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Article

Farmland Rental Participation, Agricultural Productivity, and Household Income: Evidence from Rural China

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Abstract: The rural land rental market is playing an increasingly important role in the agricultural transformation period for developing countries, including China, where rural farmland rental is highly context-specific with the implementation of the collective-owned rural land system; thus, in turn, the access to farmland rental markets for rural households has profoundly influenced their livelihood strategies and income earnings. This paper investigates the income impact differences caused by rural households' farmland rental participation activities and explores such impact mechanisms by further evaluating the income impacts caused by rental area and household agricultural productivity. Data from the Chinese national household survey were used for estimating the empirical models. Our results show that farmland renting has positively affected households' on-farm and total income, but there is no significant effect upon off-farm income. According to income differences across quantiles, we find households with high on-farm income are more sensitive about enlarging their farm size by renting farmland, and households with middle and upper-middle off-income may benefit more from renting out their farmland. Furthermore, the joint effects of renting area and household agricultural productivity on lessee households' farm income is significantly positive. For lessor households, our results indicate that renting out farmland did not improve their off-farm and total income as it may have a limited effect on farm household labor distribution. Our findings suggest that engaging in farmland rental activity can enhance farming productivity efficiency and poverty alleviation among rural households. Under the collective-owned rural land system, it is urgent and necessary to initiate and design incentive policies to encourage highly efficient large farms to expand the farm size and provide smallholders with equal opportunities to engage in farmland rental activities.

Keywords: farmland rental market; household income; agricultural productivity; rural land reform



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1. Introduction

Farmland is the primary production means in agrarian economies, and a well-functioning land market is necessary for enhancing land use efficiency and contributing to agricultural development. A growing branch of literature has been addressing the significant role played by farmland rental markets in increasing income and farmland distribution equity among farm-owning households in developing countries [1–7], including China [8,9], where the rural farmland rental market is highly context-specific with the practice of collective ownership [10].

The most significant difference between farmland rentals in China and other countries is that only farmland management rights can be transferred to lessee units. At the same time, the village collective retains the ownership and the lessor households keep the contractual rights [10,11]. Chinese rental markets hold more importance as a land redistribution mechanism rather than as means of administrative reallocation [10]. Over the decades since the beginning of the Household Responsibility System (HRS) land reform (1978), many changes have occurred in the farmland rental system, from the prohibition of

farmland rentals among farmers to the legalization of farmland rental activities. The HRS initially marked dramatic changes for land tenure institution and production relations—chiefly, a shift from collective farming to household-based farming [12]. HRS was widely recognized as a successful reform for stimulating rural households' incentives to increase their production yield, boosting autarkical small-scale farming in rural China [13,14]. With the requirement for intensive farming and the growth of off-farm work opportunities among farmers, the farmland rental market emerged after almost two decades of HRS reform [15]. In 2014, the Three Property Rights Separation (TPRS) reform reconstructed the farmland property rights system and further separated land management rights from land contractual management rights by legalizing national farmland rental practices [14]. By the end of 2020, the total farmland rental area reached 37 million ha¹, which accounted for 30% of the total farmland area in China.

Farmland is a fundamental asset for determining rural households' livelihood strategies [16,17]. Thus, farmland rental participation is strongly associated with the reallocation of land holdings and labor endowment distribution between farming and non-farming activities; it therefore affects household income earnings. Previous studies have documented that increasing household farm size by renting farmland from others ("rent in") can enhance agricultural output and farm income [7,18–20]; however, renting out farmland ("rent out") had a limited and mixed effect on farm income [6,19]. Furthermore, the impact of farmland rental on off-farm income remains controversial [19,21,22]. Studies on the exact impact mechanism of farmland rentals on household income have been neglected despite the merits. Household agricultural productivity holds important implications for determining farmland rental strategies, which have not attracted adequate research attention thus far. Farmland rental markets facilitate the transfer of land use rights from less effective producers to households with higher agricultural capabilities through the farmland rental market [7,10].

Moreover, the close correlation between productive efficiency and farm size implies that the household on-farm income may be affected by households' agricultural production conditions and the amount of area being rented or rented out [23–26]. For rural households with off-farm earnings, it is unclear whether the increase or decrease in non-agricultural labor inputs brought about by land outflow (inflow) can affect such households' off-farm incomes. In this regard, this paper aims to investigate income impact differences resulting from rural households' farmland rental activities and explore this impact mechanism by further evaluating the income impacts of farmland rental area and household agricultural productivity. Specifically, employing data from the Chinese national household survey, we empirically used OLS and IV regression to examine the average impact of farming households' farmland rental market-related decision making on household income and the effects of farmland rental area and household agricultural productivity on the former impact mechanism. We also employed Quantile Regression (QR) to investigate income differences among households with different income levels as a robustness test and to provide a more complete picture. This study thus contributes to the literature on the influence underlying farmland rental on rural households' incomes and also has some essential value for policymaking in terms of assessing the potential for reducing rural income inequality and improving agricultural modernization by enhancing farmland access for farmers through newly formed farmland markets.

This paper is further structured as follows. Section 2 discusses the institutional background of the farmland rental market in rural China. Section 3 reviews related theories and delivers key hypotheses accordingly. Section 4 presents model specifications, estimation strategies, and data sources. Section 5 presents empirical results, followed by Section 6, which contains results-based discussions. Section 7 concludes with findings and policy implications.

2. Institutional Background

2.1. Household Responsibility System (HRS) and Smallholders' Agricultural Production Performance

Institutionalization of land property rights has always been a central issue in political economy development for nation states throughout history [27,28], including China. Since the reform and opening-up in 1978, the Chinese government has implemented a series of rural reforms to develop the rural economy. Among the reforms, the most remarkable change was the emergence of the Household Responsibility System (HRS), which separated land contractual management rights from collective ownership, thus greatly stimulating rural economic development and urbanization in China [29]. The official universally acceptable implementation of HRS resulted from farmers' institutional choice [30], thus reinstating individual households (instead of "collective production teams") as units of agricultural production.

Under HRS, individual village households were granted a particular share of farmland depending on family size and allowed to retain rights to utilize and operate the farmland. When HRS was initially implemented, farmland could not be transferred among households, and the reallocation of farmland shares among farm units was explicitly disallowed to retain each landholder's land tenure security. Since the farmland was not allowed to be leased among small-scale production units, some hotly debated concerns have emerged, including dwindling farm size and fragmented farming units [31–33]. A few arguments even believe that excessive farmland fragmentation will reduce the agricultural productivity [34]. There was abundant evidence to show that small landholdings under HRS could generate incentives for households to improve their agricultural performance—in the early years after HRS was introduced (1978–1984), great incentivizing changes under HRS were regarded as the dominant source of agricultural output growth [9,35–37].

However, since the 1990s, advancements in agricultural production technologies, changes in agricultural labor, and rapid industrialization and urbanization processes reduced the proportion of rural economy contributions made under the HRS [36,38,39]; this situation induced farmland rental behaviors and rural farmland market functions.

2.2. The Development of Farmland Rental Market and Market-Oriented Reforms

After 1984, China's agricultural output growth stagnated with a remarkable decline in collective agricultural investments [9,40,41]. Several studies have shown that incomplete land tenure and associated property rights for household responsibility farmland can reduce long-term farmland security, thus leading to low agricultural investment levels among farmers [42]. By its very nature, positive reactions to HRS reforms were mainly adaptive improvements in household labor productivity, while traditional patterns produced through small-scale household production did not change (Hong and Wang, 2019). Meanwhile, post-1978 market economy growth accelerated rural farmland rental market development, gradually exposing the unadaptable issue of incomplete rural farmland property rights in the growing area of farmland rental activities. After dramatic changes involving rural land policies, including the extension of duration for rural farmland contractual management rights (introduced in 1998 Land Law, 2003 Rural Land Contract Law, and 2007 Property Law), the abolition of agricultural taxes for responsibility farmland (introduced in 2006 No. 1 central document of CPC), and the permitting of farmland rental market development (introduced in 2003 Rural Land Contract Law), the security of responsibility farmland was deeply strengthened.

Rapid urbanization, on another note, promotes the continuous migration of agricultural labor to urban sectors, and this allocation of labor forces led to the growing popularity of farmland rental markets in rural areas [15,43] (Figure 1 depicts the increasing amount of farmland rental activities over the past decade). The farmland rental market has developed rapidly with the emergence of specialized farming units (including family farms and agricultural enterprises). In three years (2015–2017), 55% of total rented farmland was

obtained by intensive farming producers, agricultural enterprises operated 32%, and 13% was obtained by other business entities [44].

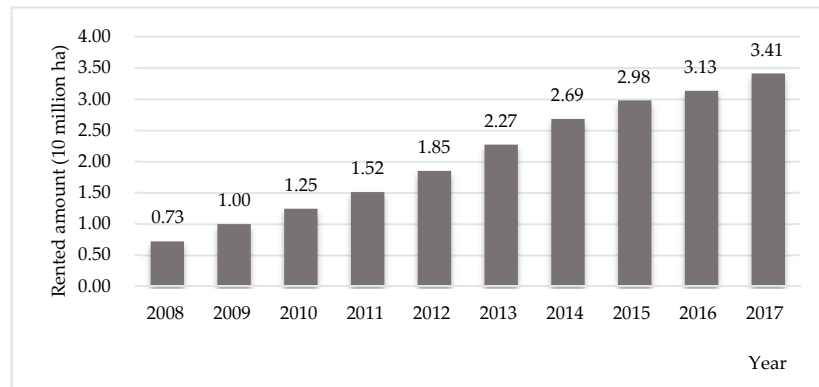


Figure 1. The variation of the total rented farmland area nationwide (2008–2017). Resource: Ministry of Agriculture and Rural Affairs of the People’s Republic of China.

After the introduction of HRS, to enhance property rights-related security for both outflow entities (farmland contractors) and inflow entities (farmland producers), farmland rental policies have experienced a shift from strictly forbidding open-market rentals to allowing unfettered rental of farmland [45]. In 2014, the Three Property Rights Separation (TPRS) reform further separated land contractual right and management right from land tenure—and thus enhanced farmland tenure security by improving property rights stability [46]. This 2014 TPRS reform has essentially legalized farmland rental practices over the past few decades, which was intended to create a relaxed institutional environment for a well-functioning farmland rental market [47].

3. Theoretical Framework

3.1. Farmland Rental and Its Income Impacts

The TPRS reform in China divides farmland property rights into collective ownership rights, contractual rights, and management rights. Within the contract period, the management right is the only transferable right, and the contractual right should always be retained by the farmland contract household [14,48]. Thus, under the “three property rights” structure, all rural households could be divided into three groups based on what property rights they can retain and enjoy (see Figure 2):

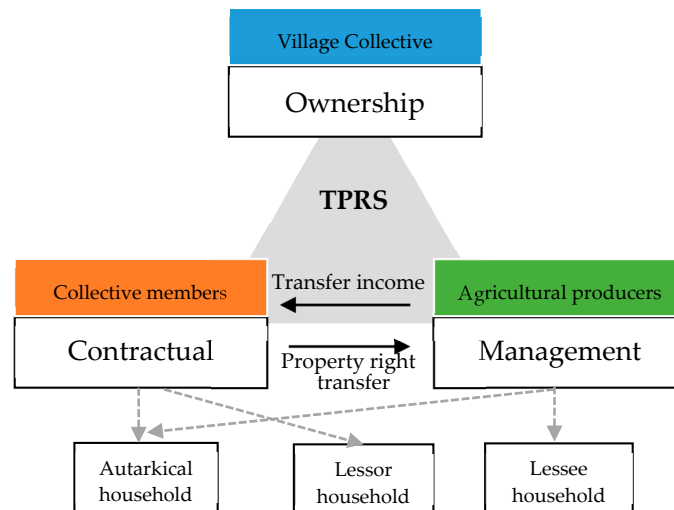


Figure 2. The possession status of farmland property rights among rural households under the TPRS system.

The first group includes autarkical households who do not participate in any rental activities; they enjoy complete contractual management rights over their responsibility farmland. The second group includes lessor households who only retain contractual rights and rent out their responsibility farmland's management rights to other farming units. The third group includes lessee intensive farming households with large landholdings. They borrow farmland from lessor households to enlarge their farm size and probably increase their investment in farming production to achieve higher agricultural productivity [49,50]. For the rented rental farmland, they only retain management rights. Through the participation in the farmland rental market, rural households' livelihood strategies and income earnings were profoundly influenced by the reallocation of land-labor resources inputs [51,52].

Few pieces of research have examined the mechanisms underlying the influence of farmland rentals on household income [6,19]. Theoretically, rural households' on-farm and off-farm incomes are expected to be influenced as follows:

(i) For renting out (lessor) households. Renting out farmland could lead to a decline in farmland size, with surplus labor and other inputs leaving on-farm activities, thus decreasing farm income. Off-farm income is expected to increase significantly along with rental income received from tenants since labor forces released from on-farm activities are able to obtain higher wages through off-farm employment. Thus, total household income would improve significantly.

(ii) For renting in (lessee) households. Farmland rental is economically efficient because it allows highly farm-efficient households to increase their farm size by renting in farmland from low-efficiency households. For specialized households renting in farmland from lessor households, operational landholdings could significantly increase [49,50]. Consequently, on-farm income for such households could improve if net farm revenue is higher than the payment for rented land [19]. Accordingly, the first hypothesis of this study was proposed as follows:

Hypothesis 1 (H1). *Participating in farmland rental activities will raise rural household income. For lessee households, farmland rental will boost their on-farm income; while for lessor households, farmland rental will increase their off-farm income significantly.*

3.2. Farmland Rental Area, Productive Efficiency, and Household Income

Productive efficiency is a crucial factor affecting rural households' farmland rental strategy. With the permission for farmland rental to occur freely, highly efficient producers are more likely to increase farm size by renting land shares from others, and less efficient producers tend to rent out their land and engage in other off-farm work. Therefore, the close relationship between farm size and household productive efficiency directly affects household income. In this regard, it is worth recapping the incentive-related debates regarding the relationship between farm size and agricultural productive efficiency outlined by agricultural economics. The economic theory proposed that agricultural productivity should be equal across farms [53]; however, in empirical studies, the inverse "size-productivity relationship" of farming is widely accepted in low-income economies [54–64]. One dominant reason for this situation is that these developing economies' factor markets are imperfect. Without modern machinery, small-scale farming enjoys significant advantages over larger units, as labor costs form the bulk of total agricultural costs [65]. Moreover, land markets are also highly imperfect in underdeveloped rural areas, so farmland cannot be reasonably allocated or transferred to highly efficient small farmers. This situation allows such smallholders to obtain higher land productivity by replacing land with labor and generating more agricultural land income.

However, when the country's economy begins to develop with increased use of capital-intensive technology, agricultural machinery, and hired labor, scale economy's advantages emerge in larger farms. Larger and more mechanized farms increase technical efficiency and productivity in agricultural performance [65]. Evidence from such developed

economies has confirmed that small farms are less technically efficient [66], while large farms have much higher labor productivity and cost efficiency, which is gained by taking advantage of the scale and diversification economies [23,25,67].

Currently, China is undergoing a transition period in its goal of achieving agricultural modernization. The conventional claim that “small is beautiful”—which is proved by Chinese studies’ empirical observations that small farms’ agricultural productivity is higher than that of larger farms [68–70]—is being challenged by the factor-market economy development and massive farmland rental movements, which are promoted by the Chinese government [24,71]. Recent Chinese studies show that the increase in farm size benefits farmers’ net profit, as well as economic, technical, and labor efficiency [72]. Furthermore, agricultural productivity increases with farm size over the years [10,24,26]. Meanwhile, some scholars are attaching great importance to optimal sizes for Chinese farms during the transition period; this issue concerns farmers’ primary livelihood and the country’s food security. Regarding the area of farmland rental and agricultural productivity, few empirical studies have addressed this issue thus far. Highly farming-efficient households tend to rent farmland from other units. Most such households are specialized farming units (family farms or agricultural enterprises) with farming machinery or equipment. According to existing literature, renting farmland from other households indicates better agricultural labor productivity [73]; furthermore, it will significantly increase agricultural productivity. Accordingly, the second hypothesis regarding the positive relationship between farmland rental area and agricultural production would be put forward as:

Hypothesis 2 (H2). *Agricultural productive efficiency will significantly improve household on-farm income. Lessor households’ on-farm income will decline with increases in rental area, and off-farm income will increase with labor migrations to off-farm sectors. For lessee households, increasing farmland rental area will improve their on-farm income; however, simultaneously, the interaction between the farmland rental area and agricultural productive efficiency will positively affect their agricultural income.*

4. Methods and Data

4.1. Model Specification and Estimation

4.1.1. Empirical Model Specification

First, a simple production model was constructed to trace how farmland rental affects households’ income. Each household, i , has the labor force endowment, L_i , A_i units of owned responsibility farmland, and a given agricultural efficiency, a_i . To generate income, rural households can input labor and land to produce agricultural output, which follows the production function $f(a_{i,on-farm}, L_{i,on-farm}, A_{i,on-farm})$, where $L_{i,on-farm}$ and $A_{i,on-farm}$ represent the labor and farmland used for generating agricultural income [8,74]. Household income depends on the market value of agricultural output and earnings from off-farm employment. Accordingly, we expressed household income as follows:

$$I_t = I_{on-farm} + I_{off-farm} = pf\left(\alpha_{i,on-farm}, L_{i,on-farm}, A_{i,on-farm}\right) + wL_{i,off-farm} \quad (1)$$

Farmland rental participation behaviors influence the land input and further on the earnings from on-farm activities. Specifically, to depict how participation in farmland rental markets affected household income, we construct the income-generating functions for renting out households and renting in households as follows.

Renting out households’ total incomes include income from renting out farmlands and working on off-farm activities. That is,

$$\begin{aligned} I_{out,i} &= I_{out,on-farm} + I_{out,off-farm} \\ &= pA_{out,i} - p_0f\left(\alpha_i, L_{out,i,on-farm}, A_{out,i}\right) + wL_{out,ioff-farm}, \end{aligned} \quad (2)$$

where the total labor of the renting out households is estimated as follows: $L_{out,i,t} = L_{out,i,t,on-farm} + L_{out,i,t,off-farm}$; here, $L_{out,i,t,off-farm}$ represents the labor force working on renting out households' off-farm activities. p_0 , p , and w represent the standardized average prices of agricultural products, rental lands (i.e., rents), and wages from off-farm activities, respectively. Moreover, $A_{out,i}$ denotes the amount of outflow area held by household i , and $f(\alpha_i, L_{out,i,t,on-farm}, A_{out,i})$ demonstrates the production function of the renting out households; this implies that the productivity of their on-farm activities primarily depends on labor and rental land inputs.

However, renting in households' total incomes include profits from farming on rental lands (i.e., farming incomes minus rental costs) and remunerations from the off-farm work. Thus,

$$\begin{aligned} I_{in,i,t} &= I_{in,on-farm} - C_{in,on-farm} + I_{in,off-farm} \\ &= p_0 f(\alpha'_i, L_{in,i,on-farm}, A_{in,i}) - p A_{in,i} + w L_{in,i,off-farm} \end{aligned} \quad (3)$$

where total labor performed by renting in households is calculated as follows: $L_{in,i,t} = L_{in,i,on-farm} + L_{in,i,off-farm}$; $A_{in,i,t}$ denotes the amount of inflow area held by household i in the year t . Furthermore, $f(\alpha'_i, L_{in,i,on-farm}, A_{in,i})$ demonstrates the production function of the renting in households.

Furthermore, to estimate the impact of rural households' participation in farmland rental markets on household income, we empirically discussed the influence of farmland rental choices on household incomes (H1) along with relevant influencing mechanisms in terms of rental area and agricultural productivity (H2). Specifically, based on research questions and hypotheses, household income (I) was treated as the dependent variable, which was used for illustrating household on-farm income, off-farm income, or total income when examining different hypotheses. Next, dummy variables reflecting household farmland-related rental choices (If_rentin or $If_rentout$), the amounts of rental area that reflected the farmland rental scale (In_area or Out_area), and the agricultural productivity (Agr_eff) were considered as the core explanatory variables. Furthermore, we examine the cross effect of farmland outflow scale and off-farm working hours (Off_hour) to identify whether there is a significant moderating effect between farmland rental participation and non-agricultural employment input. Based on these considerations, the reduced-form income equation could be expressed as follows:

$$I = \alpha + \beta_1 If_rentin + \beta_2 If_rentout + \gamma V + \varepsilon \quad (4)$$

$$I_{in,on-farm} = \delta + \theta_1 In_area + \theta_2 Agr_eff + \theta_3 (In_area * Agr_eff) + \rho V + \varepsilon \quad (5)$$

$$\begin{aligned} I_{out,on-farm} &= \delta' + \theta'_1 Out_area + \theta'_2 Agr_eff + \theta'_3 (Out_area * Agr_eff) \\ &+ \rho' V + \varepsilon \end{aligned} \quad (6)$$

$$\begin{aligned} I_{out,off-farm} &= \delta'' + \theta''_1 Out_area + \theta''_2 Off_hour \\ &+ \theta''_3 (Out_area * Off_hour) + \rho'' V + \varepsilon \end{aligned} \quad (7)$$

where β , θ , γ , and ρ refers to the regression coefficients of the corresponding independent variables and control variables (V); ε represents the disturbance term with standard properties. The more detail variable selection considerations are explained as follows:

(i) Household income. This study classified household income into on-farm income and off-farm income. On-farm income refers to income obtained by farming households as agricultural production and operation units on the farm. Off-farm income considered in the study contains wage income (mainly from off-farm employment), business income, property income, and transfer income. Rental income received from farmland rental activity was included with property income derived from land assets. Thus, the dependent variables contained the household's total income and its components (on-farm income and off-farm income).

(ii) Household farmland rental participation choice. Two dummy variables indicating whether a household participated in farmland rental activities (If_rentin or If_rentout) were included in the models as an indicator of household farmland rental decisions. When farming households choose to rent out their farmlands (i.e., If_rentout = 1), they become free from agricultural activities and are thus more likely to migrate to cities to find non-agricultural jobs; this could decrease on-farm income and increase off-farm incomes.

(iii) Household farmland rental area. According to the given income-generating functions, it is evident that on-farm income is directly correlated to the household farmland rental scale. Thus, we used the amount of outflow or inflow area (In_area or Out_area) to discuss the specific influence of farmland rental activity on household incomes. Farmlands are viewed as a crucial agricultural production factor, so when rural households rent out more farmlands, on-farm income will decline more significantly. In other words, for renting in households, increasing farmland rental area could improve their on-farm income.

(iv) Household agricultural productivity. Household agricultural productivity is affected by farmland renting and has impacts on household income, especially on-farm income. Therefore, we used the average annual unit output to measure agricultural productivity (Agr_eff) and further explored its influence on income in different groups of households.

(v) Control variables. Control variables in the models mainly included other certain production input variables and demographic characteristics. Table 1 reports the definitions and summary statistics of this study's employed variables.

Table 1. Description and descriptive summary of the key variables.

Variable name	Description	Observations	Mean	Std. Dev.	Min	Max
Household income						
On-farm income	Income generated from agricultural production (yuan/year)	11,591	8130.68	50,912.67	0	3×10^6
Off-farm income	Income generated from off-farm activities (yuan/year)	11,597	23,915.62	84,360.27	0	6×10^6
1.Wage income	Wage earnings (yuan/year)	11,604	16,962.60	30,600.85	0	318,000
2.Business income	Income generated from family business activities (yuan/year)	11,597	1857.51	65,697.21	0	6×10^6
3.Property income	Income generated from managing household owned movable property and real estate (yuan/year)	11,604	614.24	12,811.70	0	1×10^6
4.Transfer income	Income received from transfer payments (such as retirement pension, dismissal payment, housing accumulation fund, etc.).	11,604	4473.18	41,074.88	0	4×10^6
Farmland rental						
If_rentout	Whether such household participates in farmland renting out (dummy variable, if yes = 1)	9748	0.14	0.35	0	1
Out_area	Amount of outflow area (mu *)	9708	0.79	10.63	0	1000
If_rentin	Whether such household participates in farmland renting in (dummy variable, if yes = 1)	11,587	0.14	0.35	0	1
In_area	Amount of inflow area (mu *)	11,562	2.03	13.91	0	650
Production input						
Agr_eff	Annual agricultural output yield (kilogram/mu *)	4042	363.17	402.24	0	2925
Farmland_area	Household contractual responsibility farmland area (mu *)	9384	4.91	3.56	0.3	60

Table 1. Cont.

Variable name	Description	Observations	Mean	Std. Dev.	Min	Max
Land quality	The average quality of household farmland (1. very poor, 2. poor, 3. average, 4. good, and 5. very good)	9720	3.29	1.00	1	5
Agr_input	Annual investment in agricultural production (including costs of fertilizers, pesticides, seeds, rental machinery, hired labor etc., yuan/year)	10,562	4278.98	7657.88	0	64,100
Agr_labor	The number of family members engaged in agricultural production	8446	1.96	0.91	0	14
bus_hour	Average daily business hours per family member(hours)	11,527	0.96	3.20	0	24
work_hour	Average daily working hours per family member(hours)	11,604	1.92	3.93	0	24
Household characteristics						
Head_gender	Gender of household head (female = 1; male = 2)	11,604	1.88	0.33	1	2
Head_age	Age of household head (years old)	11,603	55.68	12.54	3	99
Head_edu	Educational level of household head (1. no schooling, 2. primary school, 3. junior high school, 4. senior high school, 5. technical secondary school/vocational high school, 6. junior college/vocational college 7. undergraduate, 8. master, and 9. doctor)	11,588	2.48	0.98	1	7
If_official	One (or more) family member is village official (dummy variable, if yes = 1)	8372	0.06	0.24	0	1
Family size	Number of family members	11,604	4.11	1.93	1	19
Health_condition	Average health status of family members (1. very good, 2. Good, 3. Average, 4. Bad, and 5. very bad)	11,602	2.74	0.81	1	5
Instrumental variables						
Share_out	Share of households participating in renting in farmland activity at provincial level (%)	11,604	0.14	0.04	0.01	0.26
Share_in	Share of households participating in renting out farmland activity at provincial level (%)	11,604	0.14	0.03	0.09	0.22
Land_title	Whether the household was issued with land title registration (dummy variable, if yes = 1)	9446	0.45	0.50	0	1

* ‘mu’ denotes a unit of area (=0.0667 hectares).

4.1.2. Estimation Method

The Equations (4)–(7) were first estimated using ordinary least squares (OLS) regression, which provides mean results for the relationships between explanatory variables and dependent variables. It should be noted that rural household’s choice on participation in farmland rental may be endogenous since there are unobserved variables (such as policies of intervening farmland rental market or guiding rural households’ employment) that may influence households’ farmland rental choice and income level. In order to solve the poten-

tial endogenous issue, the instrumental variable (IV) approach was applied. Specifically, the share of households participating in farmland rental activity at the district level could be used as the instrumental variable. In Zhang's study [19], the share of households in the village participating in the farmland rental market has been confirmed to be served as a proxy for transaction costs in the farmland rental market and it is positively correlated with household's rental decisions but has no direct influence on household income earnings. Our database enables us to calculate the provincial-level farmland rental share, which reflects the implementation status of the national policy to guide farmland rental activity for each province. To make the instrumental variable more reflective of the local context, we employed land title registration issued by the grass-roots government as the cross-term for the provincial-level farmland rental share, since a household with a land certificate is more likely to participate in farmland rental activity if they have secure property rights in law. In this case, Equation (4) is estimated using both ordinary least squares (OLS) and two-stage least squares (2SLS) regression.

Additionally, to provide a more complete picture, a quantile regression (QR) method was then used to explore the income impact differences from households' choice on farmland rental participation for households at various quantiles of the income distribution. This provides more robust results by permitting natural generalization to the linear model [75] and has been regarded as a more complete statistical model than mean regression [76]. We divided all the samples into five quantiles (0.1, 0.25, 0.5, 0.75, and 0.9) for a set of income distributions.

The specific descriptions of all variables are provided in Table 1.

4.2. Data Source

This study used data from a national household survey conducted by the China Household Finance Survey (CHFS). The CHFS was designed to construct a nationally representative micro-database to collect household finance information to provide a comprehensive and detailed picture of household economic and financial behavior. This longitudinal survey included a rich questionnaire for assessing housing assets, financial wealth, income and consumption, demographic characteristics, etc., of residents nationwide, which covers 29 provinces, 363 county-level units, and 40,000 households. More information about this database could be known from [77]. This study's analysis used the data of the 2015 wave from CHFS and it only focused on rural households who contract responsibility farmland from village collectives.

Using the data, we summarized the descriptive statistics of all variables in Table 1. The average on-farm income of all households is 8130.68 yuan, and the average off-farm income is 23,915.62 yuan. Among our samples, the percent of households participating in the farmland rental market was 28.25% (lessor: 13.94%; lessee: 14.31%).

Rural household income is summarized by on-farm income, off-farm income and total income; the rural households are divided into lessor households, lessee households, and non-participating households. The summary shows (see Table 2) that the annual average income from on-farm production is 8130.68 yuan—significantly lower than average income from off-farm activities (23,915.62). Regarding income differences, lessee households' average on-farm income (17,450.18 yuan) far exceeded that of non-participating households (7038.51 yuan) and lessor households (3543.089 yuan). For all groups, off-farm income was the primary household income source. Lessor households earned more off-farm income (30,508.11 yuan) than lessee households (22,774.5 yuan), with non-participating households earning a lower off-farm income (21,574.97 yuan). Regarding total income, compared with non-participating households (30,181.02 yuan), the lessor (34,079.13 yuan) and lessee (40,245.48 yuan) household incomes were much higher.

Table 2. The income differences among households.

	On-Farm Income		Off-Farm Income		Total Income	
	Observations	Mean (yuan) (Std. Dev.)	Observations	Mean (yuan) (Std. Dev.)	Observations	Mean (yuan) (Std. Dev.)
Rent out households	1305	3543.089 (44,104.23)	1305	30,508.11 (49,289.11)	1304	34,079.13 (66,074.62)
Rent in households	1654	17,450.18 (44,606.01)	1658	22,774.50 (105,124.2)	1654	40,245.48 (114,952.40)
Autarkic households	8632	7038.501 (52,771.12)	8635	23,139.17 (84,042.72)	8627	30,181.02 (100,301.90)

Note: The standard errors are given in parenthesis.

5. Results

5.1. Farmland Rental Participation and Household Income

First, we discussed the results of household farmland rental choice-related average income impacts. Before using the IV model to complete the estimation, we examined the validity of our instrumental variables. According to the results of 2SLS first-stage regression (Table 3), the coefficients on our instrumental variables, namely, the cross-terms of rental services and farmland renting in/renting out share, were significant at 1% significance level ($p = 0.000$), which suggests the instrumental variables have good interpretive power for explaining the host variable. Furthermore, several tests were conducted to check the strength of the instrumental variables. The F-statistics of the first-stage regressions were larger than the threshold value of 10 [78], and the Cragg–Donald minimum eigenvalue statistics were larger than the critical value of each model for the nominal 5% Wald test, suggesting that the instrumental variables satisfied the strength requirement.

Table 3. 2SLS first-stage regression results.

Variable Name	Total Income		On-Farm Income		Off-Farm Income	
	If_Rentin	If_Rentout	If_Rentin	If_Rentout	If_Rentin	If_Rentout
Share-in×Land_title	0.2642 *** (0.0884)		0.1956 *** (0.1010)		0.2735 *** (0.0745)	
Share-out×Land_title		0.1641 *** (0.0638)		0.2019 *** (0.0695)		0.2120 *** (0.0594)
Observations	3394	3394	2792	2792	5097	5097
F-statistic	17.82 ***	14.54 ***	19.29 ***	13.73 ***	24.10 ***	21.74 ***
Minimum eigenvalue statistic	19.66	17.70	14.00	18.32	24.82	24.09

Note: (i) The above table only reports the estimation results of instrumental variables on endogenous variables (farmland rental participation decision variables). (ii) The standard errors are given in parenthesis. (iii) *** $p < 0.01$.

Table 4 presents the OLS and 2SLS second-stage regression results. Overall, the 2SLS second-stage regression results marginally differ from the OLS regression results, with the signs, figures, and significance of coefficients on host and other independent variables not showing obvious changes compared with the results of the OLS model. According to the estimated results, the coefficients on renting in farmland choice in columns (5) and (7) are positively significant and the coefficients on renting out farmland choice in columns (6) and (8) are negatively significant, suggesting that farmland inflow/outflow has a mostly direct impact on on-farm income level. This means that participating in farmland rent in activity has a positive and significant relationship with household on-farm income while farmland rent out activity significantly reduces household on-farm income; this finding partially verifies our Hypothesis 1.

Table 4. The effects of farmland rental participation on household income.

Variable name	Total Income				On-Farm Income				Off-Farm Income			
	OLS (1)	OLS (2)	2SLS (3)	2SLS (4)	OLS (5)	OLS (6)	2SLS (7)	2SLS (8)	OLS (9)	OLS (10)	2SLS (11)	2SLS (12)
<i>If_rentin</i>	0.1986 *** (0.0482)		1.1246 ** (1.3495)		0.2636 *** (0.0537)		0.7020 *** (1.4977)		0.0573 (0.0515)		1.5128 (1.0681)	
<i>If_rentout</i>		0.1029 (0.0883)		0.7309 (2.8278)		−0.1842 ** (0.0868)		−1.5441 *** (1.5547)		0.0731 (0.0761)		1.8395 (1.5598)
<i>Farmland_area</i>	0.0220 *** (0.0026)	0.0214 *** (0.0026)	0.0305 *** (0.0056)	0.0187 *** (0.0039)	0.0427 *** (0.0031)	0.0420 *** (0.0031)	0.0405 *** (0.0052)	0.0424 *** (0.0033)				
<i>Land_quality</i>	0.0830 *** (0.0202)	0.0825 *** (0.0202)	0.0805 *** (0.0292)	0.0258 *** (0.0426)	0.0871 *** (0.0210)	0.0886 *** (0.0210)	0.0821 *** (0.0225)	0.0656 *** (0.0286)				
<i>Agr_eff</i>	0.0002 *** (3.81 × 10 ^{−5})	0.0002 *** (3.7 × 10 ^{−5})	0.0002 *** (0.0001)	0.0001 *** (0.0001)	0.0002 *** (4.9 × 10 ^{−5})	0.0002 *** (4.5 × 10 ^{−5})	0.0002 *** (0.0001)	0.0002 *** (0.0001)				
<i>Agr_labor</i>	−0.1102 *** (0.0266)	−0.1087 *** (0.0267)	−0.1126 *** (0.0365)	−0.0403 *** (0.0541)	0.0690*** (0.0260)	0.0667 *** (0.0260)	0.0710 *** (0.0276)	0.0906 *** (0.0341)				
<i>Agr_input</i>	1.24 × 10 ^{−5} *** (3.19 × 10 ^{−6})	1.60 × 10 ^{−5} *** (3.10 × 10 ^{−6})	3.71 × 10 ^{−5} * (2.36 × 10 ^{−5})	2.52 × 10 ^{−5} *** (6.35E × 10 ^{−6})	4 × 10 ^{−5} *** (3.43 × 10 ^{−6})	4.4 × 10 ^{−5} *** (3.35 × 10 ^{−6})	5.41 × 10 ^{−5} *** (2.33 × 10 ^{−5})	4.53 × 10 ^{−5} *** (3.86 × 10 ^{−6})				
<i>Bus_hour</i>	0.0536 *** (0.0068)	0.0533 *** (0.0068)	0.0531 *** (0.0099)	0.0306 *** (0.0167)					0.0110 *** (0.0066)	0.0144 *** (0.0067)	0.0204 *** (0.0078)	0.0068 *** (0.0099)
<i>Wage_hour</i>	0.0685 *** (0.0046)	0.0672 *** (0.0046)	0.0841 *** (0.0096)	0.0496 *** (0.0124)					0.0993 *** (0.0043)	0.1000 *** (0.0044)	0.1185 *** (0.0128)	0.0927 *** (0.0074)
<i>Head_gender</i>	0.1398 (0.0692)	0.1338 (0.0697)	0.2915 (0.1163)	0.2314 (0.1223)	0.0168 (0.0677)	0.0026 (0.0676)	0.0245 (0.1090)	0.0434 (0.0792)	0.0997 (0.0736)	0.1209 (0.0756)	0.2568 (0.1103)	0.1543 (0.0907)
<i>Head_age</i>	0.0031 (0.0021)	0.0024 (0.0021)	0.0085 (0.0036)	0.0084 (0.0066)	−0.0046 (0.0021)	−0.0049 (0.0021)	−0.0069 (0.0039)	−0.0071 (0.0028)	0.0052 (0.0020)	0.0053 (0.0021)	0.0119 (0.0049)	−0.0025 (0.0052)
<i>Head_edu</i>	0.1470 *** (0.0226)	0.1441 *** (0.0226)	0.1918 *** (0.0369)	0.1321 *** (0.0354)	0.0851 *** (0.0225)	0.0804 *** (0.0225)	0.0685 *** (0.0374)	0.0778 *** (0.0249)	0.0784 *** (0.0219)	0.0731 *** (0.0225)	0.0996 *** (0.0289)	0.0740 *** (0.0265)
<i>If_official</i>	0.1106 (0.0763)	0.1140 (0.0765)	0.1047 (0.1099)	0.2563 * (0.1250)	0.1331 (0.0894)	0.1275 (0.0903)	0.1188 (0.0978)	0.1690 (0.1050)	0.0961 (0.0762)	0.0668 (0.0779)	−0.0109 (0.1010)	0.0856 (0.0931)
<i>Family_size</i>	0.1765 *** (0.0117)	0.1749 *** (0.0119)	0.1773 *** (0.0163)	0.1839 *** (0.0197)	−0.0201 (0.0127)	−0.0198 (0.0127)	−0.0212 (0.0134)	−0.0227 (0.0137)	0.2110 *** (0.0115)	0.2172 *** (0.0117)	0.2131 *** (0.0126)	0.2514 *** (0.0239)
<i>Health_condition</i>	−0.2768 *** (0.0272)	−0.2776 *** (0.0273)	−0.2357 *** (0.0430)	−0.2143 *** (0.0533)	−0.1439 *** (0.0271)	−0.1503 *** (0.0272)	−0.1585 *** (0.0374)	−0.1300 *** (0.0355)	−0.2439 *** (0.0270)	−0.2439 *** (0.0278)	−0.2207 *** (0.0333)	−0.2454 *** (0.0322)
VIF-value	1.13	1.12			1.12	1.1			1.09	1.08		
F-statistic	94.25 ***	93.3 ***			85.24 ***	81.49 ***			133.12 ***	128.68 ***		
Wald chi2			589.71 ***	470.08 ***			848.31 ***	843.36 ***			952.73 ***	817.76 ***
R2	0.2503	0.2469			0.3345	0.3292			0.1574	0.1627		
Observations	3471	3472	3394	3394	2853	2852	2792	2792	5548	5243	5097	5097

Note: (i) The standard errors are given in parenthesis. (ii) * $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Somewhat surprisingly, the coefficients on farmland rental choices in columns (9)–(12) are not significant, indicating that farmland rental activity has no significant effect on off-farm income among both lessee and lessor households, which is consistent with the results of the existing literature [4,19]. For most lessor households, the renting out choice concerning their responsibility farmland may have had no significant impact on their existing income source. The study's sample featured a relatively high proportion of rural households participating in off-farm jobs (68.98% earned income from off-farm activities), and there was a remarkable gap between rental income (the average annual rent is 496.97 yuan/mu in our sample) received from lessee household(s) and wage or business income generated from off-farm employment. With relatively full off-farm employment, farmland renting out activity does not affect household off-farm income, as the rents received from the lessee unit are insignificant to the household's off-farm income, and thus the farmland rental's income impact on off-farm earnings was not evident. With regard to the total income (columns (1)–(4) in Table 4), the positive effect of farmland renting in activity on income is evidenced. At the same time, the renting out activity shows

no significant signs of a positive effect on total income, implying only lessee households prominently gain benefits from the additional farm size.

In addition to our main variables of interest, the coefficients on household endowments, labor input, and demographic characteristics in the estimations are consistent with our expectations. It is interesting to note that we find a similar result with Jin and Jayne's evidence in rural Kenya [4], that the household head's education is not significantly associated with on-farm income. Education has a positive and significant relationship with total income, implying higher returns to education in off-farm jobs.

Next, we examine whether the income impact of farmland rental participation decisions varies across different income levels. Table 5 presents the results of quantile regressions. Based on the results presented in Table 5, we find the quantile regression results suggest that the OLS (mean) results mask the significant variation in returns across the income distribution. Based on the results presented in Table 5, we find that the coefficient on farmland renting in activity has a significant positive impact on total income at all income quantiles, which is consistent with benchmark results estimated with OLS regression. Notably, while farmland renting in activity increases household total income at all quantile levels, its income-increasing effect gets smaller in households at higher quantile levels (see Figure 3). This result indicates that the return to farmland renting in activity for low-income households is higher than that for high-income households. Hence, the inflow of farmland to low-income households is more sensitive about raising their income levels.

Table 5. Differential effects of farmland rental participation on rural household income.

		Quantiles					Observations
		0.1	0.25	0.5	0.75	0.9	
Total income	<i>If_rentin</i>	0.3650 *** (0.0997)	0.2213 *** (0.0735)	0.1082 * (0.0666)	0.1082 *** (0.0666)	0.1692 *** (0.0563)	3471
	Pseudo R2	0.1271	0.1600	0.1623	0.1519	0.1475	
	<i>If_rentout</i>	−0.0797 (0.2157)	0.0777 (0.1644)	0.1597 * (0.0852)	0.1913 *** (0.0684)	0.0685 (0.1201)	3472
	Pseudo R2	0.1227	0.1574	0.1621	0.1514	0.1448	
On-farm income	<i>If_rentin</i>	0.1428 *** (0.1135)	0.2416 *** (0.0748)	0.3025 *** (0.0541)	0.3273 *** (0.0711)	0.3460 *** (0.0722)	2853
	Pseudo R2	0.1180	0.1634	0.2323	0.2607	0.2620	
	<i>If_rentout</i>	−0.1969 ** (0.1512)	−0.2773 ** (0.1133)	−0.1536 ** (0.0775)	−0.2023 *** (0.1380)	−0.1784 (0.1397)	2852
	Pseudo R2	0.1181	0.1625	0.2274	0.2548	0.2533	
Off-farm income	<i>If_rentin</i>	−0.0107 (0.0947)	−0.0669 (0.0946)	−0.1179 (0.0613)	−0.0194 (0.0500)	0.0155 (0.0574)	5548
	Pseudo R2	0.0952	0.1063	0.0987	0.0806	0.0775	
	<i>If_rentout</i>	−0.2392 (0.2259)	−0.1179 (0.0613)	0.0192 (0.0776)	0.1104 ** (0.0553)	0.1246 (0.0770)	5243
	Pseudo R2	0.0983	0.1092	0.1005	0.0833	0.0802	

Notes: (i) The above table only reports the estimation results of farmland rental participation variables. (ii) The standard errors are given in parenthesis. (iii) * $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Meanwhile, we find the coefficient on farmland renting out activity is significantly positive with total income at middle and upper-middle income quantiles (0.5 and 0.75), while the OLS return to farmland renting out activity is not statistically significant. One likely explanation is that, compared with highest-income households who have largely left agricultural production and lowest-income households who are almost entirely dependent on farmland for agricultural production, middle and upper-middle income households are

usually capable of both agricultural production and non-agricultural employment, and the off-income earned by the agricultural producer in middle and upper-middle income household who has the ability to participate in non-agricultural employment probably has a significant impact on their household income after renting out farmland. At the same time, we observe that the estimated coefficient of the impact of farmland renting out activity on off-farm income is significantly positive at the 75% quantile, revealing the positive effect of farmland renting out activity on increasing off-farm income for upper-middle income households.

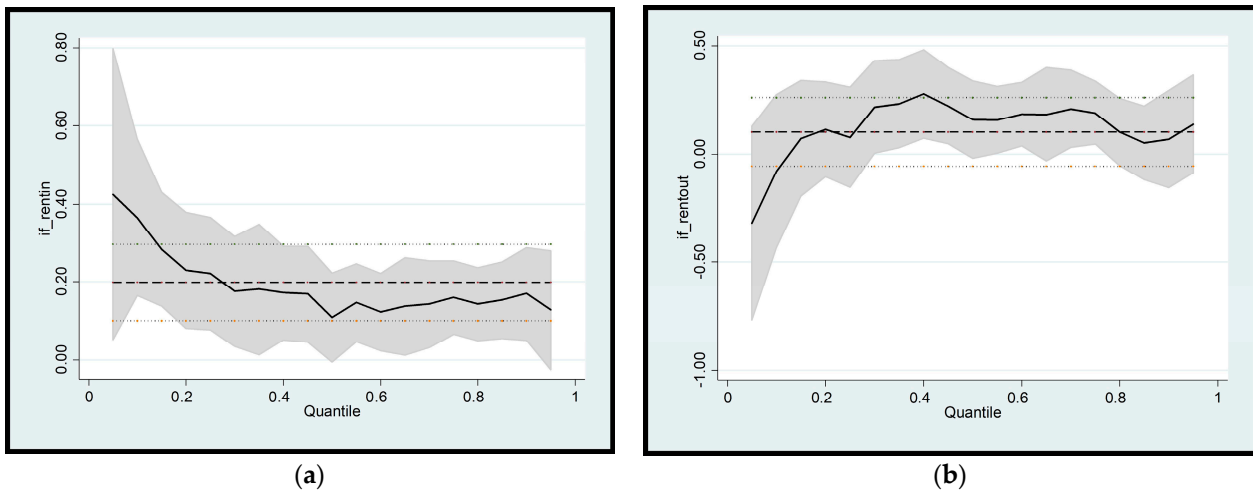


Figure 3. The effects of farmland renting in (a) and /renting out (b) on household total income across quantiles.

Regarding the on-farm income, the estimated coefficients describing the effect of farmland renting in activity on farm income are significantly positive at all farm income quantiles, and the return on farm income to farmland renting in activity increases with the rise of farm income level (see Figure 4). These estimates confirm the previous finding that rural households with relatively high farm income are more likely to achieve economies of scale and therefore seem to benefit more from enlarging additional land. The coefficient on renting out farmland is negative and statistically significant at 0.1, 0.25, 0.5, and 0.75 quantiles. Possible reasons why renting out farmland is not substantial for households with the highest farm income are that those households are mainly intensive farming producers, and they mostly do not rent their farmland to others.

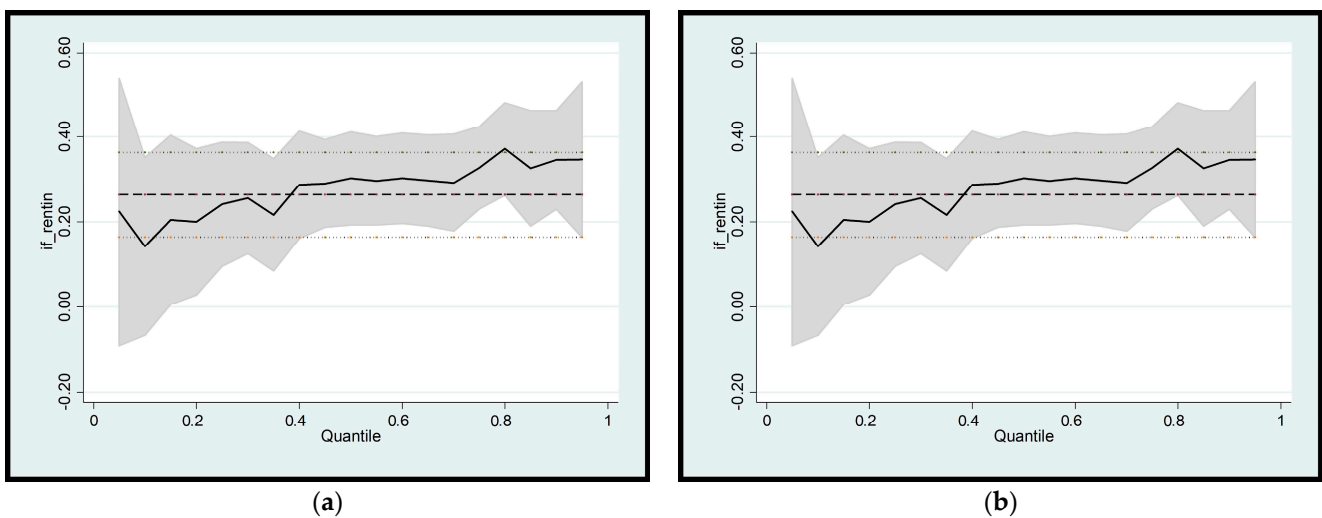


Figure 4. The effects of farmland renting in (a)/renting out (b) on household on-farm income across quantiles.

Furthermore, in this case, despite the fact that the estimated coefficient of farmland impact of renting out activity on off-farm income is significant at the 75% quantile, the results show farmland rental participation activities have no significant effects on household off-farm income at all quantiles, which agrees with OLS results in Table 4.

5.2. The Impacts of Rental Area and Agricultural Productivity

Regarding lessee households, farmland rent in participation has no significant impact on household off-farm income. Thus, this part of the study mainly evaluated lessee households' on-farm income and total income impacts based on the renting in area and farming efficiency. The result (Table 6, column 1) confirms the significant positive effect of the renting in area on a lessee households' on-farm income. This finding indicates that increasing farmland production elements' input can contribute to agricultural yield and suggests that lessee households with increased farm size could receive chances to achieve scale economies and thus obtain more income. Meanwhile, results also indicate significant positive effects of agricultural efficiency on household on-farm income. Column 2 further illustrates the result of the on-farm income impact of the interaction item between the renting in scale and agricultural efficiency. The result also shows that the interaction item had a significant positive effect on household on-farm income variables, thus suggesting that increasing the scale of area rented or household agricultural efficiency could boost each other's positive impact on on-farm income. This result also implies that highly productive rural households benefited more from renting in farmland. Similarly, households with additional rentable farmland earned more on-farm income when their productivity improved. Since farmland renting in participation and the rented area are not significantly associated with off-farm income and have significant positive relationships with total income, this suggests higher returns to increasing farm size through the rental market for lessee households.

Table 6. The effects of the rented in area and agricultural productivity on household on-farm income for lessee households.

Variable Name	On-Farm Income		Total Income	
	(1)	(2)	(3)	(4)
<i>In_area</i>	0.0131 *** (0.0019)	0.0097 *** (0.0017)	0.0060 *** (0.0017)	0.0031 *** (0.0024)
<i>Agr_eff</i>	0.0001 *** (4.72×10^{-5})	0.0001 *** (3.9×10^{-5})	7.75×10^{-5} *** (2.75×10^{-5})	5.50×10^{-5} *** (1.94×10^{-5})
<i>In_area*Agr_eff</i>		1.5E-05 *** (4.94×10^{-6})		1.49×10^{-5} *** (4.67E-06)
<i>Farmland_area</i>	0.0321 *** (0.0040)	0.0315 *** (0.0040)	0.0131 *** (0.0044)	0.0130 *** (0.0044)
<i>Land_quality</i>	0.0783 * (0.0436)	0.07569 * (0.0433)	0.1167 *** (0.0402)	0.1154 *** (0.0400)
<i>Agr_labor</i>	0.0849 *** (0.0600)	0.0909 *** (0.0602)	−0.0878 *** (0.0542)	−0.0834 *** (0.0542)
<i>Agr_input</i>	2.33×10^{-5} *** (5.09×10^{-6})	2.1×10^{-5} *** (5.29×10^{-6})	2.76×10^{-6} *** (4.93×10^{-6})	$−1.26 \times 10^{-6}$ *** (5.46×10^{-6})
<i>Head_age</i>	−0.0119 *** (0.0043)	−0.0116 *** (0.0043)	−0.0131 *** (0.0042)	−0.0129 *** (0.0042)
<i>Head_edu</i>	0.0932 * (0.0515)	0.0875 * (0.0513)	0.1231 ** (0.0496)	0.1198 ** (0.0495)
<i>Head_gender</i>	0.0360 (0.1659)	0.0226 (0.1648)	0.0155 (0.1566)	0.0044 (0.1552)
<i>If_official</i>	0.3139 ** (0.1405)	0.3024 ** (0.1444)	0.2201 (0.1515)	0.2107 (0.1518)
<i>Family_size</i>	−0.0510 *** (0.0294)	−0.0488 * (0.0291)	0.1988 *** (0.0217)	0.2014 *** (0.0217)
<i>Health_condition</i>	−0.2179 *** (0.0639)	−0.2221 *** (0.0633)	−0.2773 *** (0.0577)	−0.2792 *** (0.0572)
<i>Constant</i>	9.1777 *** (0.4992)	9.2139 *** (0.4981)	9.9176 *** (0.4517)	9.9395 *** (0.4480)
VIF	1.16	1.27	1.2	1.31
F- statistic	44.62 ***	43.84 ***	26.2 ***	26.39 ***
R ²	0.4096	0.4163	0.2613	0.2684
Observations	630	630	706	706

Notes: (i) The standard errors are given in parenthesis. (ii) * $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$. (iii) The number of valid samples reduced due to the analysis on lessee households only.

For lessor households, the farmland renting out activity was initially examined to reduce household on-farm income, while its impact on off-farm income was limited. This section further explores the impact of farmland area rented out and agricultural productive efficiency on household on-farm income, and evaluates the interaction effect between farmland outflow scale and household non-agricultural working hours on off-farm income to identify whether the outflow area of farmland regulates the income impact from household off-farm labor volumes. Based on the estimated results (Table 7, column 1), the coefficients on the rented out area and agricultural productivity are both significant, suggesting household on-farm income declined significantly with the increase in an area rented out and household agricultural productivity still had a positive impact on farm income. Column 2 presents results from the interaction item of the rented out area and agricultural productivity, which is positively associated with household on-farm income, implying that improving household agricultural productivity could slightly offset the negative farm income impact from reduced farmland area. Columns 3 and 4 display the estimated results of the off-farm income impact from the rented out farmland area and off-farm working hours. The coefficients on the rented out area and its cross terms with wage hours and business hours in columns (3) and (4) are not significant, suggesting that the rented out area and its interaction effect with off-farm working hours input had no significant impact on household off-farm income. This is probably because lessor households usually engaged in non-agricultural jobs or discontinued on-farm production for the agricultural labor shortage and thus the household non-agricultural employment capacity released by renting out farmland was limited, so the impact of renting out scale on off-farm income was not significant.

Table 7. The effects of the rented out area and agricultural productivity on household on-farm income for lessor households.

	On-Farm Income		Off-Farm Income	
	(1)	(2)	(3)	(4)
<i>Out_area</i>	−0.0031 ** (0.0268)	−0.0296 ** (0.0270)	0.0138 (0.0093)	0.0130 (0.0101)
<i>Agr_eff</i>	6.10×10^{-5} *** (1.32×10^{-5})	4.48×10^{-5} *** (3.04×10^{-5})		
<i>Out_area* Agr_eff</i>		3.56×10^{-5} *** (1.14×10^{-5})		
<i>Bus_hour</i>			0.0096 *** (0.0261)	0.0161 *** (0.0355)
<i>Wage_hour</i>			0.1060 *** (0.0142)	0.1047 *** (0.0193)
<i>Out_area* Bus_hour</i>				0.0015 (0.0036)
<i>Out_area*Wage_hour</i>				0.0002 (0.0018)
<i>Farmland_area</i>	0.0107 (0.0186)	0.0245 (0.0194)		
<i>Land_quality</i>	0.0242 (0.0899)	0.0428 (0.0912)		
<i>Agr_labor</i>	−0.0816 (0.0992)	−0.0915 (0.1000)		
<i>Agr_input</i>	6.27×10^{-5} *** (1.35×10^{-5})	6.14×10^{-5} *** (1.17×10^{-5})		
<i>Head_age</i>	−0.0126 (0.0088)	−0.0109 (0.0086)	−0.0015 (0.0072)	−0.0017 (0.0074)
<i>Head_edu</i>	0.0086 (0.1051)	0.0015 (0.1045)	0.0878 (0.0798)	0.0888 (0.0801)

Table 7. Cont.

	On-Farm Income		Off-Farm Income	
	(1)	(2)	(3)	(4)
<i>Head_gender</i>	0.1743 (0.2719)	0.1580 (0.2604)	0.8537 (0.3002)	0.8525 (0.3003)
<i>If_official</i>	−0.3656 (0.2444)	−0.3866 (0.2459)	−0.1186 (0.2852)	−0.1197 (0.2869)
<i>Familysize</i>	0.0625 (0.0519)	0.0756 (0.0501)	0.2132 *** (0.0414)	0.2134 *** (0.0415)
<i>Health_condition</i>	−0.0995 (0.1114)	−0.0958 (0.1096)	−0.0916 (0.0972)	−0.0890 (0.0980)
<i>Constant</i>	9.1132 *** (0.7758)	8.9085 *** (0.7457)	9.2033 *** (0.7417)	9.2059 *** (0.7504)
VIF	1.35	1.7	1.11	1.39
F-value	28.40 ***	36.34 ***	15.59 ***	14.35 ***
R ²	0.3385	0.3731	0.1897	0.1899
Observations	158	158	485	485

Notes: (i) The standard errors are given in parenthesis. (ii) ** $p < 0.05$, *** $p < 0.01$. (iii) The number of valid samples reduced due to the analysis on lessor households only.

6. Discussion

Land reform has been regarded as the most effective remedy for reducing income inequality [74]. Several rounds of market-oriented rural land reform foster the development of the farmland rental market by encouraging farmland rental activities among farm units, which profoundly influences rural households' livelihood strategies and income earnings. The study results suggest that farmland rental participation activity significantly affected Chinese rural households' on-farm income. Renting in farmland significantly and positively affected lessee households' on-farm income and household total income, which agrees with existing findings in previous studies [4,19,20]. Meanwhile, the increase in farmland renting in area and household agricultural productivity directly improve their on-farm income and strengthened each other's role in promoting farm income. Essentially, most lessee tenants in rural China have the necessary conditions to achieve intensive specialized production (see Figure 3). We also find the return on household's on-farm income to farmland renting in increases with the rise of farm income level through QR regression. Thus, our study's evidence supports that, for high-productivity specialized households with relatively high farm income levels, expanding farm size was more output-sensitive and, therefore, benefited more from increasing farm size.

Additionally, the study results show farmland outflow could significantly reduce household on-farm income, while it had no significant impact on off-farm income on average. These results are consistent with Zhang et al. [19], who found that renting out land fails to improve lessor households' off-farm income. Furthermore, the scale of farmland outflow's indirect effect on household off-farm income was not evident; this shows that land outflow has little impact on household labor force distribution. Rural households with stable off-farm employment opportunities are often more inclined to rent out their farmland [43,52,79,80]. Accordingly, within lessor households with experience in off-farm employment, young and middle-aged males, who form the dominant labor force within such households, usually migrate to cities or suburbs to find off-farm work. Even when farmland is not rented out, left-behind elderly or women stay at home to do farm work [81–83], thus, the potential non-agricultural labor force released from farmland rental becomes limited. At the same time, study findings from QR regression results initially provide evidence supporting for those lowest and middle and upper-middle income households with both agricultural and non-agricultural employability, and farmland renting out has potential contribution in improving their off-farm earnings. For those households with non-agricultural employability while also having no work experience in any off-farm sectors, off-farm income may depend positively on farmland renting out activities, and

thus governments could promote off-farm employment by organizing land cooperatives to stimulate their willingness to rent out land and enhance livelihood diversities [51].

Currently, along with the market-oriented reforms in China's agricultural land property rights system, the gradual functioning farmland rental market has also challenged traditional household production patterns. It has taken on a more important role in improving agricultural productivity and accelerating agricultural modernization processes. One study [8] suggested that farmland productivity would increase to about 60% through farmland rental in rural China. This productivity improvement would translate into increased welfare for lessor households by facilitating occupational diversifications. In this case, expanding farmland production scale could be a realistic choice for achieving agricultural modernization in China. Indeed, most of the specialized farming units were cultivated with guidance and support by local governments. Even the specialized farming units were regarded as major bodies for achieving agricultural modernization in China, current farm sector development is still dominated by autarkical small-scale farming, with farmland fragmentation as the fundamental characteristic of agricultural production [34]. Along with TPRS reform, the central government promoted various reform policies, such as establishing rural land trading center, promoting rural collective land registration, granting rental subsidies to leaseholders, etc., which jointly accelerated the development of farmland rental markets. However, these policies are potentially more beneficial for intensive specialized units rather than smallholders. With government support, the number of smallholders renting their responsibility farmland to agricultural enterprises and cooperatives has increased, while in turn, the possibility of mutual leasing of farmland among smallholders would decrease. This potential for increasingly uneven farmland distribution could lead to overall inequality in terms of income and benefits [18]. Consequently, the release of non-agricultural labor force should be undertaken simultaneously with productivity improvement in intensive farming producers. In this regard, it is necessary to prevent a large number of farmers from becoming unemployed subjects with no off-farm jobs and no farmland to support their fundamental livelihoods.

7. Conclusions and Policy Implications

The rural land rental market plays an increasingly important role in the agricultural transformation of the current period in China. This paper investigated the impact of farmland rentals on household income in rural China. Even though we chose only China as our case study, this discussion issue is relevant for a wide range of transition countries, including those in Southern Africa, Southeast Asia, and Eastern Europe, which are dominated by smallholder farms and liberalized land exchange constraints because of land reforms or farm restructuring. This paper's major contribution was exploring mechanisms underlying farmland rental markets' effect on households' earnings by further investigating the relative roles of farmland rental area and household agricultural productivity.

This paper's results showed that farmland rental participation affected household income significantly—that is, lessees' renting of farmland positively increased their households' on-farm and total income; furthermore, this on-farm income positively depended on renting scale and household agricultural productivity, while renting out farmland fails to improve lessor households' off-farm and total income on average. With regard to income differences across quantiles, we found that households with high on-farm income are more sensitive about enlarging farm size by renting farmland, and households with middle and upper-middle off-income may benefit more from renting out their farmland. Meanwhile, the positive farm income impact from the interaction relationship between enlarged farm size and improved agricultural ability indicates that highly productive rural households could benefit more by expanding their farm size through the farmland rental market. For lessor households, our results imply that farmland renting out may limitedly affect their labor force distribution since renting out farmland was more likely to factor in decision making among rural households with stable off-farm employment but less agricultural labor. Simultaneously, since households that have high return non-agricultural employ-

ment are not dependent on farmland for their livelihood, farmland renting out forms an insignificant proportion of such households' total and off-farm income.

Our relevant policy-related findings were as follows. Within the collective-owned rural land system, developing farmland rental market—a process accelerated by TPRS reform—contributed toward land reallocation among farming households. Consequently, lessee households' income increased significantly through farm size enlargement; households with non-agricultural employability are able to enhance their livelihood diversities, and thus, income gaps among farmers could largely decrease. However, some Chinese government interventions still affect the imperfect farmland rental market, and extensive farmland was rented out to large-scale operators through rental cooperative organizations. Whether the farmland rental market provides equal access opportunities for smallholders and reduces income inequality among all farm units remains to be seen. Despite these imperfections and uncertainties, our findings suggest that a well-functioning farmland rental market in rural China can play a positive role in achieving farming efficiency and poverty reduction. Therefore, policies addressing the twin goals of efficiency improvement and income increase should be properly oriented. However, various forms of moderate scale production should be developed vigorously, and large-scale farm operators should receive leading roles in modern agricultural development. Various government-launched service organizations, including established land transfer centers promoting farmland consolidation, are still essential for supporting highly efficient large farms in enlarging farm size. Nevertheless, to secure smallholders' share of land reform benefits, related policies should provide each rural household with equal opportunities to engage in farmland rental activities based on their land and labor endowments. For households with the lowest off-farm income and for rural households close to the poverty line, improving their development ability and resource use efficiency is essential for maintaining their sustainable livelihood development [84]. In this case, it is effective and valuable to actively organize farmland rental cooperatives to aid households having fewer off-farm employment opportunities to engage in farmland rental and thus enhance their off-farm livelihood diversities.

Several research prospects still need to be explored based on our findings. First, as there is internal regional heterogeneity in China's farmland rental market, for example, the transaction cost of farmland transfer is higher in less-developed areas than in developed areas [85], which may lead to geographical differences in the income effects of farmland transfer on rural households and could be further investigated in future studies. Second, it is also worth discussing how market interference by local governments (the information is challenging to collect by national survey) is fair for smallholders to access the farmland rental market and whether this helps narrow income inequality among farmers.

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Note

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