the land; 1 means that the farmer specified a fixed tenancy period. $Rent_i$ represents the profitability of the land transfer contract of the ith farmer, including non-remunerative transfer and remunerative transfer, 0 means that the farmer transferred the land gratuitously; 1 means that the farmer paid the rent when he transferred the land. $Control_i$ represents control variables. Referring to related studies, the control variables include farmers' personal characteristics, household characteristics and business characteristics [9,13,21]. μ_i denotes a random disturbance term.

3.3. Variables Statistical Analysis of Samples

As is shown in Table 1, the average behavior of farmers using SR technology in 3830 samples is 0.31, indicating that 31% of farmers have adopted the behavior of SR. The mean value of transfer contract standardization is 0.08, which indicates that 8% of farmers have signed a written type of contract at the time of land transfer. The mean value of transfer contract stability is 0.08, which indicates that 8% of the farmers agreed on a clear lease period when they transferred their land. The mean value of the profitability of the transfer contract is 0.17, which means that 17% of the farmers in the sample chose to pay rent to transfer land. Among all the farmers surveyed, 93% of the household heads are male, the average age of the household heads is 56.93 years old, the average educational experience is 2.76, the average number of workers in the household is 2.88, the average logarithmic average of the household annual income is 10.67, the average area of cultivated

land is 20.12 mu, of which 30% of the land is planted with grain and 62% of the land is irrigated.

Table 1. Descriptive statistical analysis of variables.

Variable	Definitions	Mean	SD [a]
SR	Whether farmers adopt the behavior of straw return technology (0 = No; 1 = Yes)	0.31	0.46
Contract Standardization	Whether a written deed was signed for the transferred land (0 = No; 1 = Yes)	0.08	0.28
Contract Stability	Whether the transferred land has agreed on a clear lease period (0 = No; 1 = Yes)	0.08	0.27
Contract Profitability	Whether rent is charged for the transferred land (0 = No; 1 = Yes)	0.17	0.38
Sex	Household head sex (0 = female; 1 = male)	0.93	0.25
Age	Household head age (years)	56.93	11.33
Edu	Educational attainment of the head of the farm household (1–8 indicates no schooling, elementary school, junior high school, high school, secondary school, vocational high school, university college and undergraduate college, respectively)	2.76	1.08
Labor	Number of household laborers	2.88	1.38
Income	Logarithm of the household's total income in a year	10.67	1.19
Land	Total area of land being operated (mu)	20.12	73.60
Grain	Area under food crops	0.30	0.40
Irrigable	Percentage of irrigable farmland to the total area of farmland being operated	0.62	0.43

Note: [a] SD = Standard deviation.

3.4. Comparison of the Impact of Land Transfer Contracts on the Return of Straw to the Field

As is shown in Table 2, the SR rate for the full sample of farmers was 31%. Among them, the SR rate was 50% for those who transferred land through a written contract and 29% for those who used a verbal contract. The SR rate of farmers who transferred land with a clear deadline was 47%, which was significantly higher than the SR rate of 29% of farmers who did not have a clear deadline. In addition, the SR rate of farmers who transferred land with compensation was 49%, much higher than the SR rate of farmers who transferred land without compensation, which was 27%.

Table 2. Comparison of the impact of land transfer contracts on farmers' return of straw to the field.

Contract Standardization	Total Sample	Written Contract	Verbal Contract	Mean Value Difference
	0.31	0.50	0.29	0.21 ***
	(0.46)	(0.50)	(0.45)	(0.03)
Contract Stability	Total Sample	Fixed Term	Non-Fixed Term	Mean Value Difference
	0.31	0.47	0.29	0.18 ***
	(0.46)	(0.50)	(0.46)	(0.03)
Contract Profitability	Total Sample	Remunerative	Non-Remunerative	Mean Value Difference
	0.31	0.49	0.27	0.22 ***
	(0.46)	(0.50)	(0.44)	(0.02)

Note: *** refer to $p < 0.01$.

4. Results

4.1. Analysis of Regression Results

The effect of the standardization, stability, and profitability of land transfer contracts on farmers' SR behavior is shown in Table 3. It can be seen that the coefficients of the three core explanatory variables are positive at the 1% level. Moreover, the probability of adopting SR is 16.7% higher when farmers sign a written contract than when they sign a verbal contract. The probability of adopting SR is 11.7% higher when farmers sign a fixed-term contract than when they sign a non-fixed-term contract. The probability of adopting SR is 15.8% higher when farmers sign a remunerative contract than when they sign a non-remunerative contract. The regression results are consistent with the theoretical analysis. Results indicate that, compared with the verbal contract, the written transfer contract, by its security, legality, and other advantages, can effectively contribute to the formation of the normal transfer relationship and promote the adoption of SR technology by the farmers. A transfer contract with a definite fixed term can ensure that farmers can carry out long-term investment planning and maintain the sustainable use of resources by adopting behaviors. In addition, compared with non-remunerative transfer, remunerative transfer households are more willing to adopt SR. The results also show that H1–H3 were verified.

Table 3. Regression Results.

	SR		
Contract Standardization	0.557 ***		
	(0.087)		
Contract Stability		0.388 ***	
		(0.089)	
Contract Profitability			0.531 ***
			(0.065)
Sex	0.251 ***	0.258 ***	0.211 **
	(0.097)	(0.097)	(0.097)
Age	0.003	0.002	0.004 *
	(0.002)	(0.002)	(0.002)
Edu	0.077 ***	0.077 ***	0.082 ***
	(0.022)	(0.022)	(0.022)
Labor	0.034 *	0.032 *	0.027
	(0.017)	(0.017)	(0.018)
Income	−0.057 ***	−0.056 ***	−0.057 ***
	(0.020)	(0.020)	(0.020)
Land	−0.001	−0.001	−0.001 **
	(0.001)	(0.001)	(0.001)
Grain	1.217 ***	1.203 ***	1.183 ***
	(0.055)	(0.055)	(0.056)
Irrigable	0.318 ***	0.334 ***	0.316 ***
	(0.055)	(0.054)	(0.055)
Constant	−1.278 ***	−1.237 ***	−1.310 ***
	(0.291)	(0.289)	(0.291)
Marginal Effect	0.167	0.117	0.158
N	3830	3830	3830

Note: Robust standard errors in parentheses; *, ** and *** refer to $p < 0.1$, $p < 0.05$, and $p < 0.01$.

Among the control variables, gender factors significantly influence SR technology adoption behavior, indicating that males are more willing to adopt SR technology than females. A possible explanation is that in the Chinese rural life pattern, males are still dominant in agricultural production by virtue of their physical strength advantage. Educational experience is also an important factor influencing the behavior of SR. This suggests that as farmers' education level increases, they are able to more accurately recognize the benefits of SR in terms of environmental protection and are, therefore, willing to carry out SR.

4.2. Robustness Tests

Theoretically, omitted factors and mutual causation between farmers' land transfer contracts and SR may make the primary explanatory variables endogenous. To handle model estimation endogeneity and maintain accuracy, this paper selects village-level contract standardization (the proportion of other farmers in the village who have signed a written land transfer contract, except for this household), village-level contract stability (the proportion of other farmers in the village who have determined the duration of land transfer, except for this household), and village-level contract profitability (the proportion of other farmers in the village who have paid for land transfer, except for this household) as instrumental variables for the three core explanatory variables [5,50–52]. The data results were re-measured using the IV-Probit model.

Instrumental variables are chosen based on these factors: under the influence of the unique agricultural culture in rural areas of China, farmers will refer to the land transfer methods of other farmers in the same village when stipulating the content of the land transfer contract, which will affect the standardization, stability, and profitability of the contract. The behavioral differences of other farmers in land transfer do not directly affect the SR behavior of farmers. This renders instrumental and endogenous variables strongly coupled and independent, satisfying the exclusivity condition.

Table 4 shows the re-measurement findings. After employing the instrumental variable method, the three main explanatory variables still strongly impact SR, and there is no weak instrumental variable issue. A correct choice of instrumental variables and robust regression results are shown.

Table 4. Robustness Tests.

	IV-Probit					
	First Stage			Second Stage		
	Contract Standardization	Contract Stability	Contract Profitability	SR		
Village-Level Contract Standardization	0.506 *** (0.032)					
Village-Level Contract Stability		0.510 *** (0.032)				
Village-Level Contract Profitability			0.628 *** (0.026)			
Contract Standardization				1.873 *** (0.280)		
Contract Stability					1.185 *** (0.318)	
Contract Profitability						1.305 *** (0.153)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Weak Identification	249.740 ***	254.391 ***	573.760 ***	249.740 ***	254.391 ***	573.760 ***
N	3830	3830	3830	3830	3830	3830

Note: Robust standard errors in parentheses; *** refer to $p < 0.01$.

4.3. Heterogeneity Analysis

4.3.1. The Effect of Terrain on the Heterogeneity of SR

In Table 5, the role played by land transfer contracts varies across different terrains. In the plains, the role of each core explanatory variable on SR is significantly stronger than in the mountains. The possible explanation is due to the fact that SR mainly relies on mechanized operations, and the difficulty of mechanized operations varies greatly in different terrains. Compared to mountainous areas, the difficulty and cost of adopting mechanical operations in the plains are lower, and farmers' perceived ease of use is stronger, making it more suitable for mechanization. Therefore, the probability that farmers in the plains adopt the SR is greater.

Table 5. Terrain Differences.

	SR								
	Plain Area			**Hilly Area**			**Mountain Area**		
Contract Standardization	0.426 *** (0.117)			0.660 *** (0.173)			0.260 (0.257)		
Contract Stability		0.313 ** (0.123)			0.261 (0.169)			0.248 (0.236)	
Contract Profitability			0.661 *** (0.091)			0.207 (0.148)			−0.025 (0.169)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1680	1680	1680	829	829	829	1321	1321	1321

Note: Robust standard errors in parentheses; ** and *** refer to $p < 0.05$, and $p < 0.01$.

4.3.2. The Effect of Scale of Operation on the Heterogeneity of SR

Based on the previous analysis, at present, China's average household and per capita cultivated land area is below 10 mu and 2 mu, respectively, thus, this paper divides the small, medium and large operation scales with 2 mu and 10 mu as the boundary [14,53]. In Table 6, the three sets of regression results show that each core explanatory variable promotes SR more than the small and medium-sized business scale under the condition of the large business scale. This indicates that with the expansion of the land operation scale of farm households, their dependence on and emphasis on agricultural production will also increase, and they will pursue the sustainable utilization of agricultural resources more and thus be more willing to adopt SR technology. In addition, large-scale cultivated land is suitable for uniform mechanization, while the average cost of agricultural mechanization is higher on small- and medium-scale cultivated land. Therefore, large operations have a greater contribution to the promotion of SR. The results in Tables 5 and 6 also show that H1–H5 holds even in the case of subsample regression.

Table 6. Scale Differences.

	SR								
	Small Scale			**Medium Scale**			**Large Scale**		
Contract Standardization	0.696 * (0.419)			0.289 (0.190)			0.475 *** (0.102)		
Contract Stability		0.440 (0.489)			0.370 * (0.206)			0.302 *** (0.100)	
Contract Profitability			0.607 * (0.332)			0.286 ** (0.124)			0.616 *** (0.090)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1429	1429	1429	1321	1321	1321	1080	1080	1080

Note: Robust standard errors in parentheses; *, ** and *** refer to $p < 0.1$, $p < 0.05$, and $p < 0.01$.

5. Discussion

Currently, the Chinese land transfer market still has many verbal, non-fixed term, and non-remunerative transfer contracts. These contracts have a negative impact on the further development of agriculture. Therefore, this paper examines the impact of key factors in the land transfer contract on farmers' SR by combining the 2020 CRRS database with a theoretical framework that incorporates standardization, stability, and profitability of the contract. The study's objective is to offer pertinent theoretical support and policy references for the effective preservation of arable land and the rational utilization of straw.

The primary innovations of this research are: (1) Focusing not only on farmers' land transfer decisions but also on different types of land transfer contracts in current rural areas of China. From the perspective of land transfer contracts, the influence of land transfer contract content on SR is examined in detail. Thus, more detailed and accurate conclusions

of the results are provided. (2) Differences in SR adoption by different groups of farmers were analyzed based on differences in terrain and farmland size. This makes the studies and suggestions more thorough and reasonable, making them relevant to more farmers and the government.

The research found that written contracts provide more extensive explanations of transfer contracts than verbal contracts. This protects both parties' rights and duties and prevents information imbalance. Consequently, farmers' behavior is restricted, increasing the likelihood of SR occurrence. These findings support previous studies [19,21,54], confirming H1. Stability makes fixed-term contracts better for SR than non-fixed-term ones. This supports H2 and prior research [40,46]. This may be because SR requires long-term production and is more expensive. Farmers may be unwilling to embrace SR if the transfer time is unknown because they may struggle to return their investment. Farmers may trust fixed-term contracts to stabilize and ensure agricultural productivity. This motivates farmers to preserve and invest in land [55]. In contrast to Zhu et al. [56], this study suggests that farmers are more likely to rationalize farming and increase farm income to compensate for the transfer cost in the context of remunerative transfer [57]. This increases farmers' willingness to protect arable land, as verified by H3. The land transfer contract affects SR differently based on geography and size. As the production scale expands, farmers prioritize the sustainability of agricultural resources, increasing the probability of using SR, which supports H4 and H5 [58].

Additionally, this research has flaws. Further empirical research is needed to prove the mechanistic link between the two and to understand how land transfer contracts impact SR. Due to China's rural society's variety, farm families have varied land use and development methods. Treating families as a whole may alter studies. More critically, farm families' SR willingness evolves over time and is affected by different factors. Using multi-year continuous tracking data to examine farm families' SR willingness may be more accurate. However, data limitations prevented addressing these shortcomings. In the future, this study will enhance the scope of the research by seeking more extensive data to overcome the aforementioned limitations and get more practical findings and conclusions.

6. Conclusions

The main research conclusions of this paper include: (1) The written contract will encourage the land transferor to adopt SR conduct owing to the contract's limitations and norms. (2) Under the fixed period of transfer, the farmers can reasonably arrange agricultural business activities according to the transfer-ring period, which reduces opportunistic behavior and adopts SR. (3) The unpaid transfer between friends and relatives is constrained by the relationship between the two parties and sentiment, which is not conducive to the adoption of the transferring farmer's SR behavior. (4) The plain's flat geography and low triviality promote the development of agricultural production. Farmers can accept SR technology more easily than mountains. (5) Compared with small and medium-sized farmers, large agricultural households are more ready to adopt SR because they have more arable land and are more dependent on agriculture.

From the foregoing results, this study recommends the following policies:

(1) The government should guide and encourage farmers to sign a remunerative land transfer contract so that through the drive of economic benefits, the transferring households will pay more attention to the long-term use of the land. Fixed-term contracts can give transferring households a stable period of use, which helps them make long-term plans and investments and ensures that farmers have enough time to implement soil improvement measures, such as SR, in order to improve soil quality. Oral contracts, while simple, lack legal validity and are prone to disputes. The government should vigorously promote written land transfer contracts to provide legal protection for agricultural practices such as SR. Therefore, the government should address the imperfect land transfer contracts that currently exist in China's rural areas and promote written, fixed-term, and remunerative contracts through

targeted policies and regulations in order to increase the rate of SR and support the sustainable development of agriculture.

(2) The government should formulate differentiated policies for the different situations in plains and hilly areas. In plain areas, the existing SR experience can continue to be strengthened and promoted while more policy support and economic incentives, such as increased subsidies, can be provided to further encourage the active participation of large-scale operational farmers. For farmers in hilly areas, the government needs to formulate more flexible and specific support policies, taking into account the constraints of terrain and scale of operation. For example, SR technologies and equipment suitable for small plots and hilly environments can be provided, and subsidies can be given for the purchase and use of such equipment to lower the adoption threshold for farmers. In addition, the government should increase research and development on SR-related technologies, especially for technological innovation in hilly areas. Develop lightweight, efficient machinery suitable for small plots and complex terrains to solve the difficulties encountered by small-scale and hilly farmers in practice. Meanwhile, SR technology must be promoted and popularized to assist farmers in grasping and mastering technical aspects and operating procedures and enhance their desire to accept and capacity to operate.

(3) To improve the agricultural land transfer market, policy and control of the major body of the transfer must be strengthened, and interest conflicts and transaction costs reduced. To reduce the fragmentation and dispersion of farmers' farmland, it is recommended to use land transfer in a flexible manner by merging and reorganizing plots. It should explore formal, legal, and market-oriented land transfer transactions according to local conditions and actively publicize and guide agricultural management subjects to improve the enthusiasm of farmers to make rational use of resources. Thus, farmers' willingness to invest in and protect long-term land is enhanced, such as through the use of SR to replace straw burning, and the multiple benefits of improving crop yield, arable land protection, and environmental improvement are obtained.

Author Contributions: Conceptualization, R.L., B.H. and S.L.; methodology, D.X.; formal analysis, S.L.; investigation, R.L.; writing—original draft preparation, R.L., B.H. and D.X.; writing—review and editing, R.L.; supervision, D.X.; funding acquisition, D.X. All authors have read and agreed to the published version of the manuscript.

Funding: This project was funded by the Special Program for Cultivating Excellent Young Talents under the Dual Support Plan of Sichuan Agricultural University, a Key Research Base Project of Sichuan Province Philosophy and Social Science (SC22EZD038) and Supported by Sichuan Rural Development Research Center (2023CR27).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

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