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# Can farmland transfer reduce vulnerability as expected poverty? Evidence from smallholder households in rural China

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**Introduction:** Extant literature has extensively explored farmland transfer's impacts, confirming its essential role in poverty alleviation. However, most studies focus on poverty measures that exclusively emphasize current poverty status without adequately addressing the potential of falling into or remaining in poverty. Furthermore, the role of farmland transfer in helping the smallholder households in rural areas appears to be underexamined in the literature.

**Methods:** To address this knowledge gap, this study investigates whether farmland transfer can reduce household vulnerability to poverty. A theoretical framework is developed to capture the mechanism by which farmland transfer has a vital role in smallholder households and impacts the probability of being poor in the future. The China Family Panel Studies Survey data set from 2010 to 2018 is used to explore this issue.

**Results and Discussion:** The results show that land transfer-out households are seemingly the most effective at reducing vulnerability, whereas the reduction effect is not obvious among transfer-in households. Specifically, the vulnerability of transfer-out households is reduced by about 39.52%. Furthermore, we analyze the reasons for heterogeneity in the poverty reduction effects and find that the key mechanism is on the labor resource allocation decision the heterogeneity of the effects of different types of income. Actually, for transfer-out households, farmland transfer can increase the probability of migrant work and business opportunities, as well as the labor input for non-agricultural production, which helps to reduce vulnerability to poverty. On the other hand, for transfer-in households, they will invest more labor in agricultural production and increase agricultural inputs, whereas increased inputs to agricultural production do not actually reduce vulnerability to poverty. Transferring out land can significantly increase farmers' wage income and thus compensate for the loss of farm income; however, the increase in farm income generated by transferring in land roughly offsets the loss of wage income for farmers. This study provides a new research perspective on the long-term effects of farmland transfer on rural poverty.

## KEYWORDS

farmland transfer, poverty vulnerability, future poverty, difference-in-difference, smallholder households

## 1. Introduction

Poverty eradication is a common goal of humanity. In recent years, as the reform of China's rural land system continues to progress, land transfer decisions are playing an increasingly important role in poverty alleviation. According to property rights theory, farmland transfer can contribute significantly to income growth as well as being an essential means for farmers to overcome poverty (Deininger and Jin, 2005). This is due to the fact that an unrestricted market for the transfer of land property rights allows for the transfer of comparative advantage, allowing both transfer-in and transfer-out farmers to specialize in the occupation to which they belong, increasing farmer productivity and their ability to combat poverty risks (Besley, 1995; Cheynier et al., 2013). Nonetheless, there are still many differences in the conclusions of existing researches on the impact of farmland transfer on rural poverty. Clarifying the impact of land transfer on farm poverty has important implications for poverty alleviation in underdeveloped areas.

Although most studies believe that farmland transfer can increase farmers' incomes (Tan et al., 2021; Yang et al., 2021), improve the productivity of farmers (Lu et al., 2020; Zhou et al., 2020), and reduce the risk of poverty for farmers (Wang et al., 2022), some scholars point out that farmland transfer is a double-edged sword that may also aggravate the risk of poverty for farming households (Li et al., 2021; He et al., 2022). The reason is that land is an important safeguard for farmers' livelihoods, having to carry out a variety of functions such as production, livelihoods and social security (Devereux, 2001; Davies et al., 2009). Farmers may lose their most fundamental source of revenue of land alienation, increasing their risk of poverty (Kanbur and Squire, 2001). Farmland plays a more prominent role in resisting poverty risks for Chinese farmers. Because small farmers are typical characteristics of rural areas in China. China's *per capita* cultivated land area is about 0.097 hectares, far below the world average level, which leads to the agricultural land playing a more important role in the basic living security of farmers (Adger and Kelly, 1999; Dercon and Christiaensen, 2011).

Further analysis reveals that there are currently two main reasons why scholars believe that the poverty-reducing effects of farmland transfer are wildly different. First, self-selection in farmland transfer is ignored. As agriculture is disadvantaged in terms of marginal output compared to non-agriculture (Christiaensen et al., 2011; Dev, 2017), farmers who are willing to transfer to land may themselves have significant advantages in terms of economic power, education and farming operations (Lagakos and Waugh, 2013), i.e., there is "self-selection." Most of the previous literature uses OLS (Ordinary Least Squares) estimation methods to measure the impact of farmland transfer on poverty, without taking into account the "self-selection" of the farmers in the sample, which may lead to biased estimation results. Second, the differences in the impact of farmland transfer on transfer-in and transfer-out households are ignored. Most studies usually study transfer-in and transfer-out households as a whole and do not take into account the different poverty risk pathways of transfer-in and transfer-out households after participating in farmland transfer, which inevitably leads to a misestimation of the poverty reduction effects of farmland transfer. As a result, despite the fact that a great number of studies on the poverty-reducing impacts of farmland transfer have been done, discrepancies in study methodologies and views have not resulted in total agreement on the current findings.

In addition, existing studies have overlooked one important issue, namely that only the short-term effects of farmland transfers have been analyzed, without considering the long-term effects. This is because poverty-measurement indicators are an ex-post measure that can only be used to statically measure the welfare status of an individual or household at a point in time, and do not reflect future welfare status and the associated risks (Garmezy, 1991; Moser, 1998; Dercon and Krishnan, 2000). The impact of farmland transfer on the current welfare of rural households is a short-term effect, but rural households may fall into poverty in the future as a result of various negative shocks, so policies based on the short-term effects of farmland transfer do not apply to those households that will fall into poverty in the future (Bouzarovski, 2014; Middlemiss and Gillard, 2015). It is well known that the "prevention" of poverty is far more important than the "cure" of poverty (Eriksen and O'Brien, 2007), and that the "prevention" of poverty requires an assessment of poverty vulnerability. Poverty vulnerability was introduced by the World Bank in the 2002 World Development Report to measure the likelihood of an individual or household falling into poverty in the future (Gillard et al., 2017; Koomson et al., 2020). Vulnerability to poverty is an ex-ante measure of poverty for farming households that can be used to measure the long-term effects of the transfer of farming land in a forward-looking manner, so that households that are likely to fall into poverty in the future can be accurately identified and policies can be developed to effectively prevent them from falling into poverty in the future (Middlemiss and Gillard, 2015; Koomson et al., 2020). On the basis of previous researches, we consider the farmland transfer of Chinese farmers as a quasi-natural experiment and re-examine the poverty reduction effects of farmland transfer from the perspective of poverty vulnerability.

In recent years, the Chinese government has paid great attention to improving the rural land system and made farmland transfer policies an important initiative to promote an effective link between smallholder farmers and modern agriculture (Lu et al., 2020; Fei et al., 2021; Yang et al., 2021). For a long time in the past, China's rural land has been a collective land property that cannot be bought and sold freely in the market like other commodities (Xu et al., 2020; Zhou et al., 2021). The old land policy has, to a certain extent, constrained agricultural productivity and deterred rural labor from moving to higher-income sectors and regions (Ye, 2015; Huang et al., 2020). To address this issue, the Chinese government has introduced a series of policies to continuously improve the land property rights system (Li et al., 2015; Kong et al., 2018). In 2017, China's Rural Work Conference plainly explained that farmland transfer should be accelerated, modest magnitude operations should be developed, the management structure should be optimized, and the promotion of scale operations should be combined with driving farmers to increase their income (Deng et al., 2019). In 2020, China's "Document No. 1" also states that farmland transfer profits should be progressively provided in the growth of rural operations (Liu et al., 2017). By the end of 2020, 37.3 million hectares of farmland had been transferred from farming households in China, accounting for 35% of the country's arable land area (Zhou et al., 2020). In the process, a large amount of surplus labor is generated and transferred to cities, supporting urbanization and industrialization (Andreas and Zhan, 2016; Wang and Zhang, 2017), and also breaking the disadvantages of rural land fragmentation by means of farmland transfer (Wang et al., 2012; Li et al., 2018), providing conditions for agriculture to achieve scale and modernization (Wilmsen, 2016; Wang and Zhang, 2017), and

becoming an effective path to poverty eradication practices in rural areas of China (Feng et al., 2014; Xu et al., 2018). In this context, does farmland transfer serve the function of “poverty reduction” for the current poor, but also “poverty prevention” for the quasi-poor who may fall into or return to poverty in the future? The answer to this question has important theoretical and practical implications.

Utilizing tracking data from five rounds of the China Family Panel Studies (CFPS) 2010–2018, we regard the farmland transfer practices in rural China as a quasi-natural experiment and investigate its impact on poverty vulnerability based on a progressive DID model. This paper mainly answers the following questions: (1) Does farmland transfer reduce poverty vulnerability of farmers in China? (2) How does the impact of farmland transfer on poverty vulnerability differ between transfer-out farmers and transfer-in farmers? (3) What is the underlying mechanism involved?

There are three contributions of this study. First, in terms of research subjects, we explored the relationship between farmland transfer and farmers’ future poverty from the perspective of poverty vulnerability. It is well known that the “prevention” of poverty is far more important than the “cure” of poverty. Existing researches ignore the impact of farmland transfer on future poverty prevention. Poverty vulnerability, as a dynamic, forward-looking ex ante poverty indicator, sheds fresh light on the topic of future poverty risk and the long-term impacts of farmland transfer on poverty alleviation. Second, in terms of the identification strategy, this paper mainly uses the DID method, which helps eliminate the interference of self-selective behaviors in the farmland transfer process, obtain the net effect of the farmland transfer on farmers’ future poverty. Most of the previous literature has not considered the issue of sample selection bias in models when analyzing the impact of farmland transfer on poverty, but whether or not farmers engage in farmland transfer is likely to be the result of self-selection. This is because farmers’ farmland transfer decisions can be influenced by household resource endowments, thus leading to the fact that whether farmers choose to transfer land or not is not completely random, and if traditional econometric methods are still used for estimation, the accuracy and validity of the model estimates will inevitably be reduced. Third, in terms of the research conclusions, this paper finds that farmland transfer can reduce the poverty vulnerability of transfer-out farmers, but has no significant effect on the poverty vulnerability of transfer-in farmers, which provides an important reference for the design and implementation of China’s land policies in the future.

The remainder of the paper is organized as follows: Section 2 is the literature review and research hypotheses. Section 3 introduces the identification strategy, variables, and data for this study. Section 4 tests the three hypotheses and presents the regression results. Section 5 covers the analysis of the impact mechanisms. Section 6 provides the discussions and related policy implications. Section 7 summarizes the main conclusions of this paper.

## 2. Theoretical analysis and hypothesis

### 2.1. Direct effect analysis

#### 2.1.1. Theoretical analysis of the transfer-out land affecting poverty reduction

Land is the main asset for most rural households (Ravallion and VanDeWalle, 2008). However, uncertainty and legal barriers prevent land from being bought and sold freely in the market like other

commodities (O’Laughlin et al., 2013; Wang and Zhang, 2017). According to modern property rights theory, property rights are the socially enforced right to choose between multiple uses of a good, including the right to own, possess, dominate, use, benefit and dispose of the good (Mayhew, 1985; Furubotn, 1988). China’s land property rights system has been in a constant process of change and improvement, and the introduction of the “three rights” to contracted land in 2014 means that farmers are given the right to dispose of and earn income from their land management rights, which can be freely transferred in the market, activating the performance of land property (Wang and Zhang, 2017; Zhou et al., 2020). The transfer of land out of the household can reduce the occurrence of idle and wasteful land use, reduce agricultural production and operational inputs, and enable farming households to obtain a relatively sustainable and stable income from land rent (Berge et al., 2014; Zhou et al., 2020).

#### 2.1.2. Theoretical analysis of the transfer-in land affecting poverty reduction

Duality economy theory suggests that because the amount of land is fixed, agricultural output tends to show diminishing marginal returns as the population base increases (Donato et al., 2008; Ren, 2015). Therefore, it is important to restructure land to improve the utilization of land resources, develop large-scale operations and transfer land to farmers with a higher level of agricultural production to achieve the marginal output levelling effect (Ruan and Xia, 2011; Shi et al., 2022). For farmland transfer households, the transfer of land has expanded the scale of land operations, promoted the development of agricultural mechanization, saved time and labor costs, and combined with the continuous input of agricultural technology and new varieties, has led to a significant increase in the land output rate, which in turn has led to a rapid increase in the production and operational income of farming households (Dong, 2018; Yang et al., 2020; Xiong and Wang, 2022).

On the basis of the above analysis, we propose hypothesis 1 and hypothesis 2.

*Hypothesis 1.* Transferring-in farmland can significantly reduce the vulnerability of farming households to poverty.

*Hypothesis 2.* Transferring-out farmland can significantly reduce the vulnerability of farming households to poverty.

### 2.2. Indirect effect analysis: labor allocation effects-household income effects

Farmland transfer can have labor allocation effects (Zhang, 2012). The essence of rural farmland transfer is that in the context of a multifactorial agricultural economy, the land rental market helps farmers with different land labor endowments to readjust their marginal products by transferring land use rights from those with lower land valuation to those who are more eager to increase their production value through a price equalization mechanism (Yu et al., 2014). In addition, farmland transfer helps facilitate the transfer of surplus rural labor from agriculture to other sectors (Zhang, 2012; Gao et al., 2020). This is an inherent mechanism for achieving higher farmers’ household income through farmland transfer.

Household income is the most direct and important factor in the poverty vulnerability of farmers (Banks et al., 2017; Ma et al., 2019). For the transfer-in farmer, owning more land can help him gain a certain degree of economies of scale and improve household operational income, but wage income decreases because of the decline in off-farm input time (Renwick et al., 2013; Liu et al., 2018). After leasing in land, farmers need to invest more money in agricultural production, and has less money available for investment and financial management, which reduces his property income (Li et al., 2018). After transferring in the land, the transfer-in households may need to purchase more good seeds and agricultural machinery, and receive more subsidies for good seeds and agricultural machinery, which increases their transfer income (Fei et al., 2021). Farmers who transfer out of the land have increased resources invested in the non-farm sector, and their wage income rises while their farm operational income decreases (Ma et al., 2020). On the other hand, farmers who transfer out of the land can get a stable rental income, and at the same time, the capital needed for agricultural production is reduced after transferring out of the land, and this capital can be used for financial investment, which increases property income (Guo and Liu, 2021; Yu et al., 2022). Under the current agricultural subsidy policy, despite the transfer out of the original contracted land, most regions still pay direct food subsidies and comprehensive agricultural subsidies directly to the original contracted households, thus, the transfer out of land may not lead to a decrease in transferring income (Li et al., 2014). Based on this, we propose hypothesis 2.

*Hypothesis 2.* farmland transfer promotes labor reallocation, resulting in household income effects to reduce farmers' poverty vulnerability.

Figure 1 shows the research framework of this paper.

### 3. Materials and methods

#### 3.1. Methodology

##### 3.1.1. Poverty vulnerability measurement

Poverty vulnerability, which connects risk shocks to the degree of household welfare, is often seen as unobservable, dynamic, and forward-looking, with a focus on poverty generation expectations (Eriksen and O'Brien, 2007; Bouzarovski, 2014). Poverty vulnerability is the probability that a household or individual will fall into poverty or fail to escape from poverty as a result of exposure to uncertainty risk shocks (Hardoy and Pandiella, 2009; Gillard et al., 2017). Poverty vulnerability is calculated as follows.

$$\hat{V}_i = Prob(\ln c_i < \ln z | X_i) = \Phi \left[ \frac{\ln z - X_i \hat{\beta}_{FGLS}}{\sqrt{X_i \hat{\theta}_{FGLS}}} \right] \quad (1)$$

Where  $\hat{V}_i$  is an estimate of the probability of future poverty for farmer  $i$ ,  $c_i$  is the value of *per capita* household consumption,  $z$  is the delineated poverty line,  $\Phi$  is the cumulative distribution function of the normal distribution,  $\hat{\beta}_{FGLS}$  and  $\hat{\theta}_{FGLS}$  denote the expected value and variance of future household consumption estimated by the FLGS

method, respectively.  $X_i$  is an observable variable, referring to Wang et al. in their examination of poverty vulnerability by introducing household characteristics variables (including household income, household size, land assets, liabilities, agricultural machinery, etc.) and household head characteristics variables (including age, gender, education, etc.; Wang et al., 2022).

##### 3.1.2. Did model

To examine the impact of farmland transfer on farmers' poverty vulnerability, the basic model is set up as in Eq. (2):

$$vul_{it} = \alpha + \beta transfer_{it} + \theta X_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2)$$

where,  $transfer_{it}$  is a dummy variable, with  $transfer_{it} = 1$  indicating that household  $i$  transferred out or transferred in land or participated in the transfer at time  $t$  and  $transfer_{it} = 0$  indicating not involved in farmland transfer.  $vul_{it}$  denotes the poverty vulnerability of farm household  $i$  in period  $t$ .  $X$  denotes a series of control variables affecting farmers' income, such as gender, age, and education level in the individual characteristics of the household head, and household size, land assets, and agricultural machinery assets in the household characteristics.  $\mu_i$  denotes individual fixed effects,  $\delta_t$  denotes time fixed effects, and  $\varepsilon_{it}$  is a random error term. In the empirical analysis, the regression analysis was conducted separately for transferred-in and non-transferred households, transferred-out and non-transferred households, and participated in the transfer and non-transferred households.

##### 3.1.3. Multi chain mediation effect model

Considering the interaction between labor allocation and income effects, i.e., the time-series characteristics of labor allocation for household income effects. With reference to existing studies (Wei et al., 2019; Han and Gao, 2020), the chain mediated effects model is designed to address this issue:

$$Med_{1,it} = \alpha + \beta_1 did_{it} + \theta X_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3)$$

$$Med_{2,it} = \alpha + \beta_1 did_{it} + \beta_2 Med_{1,it} + \theta X_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (4)$$

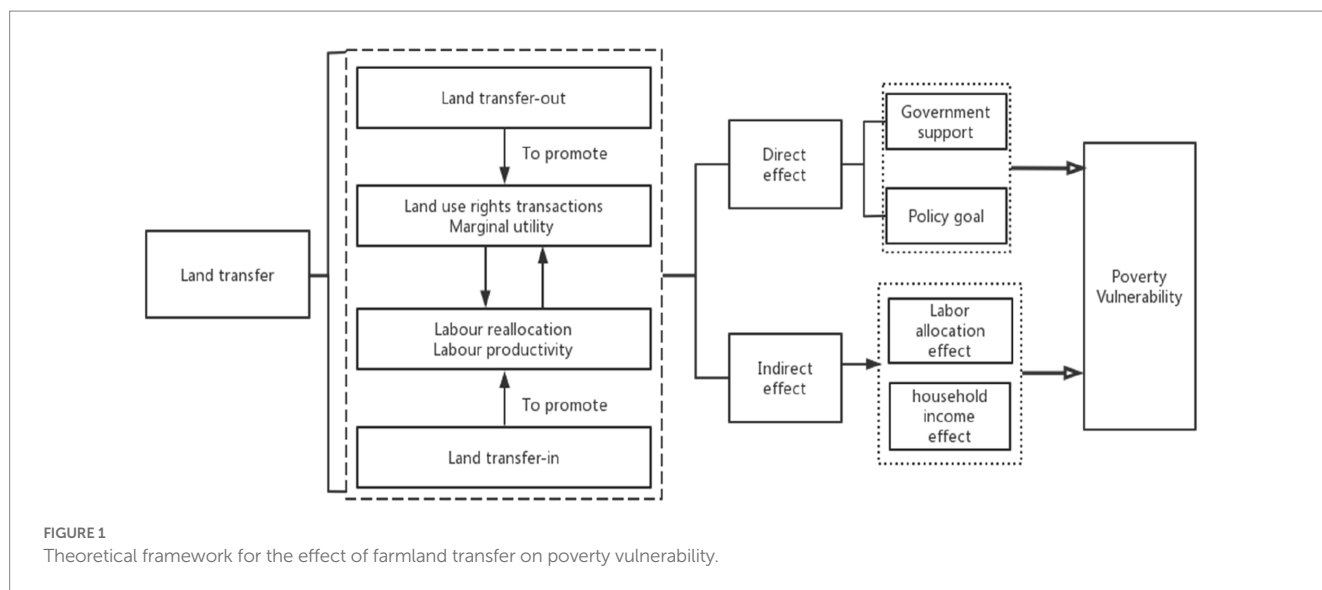
$$Vul_{it} = \alpha + \beta_1 did_{it} + \beta_2 Med_{1,it} + \beta_3 Med_{2,it} + \theta X_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (5)$$

where,  $Med_{1,it}$  represents innovation and labor allocation effects,  $Med_{2,it}$  refers household income effects. And Eqs. 3–5 constitute multiple equation systems.

### 3.2. Variables and data

#### 3.2.1. Dependent variable

To forecast household poverty vulnerability, this article uses household *per capita* consumption. One reason for using consumption to define poverty is that income is easily underestimated in micro-surveys, whereas consumption can better reflect the level of family welfare, and the other is that using income as an explanatory variable



can easily lead to strong endogenous problems in the measurement model. Regarding the choice of the poverty line, there are primarily two standards of *per capita* daily consumption of US\$1.9 and US\$3.1 proposed by the World Bank in 2015 (Ceriani, 2018; Chen et al., 2021), which we convert into ¥2,800 and ¥4,570 *per capita* annual consumption based on China's average purchasing power and CPI index. In the subsequent analysis, we focus on ¥4,570 as the poverty standard line.

### 3.2.2. Core explanatory variable

The core explanatory variables are whether to transfer out, whether to transfer in, and whether to transfer land. According to Table 1, 126 households participated in farmland transfer in 2010, accounting for 19.74% of the total sample, with 25 households transferring out, accounting for 3.91%, 107 households transferring in, accounting for 16.77%, and 6 households both transferring in and out, accounting for 0.94%. In the years that followed, the proportion of farmers who transferred land in rural China increased more than the proportion of transferred-in households, and as of 2018, the number of transferred-out households increased by 141, accounting for 26.01%, while the number of transferred-in households was 236, accounting for 36.99%, and the number of farmers who transferred land was 361, accounting for 56.68%. At the same time, the number of farmers who both transferred in and transferred out increased year by year, indicating that more and more farmers are replacing their land in order to realize centralized production and management, and farmers' awareness of production management has increased.

### 3.2.3. Control variables

Based on reference to other literature (Yu et al., 2014; Lu et al., 2020; Fei et al., 2021), we selected household head characteristics variables (gender of household head, age of household head, education level of household head) and household characteristics variables (household size, value of agricultural machinery, cash savings, etc.) that may have an impact on the poverty vulnerability of farm households as control variables.

The data in this paper are from the 2010–2018 China Family Panel Studies (CFPS) 24-province household survey data. Firstly, the data of non-rural households were excluded from the overall data; secondly, only the data of farm households that were all tracked in 2010, 2012, 2014, 2016, and 2018 were retained; finally, the data of farm households with serious deficiencies were excluded, and finally the data of 638 farm households remained, with a total of 3,190 observations. Descriptive results for the relevance variables are shown in Table 2.

## 4. Empirical results

### 4.1. Baseline regression results

As shown in Table 3, column (1) reports the effect of participation in farmland transfer on farm household poverty vulnerability. Furthermore, to validate the effects of different types of farmland transfer on farm household poverty vulnerability, columns (2) and (3) report the effect of farmland transfer in and farmland transfer out on farm household poverty vulnerability, respectively.

The results show that the coefficient of transfer is  $-0.0407$  and significant at the 1% statistical level, which indicates that farmland transfer can reduce farmers' poverty vulnerability. This conclusion is consistent with existing research findings. However, further analysis reveals that the coefficient of transfer-out is  $-0.0688$  and significant at the 1% statistical level; but the coefficient of transfer-in is  $-0.0193$  and insignificant. Thus, farmland transfer does reduce the vulnerability of farm households to poverty, but mainly in terms of its poverty-reducing effect on the transfer-in farm households and not in terms of its poverty-reducing effect on the transfer-out farm households.

In addition, we calculated the reducing effect size. During 2010–2018, the average poverty vulnerability of farmers involved in transfers-out farmland are 0.1741. Through land transfers out, the poverty vulnerability of this group of farming households was significantly reduced by 0.0688. As a result, the transfer-out farmland reduces poverty vulnerability by about 39.52%.

TABLE 1 Sample distribution of core explanatory variables.

Year	Transfer-in		Transfer-out		Transfer-in and transfer-out		Transfer-in or transfer-out	
	Sample size	Percentage	Sample size	Percentage	Sample size	Percentage	Sample size	Percentage
2010	107	16.77%	25	3.91%	6	0.94%	126	19.74%
2012	155	24.29%	63	9.84%	10	1.57%	208	32.61%
2014	200	31.34%	97	15.20%	19	2.97%	278	43.57%
2016	225	35.27%	130	20.37%	27	4.23%	328	51.41%
2018	236	36.99%	166	26.01%	41	6.43%	361	56.58%

TABLE 2 Definitions and descriptive statistics of variables.

Variables	Definitions	Obs	Mean	SD	Min	Max
<b>Dependent variable</b>						
Vulnerability	Poverty Vulnerability	3,190	0.2185	0.3161	0.0090	0.7151
<b>Independent variable</b>						
Transfer	Transfer-in or transfer-out	3,190	0.4078	0.4915	0	1
Transfer-in	Transfer-in lands	3,190	0.2893	0.4535	0	1
Transfer-out	Transfer-out lands	3,190	0.1507	0.3578	0	1
<b>Control variables</b>						
Age	Age of household head in survey year	3,190	54.0062	10.7957	23	91
Gender	Gender of household head; Female = 0; male = 1	3,190	0.8414	0.3653	0	1
Education	Years of education of household head	3,190	6.2435	4.0500	0	16
Family size	Number of persons in the household	3,190	3.8918	1.9570	1	15
Labor size	Number of labor force population	3,190	2.4281	1.6134	1	12
Deposit	Logarithm of bank deposits or cash	3,190	5.1161	4.5876	0	13.8155
Machinery	Logarithm of agricultural machinery assets	3,190	4.5082	4.0686	0	13.4588
Land	Logarithm of land assets	3,190	9.3046	2.9903	0	14.8495
Gift	Logarithm of investments in human relations	3,190	5.5329	3.3148	0	11.8494

### 4.2. Parallel trend analysis and policy dynamic effects

In this section, we use event analysis to examine parallel trends and to adjust the dynamic effects of farmland transfer (including transfer-in and transfer-out). The event analysis model is shown in Eq. (6):

$$vul_{it} = \alpha + \sum_{h \geq -3} \beta_h did_{it}^h + \theta X_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (6)$$

Based on Eq. (1), we construct a new variable  $did_{it}^h$ , which represents the event impact of farmland transfer (including transfer-in

and transfer-out). In the model, the year of farmland transfer is taken as the base year. A graphical technique is used to investigate parallel trends and dynamic impacts.

Figure 2 reports the variation of the coefficient of variable  $did_{it}^h$  in Eq. (6) over time (confidence interval 95%). Before the point of farmland transfer, the change of poverty vulnerability can not be significantly different from 0. Therefore, this study satisfies the parallel trend hypothesis.

Also, analysis of the dynamic effects of the policy shows that the vulnerability of farm households to poverty has been significantly reduced for three consecutive years after the transferring out land, and, the reduction effect is increasing every year. However, the transferring in land did not result in a significant reduction in the

TABLE 3 The effect of farmland transfer on poverty vulnerability: DID method.

Variables	(1)	(2)	(3)
Transfer	-0.0407*** (0.0163)		
Transfer-in		-0.0193 (0.0223)	
Transfer-out			-0.0688*** (0.0238)
Age	0.0042 (0.0066)	0.0031 (0.0069)	0.0049 (0.0065)
Gender	0.2211* (0.1226)	0.2237* (0.1210)	0.2025* (0.1232)
Education	-0.0142** (0.0061)	-0.0152** (0.0062)	-0.0132** (0.0061)
Family size	0.0207*** (0.0057)	0.0219*** (0.0057)	0.0206*** (0.0057)
Labor size	-0.0243*** (0.0016)	-0.0257*** (0.0016)	-0.0242*** (0.0016)
Deposit	-0.0031** (0.0012)	-0.0052*** (0.0012)	-0.0027** (0.0012)
Machinery	0.0002 (0.0014)	-0.0008 (0.0019)	0.0004 (0.0014)
Land	-0.0141*** (0.0023)	-0.0235*** (0.0023)	-0.0138*** (0.0023)
Gift	-0.0003 (0.0019)	-0.0008 (0.0019)	-0.0003 (0.0019)
Year-FE	Y	Y	Y
Individual-FE	Y	Y	Y
Obs	3,190	3,190	3,190
R <sup>2</sup>	0.2942	0.2933	0.2936

The standard error of clustering to individual level is shown in parentheses.

\*Statistically significant at 10% level.

\*\*Statistically significant at 5% level.

\*\*\*Statistically significant at 1% level.

vulnerability of farm households to poverty. Therefore, we need to use the DID model for a more in-depth analysis.

$$PS_i = \Pr[D_i = 1|X_i] = E[D_i = 0|X_i] \tag{7}$$

### 4.3. Robustness tests

$$ATT = \frac{1}{N^t} \sum_{i \in I^t \cap S} \left\{ Y_i - \sum_{j \in I^c \cap S} W_{ij} Y_j \right\} \tag{8}$$

#### 4.3.1. Changes to the poverty threshold

In the above analysis, we have mainly used an average daily consumption level of US\$3.1 as the poverty threshold. In this section, we further conduct robustness tests using an average daily consumption level of US\$1.9 as the poverty criterion line, and the results are shown in Table 4. There are no significant changes in the sign and significance of the coefficients on all policy variables compared to the baseline model, thus arguing the robustness of the result.

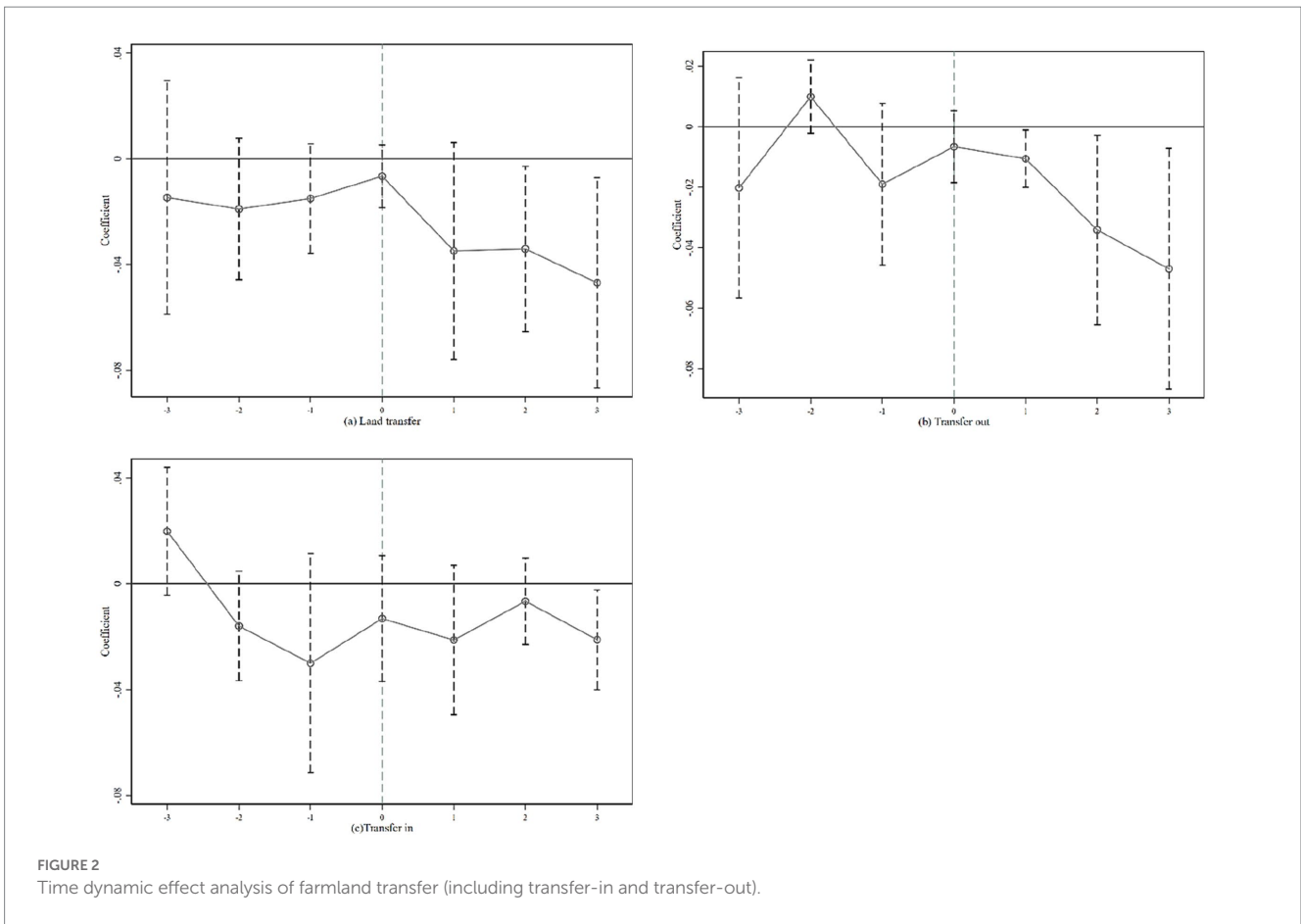
#### 4.3.2. Use the PSM-DID method

In an ideal quasi-natural experiment, the treatment and control groups' samples are drawn at random (Hatzenbuehler et al., 2012; Cai et al., 2016). However, when farmers decide whether to participate in farmland transfer, each individual's strengths in various areas must be considered, including the economy and the environment. This could result in sample selection bias and significant differences between the treatment and control groups prior to policy implementation (Rassen et al., 2012). A propensity score matching (PSM) technique is employed in this research to eliminate sample selection bias by matching treatment and control group samples one-to-one. The PSM estimation method is used to test the robustness of the Logit regression results. The logit model is used to calculate the conditional probability fitting value of the sample farmers' farmland transfer, which is the propensity score (PS).

Among them,  $N^t$  is the number of samples of farmland transfer households,  $I^t$  is the sample set of the disposal group (participating in farmland transfer),  $I^c$  is the sample set of the control group (not involved in farmland transfer),  $Y_i$  is the observed value of the sample of the disposal group, and  $Y_j$  is the sample of the control group. The observations of  $j$ ,  $S$  is the common support domain set,  $W_{ij}$  is the matching weight, and ATT is the average disposition effect. The main method is to match the samples of the control group and the disposal group according to the propensity value to ensure that there is no significant difference in their main characteristics; then use the control group to estimate the counterfactual state of the treatment group (that is, not participating in the transfer), and calculate the poverty caused by farmland transfer. Net treatment effect of vulnerability ATT. Table 5 displays the PSM-DID regression results after excluding samples that were not successfully matched. Specifically, there is no change in the sign or significance of the all land-transfer explanatory variables, which suggests that the findings of this paper are robust.

#### 4.3.3. Add the province-year joint fixed effects

We controlled for time fixed effects and individual fixed effects in the preceding analysis. However, because policies in China are generally implemented at the provincial level, and



**TABLE 4** Robustness test results: US\$1.9 poverty threshold.

Variables	(1)	(2)	(3)
Transfer	-0.0495*** (0.0174)		
Transfer-in		-0.0022 (0.0051)	
Transfer-out			-0.0557** (0.0206)
Controls	Y	Y	Y
Individual -FE	Y	Y	Y
Year-FE	Y	Y	Y
Obs	3,190	3,190	3,190
R <sup>2</sup>	0.1866	0.2237	0.1862

The standard error of clustering to individual level is shown in parentheses.  
 \*Statistically significant at 10% level.  
 \*\*Statistically significant at 5% level.  
 \*\*\*Statistically significant at 1% level.

**TABLE 5** Robustness test results: PSM-DID method.

Variables	(1)	(2)	(3)
Transfer	-0.0305*** (0.0098)		
Transfer-in		-0.0122 (0.0151)	
Transfer-out			-0.0413*** (0.0104)
Controls	Y	Y	Y
Individual -FE	Y	Y	Y
Year-FE	Y	Y	Y
Obs	2,140	2,140	2,140
R <sup>2</sup>	0.1016	0.1233	0.1412

The standard error of clustering to individual level is shown in parentheses.  
 \*Statistically significant at 10% level.  
 \*\*Statistically significant at 5% level.  
 \*\*\*Statistically significant at 1% level.

some provinces may also implement some farmland transfer policies, the effect of different provinces over time is difficult to capture by the aforementioned time-fixed and individual-fixed effects (Zhou et al., 2020), this paper further introduces joint province-time fixed effects as a way to control for the land-transfer effects at the provincial level. Robustness tests are

conducted on the previous findings. The regression results after introducing the joint province-time fixed effects are shown in Table 6. The primary explanatory variable transfer (including transfer-in and transfer-out) not change considerably after correcting for the province-time impact, supporting the earlier conclusion.



## 5. Further analysis

### 5.1. Mechanism analysis: labor allocation effects

In this section, we try to find the potential mechanisms by which farmland transfer (including transfer-in and transfer-out) work. For farmland transfer in, we introduce two new variables, the number of laborers participating in agricultural production and the net household income *per capita*. As shown in Table 7, the column (1) shows that the coefficient of transfer-in is 0.0321 and significant, which indicates that farmland transfer in requires increased inputs of labor for agricultural production. However, the increase in labor inputs for agricultural production has not significantly raise net household income *per capita*, as reported in column (2). In column 3, this conclusion is further verified. The coefficient of transfer-in is 0.0088 and insignificant, which indicates that transfer in of land does not significantly reduce the poverty vulnerability of farm households.

For farmland transfer out, we also introduce two new variables, the number of outworking labor force and the net household income *per capita*. As shown in Table 8, the column (1) shows that the coefficient of transfer-in is 0.0515 and significant, which indicates that the transfer out of land will lead to more rural labor going out to work. It is worth noting that an increase in the number of migrant workers can significantly raise the income levels of farming households, as reported in column (2). In column 3, this conclusion is further verified. The coefficient of transfer-out is 0.0579 and significant, which indicates that transfer out of land can significantly reduce the poverty vulnerability of farm households. Therefore, the chain mediation effect is expressed as “transfer out of land → increasing the outworking workforce → increasing net household income → reducing poverty vulnerability.”

### 5.2. Mechanism analysis: analysis of the contribution of farmland transfer to household income

Based on the above analysis, it is clear that transfers out of land can significantly increase the net household income of farmers and thus reduce poverty vulnerability, but transfers in of land cannot do so. In this section, we classify farm-household income into five categories: operational income, transfer income, property income, wage income and agricultural income. Among them, operational income includes income from agricultural production and income from non-agricultural production. Transfer income mainly includes government subsidies to farmers, etc. Property income refers to income earned from financial investments. Wage income is mainly the income of farmers working outside the home. Agricultural income represents the income from agricultural production. With reference to existing studies, we use the treatment group average treatment effect (ATT) obtained from the propensity score matching method to demonstrate the extent to which farmland transfer affects different types of income, with a 1:1 nearest neighbor matching, set up in line with the PSM-DID model above.

As shown in Table 9, the net household income of farmers who transferred their land increased by RMB 2030 compared to those who did not, of which operational income increased by RMB1235, an increase of 60.83%, while wage income did not increase significantly.

TABLE 6 Robustness test results: Add the province-year joint fixed effects.

Variables	(1)	(2)	(3)
Transfer	-0.0319*** (0.0107)		
Transfer-in		-0.0128 (0.0191)	
Transfer-out			-0.0502*** (0.0141)
province-year joint fixed effects	Y	Y	Y
Controls	Y	Y	Y
Individual -FE	Y	Y	Y
Year-FE	Y	Y	Y
Obs	3,190	3,190	3,190
R <sup>2</sup>	0.2136	0.2123	0.1942

The standard error of clustering to individual level is shown in parentheses.

\*Statistically significant at 10% level.

\*\*Statistically significant at 5% level.

\*\*\*Statistically significant at 1% level.

TABLE 7 Mechanism test results: transfer-in.

Variables	(1)	(2)	(3)
	Agricultural labor	Household net income	Poverty Vulnerability
Transfer-in	0.0321*** (0.0055)	0.0101 (0.0960)	-0.0088 (0.0161)
Agricultural labor		-0.0165 (0.0213)	0.0408 (0.0533)
Household net income			-0.0805*** (0.0105)
Controls	Y	Y	Y
Individual -FE	Y	Y	Y
Year-FE	Y	Y	Y
Obs	3,190	3,190	3,190
R <sup>2</sup>	0.1856	0.1910	0.2396

The standard error of clustering to individual level is shown in parentheses.

\*Statistically significant at 10% level.

\*\*Statistically significant at 5% level.

\*\*\*Statistically significant at 1% level.

The net household income of farmers who have transferred out their land increased by RMB6875, about 86% of which came from an increase in wage income, with other income contributing less to the change in net household income. For farmers who transfer out of their land, the probability of the household labor force engaging in non-farm operational increases after the farmland transfer, so the decline in household operational income is less than the decline in income from agricultural production. However, for farmers who transferred in their land, the decrease in wage income by RMB2053 was much higher than the increase in operational income, so the net household income of farmers who transferred their land fell instead compared to farmers who did not transfer their land. In conclusion, the results show that farmland transfer does have a significant income

growth effect, but the increase in income is mainly due to the significant increase in the income of the farmers who transferred out of the land; as the agricultural production and operational income of the farmers who transferred into the land did not increase significantly, the poverty reduction effect of farmland transfer on the farmers who transferred into the land was not significant.

## 6. Discussion

Existing research is divided on whether farmland transfers may alleviate farmer poverty, particularly future poor. We contend that these disparities are the result of neglecting the diverse impact of farmland transfers on transfer-out and transfer-in farmers, as well as varied sources of income such as wage income and agricultural production income. The paper contends that these disparities in empirical data are attributable to a failure to account for the varied impact of farmland transfer. Misleading results may be obtained when disparities in the impact of farmland transfers on transfer-out and transfer-in farmers, as well as on different sources of income, such as wage income and agricultural income, are ignored.

From a poverty vulnerability perspective, this paper analyses the impact of farmland transfer on the future poverty of transferred-in and transferred-out farmers, based on inter-period data from 638 farming

households in China. It is found that farmland transfer does reduce poverty vulnerability in general, but the poverty reduction effect is mainly due to the fact that farmland transfer significantly reduces the poverty vulnerability of the transferred-out farmers.

Further analysis shows that the difference in the impact of farmland transfer on poverty vulnerability is mainly due to the significant labor allocation effect of farmland transfer. In other words, farmers who transfer out of the land put more labor into non-farm production (e.g., increased probability of going out to work and starting a business), while farmers who transfer into the land put more labor into agricultural production. However, an analysis of the contribution of farmland transfer reveals that for farmers who transferred their land out, the increase in wage income was much higher than the decrease in business income, and the level of net household income rose significantly, with nearly 86% of this increase coming from wage income. In contrast, for the farmers whose land was transferred in, the income improvement effect of agricultural operations and production was weaker, resulting instead in no significant improvement in the household income of the nongame households whose land was transferred in.

Generally speaking, farmland transfer has an impact on the allocation of labor resources for both transfer-in and transfer-out farmers, and promotes the division of labor, but the improvement of labor productivity depends not only on the division of labor, but also on the improvement of specialized production (Wang and Zhang, 2017; Li et al., 2018; Shi et al., 2022). However, China's current farmland transfer policy focuses more on encouraging farmers with advantages in agricultural production to transfer into the land for large-scale operation, and seldom involves technical training to improve specialized production (Long et al., 2007, 2012; Chen et al., 2014). The labor force of farmers transferred out of land is mainly engaged in unskilled work, and the level of specialization can easily be improved, while large-scale agricultural operations require relevant professional management knowledge to improve the efficiency of production and operation (Ho and Lin, 2003; Mullan et al., 2011; Long, 2014). According to data from the China Household Finance Survey 2015, for example, less than 15% of land-transferred farmers have ever received agricultural technology instruction, indicating that the current large-scale agricultural operation of transfer-in farmers in China is more reflected in the expansion of production scale, but lacks corresponding management and technology, and does not improve the level of specialized production (Yang et al., 2022; Zhou et al., 2022; Li et al., 2023). Our findings offer a fresh look at future poverty and the long-term viability of poverty-reduction initiatives.

However, it is important to note that the research methodology and thinking of this paper still needs to be refined. Firstly, this study

TABLE 8 Mechanism test results: transfer-out.

Variables	(1)	(2)	(3)
	Outworking labor	Household net income	Poverty Vulnerability
Transfer-out	0.0515*** (0.0113)	0.2239*** (0.0763)	-0.0579** (0.0227)
Outworking labor		0.0280*** (0.0077)	-0.0119*** (0.0024)
Household net income			-0.0309*** (0.0085)
Controls	Y	Y	Y
Individual -FE	Y	Y	Y
Year-FE	Y	Y	Y
Obs	3,190	3,190	3,190
R <sup>2</sup>	0.1716	0.1835	0.2100

The standard error of clustering to individual level is shown in parentheses.

\*Statistically significant at 10% level.

\*\*Statistically significant at 5% level.

\*\*\*Statistically significant at 1% level.

TABLE 9 Propensity scores matching average treatment effect results.

Variables	Operational income	Transfer income	Property income	Wage income	Agricultural income	Household net income
Transfer ATE	1235.0332*** (397.5610)	231.7371 (326.1757)	269.4137*** (37.0362)	304.5172 (690.1033)	1206.2211*** (301.0083)	2030.1692** (989.0143)
Transfer-out ATE	-732.1089 (637.6904)	769.6891 (619.1041)	536.2146*** (90.0467)	5918.2281*** (1278.1448)	-1318.9187*** (350.1035)	6875.3143*** (1661.0538)
Transfer-in ATE	1634.5209*** (496.5021)	-501.3569** (209.1012)	31.2139 (38.0649)	-2053.3321** (605.1296)	2297.4631*** (348.1137)	-1467.0157 (983.0421)

The standard error of clustering to individual level is shown in parentheses.

\*Statistically significant at 10% level.

\*\*Statistically significant at 5% level.

\*\*\*Statistically significant at 1% level.

focuses on rural China and does not consider samples from other countries. Therefore, how farmland transfer affects the poverty vulnerability of farm households needs to be more fully verified in the future. Secondly, in terms of cause analysis, this study is mainly based on the heterogeneity of farmland transfer types and income sources, and may have overlooked other potential mechanisms, and more empirical studies are needed to further complement and improve the relevant impact mechanisms. Thirdly, in the robustness test, we used a range of methods such as PSM-DID to mitigate endogeneity issues, but a better approach would be to test using instrumental variables, which is a difficult but meaningful exercise for future research.

## 7. Conclusion

Based on data from the China Family Panel Studies (CFPS) from 2010 to 2018, this research explores the influence of farmland transfer on future poverty. The paper first estimates poverty vulnerability using the vulnerability theory of expected poverty, and then constructs a poverty vulnerability model using the DID method to quantify the likelihood of farm households falling into poverty in the future and reassess the poverty reduction effect of farmland transfer with a forward-looking perspective. The following basic conclusions are presented.

- (1) Farmland transfer does reduce the poverty vulnerability of farming households in general, but the poverty reduction effect is mainly due to the fact that farmland transfer significantly reduces the poverty vulnerability of farmers who transfer out of the land and has no significant effect on the poverty vulnerability of farmers who transfer into the land. Specifically, the poverty vulnerability of farmers who transfer out of the land is reduced by an average of 39.52%.
- (2) The difference in the poverty reduction effect of farmland transfer is due to the fact that farmland transfer produces a significant improvement in the allocation of labor, that is, farmers who transfer out of the land put more labor into non-agricultural production (e.g., increased probability of working outside the home and starting a business), which increases net household income and reduces poverty vulnerability, while farmers who transfer in of the land put more labor into agricultural production, which does not increase net household income and does not reduce poverty vulnerability.
- (3) The contribution of farmland transfer to the household income of different types of farmers differs. For farmers who transfer out of the land, the increase in wage income was much higher than the decrease in operational income, and the level of net household income of farmers rose significantly, of which 86% of the increase came from wage income. However, for the farmers who transfer in of the land, agricultural production income and operational income grew less, which resulted in no significant improvement in the net household income of the farmers who transfer in of the land.

The research reveals that the poverty-reducing impacts of farmland transfer need to be enhanced further, and that farmland transfer in particular does not considerably raise farm households' net household income. The following policy recommendations are offered based on the preceding study. First, China should improve agricultural technology training, raise farmers' management awareness, take advantage of

large-scale and intense production, boost agricultural production efficiency, and increase the household income of farmers who has been transferred into land (Tian et al., 2022; Zhao, 2022). At the same time, for farmers who have not participated in farmland transfer, the government should guide them according to their household resource endowments so that they can participate in the farmland transfer process, and increase their net household income. Second, China's agricultural support and protection policies should be improved. Using the current subsidy policy for purchasing agricultural machinery as an example, only farmers who purchase large-scale agricultural machinery can obtain this portion of the transfer payment income, but most small and medium-sized transfer-in farmers are unable to purchase large-scale agricultural machinery and thus cannot benefit from it which may result in the phenomenon of the poor getting poorer and the rich getting richer, leading to the further expansion of the inequity (Deng et al., 2022; Wei, 2022). As a result, agricultural subsidy policy standards must be adjusted. Farmers who have transferred into the small to medium sized land may benefit as well. Finally, the above analysis finds that farmland transfer mainly contributes to the growth of net household income through wage income and property income, but the contribution of farmland transfer to property income is still extremely low, so the government needs to further improve the farmland transfer market to reveal the asset value of land resources, increase farmers' property income, and enhance farmers' resilience to future poverty. In order to achieve this goal, China should develop a clear and appropriate national framework for transferring land management rights and strengthen the process for transferring rural land management rights.

## Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

## Author contributions

JC: conceptualization. JC and MY: methodology, formal analysis, resources, writing—original draft preparation, and visualization. MY: software, validation, and writing—review and editing. JC and ZW: investigation. MY, ZZ, and JZ: data curation and supervision. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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