



Responsible Land Governance: Towards an Evidence Based Approach

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HOW DO LAND RENTAL MARKETS AFFECT HOUSEHOLD INCOME? EVIDENCE FROM RURAL JIANGSU, P.R. CHINA

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Abstract

The development of land rental markets in developing countries attracts much attention, but little is known about its impact on household incomes. This study empirically examines the effects of land rental decisions of farm households on their income and income components, i.e. farm, off-farm and transfer income, taking into account potential endogeneity of land rental decisions. Rural household survey data for 1,080 households in 128 villages in Jiangsu Province, China are used to estimate these effects. Quantile regressions are used to examine to what extent effects differ between income groups. Results indicate that lessee households generate higher total income as compared to autarkic households, in particular in the lower income groups, although they earn higher farm income throughout the entire farm income distribution. No significant differences in off-farm income between transacting households (i.e. lessee households or lessor households) and autarkic households are found. Transfer income of lessor households is significantly lower than those of autarkic households, especially those in the low-income quantiles.

Key Words:

Land rental market; Household income; Income components; Quantile regression; China

1 Introduction

Land rental markets (or, more generally, land use rights transfer) have drawn increasing attention in recent years as an important instrument to improve efficiency as well as equity, in terms of land distribution and household income, in developing countries. Theoretically, well-functioning land rental markets equalize factor ratios (i.e., land, labor, and agricultural asset ratios) across households with different resource endowments (Otsuka, 2007; Rahman, 2010; Jin and Jayne, 2013), and facilitate transfer of land from less efficient producers to more efficient ones (Feng, 2008; Deininger *et al.*, 2008a), enhancing efficiency. Well-functioning land rental markets also appear to be an important avenue for landless rural households to access land (Teklu and Lemi, 2004; Deininger *et al.*, 2008b). The markets provide a sorting mechanism by which households with higher agricultural ability and less off-farm job opportunities can rent in additional land and expand farm operation, while less efficient farm households that are more successful in off-farm employment can opt out of agriculture and rent out their land (Deininger and Jin, 2005; Zhang, 2008; Jin and Jayne, 2013).

Despite the potential of land rental markets to enhance efficiency and equity, whether or not they do so in practice is context dependent and hence an empirical matter (Otsuka, 2007). In developing countries, where labor, credit and other factor markets function imperfectly or may even be missing, land rental markets often contribute less to efficiency and equity than expected. Efficient but poor smallholders have a disadvantage in accessing land and capital when credit and insurance markets are underdeveloped or missing (Tian *et al.*, 2012). In such cases, land rental markets may even transfer land from poor and land-constrained households to relatively rich and land-abundant ones (Jin and Jayne, 2013). In addition, farm labor markets may be thin, due to moral hazard problems with hired labor and high monitoring costs of farm work, and prohibit the hiring of labor up to the quantity that would equalize its marginal product across households (Binswanger *et al.*, 1995; Van den Berg *et al.*, 2007). Factor market failures may therefore induce an inverse relationship between the size of land holdings and productivity, with land rental markets unable to correct these failures. Therefore, whether participation in land rental markets improves efficiency and equity is ultimately an empirical issue.

To date, a large body of literature focuses on the efficiency impacts of land rental markets, either on allocative efficiency (Deininger *et al.*, 2008b; Jin and Deininger, 2009; Jin and Jayne, 2013) or on productivity and technical efficiency (Deininger and Jin, 2005; Feng *et al.*, 2010; Gao *et al.*, 2012; Deininger *et al.*, 2013). Studies on the equity impacts of land rental markets mainly focus on the extent to which land rentals equalize the operational land distribution (Deininger *et al.*, 2003; Vranken and Swinnen, 2006; Zhang, 2008). The effects of land rental markets on rural household income and its distribution have received much less attention. Available studies on this topic present mixed evidence for

rural household income levels (Kung and Lee, 2001; Zhang, 2008; Jin and Jayne, 2013; Chamberlin and Ricker-Gilbert, 2016) and for the inequality of rural household incomes (Benjamin and Brandt, 1997; Sarap, 1998; Carter and Salgado, 2001; Xing *et al.*, 2009; Yang, 2015).

Understanding the income and equity effects of rural land rental markets is highly relevant for current policy-making in China. How to consolidate small plots into sufficiently large ones and how to increase rural household income, given the fragmented and small-scale landholdings that resulted from the egalitarian allocations of farmland since the late 1970s, are major problems in rural development policy in China. Rural land rental markets are viewed by both researchers and policy-makers as a tool to solve these problems, and have actively been promoted in recent years. The income effects of participation in rural land rental markets have been examined in some of the studies mentioned, but these studies do not take into account the recent rapid developments in land rental markets in China nor do they examine the potential heterogeneity of income effects. This paper therefore aims to examine: (1) the impact of land rentals on rural household income in a more developed land rental market; and (2) income disparities across rural households and the differential income effects of participation in land rental markets.

We use a quantile regression approach to estimate income effects for households in different brackets within the income distribution. To deal with potential endogeneity of land rental variables in the income equation, predicted probabilities of land rental decisions are estimated from a bivariate probit model, and are used as instruments for land rental decisions in the income equation.

The remainder of this paper is organized as follows. In Section 2 we outline a conceptual framework. In Section 3 we introduce the research site and the dataset used, and present some descriptive statistics of the variables used for the empirical analysis. In Section 4 we present the model specification and estimation strategy. Empirical results are presented in Section 5, whereas Section 6 concludes with a summary of our main findings and a discussion of policy implications.

2 Impact Mechanisms of Participation in Land Rental Markets on Household Income

In our analysis we classify rural household income into three categories: farm income, off-farm income and transfers. Farm income refers to income obtained by farm households as units of production and operation on-farm. Rental income on leased-out land and dividend income gained from shareholding in farmer cooperatives are counted as farm income as well. Off-farm income includes wage income from on-farm and non-farm employment, retirement pensions, and family operation income from business activities. Transfers refer to agricultural subsidies provided by state and local government, including direct payment to grain producers, general agricultural input subsidies for grain producers, improved strains of seed subsidies, and machinery-purchase subsidies. We distinguish four types of farm

households: those who rent-out land (lessor households), those who neither rent-in nor rent-out land (autarkic households), those who rent-in land (lessee households), and those who rent-out and rent-in land at the same time (lessor-cum-lessee households).

Farm households' participation in land rental markets has direct and indirect impacts on household income. Specifically, when renting in or renting out farmland, rural households' resource endowments and allocations are likely to change. With those changes in resource endowment, the total income level of rural households and its structure will change accordingly.

2.1 Effects of Renting-in Land on Household Income

For households on the demand side of land rental markets, the most likely impacts of renting-in land on their income are:

(1) *Direct and indirect effects on farm income.* After renting in farmland, it is anticipated that the size of lessee households' operational land holdings increases, requiring a higher use of labor and other inputs in farming activities. As a result, net farm revenue from crop production (after deducting production costs) generally increases. In some situations in which land rental transactions are made between relatives, neighbours or friends, the land rental rate is zero or even negative (i.e., lessee households may be compensated to look after lessor households' land) (Tian *et al.*, 2012). However, in many cases lessee households can access additional land only if they make rental payments to the landowner. Consequently, farm income of lessee households may rise or fall depending on whether the actual growth of net farm revenue is higher or lower than the payment for renting-in land.

(2) *Indirect effects on off-farm income.* Theoretically, with a farm size increase more labor and capital of lessee households will be allocated to agricultural production. Hence, an absolute or relative decline in off-farm income may occur because of decreasing labour availability for off-farm work. In reality, however, the volume of land that most lessee households rent-in may be small, given the small size of landholdings and the predominance of household-to-household transactions within the same community. Also, with the rise of the secondary and tertiary sector in urban areas and township and village enterprises and private enterprises in rural areas, both migration and local off-farm employment may have become widespread. Taken together, if lessee households are able to combine local off-farm employment with on-farm work (due to the small operational farm size and the seasonality of agricultural production), participation in land rental markets may have little effect on their off-farm income.

(3) *Indirect effects on transfer income.* Whether renting-in land affects transfer income of lessee households depends on the way agricultural subsidies are allocated to farm households by local officials. Although policy guidelines from the Ministry of Finance suggest that the amount of subsidy received by each household should depend on the actual area planted with particular grain crops, the policy also states that local governments can decide how best to allocate agricultural subsidies to households 'based on the

locality's actual situation' (Huang *et al.*, 2013). In many areas, grain subsidies (including the direct subsidy payment, the general-input subsidy, and the improved-seed subsidy) are given out on the basis of contracted land areas. Even when land is rented-out to another cultivator, the subsidies often are paid to the holder of land contract rights (i.e. the land contractor), not to the cultivator (i.e. the lessee household) (Gale, 2013). A number of provinces distribute grain subsidies based on actual grain planting areas, and lessee households should have received grain subsidies on rented-in land. In practice, however, grain subsidies are mostly being given to the land contractor rather than the cultivator (Huang *et al.*, 2011). Even when lessee households receive grain subsidies, these subsidies may be capitalized into land rent and implicitly go to the contractor (Yi *et al.*, 2015). Compared with grain subsidies which are paid to most grain-producing rural households, machinery-purchase subsidies are received by only a small fraction of farm households since few buy medium- or large-size machines. In conclusion, lessee households' renting-in of land may have a positive though probably small effect on transfer income depending on whether the lessee household or the land contractor receives grain subsidies.

The total income effect, i.e. the aggregate of the direct and indirect effects of land renting-in on the three sources of income, is expected to be positive if there is an increase in lessee households' farm income or transfer income; otherwise, renting-in land will have little effect on total income of lessee households.

2.2 Effects of Renting-out Land on Household Income

For households supplying land for rent, the most likely effects of participation in land rental markets on their income are:

(1) *Direct and indirect effects on farm income.* The effect of lessor households' participation in land rental markets on farm income is ambiguous. Renting-out of farmland results in a decline of land, and usually also labor and other inputs, allocated to on-farm production activities. The result is a decrease in gross farm revenue, provided the land rented-out was not left fallow. If the loss of farm revenue exceeds the saved production costs plus the rental income, lessor households will suffer a drop in farm income. When the land rent exceeds the net farm revenue from cultivating the rented-out land by lessor households themselves, or where the rented-out land was originally left fallow, renting-out of land will improve farm income. Therefore, farm income of lessor households may fall or rise depending on whether the lost net revenue from crop production is greater or smaller than the rent received from leased-out land.

(2) *Indirect effects on off-farm income.* The impact of renting-out land on lessor households' off-farm income is less straightforward. Renting-out land is typically regarded as having a positive effect on off-farm income due to labor re-allocation from farming activities to off-farm employment. This view, however, ignores the possibility that the allocation of the lessor households' labor force has reached an

optimal level, with younger laborers engaging in non-agricultural activities and older family members working on-farm. In this case, land may be rented out just because of the decline of older members' physical attributes or their wish for leisure. We therefore expect the effect of participation in land rental markets on off-farm income to be either positive or insignificant.

(3) *Indirect effects on transfer income.* Consistent with the reasoning for lessee households, lessor households' transfer income might be affected according to the local context of allocating grain subsidies to farm households. If local officials give out grain subsidies based on actual grain planting area, there may be a decline in transfer income for lessor households as a result of renting-out land and producing less grain. In practice, however, contracted land area has become the most commonly used measure to allocate subsidies, given that the administrative costs of monitoring the real grain-sown areas of large numbers of rural households would be extremely high. The land contractor (also the lessor) therefore usually receives the grain subsidies on leased-out land. Consequently, the impact of participation in land rental markets on transfer income of lessor households is likely to range from negative to insignificant.

The total effect of renting-out land on lessor household income will be the aggregate of these effects on the three income components, and can be positive or negative.

3 Data and Descriptive Statistics

3.1 Data Collection and Research Site

Our data were collected by a household- and village-level survey, based on multistage systematic sampling, held in Jiangsu Province in 2013 and the beginning of 2014. Located along the southeast coast of China, Jiangsu comprises of 13 prefecture-level cities, 77 county-level cities (or municipal districts), 957 towns (or townships), and 15,188 villages¹. As the main purpose of the survey was to gain insight into agricultural production and management, we preliminarily limited our selection to 55 county-level cities (or municipal districts) that met the following criteria: by the end of 2008 and 2009, the share of the arable land of each county-level city or municipal district in total arable land of the corresponding prefecture was above 10 per cent. From a list of the 55 eligible candidate county-level cities arranged in descending order according to grain yield per hectare, one out of every three county-level cities (or municipal districts) were randomly chosen, and thus 18 county-level cities (or municipal districts) were selected. They represent different development stages, since they are spread over the southern, central, and northern parts of Jiangsu. We then chose 64 towns (or townships), following the same procedure as for the selection of county-level cities (or municipal districts). In each town (or township) two villages were randomly selected. At the village level, a questionnaire-based interview was conducted with the village leader or village accountant, which covered a broad range of questions regarding village socio-

¹ Jiangsu Statistical Bureau. Jiangsu Rural Statistical Yearbook-2013. Jiangsu, 2013.

economic indicators, demographic characteristics, land endowments and farmland transfers, as well as agricultural production. A total of 1,202 farm households from these 128 villages were selected via random walk and were surveyed using household questionnaires, that included detailed questions on demographic characteristics, inputs and outputs for agricultural production, participation in factor markets, and income sources and expenditure components. The questions in the survey referred to the year 2012 (except questions on household assets for 2011). After cleaning the data and deleting observations with missing values, a final sample of 1,080 households could be used.

Jiangsu is well-suited for the research on land rental markets, rural household income and income disparities. As one of the economically most developed regions in China, Jiangsu has a highly-industrialized rural economy, and is a pioneer in terms of land rental market development. In 2014, it ranked second after Guangdong Province in terms of gross regional product, and its GDP per capita is more than two times the national average². Only 5.6% of its GDP is earned through primary activities, although the gross value of the primary industry in Jiangsu ranks third among the 31 provinces in mainland China³. The rapid development of Jiangsu's non-agricultural economy triggered both rural-urban migration and local rural industrialization, generating major changes in farmland supply and demand and boosting land rental markets. By the end of 2014, 46% of Jiangsu's farm households were engaged in land rental transactions. The amount of farmland transferred was 2.0 million hectares, accounting for 58% of the total area of household-contracted farmland in Jiangsu⁴; a share far exceeding the Chinese average of 30%⁵.

People's living standard in terms of per capita disposable income in Jiangsu ranked fourth among the PRC's 31 provinces in 2014⁶. Nevertheless, the province is also characterized by significant income disparities, including regional divides, urban-rural gaps, intra-rural and inter-household divides. Significant differences in living standards exist between the southern, central and northern regions in Jiangsu, similar to the national-wide differences between the eastern, middle and western areas. The ratio of average per capita disposable income of urban households to that of rural households in Jiangsu Province was 2.30 in 2014. Besides, significant income inequality also exists among households in rural areas. When rural households are classified into five income groups, the average per capita disposable

² National Bureau of Statistics of the People's Republic of China. 2015 China Statistical Yearbook. Beijing: China Statistics Press, 2015.

³ National Bureau of Statistics of the People's Republic of China. China Rural Statistical Yearbook-2015. Beijing: China Agriculture Press, 2015.

⁴ The Management and Administration Station of Rural Cooperative Economy of Jiangsu. Tabulation On Rural Collective Financial Affairs, Assets and Annual Statistical Report of Agricultural Economy Of Jiangsu-2014. Nanjing, 2015.

⁵ Ministry of Agriculture of the People's Republic of China. 2015 China Agricultural Development Report. Beijing: China Agriculture Press, 2015.

⁶ National Bureau of Statistics of the People's Republic of China. 2015 China Statistical Yearbook. Beijing: China Statistics Press, 2015.

income of the richest households is 6.3 times that of the poorest⁷. Although rural Jiangsu cannot be considered representative for rural China as a whole, the rapid recent development of land rental markets and its rural economy can provide important insights which are also relevant for other parts of China where land rental markets and the rural economy are less developed.

An overview of the land rental market participation status and the average land rental rate of households in our sample is presented in Table 1. Land rental markets are fairly active, with almost half of the surveyed households (42%) reporting to have participated in rental markets. The proportion of households participating in the land rental markets as lessor (17.8%) is lower than the proportion of lessee households (21.5%)⁸. The average area rented out (3.5 mu) is less than half of the average area rented in (7.4 mu). These characteristics indicate that lessee households often rent in land from more than one lessor households, and that not all lessor households were interviewed during the survey. A common problem with household surveys in rural China is that households that have migrated elsewhere and that rented their land out to other households cannot be interviewed. This probably also explains the discrepancy between the total rented-in and rented-out areas in our sample. With regard to the land rental price, the average rental rate of renting-out is around three times that of renting-in for the households in the sample. The main explanation for this observation is that 61% of lessor households have rented out their land to large scale-operating units (i.e., family farms, shareholding farmer cooperatives, and agribusiness firms) who are not included in our sample, and rental prices of land rented-out to these large scale-operating units are usually higher than those of land rented-out to farm households (i.e., lessee households in our sample)⁹. That's why households that rented-in land report different and much lower rental rates compared to households that rented-out land.

[INSERT TABLE 1 HERE]

3.2 Exploratory Analysis

Descriptive statistics of key variables for the four types of households show several observations of particular interest (see Table A.1 in the Appendix). We will focus our discussion on households that either rent-in land, rent-out land or are autarkic, because the group of households involved in renting-in and renting-out land is very small (2.4% of the sample).

⁷ Jiangsu Statistical Bureau. Jiangsu Rural Statistical Yearbook-2015. Nanjing, 2015.

⁸ Slightly more than 2% of the households in the sample participated in the rental markets both as lessors and as lessees. They are excluded from the table.

⁹ In rural Jiangsu, rental prices of land rented-out to the large scale-operating units include the rent that the lessee actually paid and (sometimes) grain subsidies the governments provided and (if there are any) land transfer grants. While rental prices of land rented-out to other farm households (i.e., lessee households in our sample) are low or even zero, since those land rental transactions are made between relatives, neighbours or friends. Therefore, rental rates for land transfers between lessor households and large scale-operating units (and even the rent that the large scale-operating units actually paid) are much higher than those for land transfers among farm households.

Lessee households earn on average the highest farm income (17,359 Yuan), more than twice that of autarkic households (8,065 Yuan), and three times more than that of lessor households (5,551 Yuan). Similarly, transfer income of autarkic households (570 Yuan) is significantly lower than that of lessee households (813 Yuan), but is significantly higher than that of lessor households (498 Yuan). Transfer income is relatively small, while off-farm income is the main income sources of all three groups. Lessor households have the highest off-farm income (71,403 Yuan) compared to autarkic households and lessee households (63,074 Yuan and 61,982 Yuan, respectively). In terms of total income, only lessee households have significantly higher income than non-participating households.

With regard to household endowments, we distinguish between household characteristics and human, physical, financial and social capital. The descriptive statistics presented in Table A.1 show some interesting features. Firstly, the human capital characteristics (except off-farm work experience) of the transacting farm households show significant deviations from those of the non-participating households. Both the age of household head and the average age of adults are lower for autarkic households than for lessor households, and are lowest for lessee households. On average, the educational attainment of household heads and highest education level of adults are significantly higher for both lessor households and lessee households than for autarkic households. Likewise, the share of household heads that received training in agricultural techniques is significantly larger for transacting households than for autarkic households. But the share of adults receiving agricultural training is significantly larger only for households that rent-in land.

Secondly, there are significant differences in land endowments and other physical assets between the household groups. The average amount of initial land endowment per adult for lessor households (1.87 mu) is significantly larger than that of autarkic households (1.66 mu), and is also greater than that of lessee households (1.70 mu), suggesting that land rental markets in rural Jiangsu seem to help equalize the operational land distribution. The difference between lessee households and autarkic households is not significant, which implies that both groups have similar land endowments, but one group rents additional land and the other does not. Remarkable differences in the composition of the asset portfolio are found between lessee households and lessor households, with the former possessing relatively more agricultural production assets (i.e. agricultural equipment and machinery) and the latter possessing more non-agricultural durable assets.

Thirdly, lessor households are more likely to face liquidity and credit constraints than autarkic and lessee households. Less than half (48%) of the lessor households have access to formal credit, while 56% of the autarkic households and 60% of the lessee households answer that they are able to obtain loans through the banking system.

Fourthly, lessor households have significant higher levels of social capital (measured by the number of village cadre within the household) than autarkic households. The difference in social capital between lessee households and autarkic households is not significant.

Finally, there are significant differences regarding household characteristics between households who rent-out land and those who do not participate in the rental markets. On average, the lessor households have a significantly smaller household size, and a higher share of adults in the household. Since these household characteristics have a direct effect on household consumption preferences, these observations suggest that household consumption and production decisions may be non-separable. Thus, household characteristics could affect household decisions to participate in land rental markets and thereby also household income.

To obtain more insights into the relative importance of different income sources for transacting and autarkic households at different brackets within the income distribution, we rank all sample households according to their total income level, and then divide them into six sub-samples: percentiles 0 – 10, 10 – 25, 25 – 50, 50 – 75, 75 – 90, and 90 – 100, respectively. Within each sub-sample, the level and share of different sources of income were computed for the three types of households (see Table A.2 in the Appendix).

We observe, firstly, that lessee households obtain the highest farm income compared to autarkic and lessor households in all income groups. They also receive the highest transfer income at income quantiles above 25%. Lessor households earn the highest off-farm income compared to autarkic and lessee households at all income quantiles. Secondly, the relative importance of farm income declines systematically, while the relative importance of off-farm income increases, as total income goes up for all three types of households except for autarkic and lessee households in the highest income group. Off-farm income makes up more than two-thirds of total income for household belonging to the income quantiles above 25%, even for lessee households, reflecting that off-farm income has become the leading income source for middle-income and higher-income households in rural Jiangsu. Thirdly, we find that the mean total income level of the top 10% income group equals 36 times the income level of the bottom 10% income group for the whole sample. The ratio of average income of the richest and the poorest 10% equals 32 for lessee households, 37 for lessor households and 37 for autarkic households. The Gini coefficients of total income for the whole sample (0.43), lessor households (0.44), lessee households (0.42), and autarkic households (0.42), which are not shown in the table, indicate that income inequality is slightly larger among lessor households than among lessee and autarkic households.

4 Methods

4.1 Model Specification

To estimate the impacts of participation in land rental markets on household income, we use an income-generating function. Theoretically, rural households' income and income sources are not only affected by their land rental decisions, but also by their human capital (such as education, training, and skills and experience), physical capital (such as land endowment, agricultural and durable assets), financial capital (such as credit access), and social capital (such as political status and connections) (Morduch and Sicular, 2002; Wan and Zhou, 2005; Xing *et al.*, 2009). Moreover, household characteristics (i.e., household size and share of adults) may also have a significant effect on rural household income (Wan, 2004; Shen and Yao, 2008; Liu *et al.*, 2014). Based on these considerations, the reduced-form income equation can be written as follows:

$$Y = f(A^{in}, A^{out}, HC, PC, FC, SC, Z^h) \quad (1)$$

where Y indicates household total income and its components (farm income, off-farm income, transfer income). The key variables of interest are household land rental market participation decisions in terms of land renting-in (A^{in}) and land renting-out (A^{out}). Control variables include: human capital indicators (HC), physical capital variables (PC), financial capital indicators (FC), social capital variables (SC), and household characteristics (Z^h). By estimating equation (1), the total effects (i.e. direct plus indirect) of land rental market participation on rural household income (i.e. total income, farm income, off-farm income, and transfer income) can be assessed.

Potential effects of land renting-in and renting-out on household income were discussed in Section 2.1. Renting-in land (A^{in}) is expected to have an ambiguous impact (either positive, insignificant, or even negative) on farm income, a negative or insignificant effect on off-farm income, a positive or insignificant effect on transfer income, and thus an ambiguous impact on total income. Renting-out land (A^{out}) is expected to have an indeterminate effect on farm income, a positive or insignificant impact on off-farm income, a negative or insignificant impact on transfer income, and hence an ambiguous effect on total income.

We use the average age of adults ($HC^{ageadults}$) as a proxy for the household's skills and experience, and also include the squared term ($HC^{agesadults}$) to capture possible life-cycle effect on household income. We hypothesize that household income initially rises with the average age of adults, but eventually declines due to offsetting effects of aging and cohort effects. The highest education level of adults ($HC^{eduhadults}$) serves as a proxy for the managerial ability of a family. Better educated household members are more likely to seek higher-paying off-farm jobs, and thus have higher off-farm income.

Farm income may rise with household members' education since it increases the household's ability to make farm management decisions (i.e. utilizing agricultural technologies) (Feng, 2008). On the other hand, farm income may also decline with household members' educational achievement when labour input in farming is reduced. Given the higher share of off-farm income in total income (compared with that of farm income), we expect the highest education level of adults to contribute positively to total income. The third human capital indicator in the model is the share of members who received training for agricultural techniques ($HC^{trasadults}$). Households with a larger share of members receiving agricultural training are expected to be more efficient in agricultural production and hence to earn more farm income. Lastly, households with a large share of adult members having off-farm work experience ($HC^{expsadults}$) are expected to have better access to off-farm jobs, and therefore to have higher off-farm income as well as total income.

The first physical asset in the model is the area of arable land contracted per adult (PC^{land}). Households with relatively more arable land per adult are expected to earn higher farm income. Transfer income is also expected to be larger, because grain subsidies are usually paid on the basis of contracted land areas instead of actually cultivated land areas. Land endowments may have mixed indirect effects on off-farm income. On the one hand, households with more land endowments may opt to allocate more labor to agricultural production and less labor to off-farm activities. On the other hand, farm revenue obtained from cultivating the land may be used to cover the initial costs of off-farm employment (travel & lodging, job search). Hence, the net effect is indeterminate. Nevertheless, the impact of land endowment on total household income is expected to be positive, given its positive effects on farm and transfer income. The value of agricultural assets (PC^{aasset}) and the value of non-agricultural durable assets (PC^{dasset}) are included as controls for the income-generation ability and willingness to bear risk. Households with a higher value of agricultural assets are expected to invest more in agriculture, and to be less involved in off-farm activities. So they are hypothesized to earn higher levels of farm income, but lower levels of off-farm income, while the impact on total income is ambiguous. Households with more non-agricultural durable assets are less likely to be liquidity-constrained and more willing to take risks in both agricultural production (i.e., purchasing new and improved seed varieties, adopting new technologies) and off-farm activities. To achieve higher profits, they may also shift their labor from agricultural to off-farm activities. Hence, the expected impact of the value of durable assets on farm income is ambiguous, while the impact on off-farm income and total income is expected to be positive. All three productive asset indicators are included in logarithmic form in the model in order to take their right-skewed distribution into account and to reduce the impact of outliers on the estimation results.

A dummy variable indicating whether a household has access to formal credit (FC^{credit}) is included in the model as an indicator of financial capital. If farm households have access to formal loans, they are less likely to face liquidity and credit constraints and can afford to buy more agricultural inputs and to cover the initial costs of off-farm employment. Hence, access to formal credit is expected to have a positive effect on farm income, off-farm income and total income.

The number of village cadre within the household (SC^{vcadre}) is used as a proxy for the household's social capital. Households with more village cadre members are expected to gain relatively higher farm and transfer income because they may have better access to policies regarding agricultural technology and information from the upper-level governments. Meanwhile, village cadres may be able to use their influence and social connections to obtain more lucrative salaried positions for their family members in local village industry (Walder, 2002), and therefore also increase their off-farm income. Hence, this social capital indicator is hypothesized to increase the household's farm, off-farm, transfer, and thus total income.

Household characteristics in the model include household size (Z^{hsize}) and the share of adults, defined as household members above 16 years (excluding students), in the household (Z^{hadult}). We hypothesize that larger households, and those with a larger share of adults, earn higher (farm, off-farm and total) incomes since they have more labor to allocate to on-farm and off-farm activities.

Finally, ten city-level dummy variables (D_j)¹⁰ are included in the model to control for differences in wage rates, infrastructure, agro-ecological factors and other factors that may differ between regions and affect income levels.

Assuming that the distribution of the income variables can be approximated by a log-normal distribution (Wan and Zhou, 2005), the model to be estimated is specified as:

$$\begin{aligned} \ln Y_k = & \alpha_0 + \alpha_1 A^{in} + \alpha_2 A^{out} + \alpha_3 HC^{ageadults} + \alpha_4 HC^{agesadults} + \alpha_5 HC^{eduhadults} + \alpha_6 HC^{trasadults} \\ & + \alpha_7 HC^{expadults} + \alpha_8 \ln PC^{land} + \alpha_9 \ln PC^{aasset} + \alpha_{10} \ln PC^{dasset} + \alpha_{11} FC^{credit} + \alpha_{12} SC^{vcadre} \\ & + \alpha_{13} Z^{hsize} + \alpha_{14} Z^{hadult} + \sum_j \beta_j D_j + \varepsilon \end{aligned} \quad (2)$$

¹⁰ Households in the sample are from 11 prefecture-level cities, namely, Nanjing, Wuxi, Changzhou, Suzhou, Yangzhou, Taizhou, Xuzhou, Lianyungang, Huai'an, Yancheng, and Suqian. Households in the latter city serve as the reference group.

where $k = 1, 2, 3, 4$ denotes total income, farm income, off-farm income, and transfer income respectively; $\alpha_0, \dots, \alpha_{14}$ and β_j ($j = 1, 2, \dots, 10$) are unknown coefficients, and ε is a disturbance term with standard properties.

4.2 Estimation Strategy

Equation (2) is estimated by ordinary least squares (OLS). It may be noted that OLS estimators provide only a partial view of the relationship between the dependent variables and the explanatory variables, since OLS only estimates conditional means of the outcome variable given a certain regressor. In our case, however, the effects of participation in land rental markets and other explanatory variables on household income and its components are likely to vary with the level of household income. The exploratory analysis in Section 3.2, for example, shows that the relative importance of farm income decreases systematically as total income rises for lessee households (except the top 10% income group). This may result in a declining impact of renting-in land on lessee households' total income when moving up along the income distribution, given the direct effect of renting-in land on farm income. A quantile regression (QR) procedure enables us to study the impact of land rental market participation and other regressors on the full income distribution (or any particular percentile), not just the conditional mean, therefore QR can provide a more nuanced view of the stochastic relationship between variables (Koenker and Bassett, 1978; Cameron and Trivedi, 2009; Uematsu *et al.*, 2013). Another advantage of the QR approach is its robustness for outliers. Moreover, the QR method is especially suitable for heteroskedastic data because it is semi-parametric and thereby avoids making assumptions about the distribution of regression errors.

In our analysis, we firstly use OLS regression to estimate the average effect of land rental market participation on household income for the entire sample, and then apply quantile regression to assess the potentially differentiated effects of land renting on household income for households ranking in specific income quantiles (i.e., 0.10, 0.25, 0.50, 0.75, and 0.90). It should be noted that QR for any income quantiles is done based on the entire sample, but places more weight on prediction for observations below the specific quantile than for observations above it. Moreover, QR is based on the quantiles of the dependent variable, which means that it cannot be done for a fixed ranking of households (e.g. based on total household income). Hence, we cannot compare the QR results for total household income with the QR results of the different income components because the ranking of households is not the same.

All explanatory variables in equation (2) should be exogenous. However, households' participation in land rental markets may be endogenous as there may be missing variables (such as companies renting land and offering jobs to farmers) that affect both households' income level and land rental decisions.

With the potential endogenous explanatory variables A^{in} and A^{out} , an instrumental variables (IV) approach may be more appropriate to estimate the income equations. Following the approach described in Feng (2008), a bivariate probit model is first developed to investigate farm households' land rental choices, and to predict the probabilities of households' renting-in land ($ProA^{in}$) and renting-out land ($ProA^{out}$). Next, the predicted probabilities (i.e., $ProA^{in}$ and $ProA^{out}$) are used as the instruments for actual participation in land rental markets (i.e., A^{in} and A^{out} , respectively) in the OLS and QR estimation of equation (2).

5 Estimation Results

We choose the classic five quantiles, namely 0.10, 0.25, 0.50, 0.75, and 0.90, for the QR. To avoid any distributional assumptions and to obtain bootstrap standard errors (similar to robust standard errors for ordinary regression), we utilize 500 replications in the application. The full regression results for the models are presented in Tables A.4-1 – A.4-4 in the Appendix¹¹. The results for the land rental variables are summarized in Table 2.

[INSERT TABLE 2 HERE]

With respect to *land renting-in*, we find that the estimated coefficients in the OLS regression are significantly different from zero in the total income and farm income equations, indicating that on average lessee households earn significantly higher farm as well as total income than autarkic households. In the QR regressions, 'Rent-in' has a positive and significant impact on lessee households' total income only at the lower quantiles (0.10 and 0.25). One likely explanation is that the share of farm income is small for middle- and high-income lessee households (less than 30% for lessee households ranking in quantiles above 0.25). Renting-in land therefore has a limited effect on their total income. As to the three income sources, lessee households generate significantly higher farm income as compared to autarkic households at all quantiles, suggesting that the gains in agricultural profits exceed the land rents paid by lessee households. The magnitude of the coefficients at the two highest farm income quantiles are larger than those at the middle and lower income quantiles, which indicates that households with relatively high farm income are the ones benefiting most from renting additional land. We find no significant difference in off-farm income between lessee households and autarkic households. This is in line with the fact that most lessee households combine local off-farm work with agricultural production (67% of the lessee households engage in local off-farm employment, see Appendix, Table A.5) in our research area. Failing to find a significantly higher transfer income of lessee households than that of autarkic ones is consistent with the observation that, in some localities of Jiangsu, grain subsidies are distributed to farmers

¹¹ The regression results of the land rental market participation equation are presented in Table A.3 in the Appendix.

according to the volume of contracted land (allocated by village authorities in the late 1990s), rather than the actual area of planted grain crops.

Turning to *land renting-out*, the OLS regression results show that lessor households on average gain significantly lower transfer income than autarkic households, while the other income components and the total household income do not differ significantly between the two groups. Regarding the QR estimates for ‘Rent-out’, we find that the estimated coefficients at all quantiles for total income are negative, but not significantly different from zero (at the 10 percent testing level). An explanation for the finding that lessor households fail to increase their total household income could be that these households maximize another objective (e.g. leisure), or that renting out may be a joint decision and households in rural Jiangsu may be forced (by the village leader or other households in the village) to rent out their land to a company or a collective. We further find that lessor households do not obtain significantly higher or lower farm and off-farm income than autarkic households. The finding for farm income is consistent with that of Zhang (2008) for Zhejiang Province. It implies that lessors’ gain of land rent is offset by the net revenue loss from crop production. Surprisingly, lessor households do not seem to generate higher off-farm income than autarkic households. In rural Jiangsu, off-farm employment is nearly universal. The share of farm households having off-farm jobs in the sample used for this study is 86%, and is almost the same for lessor, autarkic, and lessee households (see Appendix, Table A.5). Finally, the QR regression results show that lessor households have significantly lower transfer income than autarkic households at the three lowest quantiles. A possible explanation may be that in some cases grain subsidies have been capitalized into land rent and then been reported as rental income rather than transfer income by lessor households. Another explanation may be that some lessor households have relatively high off-farm and total household income and simply underestimate their transfer income because the latter is very small.¹² Together with the insignificant impact of land renting-in on lessee households’ transfer income, these findings indicate that local governments in Jiangsu Province use the contracted land area for providing grain subsidies to farmers.

A few interesting results emerge for the control variables that we use in the regressions (see tables A.4.1 – A.4.4 in the Appendix). As expected, we find that *human capital* variables play a role in household income. Specifically, there is an inverted-U shaped relationship between the average age of adults and household income in terms of total income (except at the 0.25 quantile) and off-farm income (except at the 0.10 quantile), suggesting a life-cycle effect of age on household income. This finding is consistent with the inverted-U shaped age – income trajectory found by Walder (2002) and Wan and Zhou (2005). As expected, the highest education level of adults is positively associated with both total

¹² In our sample, 80% of the lessor households that receive small amounts of transfer income (i.e. less than 500 yuan) have off-farm income that accounts for more than 80% of their total income.

and off-farm income (except at the lowest quantile). It supports the proposition that education level, a proxy for managerial talents, is a quality typically required in off-farm employment and contributing to larger off-farm income. The QR results show that the off-farm income returns to education tend to follow a U shaped curve with the smallest returns occurring at the middle quantile. Hence, we find that households ranked in both the lower part and the higher part of the off-farm income distribution tend to gain higher returns to education than those in the middle part. As regards the share of household members with off-farm work experience we find that it has a significant positive effect on the off-farm and total household income. The decreasing magnitudes of the estimated coefficients in the higher quantiles suggests that the effects of off-farm experience on off-farm and total income are largest in the lowest income quantiles.

With regards to *physical capital*, we find that arable land contracted per adult has a positive and significant impact on total income. The magnitude of the estimated coefficients decreases systematically across quantiles, which is in line with the observation that the relative importance of farm income declines consistently as total income goes up (except at the top 10% quantile). As regards the income components, we find that land endowments are associated with higher farm income as well as transfer income, and also with higher off-farm income at the 0.25 quantile. Besides land endowments, non-land assets also affect household income. The value of agricultural assets is positively related to farm income (at the mean and some of the quantiles) and negatively related to off-farm income (at the 0.25 quantile). This finding is in line with the hypothesis that households with more agricultural assets have a greater incentive to use more agricultural inputs, and thereby earn more farm income and less off-farm income. By contrast, the value of durable assets, a proxy for household wealth, has a highly significant positive impact on off-farm income in the OLS and QR results (and a negative effect on farm income at the 0.25th quantile). Given that off-farm income accounts for more than 80% of total income for households in the 0.25 and higher quantiles of the total income distribution, it is not surprising that the value of durable assets has a highly significant positive effect on total household income across all quantiles as well.

The results for *financial capital* are somewhat mixed. Having access to formal credit from the banking system increases households' off-farm income (except at the two extremes of income distribution), whereas it raises households' farm income at the 0.75 quantile and transfer income at the lowest quantile.

It is also noteworthy that *social capital* is positively related to household incomes. The number of village cadre within the household has a significant positive effect on households' total income (at the mean and the 0.75 quantile), farm income (at the mean and the 0.50, 0.75 quantiles), and transfer income (at the 0.50 quantile). These results, which are in line with our expectations, highlight the importance of social capital regarding cadre advantage on income generation in rural Jiangsu.

With regards to *households characteristics*, we find that the coefficients for household size are positive, both at the mean and throughout the income distribution. The magnitude of the coefficients decreases monotonically across quantiles for total, farm, and transfer income, and declines with fluctuations for off-farm income. These results are consistent with Wan (2004), who found that household size had a positive effect on rural household income because of economies of scale in income generation. Our findings also indicate that the positive income effect of household size is greater for households in the lower quantiles of the income distribution. Consistent with our hypothesis, a higher share of adults is estimated to significantly increase households' total, farm, off-farm and transfer income.

6 Conclusions

Using data collected from 1,080 farm households in 128 villages in rural Jiangsu, this study explores the impacts of land rental market participation on household income. A major advance compared to the few available studies on land rental markets' income effects in China is the use of an instrumental variables approach to correct for the endogeneity problem (i.e., the predicted probabilities of households' renting-out and renting-in land are used as the instruments for the actual participation in land rental markets) and a quantile regression procedure to capture the potentially differentiated effects across income groups of land rental market participation.

Several important findings emerge from our analysis. Firstly, lessee households generate significantly higher total income as compared to autarkic households, especially for households ranking in the lower part of the total income distribution. Lessor households do not obtain higher total income than autarkic households. The estimated coefficients for lessor households are all negative, though not significantly different from zero. Local governments in Jiangsu play an important role in promoting land transfers and the consolidation of small landholdings into large scale-operating units (i.e., family farms, shareholding farmer cooperatives, and agribusiness firms). In such circumstances, lessor households may be not those who have a comparative advantage in off-farm employment, and the total income gains from renting-out land may not be positive.

Secondly, lessee households earn significantly higher farm income than autarkic households, on average and throughout the farm income distribution. The magnitude of the coefficients at the higher income quantiles are larger than those at the middle and lower income quantiles, indicating that those in the higher quantiles of the farm income distribution are the households that achieve economies of scale and thus derive greater profits from renting additional land. The farm income of lessor households does not differ significantly from those of autarkic households, which suggests that the loss of agricultural profit is compensated by the revenues earned from renting-out land.

Thirdly, we do not find any significant differences in off-farm income between lessee and autarkic households and between lessor and autarkic households. These findings reflect the fact that participation in off-farm activities is more than 85% among all three household groups, and that local off-farm employment (which can relatively easily be combined with on-farm work) is more important than migration in Jiangsu Province.

Fourthly, transfer income does not differ significantly between lessee and autarkic households, but lessor households receive significantly lower transfer income than autarkic households (on average and at the three lower quantiles). This finding indicates that local governments in Jiangsu Province provide grain subsidies on the basis of contracted land areas, and that grain subsidies may be capitalized into land rent when the land is being rented out.

Our findings have important implications for policy making. First, given the generally positive returns to renting-in land and the insignificant returns to renting-out land, the promotion of the development of land rental markets will positively contribute to reducing rural-urban inequalities and eliminating rural poverty in Jiangsu Province. But the impact is expected to be much larger when the focus would be on building local institutions that help reduce transaction costs and facilitate land transfers between less-efficient and more-efficient farmers instead of indiscriminately forcing farm households to give up their contracted land.

Second, given the potential competition in access to land between companies or other entities and farm households, when land is rented-in by agribusiness companies or shareholding farmer cooperatives instead of farm households, the income gains of especially the poorest household groups (who want to rent additional land) get lost. Hence, when land is rented out to agribusiness companies or farmer cooperatives, the impact on reducing rural-urban inequalities and rural poverty is likely to be less as compared to land rentals to family farms or rural households.

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Appendix

[INSERT TABLE A.1 HERE]

[INSERT TABLE A.2 HERE]

[INSERT TABLE A.3 HERE]

[INSERT TABLE A.4-1 HERE]

[INSERT TABLE A.4-2 HERE]

[INSERT TABLE A.4-3 HERE]

[INSERT TABLE A.4-4 HERE]

[INSERT TABLE A.5 HERE]

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Table 1: Land rental characteristics in rural Jiangsu, 2012

	Renting-out	Renting-in
Share of households (%)	17.8	21.5
Average rented area (mu ^a)	3.5	7.4
Average land rental price (yuan ^b /mu)	642	209

Source: Own calculations based on survey.

Notes:

^a 15 mu = 1 ha; 6.07 mu= 1 acre; ^b 1 US\$ ≈ 6.23 Yuan (December 31, 2012)

Table 2: OLS and QR results for land rental variables^{a,b,c}

		OLS	Quantiles					Number of observations
			0.10	0.25	0.50	0.75	0.90	
Total income	Rent-out	-0.263 (-1.43)	-0.338 (-0.99)	-0.220 (-0.67)	-0.124 (-0.50)	-0.329 (-1.51)	-0.396 (-1.22)	1,080
	Rent-in	0.472* (1.71)	1.207** (2.26)	0.670* (1.74)	0.315 (0.92)	0.408 (1.21)	0.061 (0.15)	
Farm income	Rent-out	-0.062 (-0.25)	0.430 (1.09)	-0.217 (-0.86)	-0.090 (-0.39)	-0.106 (-0.48)	-0.251 (-1.01)	1,061
	Rent-in	0.963*** (2.67)	0.979* (1.70)	0.718*** (2.07)	0.636** (2.03)	1.401*** (3.69)	1.585*** (4.34)	
Off-farm income	Rent-out	-0.287 (-1.25)	-0.245 (-0.57)	-0.246 (-0.75)	-0.081 (-0.32)	-0.285 (-1.11)	-0.532 (-1.46)	1,005
	Rent-in	0.406 (1.17)	0.219 (0.32)	0.785 (1.60)	0.222 (0.61)	0.269 (0.69)	0.060 (0.14)	
Transfer income	Rent-out	-0.335* (-1.81)	-1.182*** (-2.75)	-0.484** (-2.58)	-0.231* (-1.74)	-0.053 (-0.42)	0.071 (0.38)	1,042
	Rent-in	0.064 (0.27)	0.319 (0.97)	0.043 (0.25)	-0.012 (-0.09)	-0.137 (-0.85)	0.113 (0.34)	

*: Significant at 10% level; **: Significant at 5% level; ***: Significant at 1% level;

Notes:

^a Figures in parentheses are *t* values;

^b The quantiles are based on the distribution of total income, farm income, off-farm income, and transfer income, respectively;

^c In our sample, 19 households did not obtain farm income and one household had negative farm income. These observations have been deleted in estimating the farm income equation. Likewise, 75 households without off-farm activities and 38 households that did not receive any agricultural subsidies from the government have been deleted from the sample used for estimating the off-farm income and transfer income equations, respectively.

Table A.1: Descriptive statistics of key variables by land rental market participation status ^{a,b}

Variables	Definition and measure	Land rental market participation				Total
		Rent-out	Autarkic	Rent-in	Rent-out & Rent-in	
Income variables						
Farm income	Sum of family operation income from agricultural production on farm and rental income (yuan)	5551.22** (5414.23)	8065.40 (15671.64)	17358.79*** (28340.30)	10966.38 (9716.68)	9684.63 (18432.87)
Off-farm income	Sum of wage income, pensions and family operation income from non-farm business activities (yuan)	71403.13 (68526.39)	63073.99 (60528.75)	61981.78 (63356.94)	59210.92 (64063.72)	64227.10 (62714.37)
Transfer income	Sum of grain subsidies and machinery-purchase subsidy (yuan)	497.62** (434.86)	569.63 (332.74)	813.47*** (1778.73)	457.46* (390.98)	606.51 (889.69)
Total income	Sum of farm income, off-farm income and transfer income (yuan)	77451.97 (68917.95)	71709.02 (63673.96)	80154.03* (68205.68)	70634.78 (62536.86)	74518.24 (65605.92)
Human capital^c						
Age of household head	Age of household head (years)	59.99* (10.64)	58.35 (10.13)	55.05*** (9.45)	58.73 (9.55)	57.94 (10.18)
Average age of adults	Average age of adults (years)	52.36*** (10.87)	48.93 (9.98)	46.95** (10.18)	51.81 (10.95)	49.18 (10.35)
Education of household head	Education level of household head (1=Illiterate; 2=Primary education; 3=Secondary education; 4=High school education; 5= Undergraduate education and above)	2.73** (1.04)	2.57 (0.97)	2.83*** (0.90)	2.62 (0.94)	2.65 (0.97)
Highest education level of adults	Highest education level of adults (1=Illiterate; 2=Primary education; 3=Secondary education; 4=High school education; 5= Undergraduate education and above)	3.71*** (1.08)	3.47 (1.00)	3.60* (0.92)	3.58 (0.99)	3.55 (1.00)
Training for agricultural techniques	Dummy variable for household head receiving training for agricultural techniques (1=yes; 0=no)	0.31* (0.46)	0.24 (0.43)	0.37*** (0.48)	0.35 (0.49)	0.28 (0.45)
Share of members with training for agricultural techniques	Proportion of adults in the household with training for agricultural techniques	0.15 (0.26)	0.12 (0.23)	0.17*** (0.25)	0.17 (0.26)	0.14 (0.24)
Off-farm work experience	Dummy variable for household head having an off-farm job before the survey year (1=yes; 0=no)	0.72 (0.45)	0.68 (0.47)	0.68 (0.47)	0.62 (0.50)	0.68 (0.47)
Share of members with off-farm work	Proportion of adults in the household with off-farm work	0.64 (0.29)	0.63 (0.29)	0.62 (0.30)	0.58 (0.35)	0.63 (0.29)

work experience	experience					
Physical capital						
Arable land contracted per adult	Area of arable land contracted per adult (mu)	1.87** (1.46)	1.66 (1.13)	1.70 (1.15)	2.00 (1.34)	1.72 (1.20)
Value of agricultural assets	Summed value of agricultural assets (including agricultural machinery, equipment and other facilities) (yuan)	3656.77 (21455.33)	3375.84 (8866.14)	9257.76*** (25710.76)	6944.62* (15462.61)	4775.22* (16738.30)
Value of durable assets	Total value of durable assets (including car, motorcycle, and other non-agricultural assets) (yuan)	18673.18 (67407.48)	13574.68 (51821.53)	9670.47 (41851.32)	29307.69 (61250.81)	14021.16 (53342.10)
Financial Capital						
Credit access	Dummy variable for household having access to formal credit from banking system (1=yes; 0=no)	0.48* (0.50)	0.56 (0.50)	0.60 (0.49)	0.38* (0.50)	0.55* (0.50)
Social Capital						
No. of village cadre within the household	Number of village cadre within the household	0.32** (0.49)	0.23 (0.44)	0.27 (0.46)	0.31 (0.55)	0.26 (0.46)
Household characteristics						
Household size	Number of household members (persons)	4.24* (1.80)	4.52 (1.83)	4.44 (1.83)	3.73** (1.69)	4.43 (1.83)
Share of adults	Proportion of adults in total household members	0.88*** (0.13)	0.84 (0.15)	0.83 (0.16)	0.90** (0.14)	0.84 (0.15)
Number of observations		192	630	232	26	1,080

Source: Own calculations based on survey.

Notes:

^a Figures in parentheses are standard deviations;

^b Asterisks indicate that the group mean is significantly different from the mean value for the autarkic group. *: Significant at 10% level; **: Significant at 5% level; ***: Significant at 1% level.

Table A.2: Level and composition of household incomes for selected quantiles, by land rental market participation status ^{a,b}

		0%-10%		10%-25%		25%-50%		50%-75%		75%-90%		90%-100%	
		Mean (Yuan)	Share (%)	Mean (Yuan)	Share (%)	Mean (Yuan)	Share (%)						
Rent-out	Farm income	3660.04	63.38	7227.96	33.18	4298.12**	9.12	6320.71	7.81	5268.76	4.28	6388.09	3.01
	Off-farm income	1605.39	27.80	13956.07	64.08	42385.17**	89.92	74149.35*	91.57	117123.90***	95.33	205182.00	96.77
	Transfer income	509.70	8.82	595.82	2.74	451.59*	0.96	503.86	0.62	473.76	0.39	463.39**	0.22
	Total income	5775.13	100.00	21779.85	100.00	47134.88	100.00	80973.92	100.00	122866.42**	100.00	212033.48	100.00
Autarkic	Farm income	4091.15	72.18	6231.10	30.27	6279.29	13.78	7759.58	9.85	7857.53	6.71	21158.78	10.13
	Off-farm income	1151.95	20.32	13782.72	66.95	38733.19	84.99	70451.60	89.41	108564.80	92.80	186925.00	89.53
	Transfer income	425.03	7.50	572.41	2.78	562.79	1.23	581.83	0.74	570.98	0.49	699.60	0.34
	Total income	5668.13	100.00	20586.23	100.00	45575.27	100.00	78793.01	100.00	116993.31	100.00	208783.38	100.00
Rent-in	Farm income	5588.35**	79.14	10405.27***	50.15	12169.67***	26.28	18196.48***	22.08	20716.32***	16.99	41578.54	18.24
	Off-farm income	1042.00	14.76	9795.76***	47.21	33514.48***	72.38	63394.29***	76.94	99700.78**	81.75	185584.20	81.43
	Transfer income	430.75	6.10	548.15	2.64	621.12	1.34	802.43***	0.98	1537.02**	1.26	751.75	0.33
	Total income	7061.10**	100.00	20749.18	100.00	46305.27	100.00	82393.20**	100.00	121954.12**	100.00	227914.49	100.00
Total	Farm income	4334.08	72.51	7456.75	36.00	7351.29	16.00	9767.12	12.19	10763.31	9.03	22386.10	10.46
	Off-farm income	1196.16	20.01	12689.79	61.26	38045.36	82.79	69750.35	87.05	107664.80	90.31	191053.70	89.23
	Transfer income	447.31	7.48	567.45	2.74	558.22	1.21	607.84	0.76	792.15	0.66	663.27	0.31
	Total income	5977.55	100.00	20713.99	100.00	45954.87	100.00	80125.31	100.00	119220.26	100.00	214103.07	100.00

Notes:

^a Asterisks indicate that means group mean is significantly different from the mean value for the autarkic group. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

^b The quantiles are based on the distribution of total income.

Table A.3: Results of the bivariate probit model for land rental market participation

Variables	Rent-out		Rent-in	
	Coef.	z-statistics	Coef.	z-statistics
Human capital variables				
Age of household head (log)	-13.651	-1.05	17.093	1.26
Household head's age squared (log)	6.798	1.05	-8.861	-1.31
Education of household head	0.024	0.36	0.095*	1.76
Training for agricultural techniques	-0.077	-0.65	0.355***	3.49
Off-farm work experience	0.152	1.34	-0.174*	-1.70
Physical capital variables				
Arable land contracted per adult (log)	0.416***	4.36	-0.224***	-2.85
Value of agricultural assets (log)	-0.045***	-3.26	0.068***	5.16
Value of durable assets (log)	-0.008	-0.70	-0.015	-1.15
Financial Capital				
Credit access	-0.179*	-1.75	-0.085	-1.00
Social Capital				
No. of village cadre within the household	0.114	0.96	0.007	0.06
Household characteristics				
Household size	0.114***	3.15	-0.076**	-2.18
Share of adults	1.469***	3.24	-0.325	-0.88
Rural market variables				
Share of households in the village participating in land rental market	2.515***	9.63	1.452***	6.40
Average land rent (yuan/mu) at the village level	0.232**	2.67	-0.205***	-3.06
City dummy variables				
Constant	-5.128***	-3.21	2.704**	2.20
Wald chi2(48)			970.55	
Prob > chi2			0.000	
Rho			-0.339***	
Observations			1,080	

* Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A.4-1: OLS and Quantile regression estimates for total income ^{a,b,c}

Variables	OLS	Quantiles				
		0.10	0.25	0.50	0.75	0.90
Participation in land rental markets						
Rent-out	-0.263 (-1.43)	-0.338 (-0.99)	-0.220 (-0.67)	-0.124 (-0.50)	-0.329 (-1.51)	-0.396 (-1.22)
Rent-in	0.472* (1.71)	1.207** (2.26)	0.670* (1.74)	0.315 (0.92)	0.408 (1.21)	0.061 (0.15)
Human capital						
Average age of adults	0.045** (2.39)	0.079* (1.92)	0.030 (0.99)	0.042* (1.90)	0.066*** (3.62)	0.073*** (2.83)
Adults' average age squared/100	-0.067*** (-3.68)	-0.106*** (-2.67)	-0.056* (-1.81)	-0.066*** (-3.03)	-0.086*** (-4.73)	-0.095*** (-3.69)
Highest education level of adults	0.114*** (3.65)	0.026 (0.43)	0.129*** (3.31)	0.109*** (3.11)	0.103*** (3.63)	0.120** (3.12)
Share of members received training for agricultural techniques	0.047 (0.44)	0.134 (0.64)	0.092 (0.64)	0.030 (0.26)	-0.068 (-0.57)	-0.007 (-0.04)
Share of members had off-farm work experience	0.893*** (9.20)	1.425*** (9.25)	1.110*** (8.40)	0.837*** (6.77)	0.541*** (4.95)	0.367*** (2.90)
Physical capital						
Arable land contracted per adult (log)	0.190*** (3.81)	0.267*** (2.65)	0.229*** (3.47)	0.148*** (2.81)	0.128*** (2.71)	0.111* (1.71)
Value of agricultural assets (log)	-0.004 (-0.51)	-0.034** (-2.05)	-0.012 (-1.00)	-0.002 (-0.21)	-0.007 (-0.94)	0.007 (0.61)
Value of durable assets (log)	0.023*** (4.33)	0.031*** (2.77)	0.026*** (3.77)	0.018*** (2.90)	0.024*** (4.18)	0.016** (2.06)
Financial Capital						
Credit access	0.076 (1.64)	0.087 (0.98)	0.071 (1.05)	0.071 (1.46)	0.061 (1.41)	0.043 (0.55)
Social Capital						
No. of village cadre within the household	0.122*** (2.80)	0.121 (1.20)	0.106 (1.43)	0.096 (1.49)	0.098* (1.78)	0.098 (1.41)
Household characteristics						
Household size	0.267*** (14.66)	0.316*** (10.16)	0.286*** (11.18)	0.244*** (10.41)	0.213*** (10.54)	0.186*** (5.57)
Share of adults	1.308*** (6.09)	1.985*** (4.81)	1.284*** (4.21)	1.050*** (4.02)	1.054*** (4.68)	0.894*** (2.81)
City dummy variables						
Constant	yes 6.554*** (12.13)	yes 4.216*** (3.59)	yes 6.418*** (7.60)	yes 7.097*** (10.28)	yes 7.146*** (13.30)	yes 7.719*** (11.34)
Pseudo R ² (R ² for OLS)	0.571	0.443	0.411	0.350	0.298	0.263
Observations	1,080	1,080	1,080	1,080	1,080	1,080

Notes: ^a * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level; ^b Figures in parentheses are *t* values; ^c The quantiles are based on the distribution of total income.

Table A.4-2: OLS and Quantile regression estimates for farm income ^{a,b,c}

Variables	OLS	Quantiles				
		0.10	0.25	0.50	0.75	0.90
Participation in land rental markets						
Rent-out	-0.062 (-0.25)	0.430 (1.09)	-0.217 (-0.86)	-0.090 (-0.39)	-0.106 (-0.48)	-0.251 (-1.01)
Rent-in	0.963*** (2.67)	0.979* (1.70)	0.718*** (2.07)	0.636** (2.03)	1.401*** (3.69)	1.585*** (4.34)
Human capital						
Average age of adults	-0.011 (-0.49)	0.044 (1.32)	0.031 (1.41)	0.011 (0.42)	-0.028 (-1.01)	-0.049 (-1.30)
Adults' average age squared/100	0.003 (0.15)	-0.049 (-1.47)	-0.034 (-1.61)	-0.014 (-0.58)	0.020 (0.76)	0.041 (1.06)
Highest education level of adults	0.015 (0.49)	0.006 (0.11)	0.014 (0.42)	0.029 (0.94)	0.059 (1.62)	0.050 (1.23)
Share of members received training for agricultural techniques	0.033 (0.28)	0.139 (0.85)	-0.019 (-0.16)	-0.087 (-0.87)	-0.127 (-0.87)	0.080 (0.28)
Share of members had off-farm work experience	-0.056 (-0.55)	0.158 (0.94)	0.041 (0.34)	-0.017 (-0.16)	-0.080 (-0.73)	-0.108 (-0.86)
Physical capital						
Arable land contracted per adult (log)	0.772*** (8.53)	0.893*** (11.62)	0.852*** (12.50)	0.904*** (14.46)	0.836*** (10.38)	0.725*** (6.56)
Value of agricultural assets (log)	0.028** (2.35)	0.009 (0.58)	0.016* (1.65)	0.022** (2.29)	0.017 (1.63)	0.023* (1.68)
Value of durable assets (log)	-0.007 (-1.26)	-0.002 (-0.17)	-0.012* (-1.66)	-0.008 (-1.21)	-0.005 (-0.78)	-0.012 (-1.45)
Financial Capital						
Credit access	0.063 (1.17)	0.078 (0.88)	0.035 (0.60)	0.081 (1.48)	0.105* (1.72)	0.069 (0.74)
Social Capital						
No. of village cadre within the household	0.119* (1.70)	-0.076 (-0.71)	0.095 (1.44)	0.122** (2.12)	0.166** (2.49)	0.125 (1.48)
Household characteristics						
Household size	0.164*** (7.51)	0.205*** (5.72)	0.189*** (7.38)	0.187*** (9.68)	0.156*** (6.27)	0.118*** (4.14)
Share of adults	0.883*** (3.43)	0.951** (2.52)	0.879*** (3.06)	0.932*** (4.12)	0.876*** (3.23)	0.585* (1.90)
City dummy variables						
	yes	yes	yes	yes	yes	yes
Constant	6.796*** (10.87)	3.973*** (3.77)	5.325*** (8.69)	6.066*** (8.94)	7.503*** (9.35)	8.767*** (8.35)
Pseudo R ² (R ² for OLS)	0.381	0.269	0.288	0.277	0.258	0.251
Observations	1,061	1,061	1,061	1,061	1,061	1,061

Notes: ^a * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level; ^b Figures in parentheses are *t* values; ^c The quantiles are based on the distribution of farm income.

Table A.4-3: OLS and Quantile regression estimates for off-farm income ^{a,b,c}

Variables	OLS	Quantiles				
		0.10	0.25	0.50	0.75	0.90
Participation in land rental markets						
Rent-out	-0.287 (-1.25)	-0.245 (-0.57)	-0.246 (-0.75)	-0.081 (-0.32)	-0.285 (-1.11)	-0.532 (-1.46)
Rent-in	0.406 (1.17)	0.219 (0.32)	0.785 (1.60)	0.222 (0.61)	0.269 (0.69)	0.060 (0.14)
Human capital						
Average age of adults	0.081*** (3.29)	0.049 (0.65)	0.117*** (3.61)	0.126*** (4.73)	0.085*** (3.80)	0.095** (2.56)
Adults' average age squared/100	-0.112*** (-4.60)	-0.093 (-1.18)	-0.153*** (-4.67)	-0.156*** (-5.93)	-0.108*** (-4.62)	-0.117*** (-3.06)
Highest education level of adults	0.124*** (3.63)	0.126 (1.62)	0.133*** (2.91)	0.090** (2.48)	0.116*** (3.76)	0.135*** (3.21)
Share of members received training for agricultural techniques	-0.094 (-0.76)	-0.161 (-0.57)	-0.145 (-0.78)	-0.026 (-0.18)	-0.047 (-0.37)	-0.115 (-0.60)
Share of members had off-farm work experience	1.062*** (8.25)	1.634*** (6.02)	1.125*** (6.81)	0.852*** (6.38)	0.574*** (5.01)	0.491** (3.45)
Physical capital						
Arable land contracted per adult (log)	0.052 (0.92)	0.090 (0.79)	0.116* (1.80)	0.028 (0.49)	0.006 (0.10)	-0.002 (-0.03)
Value of agricultural assets (log)	-0.012 (-1.27)	-0.012 (-0.57)	-0.024** (-2.07)	-0.013 (-1.34)	-0.010 (-1.10)	0.003 (0.24)
Value of durable assets (log)	0.027*** (4.82)	0.027** (2.34)	0.028*** (3.46)	0.028*** (4.38)	0.027*** (3.89)	0.021** (2.34)
Financial Capital						
Credit access	0.128** (2.14)	0.125 (1.03)	0.134* (1.72)	0.107* (1.89)	0.099* (1.92)	0.027 (0.31)
Social Capital						
No. of village cadre within the household	0.049 (0.96)	0.045 (0.34)	0.033 (0.40)	-0.018 (-0.27)	0.077 (1.24)	0.114 (1.43)
Household characteristics						
Household size	0.264*** (12.43)	0.284*** (7.15)	0.289*** (10.94)	0.249*** (10.81)	0.207*** (10.11)	0.196*** (5.94)
Share of adults	1.021*** (4.30)	1.151** (2.24)	1.083*** (2.92)	1.052*** (3.89)	0.862*** (3.34)	0.920*** (2.80)
City dummy variables						
Constant	yes	yes	yes	yes	yes	yes
Constant	5.797*** (8.58)	5.457*** (3.08)	4.506*** (5.03)	5.077*** (6.45)	6.776*** (10.08)	6.821*** (7.22)
Pseudo R ² (R ² for OLS)	0.590	0.483	0.409	0.335	0.283	0.256
Observations	1,005	1,005	1,005	1,005	1,005	1,005

Notes: ^a * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level; ^b Figures in parentheses are *t* values; ^c The quantiles are based on the distribution of off-farm income.

Table A.4-4: OLS and Quantile regression estimates for transfer income ^{a,b,c}

Variables	OLS	Quantiles				
		0.10	0.25	0.50	0.75	0.90
Participation in land rental markets						
Rent-out	-0.335* (-1.81)	-1.182*** (-2.75)	-0.484** (-2.58)	-0.231* (-1.74)	-0.053 (-0.42)	0.071 (0.38)
Rent-in	0.064 (0.27)	0.319 (0.97)	0.043 (0.25)	-0.012 (-0.09)	-0.137 (-0.85)	0.113 (0.34)
Human capital						
Average age of adults	-0.003 (-0.15)	0.033 (1.13)	0.030** (2.12)	0.014 (1.19)	0.012 (1.18)	0.001 (0.04)
Adults' average age squared/100	-0.001 (-0.03)	-0.041 (-1.31)	-0.033** (-2.30)	-0.019 (-1.57)	-0.015 (-1.54)	-0.004 (-0.12)
Highest education level of adults	0.021 (1.18)	0.002 (0.06)	0.020 (1.08)	0.014 (1.06)	0.016 (0.90)	0.015 (0.52)
Share of members received training for agricultural techniques	0.037 (0.37)	-0.049 (-0.33)	0.084 (1.23)	0.044 (0.92)	0.088 (1.03)	0.020 (0.13)
Share of members had off-farm work experience	-0.068 (-1.10)	-0.109 (-1.03)	0.013 (0.19)	-0.034 (-0.85)	-0.058 (-1.16)	-0.076 (-0.88)
Physical capital						
Arable land contracted per adult (log)	0.767*** (8.77)	0.989*** (12.97)	0.907*** (26.26)	0.933*** (32.19)	0.885*** (21.34)	0.690*** (8.21)
Value of agricultural assets (log)	0.006 (0.80)	-0.020* (-1.66)	0.003 (0.64)	0.001 (0.31)	0.007 (1.54)	0.005 (0.68)
Value of durable assets (log)	0.005 (1.17)	0.016** (2.34)	0.003 (0.82)	0.004 (1.22)	0.004 (1.11)	0.002 (0.28)
Financial Capital						
Credit constraint	0.034 (0.98)	0.150* (1.90)	0.029 (0.80)	0.018 (0.77)	-0.009 (-0.30)	0.031 (0.61)
Social Capital						
No. of village cadre within the household	0.036 (0.79)	0.056 (0.59)	-0.027 (-0.65)	0.048* (1.81)	0.044 (1.40)	0.079 (1.33)
Household characteristics						
Household size	0.193*** (12.15)	0.224*** (9.69)	0.212*** (16.66)	0.212*** (17.56)	0.207*** (12.20)	0.160*** (6.52)
Share of adults	1.050*** (5.84)	1.366*** (4.69)	1.102*** (7.30)	1.161*** (10.01)	1.012*** (6.20)	0.906*** (3.76)
City dummy variables						
Constant	yes	yes	yes	yes	yes	yes
Constant	4.296*** (7.10)	2.713*** (3.48)	3.088*** (7.70)	3.680*** (12.36)	4.036*** (11.42)	4.838*** (5.51)
Pseudo R ² (R ² for OLS)	0.523	0.368	0.416	0.440	0.397	0.301
Observations	1,042	1,042	1,042	1,042	1,042	1,042

Notes: ^a * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level; ^b Figures in parentheses are *t* values; ^c The quantiles are based on the distribution of transfer income.

Table A.5: Off-farm employment by land rental market participation status

		Land rental market participation				Total
		Rent-out	Autarkic	Rent-in	Rent-out & Rent-in	
Local off-farm employment ^a	Number	74	210	83	7	374
	Share (%)	45.12	38.32	41.09	41.18	40.17
Migration ^a	Number	41	192	67	4	304
	Share (%)	25.00	35.04	33.17	23.53	32.65
Local off-farm employment & migration ^a	Number	49	146	52	6	253
	Share (%)	29.88	26.64	25.74	35.29	27.18
Off-farm employment ^b	Number	164	548	202	17	931
	Share (%)	85.42	86.98	87.07	65.38	86.20
Total	Number	192	630	232	26	1,080

Source: Own calculations based on survey.

Notes:

^a Here “share” refers to the proportion of households engaged in different types of off-farm employment in total households with off-farm employment under different land rental market participation status;

^b Here “share” refers to the percentage of households with off-farm employment in total households under different land rental market participation status.