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Does the Different Recipients of Land Fertility Protection Subsidy Influence the Scale and Efficiency of Village Land Circulation? Evidence from a Chinese Agricultural City

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Abstract: Agricultural subsidies offer significant support for the stability of global food security. With the backdrop of land circulation, the object of China's land fertility protection subsidy is becoming increasingly ambiguous. Thus, outflower and inflower sense this subsidy as a profitable opportunity. Existing research has treated all agricultural subsidies as a whole, disregarding the distinct policy goals of different agricultural subsidies. The current study subdivides agricultural subsidies, with a focus on land fertility protection subsidies, which explores the relationship between village types dominated by subsidy recipients and the scale of land circulation. The current study, conducted on the village level, reflects individual farmers' decisions influenced by such causes as village social structure and economic network. This study shows that in subsidized outflower-led villages, the scale of land circulation is considerably large, and the proportion of farmers exiting land to promote circulation is also markedly high. The land fertility protection subsidy often deviates from its intended policy goals. Furthermore, the impact of this distribution on land circulation varies among different entities in land transactions in different villages. Therefore, additional targeted and refined policy reforms are necessary to realize the original goal and effectively promote land fertility protection subsidies.

Keywords: land fertility protection subsidy; cultivated land circulation; precise subsidy system; policy reform; China

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1. Introduction

China established a subsidy system in 2006 as part of an effort to increase fiscal support for agriculture (Veeck & Shui, 2011). However, as agricultural profitability declines and farmland fragmentation intensifies, the "generalized system of preferences" (GSP) subsidy model has struggled to address rising production costs effectively (Andrews, 2021; Sun & Lv, 2012). To address these challenges, the strategy of land circulation was introduced, aiming to consolidate cultivated land resources for scaled-up agricultural operations. Data from the Ministry of Agriculture and Rural Affairs of China indicate that since 2016, the proportion of family-contracted cultivated land circulated has remained approximately 35% of the total contracted farmland.

In the same year, the government restructured its subsidy framework, integrating direct grain subsidy, high-quality seed subsidy, and 80% of agricultural input subsidy into a unified "agricultural support and protection subsidy." This reform introduced two new categories: moderate-scale operation subsidy and land fertility protection subsidy. The land fertility protection subsidy is aimed at farmers who have land contract management rights and encourages them to actively improve soil fertility. However, the separation of farmland contracting and management rights due to land circulation has complicated the identification and allocation of subsidy beneficiaries (Guo et al., 2021).

Regional variations further complicate the implementation process (Figure 1). In such regions as Shandong and Tianjin, the primary beneficiaries of subsidy in the village are mainly actual grain growers, including traditional farmers and farmers who have entered agriculture through land circulation. By contrast, such provinces as Hebei and Henan only provide this subsidy to farmers who simultaneously hold contractual rights and actual cultivation. As the rural labor force transitions to non-agricultural sectors, this trend presents new challenges in implementing land circulation strategies.

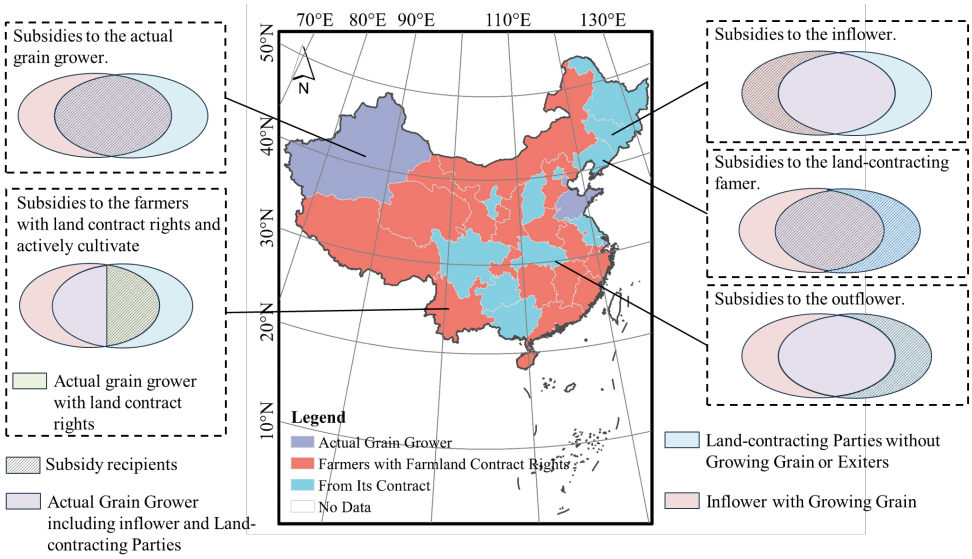

Figure 1. Provincial Policies on Recipients of Land Fertility Protection Subsidy in China.

Most regions customarily require the parties involved to sign a contract outlining the recipients of the land fertility protection subsidy. However, the specific terms and conditions of these contracts can vary depending on the region. For example, in such regions as Liaoning, Sichuan, and Guizhou, the subsidy is primarily allocated to parties who have contracted the land, regardless of their direct involvement in farming activities. These villages are subsidized outflower (SO)-led villages. In Jilin Province, the actual cultivators are legally required to receive this subsidy, and these villages are subsidized inflower (SI)-led villages. However, field interviews have revealed that this case is not always true. Furthermore, frequent changes in the main actual cultivators, driven by various interests, further complicate the distribution of this subsidy. In Hubei Province, this subsidy is distributed to outflowers when there is land circulation among farmers. However, inflow entities include farmers, village collectives, and individuals or organizations from outside the village. This situation raises the question of how the village should distribute this subsidy. These complex interest structures highlight the uncertainties in the implementation of subsidy policies.

Thus, the impact of agricultural subsidies on land circulation has long been a topic of interest in academic circles. Agricultural subsidies have been found to encourage labor contributions to agriculture (Yu & Jensen, 2010), and significantly increase agricultural production efficiency (Qian & Hong, 2016; Qi & Yang, 2022). As land circulation accelerated after the implementation of the reform, the agricultural support and protection subsidies successfully reduced the disparity in willingness to pay between individuals who engage in and discontinue the cultivation of land. Consequently, this outcome promoted the inflow of traditional farmers or new agricultural entities into land (Zhang et al., 2019; Xu et al., 2020) These findings suggest that directing subsidies to actual cultivators could encourage substantial farmer involvement in land circulation activities (Ji et al., 2015), particularly enhancing the willingness of farmers who balance between agricultural and non-agricultural incomes to adopt circulated land (Liu & Liu, 2016). During this time, the village distributed all subsidies to the actual farmers in accordance with regulations. Given that the scale of land circulation is small, the issue of subsidy distribution is also minimal. Thus, promoting land circulation (Fan et al., 2023).

However, some studies have suggested that agricultural subsidies have reduced farmers' willingness to engage in land circulation (Liao, 2012; Tian et al., 2021), thereby hindering land circulation processes (Lin & Huang, 2021). A significant portion of the existing literature has failed to distinguish between land fertility protection subsidies and moderate-scale operation subsidies. This lack of differentiation obscures the distinct policy objectives and incentive mechanisms underlying these subsidies. Specifically, the former focuses on soil quality preservation and sustainability, whereas the latter prioritizes the economic benefits of scaled agricultural operations. As a result, the absence of a clear distinction between these two subsidy types has led to conflicting conclusions regarding their respective impacts on land circulation. Furthermore, the majority of the related studies have focused on the influence of agricultural subsidies on farmers' willingness and behavior toward land circulation. However, intention does not necessarily translate into behavior. The potential impact of village characteristics on land circulation activities has often been overlooked. Farmers' decisions can vary among different villages.

Therefore, the primary inquiry is as follows: How do village types dominated by recipients of land fertility protection subsidies impact land circulation within the villages? By examining the

effects of dominant subsidy recipients of dominant villages on cultivated land circulation, this research offers several contributions. First, the impact of land fertility protection subsidy on land circulation remains uncertain, as provincial regulations vary and may not align with higher-level policies. Second, the role of this subsidy as an additional income source during land circulation has been underexplored. Finally, studying this issue in China fills a critical research gap in developing countries and offers valuable insights for nations implementing similar policies.

The remainder of this paper is organized as follows. Section 2 presents the conceptual framework and theoretical hypotheses. Section 3 describes the data sources and research methodology. Section 4 conducts a regression analysis. Section 5 summarizes and discusses the research findings.

2. Theoretical Analysis and Research Hypotheses

2.1. Decision-Making Entities and Driving Mechanisms

In the context of land circulation, the decision-making actors include farmers who outflow and inflow land. Guided by the rational economic actor model, individuals involved are primarily driven by the pursuit of profit maximization (Wang et al., 2021). Consequently, the dynamics observed in different types of dominant villages and the influence of land cultivation actors on land circulation can be seen as the allocation of land resources to optimize benefits while considering various constraints (Figure 2).

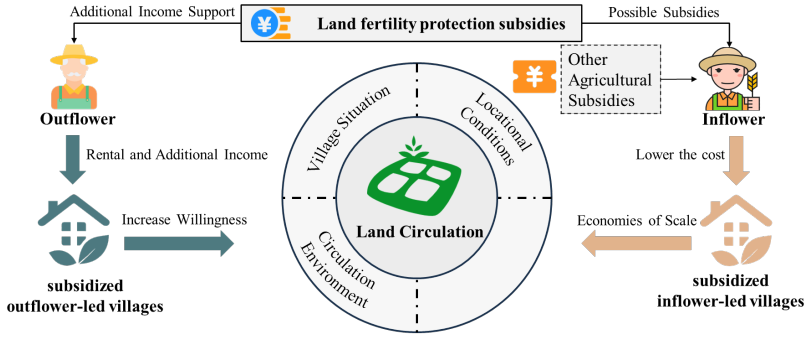

Figure 2. Theoretical framework.

Assuming the consistency of the land fertility and crop yields before and after land circulation, research has suggested that land fertility protection subsidies do not have an impact on land rental prices (Yi & McCarl, 2018; Song et al., 2022). We follow Ellis' framework on agricultural economics (Ellis, 1988/2006) and introduce Eq. (1):

$$R_i = P_i - C_i, \tag{1}$$

Here, R_i represents the net income for the entity, where i is categorized as self-cultivators, outflower, and inflower; P_i represents the total income obtained from the land; and C_i includes total costs, including agricultural inputs, labor, transaction costs, and land rent.

The extent and viability of land circulation depend on the comparative net revenues of outflowers and inflowers relative to self-cultivators.

2.2. Impacts of Subsidy on Land Circulation Behavior

Land circulation in villages primarily operates through two distinct mechanisms: interpersonal network reciprocity and market-based transactions (Ayala-Cantu & Morando, 2020; Fang, 2024). Reciprocal exchanges often involve nominal or negligible rents, particularly among close relatives or community members (Wang et al., 2018). Conversely, market-based mechanisms tend to exhibit higher transaction costs, influencing participants' sensitivity to this subsidy.

The distribution of land fertility protection subsidy without considering actual soil conservation measures, has gradually evolved into a quasi-income subsidy (Huang et al., 2011; Guo et al., 2021). In this situation, land fertility protection subsidies are considered a fixed income and is included in the net income (R_i) of outflowers and inflowers.

2.2.1. Outflowers' Sensitivity to Subsidy

Outflowers, whose primary income stems from rental earnings, exhibit heightened sensitivity to land fertility protection subsidies. This is particularly true in low-rent reciprocal networks and market mechanisms that involve high transaction costs. In interpersonal network exchanges, this subsidy plays a critical role in compensating for low rental returns. Furthermore, land not only

holds economic value but also serves as a form of social security (Xu & Yu, 2023). Outflowers may face the risk of income fluctuations and increased living expenses due to the transfer of land. As a result, they have a higher demand for subsidies.

2.2.2. Inflowers' Reduced Sensitivity to Subsidy

Inflowers' revenue, particularly in large-scale operations, is less influenced by land fertility protection subsidies. Scale economies and access to other incentives, such as moderate-scale operation subsidies or tax reductions, diminish the marginal utility of fertility protection subsidies (Alauddin & Tisdell, 1988; Cui et al., 2014). Furthermore, inflowers engaging in relational network-based transfers often incur lower input costs due to informal arrangements (Ji & Zhang, 2021). However, government policies that prioritize direct subsidies for actual grain producers further reduce inflowers' dependence on fertility subsidies. Additionally, in specific regions, initiatives have been implemented to offer one-time subsidies to actual grain producers with the aim of guaranteeing their fair income. This approach has also diminished the susceptibility of new inflowers to land fertility protection subsidies.

2.3. Different Village Types of Subsidy Recipients and Land Circulation

Within a village, the behavior of each individual who outflows or inflows land is influenced by their sensitivity to the subsidy. Their behavior interacts with the decisions of other individuals, resulting in a cumulative effect. Consequently, subsidies are not always distributed equally among outflowers and inflowers owing to traditional concepts and social networks. Instead, there will always be a dominant type of subsidy recipient within a village. The preceding analysis indicates that in SO-led villages, receiving this subsidy encourages increased participation in land circulation, resulting in a higher number of outflows and further promoting the expansion of land circulation at the village level.

Therefore, we propose the following research hypothesis:

H: The scale of land circulation is larger in SO-led villages. Conversely, the scale of land circulation is smaller in SI-led villages.

3. Research Design

3.1. Study Area and Data Sources

This study selects Xintai City as the designated location for the case study for several reasons. First, Xintai is a county-level city situated in Shandong Province and exemplifies the typical characteristics of a significant agricultural county. In 2021, the primary sector in Xintai contributed 6.285 billion yuan to the overall value added in Tai'an City, representing 19.20% of the total. In addition, the rural population in Xintai was 1.0537 million. Second, Xintai has implemented Shandong Province's policy of distributing land fertility protection subsidies to actual grain cultivators. However, outflowers and inflowers receive this subsidy in practice, with a percentage of approximately 50%. Third, by the end of the "13th Five-Year Plan," Xintai had circulated a total of 480,000 mu of land, accounting for 45.3% of the total cultivated land area. This finding indicates that the phenomenon of land circulation was relatively extensive.

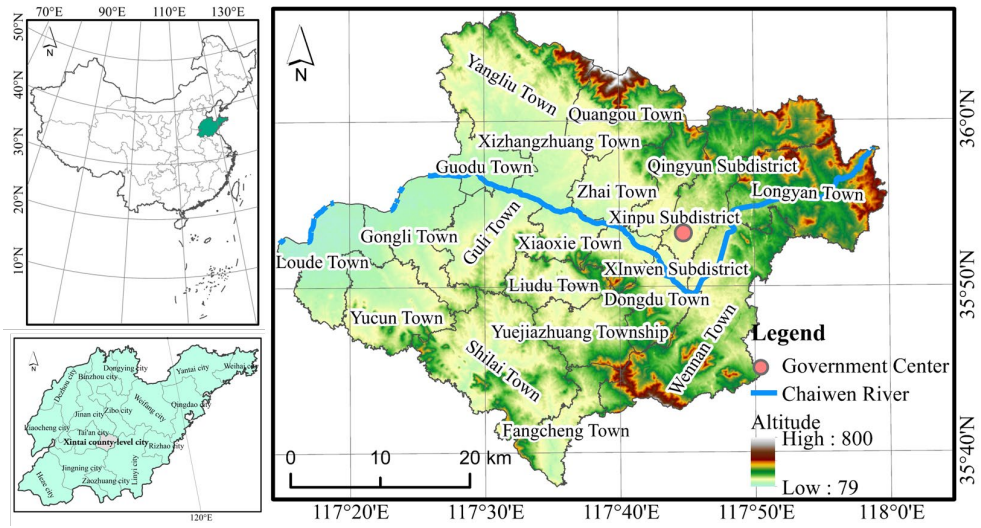

Figure 3. Research area.

Field surveys were conducted by the research group in May 2021, covering 818 villages in 20 townships and streets in Xintai City. Data were current as of the end of 2020. The screening conditions for the villages are as follows: (1) the village must have cultivated land, (2) carried out land circulation activities, and (3) have distributed land fertility protection subsidies in a timely manner. A total of 528 valid samples were obtained, accounting for 64.55% of the total number of valid samples.

Note: Although land circulation includes outflowers and inflowers, the outflow of land and the inflow of land in practice are typically balanced at the village level. Therefore, this study evaluates rural land circulation by considering the land outflow area and number of land outflow households.

3.2. Model Construction and Variable Selection

A multivariate regression model is utilized to construct the model in accordance with the research objectives and to investigate the impact of multiple independent variables on the dependent variables. The regression coefficient helps in understanding the relationship between the dependent variable (Y) and the independent variables (x_i), thereby making the model applicable to various scenarios. Equation (2) is presented as follows:

$$Y_i = C + \beta_i x_i + \sum_{j=1}^{n} \beta_j z_j + \vartheta, \tag{2}$$

where Y_i represents the dependent variable of the ith model, C is the constant term, x_i is the explanatory variable of the ith model, β_i is the regression coefficient of the explanatory variable, z_j is the jth control variable, β_j is the regression coefficient of the jth control variable, and ϑ is the random error term.

Dependent variable Y_i: The dependent variable is the proportion of land circulated area (Ji et al., 2015). The proportion is calculated as the ratio of the circulated arable land area to the total arable land area within a village.

Independent variables: The explanatory variable (x_i), which represents village types dominated by subsidy recipients, is categorized with SO-led villages assigned a value of 0 and SI-led villages assigned a value of 1, with sample sizes of 289 and 239, respectively.

Control variables z_j: These variables are derived from previous research findings and include such aspects as land circulation (Wang et al., 2020; Zhu & Yu, 2021), village situation (Wang et al., 2017; Wang & Fang, 2021), agricultural production conditions (Song et al., 2022), and locational conditions (Wang et al., 2021). The definitions and assignments for each control variable are detailed in Table 1.

Table 1. Variable indicators and descriptions.

Variables		Names	Variable Description	Expected	Count	Mean	St. Dev.
Dependent Variables		Proportion of land circulated area	Circulated arable land area/Village arable land area (%)		528	27.879	26.155
		Proportion of land circulated households	Number of households circulating land out/Total number of households (%)		528	30.692	28.671
Explanatory Variable		Village types dominated by subsidy recipients	SO-led villages = 0, SI-led villages = 1	−	528	0.450	0.498
Control Variables	Land Circulation Environment	Dominant village type	Mixed balance type = 0, Intravillage farmer dominated type = 1, Village collective dominated type = 2, Extra village dominated type = 3	+	528	1.754	0.989
		Presence of circulation incentive mechanism	No = 0, Yes = 1	+	528	0.475	0.500
		Average land circulation price in villages	Natural log of per mu land circulation price	+	528	6.354	0.610
	Village Situation	Scale of working-age labor force	Average number of labor force per household (persons/household)	−	528	1.797	0.422
		Proportion of migrant workers	Number of migrant workers/Total village population (%)	+	528	21.520	17.535
		Per capita disposable income	Average per capita income in village (10,000 yuan/person)	+	528	1.166	0.786
		Per capita arable land scale	Average per capita arable land area in village (mu/person)	−	528	1.191	0.739
	Village Agricultural Production Conditions	Proportion of non-agricultural land after circulation	Non-agricultural land area after circulated/Circulated area (%)	−	528	22.092	36.755
		Village terrain	Plains dominated= 0, Mountainous dominated= 1	+/−	528	0.345	0.476
		Presence of idle land within the village	No = 0, Yes = 1	−	528	0.225	0.418
	Locational Conditions	Distance from the village to the city center	Distance from the village to the center of Tai'an City (km)	−	528	54.428	10.911
		Presence of village public transportation	No = 0, Yes = 1	−	528	0.371	0.484

Note: The dominant village type for land direction is determined based on the classification where the cumulative area proportion of the main entrant entity exceeds 50%.

Variance inflation factors (VIFs) for all variables have been validated and confirmed to be below 5, indicating the absence of collinearity issues in the model. This finding has also been confirmed by the Pearson test. Considering the potential autocorrelation of the cross-sectional data, we employed the global Moran's I test to examine the data. The results indicated that the Z score of the global Moran's I was −0.845, with a corresponding P value of 0.398. These findings suggest

that the model does not display spatial correlation and heteroscedasticity, thus indicating the suitability of using multivariate regression.

4. Results and Analysis

4.1. Spatial Differences in Village Types Dominated by Subsidy Recipients and Land Circulation

Table 2 illustrates the direction of land circulation and the proportion of village types predominantly occupied by subsidy recipients. The majority of land circulation occurs to individuals or organizations outside the village, accounting for 67.24% of the total land circulation area. This aspect is followed by the circulation between rural households within the village, covering an area of 46848 mu and accounting for 25.73% of the total land circulation area. In terms of the dominant village type for subsidy distribution, the number of SO-led villages (289) slightly exceeds the number of SI-led villages (239).

Table 2. Direction of land circulation and the proportion of village types dominated by subsidy recipients in every township street in Xintai City.

Region	Intravillage farmer area (mu)	Village collective area (mu)	Extra village individuals or organizations area (mu)	Number of SO-led villages	Number of SI-led villages
Dongdu Town	506	105	640	9	6
Fangcheng Town	1,457	160	8,523	8	14
Gongli Town	5,248	260	7,016	23	12
Guli Town	3,953	14	11,120	18	18
Guodu Town	2,835	330	3,917	24	7
Liudu Town	953	70	1,989	6	12
Longting Town	1,585	819	1,268	8	15
Loude Town	4,193	249	3,399	12	10
Qingyun Subdistrict	1,034	140	578	4	15
Quangou Town	1,079	526	10,040	24	5
Shilai Town	4,026	50	7,880	11	34
Wennan Town	2,946	1,643	6,504	27	29
Xiaoxie Town	2,619	1,365	11,173	26	1
Xinpu Subdistrict	100	430	2,968	4	6
Xinwen Subdistrict	335	1,602	2,455	7	9
Xizhangzhuang Town	6	617	10	2	1
Yangliu Town	5,978	3,532	14,975	34	15
Yucun Town	4,052	100	2,789	11	10
Yuejiazhuang Township	3,515	25	4,360	6	11
Zhai Town	428	764	20,829	25	9
Total	46,848	12,801	122,432	289	239
Proportion (%)	25.729	7.030	67.240	54.735	45.265

An assessment of the land circulation situation was conducted using ArcGIS 10.6 for Xintai City. Kernel density estimation was used to visualize the distribution of land circulation, as shown in Figure 4(a). High-density areas, represented by the color red, indicate frequent land circulation activities. These circulation activities are closely linked to farming conditions and have resulted in the formation of large-scale circulation zones on both sides of Chaiwen River. These zones are primarily concentrated in the flat terrains of plains and hills, which align with the topographical features of Xintai City.

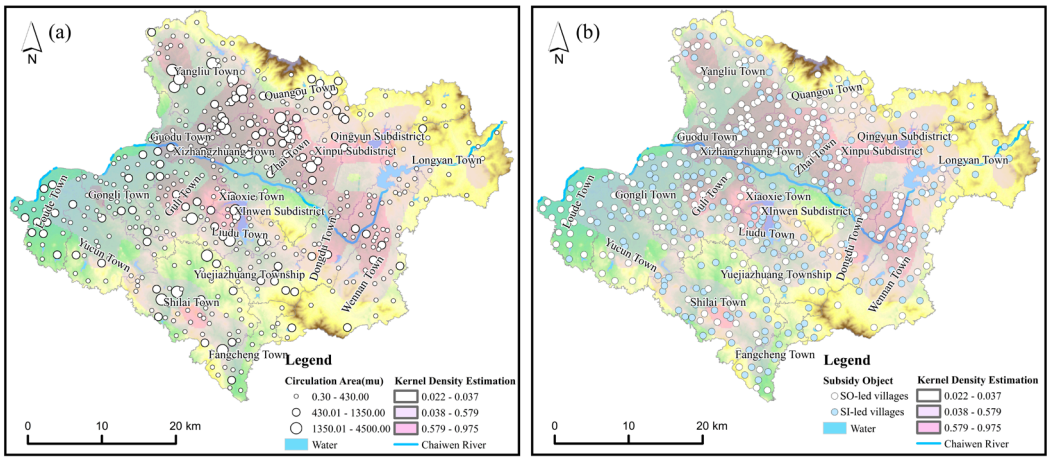

Figure 4. Spatial distribution of (**a**) land circulation and (**b**) village types dominated by subsidy recipients in Xintai City.

The observations are as follows. On the northern side of Chaiwen River, approximately 40% of the total land circulation occurs in flat terrain and the foothills of the northern mountains. The circulation foci are located at the boundaries between neighboring townships, indicating a network of interconnected land circulation. On the southern side of Chaiwen River, these areas are observed on the hillside terrains and can be clearly identified as land circulation circles. However, these areas are small in scale. In the eastern plains, the foci areas of large-scale land circulation are few. This situation can be attributed to the relative proximity to the county government or city management. Consequently, there are fewer idle lands and complex land circulation areas compared with other rural areas.

The spatial distribution of village types dominated by subsidy recipients varies. The northern and southern parts of Chaiwen River are primarily SO-led and SI-led villages, respectively (Figure 4(b)). This distribution pattern corresponds to areas where land circulation activities occur. First, in the concentrated zones of land circulation in the northern Chaiwen River, there are numerous SO-led villages, and in some towns, the percentage of villages belonging to this category exceeds 75%. Second, in the core area south of Chaiwen River, the number of SI-led villages is slightly higher than SO-led villages. In a few townships within the southernmost small land circulation circles, SO-led villages have the highest proportion. Lastly, in the eastern concentrated zones of the city, the number of SO-led and SI-led villages is approximately equal.

4.2. Analysis of the Regression Results of the Influencing Factors

Utilizing the White and corrected Breusch-Pagan tests, the results indicate that the LM statistic of the Breusch-Pagan test is 61.61, with a corresponding P-value of 0.000. The LM statistic of the White test is 179.94, and the corresponding P-value is 0.268. Since the P-value of the Breusch-Pagan test is less than the commonly used significance level (0.100), it suggests the presence of heterogeneity issues within the equation. Consequently, the feasible generalized least squares (FGLS) method was utilized to construct the model. After the necessary corrections were made, the model demonstrated P-values of 0.000, with adjusted R^2 values of 0.280 for Models 1, respectively, indicating a good fit. The regression findings are summarized in Table 3.

Table 3. Subsidy recipients and land Circulation regression.

Variable		Name		Model 1
Explanatory Variable		Village types dominated by subsidy recipients		−0.289*** (−7.390)
Control Variables	Land Circulation Environment	Dominant Village Type (Reference: Intravillage farmer dominated type)	Mixed Balance Type	0.102*** (2.682)
			Outside dominated	0.285*** (7.043)
			Extra village dominated type	0.095** (2.449)
		Presence of circulation incentive mechanism		−0.139*** (−3.674)
		Average land circulation price in villages		0.099** (2.398)
	Village Situation	Scale of working-age labor force		−0.071* (−1.851)
		Proportion of migrant workers		0.017 (0.407)
		Per capita disposable income		0.037* (0.988)
		Per capita arable land scale		−0.065 (−1.619)
	Village Agricultural Production Conditions	Proportion of non-agricultural land after circulation		−0.019 (−0.481)
		Village terrain		0.023 (0.584)
		Presence of idle land within the village		−0.087** (−2.299)
	Locational Conditions	Distance from the village to the city center		−0.038 (−0.945)
		Presence of village public transportation		−0.050 (−1.314)
Sample Size				528
R^2				0.300
Adjust R^2				0.280
F value				F=14.631, p=0.000

Note: * p<0.1, ** p<0.05, *** p<0.01, parentheses contain t-values.

Explanatory Variable: Model 1 demonstrates that the village types dominated by subsidy recipients have a statistically significant influence on land circulation, while the control variables do not exhibit any evident directional changes. The coefficient of village types dominated by subsidy recipients is −0.289, which is significant at the 1% level. This coefficient indicates a negative relationship between SI-led villages and the proportion of land circulated. This finding highlights the significant role of subsidy policy in influencing land circulation activity. In particular, land fertility protection subsidy has become an important source of income for outflowers, in addition to rent, because it serves as an economic incentive. When outflowers receive this subsidy, their psychological expectations and income needs are likely met, thereby increasing the proportion of land circulated. However, given that outflowers are no longer engaged in actual agricultural production, the subsidy policy's precise targeting expectations cannot be fully realized. This finding also validates the proposed hypothesis.

Land Circulation Environment: The regression results reveal that in contrast to the impact of the intravillage farmer-dominated type, land circulation primarily conducted by extra village domination plays a markedly significant role. This finding is indicated by the highest regression coefficient of 0.285. This aspect suggests that village marketization is considerably favorable for large-scale land circulation, particularly for circulation to entities outside of the intravillage farmer. The mixed management structure present in the village, along with the trust placed in the village collective, also contribute to land circulation. However, their effects are not as significant as those of external capital.

The observed regression coefficient of −0.139 for the circulation incentive mechanism indicates that local policies may have a negative impact on circulation. This phenomenon could be attributed to the inadequacy of local incentives in effectively reconciling the interests of outflowers and inflowers (Zheng, 2022). In addition, a considerably high land circulation price in villages, with a coefficient of 0.099, serves as a catalyst for the expansion of the land circulation scale.

Village Situation: The primary source of higher per capita disposable income in rural areas is non-agricultural labor, while rural areas have a greater amount of land resources and a higher willingness to engage in land circulation. This aspect is supported by a regression coefficient of 0.037. Conversely, a larger scale of per capita arable land, with a regression coefficient of −0.065, implies that vast expanses of arable land have altered farmers' expectations regarding their livelihoods and impeded the land circulation. By contrast, the scale of the working-age labor force and the proportion of migrant workers lack a significant influence on land circulation.

Village Agricultural Production Conditions: The presence of idle land has a significant inhibitory impact at a significance level of 1%, as indicated by a regression coefficient of −0.087. The reason is that when villages engage in land circulation, the increase in scale does not necessarily correspond to an increase in land plot size (Xie & Huang, 2022). In addition, fragmented circulation can result in idle land. In the context of limited conversion of land for non-grain purposes, no significant correlation exists between the proportion of non-agricultural land use and land circulation.

Locational Conditions: The distance of the village from the city center, which has a regression coefficient of −0.038, may be associated with limited market accessibility and markedly stable acreage owing to the significant distances. The availability of village public transportation is primarily managed at the county level. The presence of convenient transportation options enables greater flexibility in choosing between working in the county and on the land, resulting in a decrease in the number of farmers working "away from home." Therefore, this factor has a limited impact on land circulation and lacks statistical significance.

4.3. Robustness Checks

4.3.1. Robustness Test with Substitution of the Dependent Variable

Although farmers may only choose one of the contracted lands when the land is circulated, the per capita cultivated land area in the village remains fixed, and the overall amount of cultivated land circulation is dependent on the number of households involved in land circulation. On average, 31.7% of farmers in the village participated in circulation. In only 65 villages, the proportion of farmers engaging in circulation is below 5%, while in 192 villages, the proportion of farmers participating in circulation exceeds 30%. In some villages, all farmers have circulated their land. From the perspective of individuals involved in land circulation, land circulation is evidently a common occurrence within the village, with the scale and prevalence of circulation varying across villages. To ensure the reliability of the research findings, we also utilize the proportion of farmers involved in land circulation to the total number of farmers as an alternative measure for robust testing.

The regression results presented in Table 4 indicate an R^2 value of 0.238 and a P value of 0.000. This consistency with the initial regression results regarding the proportion of land circulation area highlights the reliability of the model and strengthens the validity of this study's findings and conclusions.

Table 4. Robustness test regression with the substitution of the dependent variable.

Variable	Name	Model 2
Explanatory Variable	Village types dominated by subsidy recipients	−0.218*** (−5.357)
Control Variables		Control
Sample Size		528
R^2		0.238
AdjustR^2		0.215
F value		F=10.637, p=0.000

Note: *p < 0.1, **p < 0.05, ***p < 0.01; the t values are enclosed in parentheses. The same notation applies below the table.

The regression analysis provides additional evidence with a statistically significant coefficient of −0.218 at the 1% level. SI-led villages have an impact on restricting land circulation, whereas land circulation activity in SO-led villages is more pronounced. This reverification of the research hypothesis reinforces this study's findings.

4.3.2. Subsample Robustness Test

Given the diversity of land circulation entities in Xintai City and variations in behaviors and influencing factors among different circulation entities, the impact of subsidies on internal circulation may differ from that on external or collective circulation. In reality, 378 villages have engaged in land circulation to extra village individuals or organizations, resulting in a cumulative area of 122,432 mu. These circulations have led to the cultivation of cash crops and fruit trees by the recipients, resulting in significant economic benefits and facilitating widespread land circulation. By contrast, 317 villages experienced land circulation solely among farmers within their own villages, amounting to a combined area of 46,848 mu, with the highest level of non-contractualization observed (Table 2, Figure 4). Following these circulations, the land was predominantly used for large-scale cultivation of grain crops. Lastly, 85 villages had their land circulated to village collectives, representing the smallest amount of land circulation, totaling 12,801 mu. Thus, the entire sample was divided into three subsamples based on the different entities: intravillage farmer circulated, extra village individuals and enterprises circulated, and village collective circulated. This division resulted in the creation of Models 3, 4, and 5. The results indicate that all explanatory variables passed the significance test in the subsamples, as outlined in Table 5.

Table 5. Robustness test regression results for the subsample.

Variable	Name	Model 3	Model 4	Model 5
Explanatory Variable	Village types dominated by subsidy recipients	−0.178*** (−3.134)	−0.345*** (−3.312)	−0.194*** (−3.955)
Control Variables		Control	Control	Control
Sample Size		317	378	85
R^2		0.161	0.379	0.226
AdjustR^2		0.119	0.244	0.193
F value		F=3.834, p=0.000	F=2.804, p=0.002	F=7.027, p=0.000

Regardless of the type of circulation, SI-led villages suppressed the scale of land circulation, thereby confirming the research hypothesis. However, the impact of this effect varies across different village types, dominated by subsidy recipients. In cases where land is circulated to intravillage farmers, SI-led villages experience a slight hindrance in land circulation, reflecting the complexity of internal land circulation dynamics. The most significant inhibitory effect is observed in the circulation of land to village collectives. Conversely, for circulation involving extra village individuals and enterprises, SI-led villages have significantly strengthened their inhibitory effect on land circulation.

4.3.3. Propensity Score Matching Test

We utilize a propensity score matching (PSM) approach to address potential biases that may arise from self-selection and could potentially distort the empirical findings. The villages are divided into control groups (SO-led villages) and treatment groups (SI-led villages), and nearest neighbor matching and radius matching methods are utilized for analysis. The PSM test confirms the previous results, even after accounting for sample selection biases. The evidence strongly supports the hypothesis that the scale of circulation in SO-led villages is larger.

Table 6. Results of the robustness test regression in the PSM analysis.

Methods	Difference (ATT)	Standard Errors	t	P
Nearest Neighbor Matching	−15.243	2.127	−3.765	0.000
Radius Matching	−13.362	2.127	−5.187	0.000

4.4. Moderating Effect of Subsidy and Circulation Incentives

Considering that current land circulation incentives primarily rely on financial subsidies, there may be interaction effects between these incentives and land fertility protection subsidies. To examine this, we constructed an interaction term between the two variables. Specifically, village types dominated by subsidy recipients and the presence of circulation incentive mechanisms were encoded as dummy variables, excluding a baseline category to avoid the dummy variable trap. After centralizing the data, we formulated Model 6 (Table 7). The adjusted R^2 of the model is 0.263, with an F-value of 12.740 and a P-value of 0.000, indicating that the model is statistically significant overall.

Table 7. Interaction regression results: village types dominated by subsidy recipients and circulation Incentives.

Variable	Name	Model 6
Explanatory Variable	Village types dominated by subsidy recipients	−0.294*** (−7.509)
	Presence of circulation incentive mechanism	−0.140*** (−3.690)
	Village types dominated by subsidy recipients × Presence of circulation incentive mechanism	0.054 (1.411)
Control Variables		Control
Sample Size		528
R^2		0.286
Adjust R^2		0.263
F value		F=12.740, p=0.000

The results show that, compared to Model 1 without the interaction term, subsidies allocated to SI-led villages have a more significant inhibitory effect on land circulation scale. The standardized regression coefficient of the interaction term is 0.054, suggesting that the presence of circulation incentives in SI-led villages increases the average land circulation area by 0.054 units. Although this indicator did not pass the test of statistical significance, it implies that circulation incentives do not substantially alter the effect of dominant subsidy recipient types on land circulation outcomes. Nonetheless, it hints that circulation incentives might partially offset the positive effect of subsidies provided to outflowers on promoting land circulation.

5. Conclusions and Discussion

5.1. Conclusions

In the initial stages, the scope and participants involved in China's agricultural land circulation were limited, resulting in minimal conflict between the distribution of subsidies and land circulation. However, as the distinction between contract rights for cultivated land circulation and management rights became markedly apparent, conflicts have significantly increased. This study aims to further classify the "agricultural support and protection subsidy" and focuses on the impact between different village types dominated by recipients of the land fertility protection subsidy and land circulation. To examine this phenomenon and its impact, data from 528 villages in Xintai City were analyzed. The main findings of this study are as follows.

(1) The scale of land circulation in SO-led villages is considerably large. From the perspective of the micro decision-making body, this subsidy serves as additional income that increases farmers' willingness to give up contracted land. However, the goals of the policy to protect soil fertility and achieve "precision production" have not been achieved because farmers are no longer involved in agricultural production.
(2) Different entities participating in circulation are affected by subsidy distribution in significantly different ways. When land is circulated to intravillage farmers, the circulation scale is relatively small, and SI-led villages have a markedly small effect in inhibiting the land circulation scale. By contrast, when the land is circulated to extra village individuals and enterprises, the land circulation scale in SO-led villages is larger and the promotion effect is stronger.
(3) Such factors as the dominant village type in the direction of land circulation, average land circulation price in villages, and per capita disposable income have a positive influence on the land circulation scale. Conversely, the circulation incentive mechanism, scale of the working-age labor force, and idle land within the village will hinder land circulation on a large scale.

5.2. Policy Implications and Discussion

Against the backdrop of China's current rural labor outflow resulting from urbanization and the aging of the rural labor force, the shift toward moderate-scale operations emerges as a crucial direction for agricultural development in China. In this context, the mechanism for distributing land income plays a pivotal role. To maximize the effectiveness of agricultural subsidies and facilitate the expansion of land operations, this study's findings suggest several policy recommendations.

(1) The current land fertility protection subsidy is intended to preserve the quality of land. However, in the land circulation context, this subsidy has become an additional financial advantage. The policy reform of the land fertility protection subsidy has not ensured that the subsidy received by the actual cultivators is consistent with their distribution. This situation

has hindered the transition from a universal subsidy policy to a targeted one. The conclusions drawn from the detailed agricultural support and protection subsidies differ from conventional subsidy recommendations, suggesting that the subsidy should be distributed to the actual cultivators. This difference arises because the land fertility protection subsidy, compared with the moderate-scale operation subsidy, targets different audiences, scales, and subsidy methods. Despite concerns from some quarters that distributing land fertility protection subsidies to outflowers may reduce enthusiasm among actual cultivators and potentially lead to the waste of agricultural resources, this subsidy awarded to outflowers has objectively intensified land circulation and is conducive to the scale of land management. This finding is consistent with the state's increasing investment in grain production and effort to restrict the abandonment of cultivated land.

Land fertility protection subsidy, compared with its original intention, has been transformed into a form of property income for farmers who have contracting rights. This transformation has resulted in a decrease in the effectiveness of the land quality protection policy. To achieve the goals of the policy, policymakers must coordinate the distribution mechanism of land income. A gradual reduction or even elimination of this subsidy to outflowers should be considered. Alternatively, subsidies could be restricted to land that has been successfully transferred and is being effectively utilized. Ultimately, land fertility protection subsidies should be targeted toward inflowers to achieve a "precision policy" reform that aligns with the goals of effective resource allocation and agricultural sustainability.

(2) The incentive mechanism for land circulation in the investigated region has not had a positive impact; instead, it has hindered land circulation. This effect is particularly pronounced when the subsidy is allocated to outflowers, as the guaranteed short-term income reduces their motivation to engage in land circulation.

First, the design of incentive measures should be adjusted based on the specific circumstances of subsidy implementation. Given the variations in land circulation status and agricultural development across regions, incentive mechanisms should account for regional differences. In areas with high circulation rates and advanced agricultural modernization, reducing direct subsidies and increasing support for inflowers may prove more effective. Conversely, in regions with low circulation rates, incentives should focus on facilitating outflowers' transition to ensure smoother land transfers. This differentiated incentive strategy allows for flexible policy adjustments tailored to local conditions, thereby preventing resource wastage caused by one-size-fits-all subsidy distribution.

Second, it is important to establish robust mechanisms for monitoring and adjusting incentives and subsidies to ensure their long-term effectiveness. The presence of incentive mechanisms in SI-led villages is beneficial for increasing the area of land circulation. Therefore, in SI-led villages, this can be achieved by providing productive subsidies or support for facility construction to encourage the inflow of land and promote efficient management. For instance, special subsidies for land integration can be implemented to offer comprehensive incentives, including infrastructure development, technical training, and financial assistance to those who participate in inflowers. In SO-led villages, incentives for outflowers should be linked to the progress of land transfers facilitated by outflowers. For example, outflowers could receive one-time subsidies and additional rewards after successfully transferring their land to inflowers. In this manner, the outflower can not only ensure specific economic interests but also motivate individuals to actively engage in land circulation.

Although this study has exerted effort to control various confounding variables to minimize the influence of endogeneity, there is still a possibility of a certain level of causal endogeneity in relation to the distribution of subsidy and land circulation. Additionally, due to data limitations, moderate-scale operation subsidy was excluded from the analysis. This omission prevents consideration of the potential interactions between different subsidy schemes, meaning the results cannot fully capture the combined effects of all agricultural subsidies on land circulation decisions. However, the findings of this research provide initial insights into the effects of land fertility protection subsidies on land circulation behavior. In the future, additional comprehensive research with complete data or the utilization of alternative methodologies could be conducted to accurately analyze the impact pathways connecting land fertility protection subsidy and other forms of agricultural support to the expansion of lands.

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