

Article

Farmland Rental: The Impacts of Household Demographics and Livelihood Strategies in China

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Abstract: In recent decades, there has been a rising global trend of farmland rental. Previous studies have explored the impacts of individual and household sociodemographics on farmland rental, but a holistic understanding of farmland rental in association with households' demographics and livelihood strategies has not been achieved. Using data from the China Family Panel Studies 2012–2016, we investigated the association of farmland rental with household demographics and livelihood strategies in rural China. The results suggest that farmers in rural China tend to keep a balance between landholding and household needs, a finding that not only supports the labor–consumer balance theory, but also extends its application to a capitalized and increasingly mobile society. Larger and/or married-couple households were less likely to rent out their farmland, and the household decision-maker's education level was positively associated with the probability of renting out farmland. The household decision-maker's age was negatively associated with farmland rental up to age 34, after which it has a positive effect, demonstrating a non-linear, U-shaped relationship. Livelihood strategies, including non-farm employment and migration, were positively associated with farmland rental, whereas agricultural income showed a negative effect. This study extends the understanding of factors influencing farmland rental in areas where increasing migration could reshape farmland disposal, a common scenario in contemporary China and many developing countries.

Keywords: China; farmland rental; household demographics; livelihood strategies; migration; labor–consumer balance theory; non-farm employment



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1. Introduction

Farmland is an indispensable element in agricultural production [1], especially during agrarian eras and in present-day developing countries. As a natural resource, farmland has been put on the market for transaction or circulation in many countries in recent decades, among which, farmland rental is one of the common ways in countries where farmland title is not granted to the agricultural operators. Farmland rental affects land fragmentation [2–4], agricultural efficiency [5,6], and food security at the local [7] and global level [8]. Social scientists have developed three theoretical models in explaining farmer behaviors and their impacts on farmland rental: the moral peasant model [9], the rational peasant model [10], and the labor–consumer balance model [11]. Each model makes specific assumptions about the moralities and rationalities held by the farmers, which leads to different farmland rental practices. Although these theoretical frameworks are well-suited for farmland rental in pre-industrial societies, many countries have been experiencing a rapid economic take-off in the last several decades, which creates regional differences in the levels of economic development, and causes migration flows from rural to urban areas. These phenomena could diversify rural households' livelihood strategies on the one hand and loosen their dependencies on

farmland on the other hand, promoting farmland rental. However, a holistic understanding of farmland rental in association with household demographics and livelihood strategies has not been achieved.

We begin to fill this gap by thoroughly analyzing the rental decision-making process of Chinese farmers from demographic and sociological perspectives. Unlike the rational peasant theory and moral peasant explanation, which assume the economic man and safety-first principles, we follow the labor–consumer balance model and adopt a holistic, morally neutral approach that focuses on the impacts of household demographics and livelihood strategies. Specifically, we are seeking to test the labor–consumer balance theory in a mobile and economically developed setting, and explore the pathways through which household demographics and household livelihood strategies operate in determining the farmland rental practices of rural households in China. This study contributes to the examination and expansion of the labor–consumer balance theory in a setting where massive internal migration has created opportunities for farmers to be detached from their land. For the purposes of this research, we consider farmland rental as the process of renting out all or part of the household’s farmland.

The paper is structured as follows. First, we introduce farmland and population registration reform in China, and how changes in these have historically influenced farmers’ land disposal. Second, we review the labor–consumer balance theory, its implications on farmers’ land rental decision-making, and related published studies. Third are the hypotheses derived from the theoretical discussion and extant empirical evidence. Fourth, we present the data, variables, methods, and empirical results. Fifth, we conclude with a discussion of the results, contributions, and future research directions.

2. Farmland Reform, Population Registration Reform, and Farmland Rental in Rural China

Fei ([12], p. vii) wrote “Chinese society is fundamentally rural. . . . Chinese society has grown out of its ties to the land.” This description demonstrates the nature of traditional Chinese rural society, where farmers were bonded to their farmland. In past decades, especially after a series of farmland policy reforms and massive internal migration from rural to urban areas, the tight connection between farmers and their land is changing.

The rental of farmland in China has been connected to farmland policy change. In the past half-century, China’s farmland policies shifted from collective farming to the Household Responsibility System (HRS) [13,14], and then to the separation of the ownership right, contract right, and use right [15]. In the first phase, farmers worked cooperatively on country-owned and village-managed farmland; the agricultural output was evenly distributed among villagers. Under the collective and egalitarian system, the incentive for farming and investment was low, whereas the motivation for free-riding was high [16]. In the second phase, use right was entrusted to individual households through contracts to encourage farmers to invest in their land and increase agricultural output, but the ownership and contract rights still belonged to the country and the village collectives. The length of the second-phase contract was extended from 15 years in the 1980s to 30 years in the 1990s. The most recent amendment was in 2008, when the length of the contract was extended to an unspecified long term [14,17]. During the second phase of farmland policy change, land could be contracted out to individual farmers and other economic entities, including agribusiness firms. Because of the rigid population registration system that bound farmers to their lands in the rural areas, the rate of farmland rental was low. In 2008, the amount of farmland rented out accounted for 8.7% of the total farmland in rural China [15]. The third phase, the separation of ownership, contract, and use rights, was implemented in 2014, with the hope of accelerating farmland circulation. The policy explicitly legalized and encouraged the circulation of use rights of farmland among households and other economic entities, while leaving the ownership rights and contract rights to the country and village collective and individual households [18]. One thing worth noting is that although the government allows different forms of farmland circulation between village collectives

and other economic entities, renting is the only legal form of farmland circulation between individual households.

Increasing internal migration has also contributed to the increase in farmland rental. China has experienced a dramatic increase in internal migration in recent decades because of the reform of the population registration system (known as *hukou*, see [19,20]), and unbalanced economic development across regions. Farmers are attracted to urban and developed areas for working opportunities, and are, thus, unable to perform regular agricultural activities, especially those who are year-round migrants. Renting becomes an option to secure farmland rights and maintain non-farm earnings. Using survey data from 2000 and 2008, Gao, Huang, and Rozelle [21] found a high correlation between farmland rental and migration in rural China; Hubei, Sichuan, and Hebei, which are traditional out-migration provinces, were among the provinces with high growth rates in the development of farmland rental markets. Among farmland rental transactions, 67% in 2000 and 64% in 2008 were informal agreements between relatives. Lohmar, Zhang, and Somwaru [22] found that renting outside the village and getting cash payments for rent are rare because such practices jeopardize rights to farmland. These results suggest that informal farmland rental is on the rise between individual households, especially among relatives or households within the same village.

3. Labor–Consumer Balance Theory and Empirical Evidence

Theoretically, the moral peasant approach, rational peasant approach, and labor–consumer balance theory were developed to explain farmers' agricultural practices in different settings, each of which has various implications on farmland rental. The moral peasant approach argued that farmers are risk-averse investors who usually hold to the principles of safety-first and subsistence ethics. Moral peasants tended to adopt a reciprocal relationship between renters and rentees, and employ varied rental prices based on the harvest to share risks [9]. The rational peasant approach assumed that peasants are self-interested actors and utility maximizers who treat their farmland similar to other tradable commodities [10]. Consequently, farmland is continually transacted in the market as long as such transactions are profitable. The moral peasant model and rational peasant model can be well situated in pre-capitalist and post-capitalist settings. However, they focus on the actors' agency while neglecting the impacts of contextual factors that are influential in farmers' decision-making, making these models less powerful in explaining farmland rental in most developing countries, where the market economy and farmland rental markets are in their infancy.

The labor–consumer balance theory is a more holistic and comprehensive approach in explaining farmers' agricultural arrangements and their farmland disposal behaviors. This theoretical framework originated from the organization and production school in the 1920s [11]. It focused on the relationship between production and the organization and rearrangement of the household's farmland resources in pre-capitalist villages of the Soviet Union. The labor–consumer balance theory's major argument is that household is a single economic unit whose primary goal is to keep a balance between family needs and the drudgery of its labor force supply. Reflected in the household's farmland disposal decision-making, the labor–consumer balance theory suggested that there was a negative association between landholding and the amount of income from crafts and trades, indicating that households with non-farm income tend to keep a small amount of land. In addition, the land endowment also had a long-term effect on the household's farmland organization, with the well-endowed family continually operating a large amount of farmland [11]. Compared with the moral peasant and the rational peasant models, the labor–consumer balance theory better captures the dynamic relationship between agricultural operations and household demographics and livelihood strategies. Many empirical studies have found supportive evidence for the labor–consumer balance theory in different social contexts, and have demonstrated farmland rental being closely associated with sev-

eral household demographics, livelihood strategies, characteristics of farmland, and the farmland rent contract.

First, household demographics have an effect on farmers' land rental. Holden et al. [23] found that female-headed households were more likely to rent out farmland, especially when farmland certification was granted. The age and education of the household decision-maker, presumably the household head, are significant factors in farmland rental decision-making. One study in Nicaragua found the age and education of the household decision-maker were positively associated with the probability of renting out farmland [24]. Kung [25], Feng and Heerink [26], and Huang et al. [21] found similar results in rural China, with higher-educated household decision-makers being more likely to rent out their farmland.

Second, household livelihood strategies influence farmland rental decisions, particularly in the positive effect of non-farm opportunities. Consistent with the labor–consumer balance theory's arguments, Noev's [3] study in Bulgaria showed that the higher the share of non-agricultural income, the larger the incentives for landowners either to rent out their farmland to more efficient users or to abandon it. Geng et al. [27] found in Northeast China that farmers' land rental is also associated with their non-farm income, as well as household members' part-time employment. Using survey data from rural China, Kung [25] argues that non-farm employment is exogenous to farmland rental, and concludes that there is a causal relationship between non-farm employment and farmland rental.

Third, farmland characteristics and contractual arrangements play important roles in farmland rental. Farmland titles define how farmers can dispose their farmland, and a secured farmland title grants more latitude to the landholders, thus increasing their opportunities for farmland rental and subcontracting. Holden et al. [23] found that after being issued farmland certification, Ethiopian farmers were more likely to participate in local rental markets. Wang, Riedinger, and Jin [28] found farmers who received farmland use-right documents in China have a greater sense of tenure security and a higher probability of renting out their farmland. They also found that contractual arrangements affect farmland rental practices; farmland transactions using an informal contract, such as oral agreements, usually occur between relatives, whereas formal, written contracts are almost always used between lessors and lessees who are not closely related. Swinnen et al. [29] found evidence in both Europe and central Asia that farmland rental contracts between relatives are shorter than those with formal organizations, such as corporations or the state. Previous studies have found transaction costs and rental prices influence farmland rental. For example, using survey data from Jiangsu, China, Ito et al. [14] found that institutional support, such as the Rural Shareholding Cooperatives, could decrease transaction costs and encourage farmland rental. Yan and Huo [30] found that rental price plays a significant role in determining farmland rental in China; the higher the average rental price, the more likely rural households were to rent out their farmland.

4. Conceptual Framework and Hypotheses

Drawing on the above theoretical discussions and prior empirical research on farmland rental, as well as the recent reforms in farmland policy and the population registration system in China, we argue that rural households' farmland rental in China is associated with their household demographics and livelihood strategies. Figure 1 demonstrates the conceptual framework.

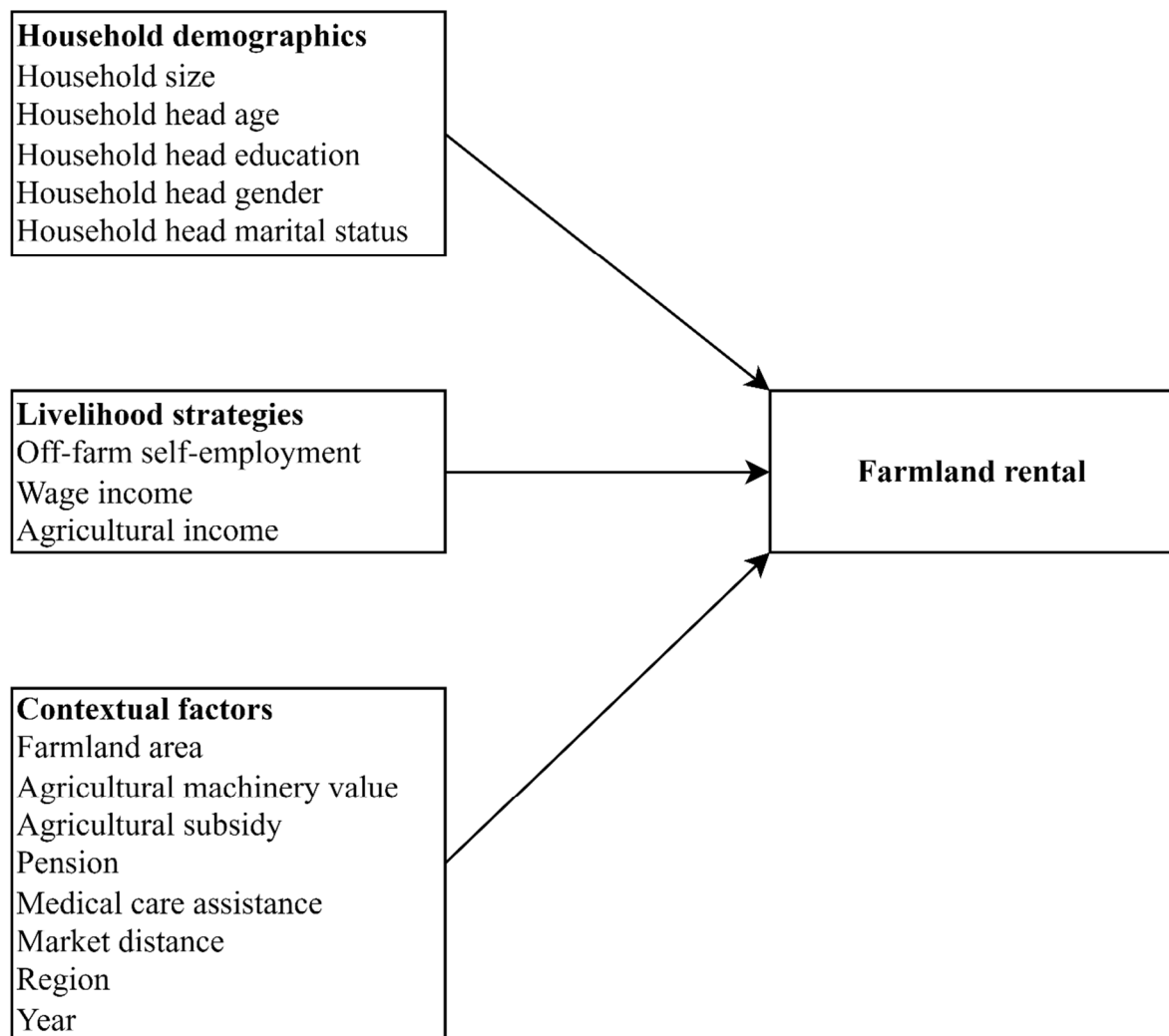


Figure 1. Conceptual framework of the driving forces of farmers' farmland rental in China.

As the labor–consumer balance theory suggests, landholding is a function of several household demographics. On one hand, the labor force supply is influential in determining landholding; larger families have a relatively sufficient labor force and tend to retain a larger amount of farmland. On the other hand, farming is a drudgery-prone activity, especially in areas where it is difficult or economically inefficient to use large agricultural machinery. As such, manual labor is still one of the important elements in agricultural activities in rural China and many other developing countries. Nevertheless, people's physical abilities for conducting agricultural activities will diminish as they get older, making them unable to continue farming. Farmers in their adulthood or the middle of their life courses may temporarily quit farming for more wage income through working in cities. Therefore, age may play a nonlinear role in affecting farmland rental. Moreover, as social capital in the form of education increases, the quality of the labor force potentially decreases along with dependence on farmland. Well-educated farmers tend to retain a smaller landholding compared with their less-educated counterparts. There could also be gender differences in farmland rental. For instance, studies have shown that female-headed households were more likely to rent out their farmland, especially after being granted land title [23], likely because land title increases land tenure security and grants more autonomy for the female-headed households to deal with their farmland. In summary, we hypothesize the following relationship between farmland rental and household demographics, on the condition that all the other factors are held constant:

H1a. Household size will be negatively associated with farmland rental; the larger the household, the lower the probability they rent out their farmland.

H1b. Age will be quadratically associated with farmland rental; particularly, there exists a U-shaped relationship between age and the probability of renting out farmland.

H1c. Education will be positively associated with farmland rental; well-educated households are more likely to rent out their farmland. Farmland rental is associated with the livelihood strategies of households. The labor–consumer balance theory and prior empirical studies have shown that non-farm opportunities are negatively associated with the size of the farmland operated by the rural households. Therefore, we could expect that non-farm employment will increase the household’s probability of renting out farmland. To increase income, rural households may strategically send migrants for remittance, providing households with secured financial situations due to the comparatively higher payment when working in urban areas. We expect wage income from migrants will be positively associated with farmland rental. In addition, agricultural production is a source of natural capital on which rural households have long relied, so it can offset the negative impact of household shocks, such as losses of jobs and household members [31]. We, therefore, hypothesize the following relationship between household livelihood strategies and farmland rental:

H2a. Households with non-farm employment are more likely to rent out their farmland than those who do not have such opportunities.

H2b. Wage income from migrants relaxes dependence on farmland and has a positive effect on farmland rental.

H2c. Agricultural income decreases the probability of renting out farmland.

5. Data and Methods

5.1. Data

We used data from the China Family Panel Studies (CFPS) to investigate the driving forces behind Chinese farmers’ land rental practices. Initiated in 2010 by Peking University, the CFPS was designed to be a nationally representative survey, and used a three-stage probability sampling strategy. It serves research needs in a variety of areas, including economic development, educational outcomes, health, migration, and family issues. Though the CFPS excluded six hard-to-reach provinces in mainland China due to cost constraints, the remaining 25 provinces account for 94.5% of the total population [32]. These characteristics make the CFPS an ideal data source for investigating farmers’ land rental in rural China.

The CFPS survey has been conducted every two years since it began in 2010. Newly formed households associated with households who participated in previous surveys are included in subsequent surveys. For this study, we used the 2012, 2014, and 2016 surveys, as they contained the dependent and independent variables in which we were interested. We confined this study to rural China, excluding households coded as urban. After basic data cleaning, we had unbalanced panel data of 6244 households in 2012, 5929 households in 2014, and 5874 households in 2016.

5.2. Variables

Farmland rental. The dependent variable is the farmland rental status. In the 2012, 2014, and 2016 surveys, one item asks if households rented out part of their collectively allocated farmland in the previous year. We coded this variable as a dummy variable to indicate the household’s farmland rental status, with 1 representing renting out part of their farmland and 0 representing not renting out farmland (see Table 1).

Table 1. Variable descriptions and coding schemes from the CFPS, 2012–2016.

	Variable	Description	Coding Scheme
Dependent variable	Farmland rental	Whether rented out part of collectively allocated farmland in the previous year	Dummy variable 0 = No; 1 = Yes
Household demographics	Household size	Household size	Continuous variable
	Household decision-maker's age	Household decision-maker's age	Continuous variable
	Household decision-maker's age, squared	Household decision-maker's squared age	Continuous variable
	Household decision-maker's education	Household decision-maker's education in years	Continuous variable
	Household decision-maker's gender	Household decision-maker's gender	Dummy variable 0 = Female; 1 = Male
	Household decision-maker's marital status	Household decision-maker's marital status	Dummy variable 0 = Single; 1 = Married
Livelihood strategy	Non-farm employment	Whether household members engaged in non-farm employment	Dummy variable 0 = No; 1 = Yes
	Wage income (log)	Wage income from migrants' work in urban areas	Continuous variable
	Agricultural income (log)	Agricultural income from farmland harvest	Continuous variable
Control variables	Farmland area (hectare)	Amount of collectively allocated farmland in hectares	Continuous variable
	Agricultural machinery price (log)	Total market price of owned agricultural machinery	Continuous variable
	Agricultural subsidy	Whether received agricultural subsidies	Dummy variable 0 = No; 1 = Yes
	Pension	Whether received pension	Dummy variable 0 = No; 1 = Yes
	Medical care assistance	Whether received medical care assistance	Dummy variable 0 = No; 1 = Yes
	Market distance (hours)	Commuting time to the nearest local market by typical transportation in hours	Continuous variable
	Region	Geographic regions by the National Bureau of Statistics of China	Categorical variable 1 = Eastern; 2 = Central; 3 = Western; 4 = Northeastern
Year	Survey year	Categorical variable 1 = 2012; 2 = 2014; 3 = 2016	

Household demographics. The labor–consumer balance model and prior research have shown that household demographics affect landholding. In this study, we included household size and the decision-makers' age, gender, marital status, and education. However, CFPS did not ask direct questions to obtain the household head's information; instead, it asked who the primary decision-maker of important household activities was, such as financial investment and agricultural arrangement. We designated the person in charge of agricultural arrangement as the household decision-maker, since this study focuses on the households' farmland arrangement. As agricultural activities demand manual labor, and physical abilities naturally diminish after peaking around the age of forty [33], we also included each household decision-maker's squared age to examine whether there exists a quadratic relationship between age and farmland rental.

Livelihood strategies. Livelihood strategies are the capacities of households to secure a sustainable supply of basic needs [34]; livelihood strategies determine the well-being of households and, therefore, can affect their landholding. We conceptualized household livelihood strategies in terms of sources of income, and used non-farm employment op-

portunity, wage income from migration, and agricultural income as measures. Non-farm employment opportunity is a dummy variable indicating whether the household has at least one member who has non-farm opportunity; wage income is the total annual salary from migrants in the household, and agricultural income is the revenue from farming.

Control variables. The control variables include farmland characteristics, social safety net participation, distance to the nearest local market, region, and survey year. Farmland characteristics can be influential when making land rental decisions, which is why we included farmland area, agricultural machinery price, and agricultural subsidies to control for these effects. The social safety net, such as medical care assistance and pensions, offers resources for eligible individuals and households, which impacts landholding and, therefore, needs to be controlled for in the model. China has developed a variety of agricultural subsidies and social safety net programs to promote agricultural productivity and people's well-being. We made these a binary variable, assigning 1 if the household received one or more of these payments, and 0 if the household did not receive any payments. Local markets are the places where information is frequently exchanged, and informal and agricultural transactions are made, another potential effect on farmland rental. We included the distance to the nearest local market to control for this effect. China is regionally diverse in natural characteristics, socioeconomic dimensions, and farmland policies; therefore, we included region and survey year to control for unobserved heterogeneity, such as differences in spatial and socioeconomic characteristics and changes in farmland policy.

Several things should be noted about the data-cleaning process. In the 2012 survey, there was a question about each household's amount of collectively allocated farmland, but in the 2014 and 2016 surveys, such information was not gathered. It is reasonable not to collect this information repeatedly, given that the length of a farmland contract is 30 years, and selling or buying at the household level is not allowed during the 30 years. We treated farmland area as a time-invariant variable, and expanded the farmland area in the 2012 data to the 2014 and 2016 data sets, continuing to treat it as a time-invariant variable in the model. Similarly, commuting time to the nearest local market was available in 2012 and 2014, but not in 2016. Some households that were in the same village in 2012 and 2014 reported different values in commuting time between the village and the nearest local market, showing that this is a subjective factor. Based on these, we assumed that within a given village, the distance to the nearest local market was time-invariant, and expanded this to the 2014 and 2016 data sets. Wage income, agricultural income, and agricultural machinery price were originally measured in *yuan*; we log-transformed them in the model to obtain a less skewed distribution. The farmland area was originally measured in *mu*, a traditional unit of area in China; we converted it to hectares, a metric unit of area. We found that among those who rented out their farmland, a small proportion (5.12% in 2012, 7.66% in 2014, and 7.11% in 2016) also rented farmland from other farmers. This could happen when farmers swapped for geographically closer farmland. Because these farmers involved did not appear to be in a farmland rental situation, we eliminated them from the research sample, as this situation falls outside of the scope of this research.

5.3. Analytical Approach

In this study, we employed panel data analysis to investigate the factors associated with farmers' land rental decision-making. For panel data, pooled ordinary least squares (OLS), and fixed- and random-effects models are often used to obtain estimates for the covariates. We used pooled OLS, and fixed- and random-effects models, as well as performed log-likelihood comparisons and the Hausman [35] test for model selection.

5.4. Missing Data

Panel data may encounter missing data issues because of sample attrition and non-response. However, the non-missing values from previous and/or subsequent waves of the survey can be the best predictors of the missing values, and multiple imputation

technologies can take advantage of the non-missing information to efficiently impute the missing values. Table 2 shows the missingness in the data. Most missing values were the household decision-maker's information because those households did not explicitly specify the person in charge of their agricultural activities. Income-related variables (e.g., wage and agricultural income, and agricultural machinery price) and social safety net participation also suffered from missing values, but the missing data accounted for less than 1% of the sample size. Farmland area and market distance were not necessarily missing because they were not collected in all surveys—as previously discussed, we treated the farmland area and market distance as time-invariant variables, and expanded data from 2012 to 2014 and 2016. Multiple imputation often assumes that the data are missing at random (MAR) [36]. We used the *mcartest* [37] to test for the MAR assumption. The result suggested that the missing data are MAR ($\chi^2 = 3305, p < 0.05$). Overall, the lack of specific data was not severe, and because the missing data were MAR, this allowed us to apply imputation to the missing data. Specifically, we employed the multiple imputation chained equation (MICE) method, and added 20 imputations based on the non-missing information in previous and/or subsequent years of the survey.

Table 2. Counts and percentages of missing data on the independent variables that contained missing values from the CFPS, 2012–2016.

Variable	Missing	Total	% Missing
Household decision-maker's age	2886	18,047	15.99
Household decision-maker's gender	2886	18,047	15.99
Household decision-maker's education	3208	18,047	17.78
Household decision-maker's marital status	2888	18,047	16.00
Wage income	35	18,047	0.19
Agricultural income	130	18,047	0.72
Farmland area	2128	18,047	11.79
Agricultural machinery price	16	18,047	0.09
Agricultural subsidy	3	18,047	0.02
Pension	67	18,047	0.37
Medical care assistance	67	18,047	0.37
Market distance	2032	18,047	11.26

For continuous variables, imputation sometimes generates values that are out of the range of the observed values. Although the effects of such outliers can be canceled out when considering all the imputations added to the data, they may potentially bias the results. To solve this problem and mimic the distribution of observed data, we employed the predictive mean matching (PMM) strategy to impute continuous variables with missing values. PMM requires specifying the number of the nearest neighbors from which it borrows information for the imputation—in this case, considering the relatively small observed samples, we set up the number of nearest neighbors to be five. This approach generates imputations that closely match the distribution of observed data (see Figures A1–A3 in Appendix A for comparisons between observed data and imputed data on the household decision-maker's age, education, and marital status). We also summarized the imputed variables by visualizing their means across the 20 imputations (see Figure A4 in Appendix A); the visualization suggested that the imputation process generated values that are generally around the mean without extreme outliers.

6. Results

6.1. Descriptive Statistics

Table 3 shows the descriptive statistics. The percentage of renting out farmland increased steadily from 10.39% in 2012 to 11.98% in 2014, and 14.42% in 2016, indicating a burgeoning level of participation in farmland rental in rural China. The household decision-maker was typically in their fifties, and most were married males. On average, the household decision-maker's amount of education ranged from 5.34 to 5.95 years, which

is primary-school level in China. The average household size was 4.21 in 2012, 4.13 in 2014, and 4.11 in 2016. Approximately 7.17% (2012), 6.66% (2014), and 7.83% (2016) of the households reported at least one household member as self-employed outside agriculture during the study period. The average logged wage income from migration was 9.98 in 2012, 10.07 in 2014, and 10.13 in 2016 and the average logged agricultural income was 8.65 in 2012, 8.96 in 2014, and 8.84 in 2016. This indicates that wage income from migration plays an increasingly important role in determining farmers' financial situations. The mean farmland collectively allocated from villages was 0.71 in 2012, 0.72 in 2014, and 0.75 hectares per household in 2016. The average logged agricultural machinery price increased from 7.06 in 2012 to 8.16 in 2016. More than half of the households received at least one type of agricultural subsidy. Social safety net participation has recently increased in rural China, especially for pensions, which rose from 22.85% in 2012 to 65.78% in 2016. Coverage for medical care assistance was high and stable at 96.65% in 2012 and 97.59% in 2016 of the sampled rural households having medical care assistance. The average commuting time to the nearest local market was 0.62 h in 2012 and 0.63 h in 2014 and 2016.

Table 3. Descriptive statistics for the sampled households from the CFPS, 2012–2016.

	2012		2014		2016	
	Mean or %	Std. Dev	Mean or %	Std. Dev	Mean or %	Std. Dev
Farmland rental	10.39%	0.31	11.98%	0.32	14.42%	0.35
Household size	4.21	1.85	4.13	1.92	4.11	1.99
Household decision-maker's age	50.51	12.24	51.11	11.74	51.96	11.91
Household decision-maker's education	5.34	4.33	5.79	4.05	5.95	4.06
Household decision-maker's gender	80.37%	0.40	59.38%	0.49	59.73%	0.49
Household decision-maker's marital status	89.50%	0.31	91.17%	0.28	90.41%	0.29
Non-farm employment	7.17%	0.26	6.66%	0.25	7.83%	0.27
Wage income (log)	9.98	1.24	10.07	1.19	10.13	1.08
Agricultural income (log)	8.65	1.25	8.96	1.24	8.84	1.28
Farmland area (hectares)	0.71	2.02	0.72	2.02	0.75	2.24
Agricultural machinery price (log)	7.06	1.71	7.51	1.50	8.16	1.42
Agricultural subsidy	68.55%	0.46	68.51%	0.46	64.30%	0.48
Pension	22.85%	0.42	69.94%	0.46	65.78%	0.47
Medical care assistance	96.65%	0.18	97.05%	0.17	97.59%	0.15
Market distance (hours)	0.62	0.96	0.63	1.01	0.63	0.99
N	6244		5929		5874	

6.2. Regression Results

We fitted pooled OLS, and fixed- and random-effects models to the panel data. Table 4 shows the results. The fixed- and random-effects models outperform the pooled OLS model because they account for the panel data structure. The outperformance of the fixed- and random-effects models is also reflected in their higher log-likelihood values than the pooled OLS. Therefore, the fixed- and random-effects models provide a better model fit than the pooled OLS. We performed the Hausman test to choose between the fixed- and random-effects model. The Hausman test suggested a preference for random-effects over fixed-effects ($\chi^2 = 10.94, p = 0.14$), so we focused on the random-effects results.

Table 4. Pooled OLS, and fixed- and random-effect results from regressing farmland rental status on household characteristics and livelihood strategies from the CFPS, 2012–2016.

	Pooled OLS		Fixed-Effects		Random-Effects	
	β	SE	β	SE	β	SE
Household characteristics						
Household size	−0.029	0.037	0.051	0.053	−0.056 *	0.027
Decision-maker's age	0.010	0.017	−0.015	0.047	−0.067 **	0.026
Decision-maker's squared	0.000	0.000	0.000	0.000	0.001 ***	0.000
Decision-maker's education	−0.015	0.009	−0.019	0.025	0.025 *	0.013
Decision-maker's gender (ref. = Female)	−0.096	0.058	−0.069	0.163	−0.145	0.104
Decision-maker's marital status (ref. = Single)	−0.071	0.091	−0.521 †	0.301	−0.591 ***	0.141
Livelihood strategies						
Non-farm employment (ref. = No)	0.669 ***	0.146	0.304	0.218	0.655 ***	0.150
Wage income (log)	0.073 ***	0.010	0.033 *	0.015	0.052 ***	0.010
Agricultural income (log)	−0.457 ***	0.013	−0.204 ***	0.017	−0.329 ***	0.013
Control variables						
Farmland area (hectares)	0.003	0.236	—	—	0.024	0.026
Agricultural machinery price (log)	−0.010	0.015	−0.001	0.018	−0.042 ***	0.012
Agricultural subsidy (ref. = No)	0.099	0.072	0.229 †	0.117	0.365 ***	0.090
Pension (ref. = No)	0.263 ***	0.075	0.287 **	0.102	0.213 *	0.085
Medical care assistance (ref. = No)	0.420 *	0.165	−0.214	0.312	−0.264	0.237
Market distance (hours)	−0.015 ***	0.209	—	—	−0.440 ***	0.103
Central (ref. = Eastern)	−19.161	713.504	—	—	0.254 *	0.129
Western (ref. = Eastern)	−18.215	713.502	−14.290	479.298	−0.519 ***	0.134
Northeastern (ref. = Eastern)	−18.656	713.504	—	—	0.197	0.165
Year 2014 (ref. = 2012)	0.753 ***	0.082	0.252 *	0.109	0.168 †	0.096
Year 2016 (ref. = 2012)	0.676 ***	0.083	0.556 ***	0.109	0.393 ***	0.094
Individual household effect	Controlled		—	—	—	—
Constant	20.159	713.503	—	—	0.272	0.719
Observations	15,766		2451		15,530	
Pseudo R ²	0.456		0.158		—	
Log-likelihood	−5889		−753		−753	
Hausman test			$\chi^2 = 10.94, p = 0.14$			

Note: The Pseudo R² and log likelihood for the fixed- and random-effects models are calculated by averaging pseudo R² and log likelihood from individual imputed data regression, respectively. The turning point for age can be obtained by the equation $-(-0.067)/(2 * 0.001) = 33.5$. SE = Standard error. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$.

At the household level, we found household size is negatively associated with farmland rental, indicating that larger households are less likely to rent out their farmland. We also found that both the household decision-maker's age and squared age are significantly associated with farmland rental, suggesting a quadratic relationship between age and farmland rental. Specifically, the relationship between age and farmland rental is U-shaped, with a turning point of 33.5 (see note in Table 4). The household decision-maker's educational attainment was positively correlated with farmland rental. These findings supported hypotheses H1a, H1b, and H1c. As to the household livelihood strategies, we found that non-farm employment and wage income from migration significantly increase the probability of renting out farmland, whereas agricultural income is negatively associated with the probability of renting out farmland. These findings supported hypotheses H2a, H2b, and H2c.

Besides the hypothesized relationship between farmland rental and household demographics and livelihood strategies, we found that married couple households are significantly less likely to rent out their farmland than households headed by non-married individuals. This distinction may be attributed to the different stages of the households' life cycle and their varying working-age labor force supplies and financial situations, which then affect their agricultural arrangements, such as farmland rental. For married couples in

the middle of the household life course, maintaining a stable landholding may be helpful in making ends meet and securing their financial situations, especially in hard times when unfavorable weather threatens agricultural harvests.

The effect of farmland areas is insignificant, suggesting that farmland rental is not significantly associated with the amount of farmland operated by the households. We found agricultural machinery price affects farmland rental negatively, suggesting that households with more agricultural machinery tend to maintain their landholding. Households who received an agricultural subsidy had an increased probability of renting out farmland. Similarly, receiving a pension has a positive impact on farmland rental, suggesting that farmers with a pension are more likely to rent out their farmland. The proximity to the local market was negatively associated with farmland rental; the closer to the local market, the higher probability of renting out farmland. There were geographic differences in farmland rental practices; notably, being in central China witnessed a positive effect on farmland rental. One reason could be that central China is the main source of rural out-migrants, thus making farmers from central China more likely to rent out their farmland in exchange for higher earnings in urban areas. Conversely, western rural China witnessed a significantly lower probability of renting out farmland; the western area is the least developed in China, and farmland may be their primary source of income, thus reinforcing the tie between farmers and their land.

6.3. Sensitivity Analyses

The previous analyses included a group of variables that may be intercorrelated, undermining the ability of causal attribution. For instance, previous studies have shown that education generally increases rural households' income [38]. The relationship between household livelihood strategies and farmland rental may be misspecified; particularly, instead of using total agricultural and wage income to measure household livelihood strategies, the proportions of agricultural and wage income are more comparable across the households, and are more likely to affect their farmland rental. Similarly, the area of farmland per capita would be a better indicator to measure the farmland endowment than the total area of farmland because the former takes into account the household size and is comparable across places where the arable land resources vary. To address those issues, we conducted sensitivity analyses using a fixed-effects model, replacing wage income and land area with the proportion of wage income and land area per capita, and selecting only three key variables. We also employed the propensity score matching (PSM) approach to validate the regression estimates (see Table 5).

Table 5. Sensitivity analyses using fixed-effects model and PSM on the key variables from the CFPS, 2012–2016.

	Fixed-Effects		PSM	
	β	SE	β	SE
Non-farm employment (ref. = No)	0.545 **	0.202	0.503 ***	0.031
Proportion of wage income	0.405 **	0.151	0.057 *	0.023
Land area per capita	0.226	0.512	0.049	0.014
Region effect	Controlled		Controlled	
Year effect	Controlled		Controlled	
Constant	—	—	−2.026 ***	0.031
Observations	54,700		66,631	
Pseudo R ²	0.056		0.071	
Log-likelihood	−884		−3413	

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

The fixed-effects model shows that, consistent with our hypotheses and previous results, non-farm employment and the proportion of wage income significantly increase the probability of renting out farmland, whereas the land area per capita shows an insignificant

impact. The PSM results show similar results in terms of the direction and significance of the parameter estimates, indicating that the results are reliable. Overall, the sensitivity analysis using the fixed-effects model and PSM confirmed our findings.

7. Summary and Discussion

Because China is one of the leading providers of many agricultural products, its farmland policies (such as farmland rental) could affect food supply at both the national and international levels. Using panel data from the CFPS, this study examined the factors that underlie farmers' land rental in rural China—the only legal way for individual farmers to circulate their land. We found that household demographics affect farmers' land rental, with larger and married-couple households being less likely to rent out their farmland, and that education has a positive impact on farmland rental. The household decision-maker's age was quadratically associated with farmland rental, with a threshold of 33.5 years old. Before the threshold, the household decision-maker's age was negatively correlated with farmland rental; after the threshold, the effect of the household decision-maker's age became positive. This reflects the nature of agricultural activities, which demand strength and agility that diminish with age. In some areas of rural China, large agricultural machinery has not been widely employed, as farmland is usually small and fragmented, forcing farmers to rely more heavily on manual labor. Finally, people in their late 30s are at the point in their lives where financial needs are severe; they are more likely to flow to urban areas for higher wages and to rent out their farmland.

The results also confirmed that livelihood strategies are influential in farmland rental decision-making. In particular, we found that households with non-farm employment opportunities are more likely to rent out their farmland. This supports the labor–consumer balance theory's assertion and Kung [25] and Huang et al.'s [21] findings that in rural China, there was a negative association between non-farm earnings and farm size [11]. We also found that wage income from migration increases the probability of renting out farmland. One reason could be, as shown in the descriptive statistics, wage income from migration plays an important role in determining the financial security of rural households, therefore decreasing their farmland dependence. Another reason might be that migration makes regular agricultural activities difficult to implement, leaving farmland rental a desirable option for rural out-migrants. This resonates with Gao et al.'s [39] finding that areas in China with a high number of rural out-migrants witnessed a high level of participation in the farmland rental market.

In summary, we found supportive evidence for the labor–consumer balance theory that farmers tend to keep a balance between landholding and household needs. We also extended the labor–consumer balance theory to a capitalized and increasingly mobile society, and examined the association between landholding and migration, an area which has not been widely studied. Migration studies have been increasing in recent decades; previous research has demonstrated that migration and the accompanying remittances help increase economic well-being at the household level [40] and develop the local economy at the community level [41]. We found evidence that wage income from migration can also reduce the dependence on farmland, the traditional provider of economic security. The findings can be also applied to the developing world at large. Like contemporary China, the developing world is or will be experiencing increasing internal and international migration. Migration, along with the accompanying remittances, change livelihood strategies and increase the well-being of the rural residents in developing countries [42], and may further affect their land disposal decisions. For instance, Holden et al. [43] found that land rental markets, especially informal markets, have been increasing in African countries, which is the same as what we have found in rural China. Holden and Otsuka [44] suggested that internal migration from rural to urban areas in Sub-Saharan Africa provides young migrants with alternative livelihood strategies that drive them out of agricultural production.

The findings have important policy implications, particularly regarding the impact of livelihood strategies on landholding. For China and many other counties that have been

experiencing rapid economic development, there exist large migration flows from rural to urban areas. Such migration serves as one of the livelihood diversification methods that helps secure the financial situation of rural households, and decreases their dependence on farmland. However, migration incomes are volatile, as less-educated and unskilled rural out-migrants are vulnerable in the labor market. Previous studies have shown that during the 2008 global financial crisis, millions of rural migrants lost their working opportunities in urban areas and returned to farming at their places of origin [45,46]. To encourage land circulation, policies should also provide training to rural out-migrants, and further reform the population registration and welfare systems to grant similar welfare benefits to rural out-migrants as is currently provided to their urban-born counterparts. Farmland rental sometimes obscures farmland titles [47] and decreases investment in rented farmland [7], affecting agricultural efficiency and food security. To address such potential issues stemming from farmland circulation, farmland policy should explicitly clarify the farmland title and farmland right for both the lessors and lessees, particularly through advocating formal contracts as opposed to informal oral agreements. New agricultural technology and farmland management education should be introduced to promote agricultural efficiency and food security.

There are limitations in this study, particularly in measurement and data availability. In the survey, the farmland area was collected only in 2012, and did not provide the amount and duration of each farmland rental; therefore, we had to treat the farmland area as a time-invariant variable in the model. In reality, the probability of renting farmland (in or out) would be more closely associated with the availability of tradable farmland than with the total amount of farmland allocated from village collectives; by keeping the farmland area constant in the model rather than considering the amount of rentable farmland, the results probably suffered from an overestimation of the relationship between the covariates and the outcome. Similarly, farmland quality and fragmentation may also play significant roles in a household's farmland rental decision-making. However, the current data did not provide such information, and we were unable to control for such effects in the model.

Future studies should be considered to address the aforementioned limitations, and to move similar studies forward. To unveil the mechanisms behind farmland rental decision-making, transaction records should be collected in a more detailed way, including amount, duration, reasons, and with whom the farmland is traded. Detailed information on farmland transactions could help researchers discover the causal mechanisms behind farmers' land disposal behavior, and contribute knowledge for the use of policymakers in regard to farmland reform and redistribution. Although we found a U-shaped relationship between age and farmland rental with a turning point of 33.5 in age, it does not necessarily mean that people generally quit farming after the threshold. The reality, as reflected in the descriptive statistics, is people in their fifties and sixties are actively engaging in farming in China [48]. Additional quantitative and qualitative studies should be conducted to examine the mechanisms behind the elder population's farming practices. Beyond the study of the driving forces of farmland rental, more work should be done to investigate the causes and consequences of other forms of farmland circulation that could have an impact on farmland acquisition, food safety, and the dynamics between rural and urban development, especially in other developing countries involved in land reform.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data and code are available upon request.

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Appendix A

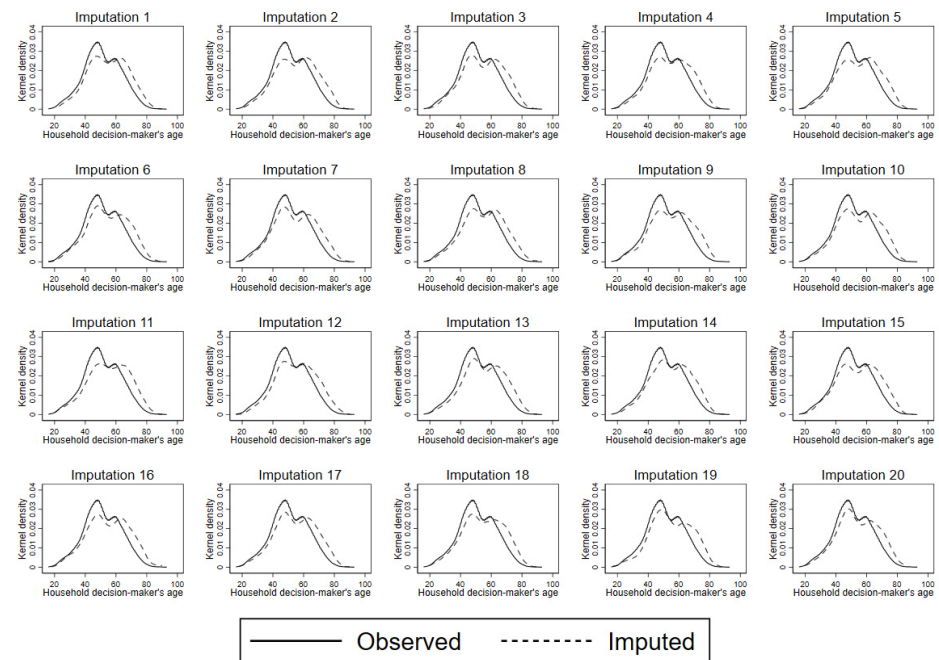


Figure A1. Comparisons between observed data and imputed data on age of the household decision-maker.

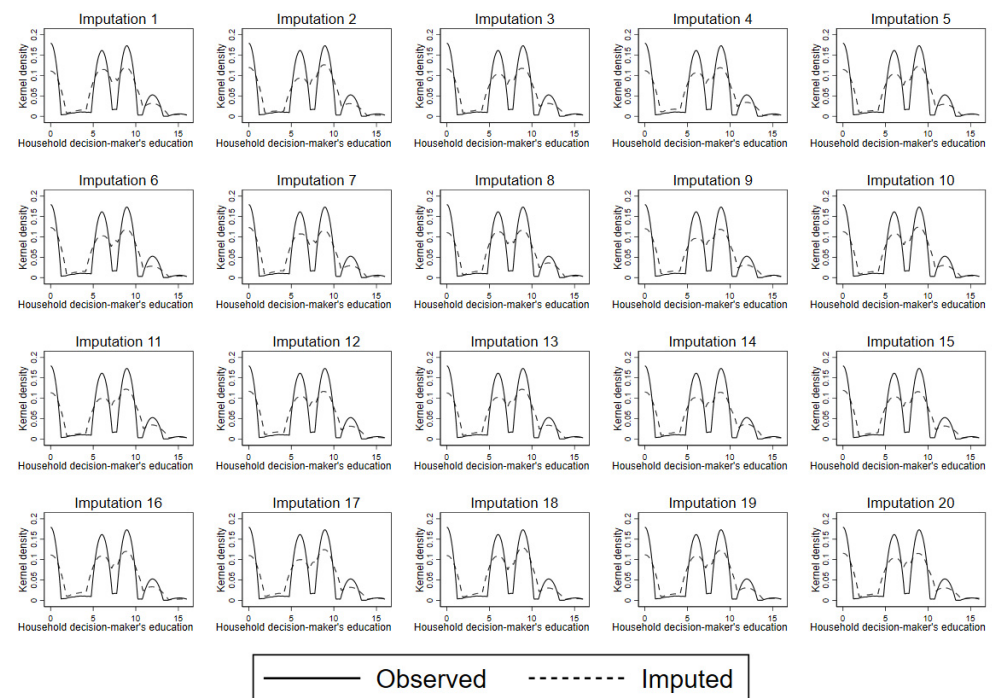


Figure A2. Comparisons between observed data and imputed data on education of the household decision-maker.

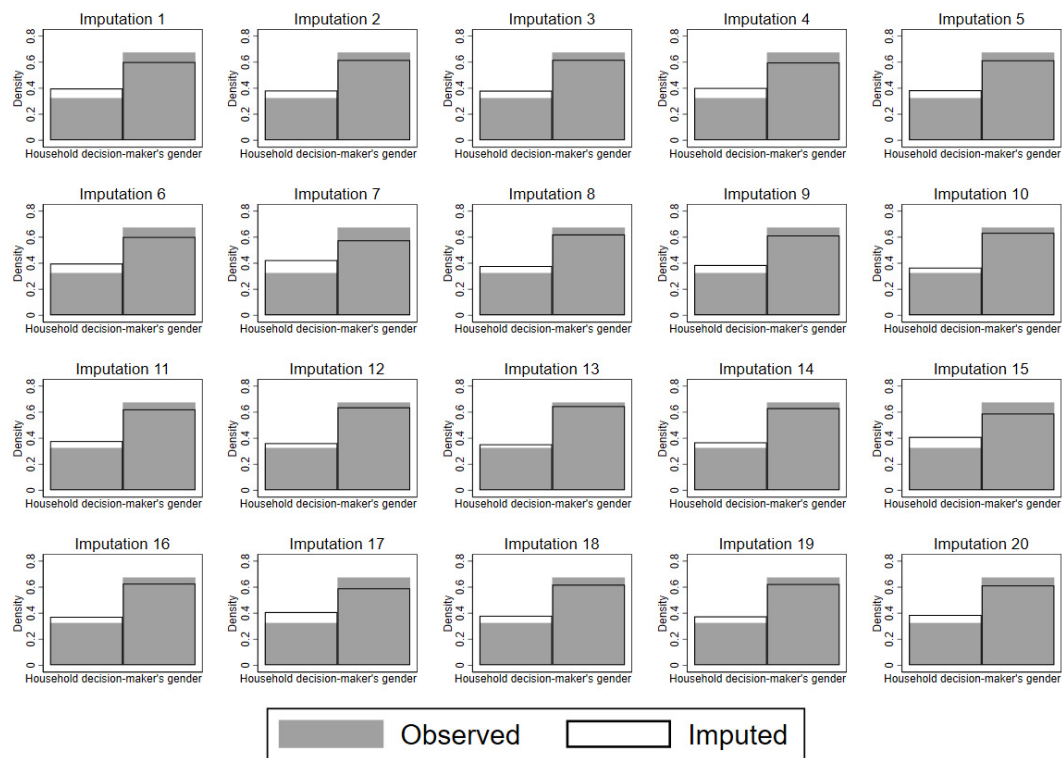


Figure A3. Comparisons between observed data and imputed data on marital status of the household decision-maker.

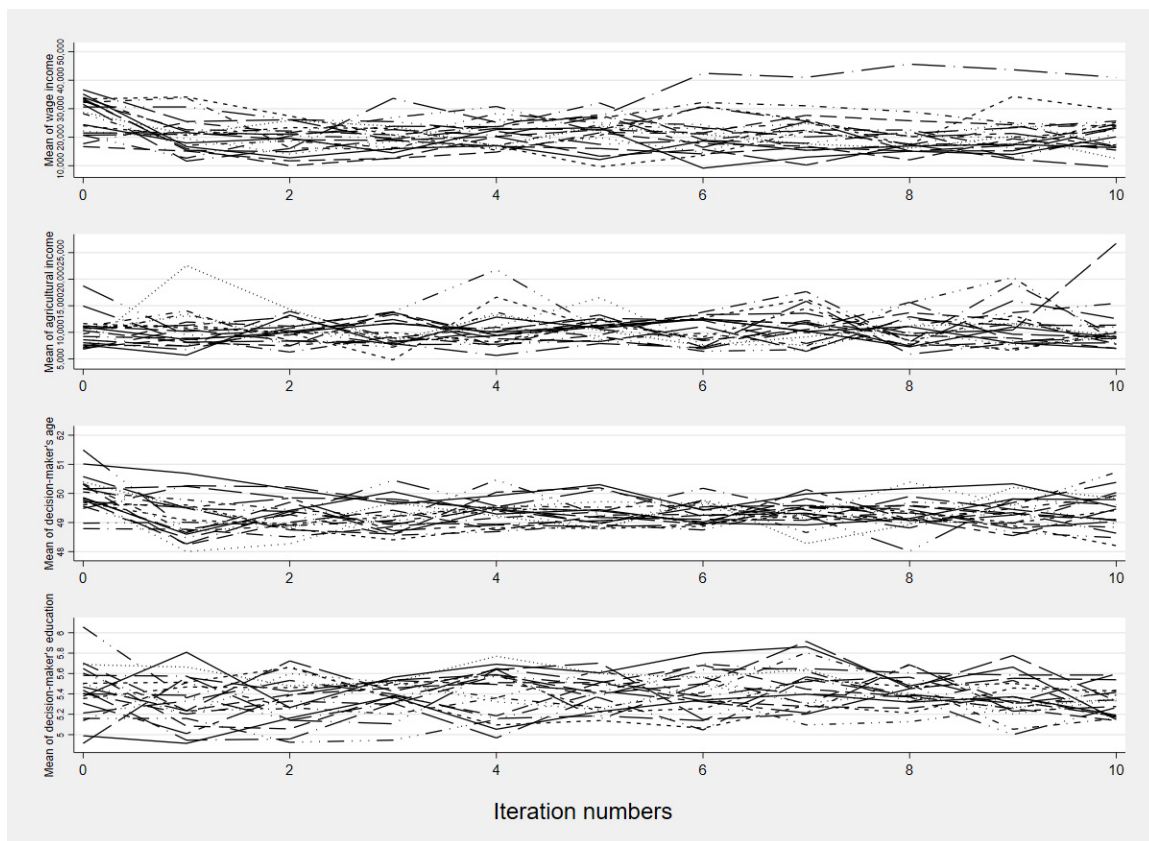


Figure A4. Summaries of imputed variables.

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