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Gains and losses: Does farmland acquisition harm farmers' welfare?

Dazhe Wang[a], Wenrong Qian[b,*], Xiaolin Guo[c]

[a] China Academy for Rural Development (CARD), School of Management, Zhejiang University, China
[b] China Academy for Rural Development (CARD), School of Public Affairs, Zhejiang University, China
[c] China Academy for Rural Development (CARD), School of Public Affairs, Zhejiang University, China

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ABSTRACT

Based on data from the China Household Income Project in 2013, this study empirically evaluates the income effect and happiness effect of land acquisition. The results show that land acquisition improves household income but reduces individual happiness. Propensity score matching (PSM) methods have proved the robustness of this result. The mechanism analysis shows that (1) land compensation is not enough to generate "labor supply effect", whereas land acquisition intensity has a dominant effect which promotes households allocate more labor on off-farm labor market, especially on local off-farm activities. The positive income effect is significant only in the eastern region of China. (2) Both the great deprivation of farmland and compensation inequality have a negative effect on happiness level, but various forms of non-pecuniary compensation have no significant effect on happiness improvement. We conclude that the increase in household income cannot offset the negative effect of land acquisition on happiness, the decrease in happiness levels of land-lost farmers may be largely due to the compensatio system which has not provided fair compensation and not sufficiently taken full account of how to secure their property rights and ensure their long-term livelihood. Finally, we provide recommendations on the reform of the current land acquisition system to improve the interests and welfare of land-lost farmers during the process of urbanization.

1. Introduction

Land acquisition and the issues it gives rise to have caused great concern and controversy worldwide. In western countries, where property rights and markets are well developed, land acquisition has been used as a policy instrument to correct market failures in urban development, to achieve environmental and social goals, or to help implement land use plans (Ding, 2007). However, in China, land acquisition is the primary means by which local governments meet the growing demand for land that is driven by rapid economic and urban growth.

After starting from a low base, China has experienced rapid and unprecedented urbanization in the past few decades. The rate of urbanization has risen from 17.92% in 1978 to 57.35% in 2016, and the built-up area has increased from 17,605 sq km in 2001 to 40,941 sq km in 2015. In this process of urbanization, the land acquisition system played an essential role through higher investment, relaxed land supply, and government-dominated regional competition. Meanwhile, the expropriation of a large proportion of farmland and cultivated land (Fig. 1) has resulted in a large number of farmers becoming landless. According to China's 2011 urban development report, the number of farmers who have lost their land is around 40–50 million, and is still increasing at a pace of about 3 million a year; it will possibly reach around 110 million farmers by 2030. Concern about the interests and welfare of these farmers has resonated among academics and policy-makers alike.[1]

Farmland acquisition directly results in large-scale land loss which may have a profound effect on farmers' career development and long-term livelihood. As is widely known, land is not only an essential means of livelihood for farmers but is also one of the most important assets that can be the principal source of wealth and power in developing countries. Particularly in China, where population is high and the availability of land is limited, the equal distribution of land provided a mechanism for distribution of risk. This practice has become an important part of the rural social assurance system (Xie and Luo, 2010). However, in recent years, with the relaxation of restrictions on rural-

* Corresponding author at: China Academy for Rural Development (CARD), School of Public Affairs, Zhejiang University, Yuhangtang Road 866, Xihu District, Hangzhou, China.
E-mail addresses: 11320059@zju.edu.cn (D. Wang), wrqian@zju.edu.cn (W. Qian), 11620065@zju.edu.cn (X. Guo).

[1] Land acquisition has become one of the important source of social discontent, there are many news exposure to the public about land seizure, inadequate compensation, conflicts and bleeding events.

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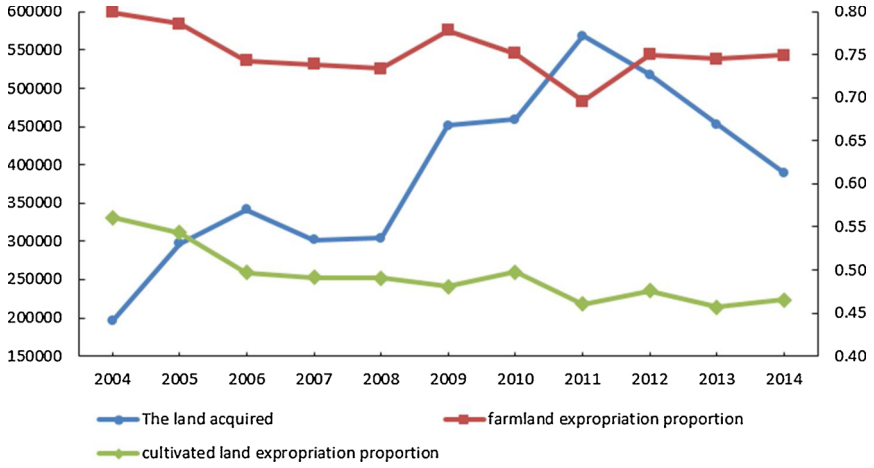

Fig. 1. The share of expropriated farmland and cultivated land during.2004–2014.

urban migration and acceleration of agricultural restructuring (Qian et al., 2016), the farmers' income structure has changed. As a result, their dependence on land has significantly decreased (Luo, 2018) which has made the welfare effect of farmland acquisition more complicated. Besides, in China, the right to change usage of land from agricultural to non-agricultural purposes is restricted and therefore, land cannot achieve its highest value under the current legal system (Cheung, 1970; Yao, 2000; Zhou, 2004). Farmers who have lost their land only receive a compensation package to make up for the deprivation of their long-term land property rights. And they are also likely to suffer the risks caused by land tenure insecurity, which may force them to make costly adjustments and resource allocation (Ma and Mu, 2017). To our knowledge, although there is a large body of literature on land property rights and farmers' decision behavior, the consequences of farmland acquisition have not been sufficiently studied. This study tries to fill the gap and gives empirical evidences on how farmland acquisition affects farmers' welfare in China.

There is limited literature focusing on the socioeconomic impact of land acquisition in less developed countries. For example, Kusiluka et al. (2011) examined the negative impact of land acquisition programs on the indigenous communities' livelihood and environment in Tanzania. Thao (2016) explored the impact of land acquisition on sustainable livelihoods in Vietnam and found both positive and negative effects. Shee and Maiti (2018) analyzed land-use changes in India and the subsequent impact of land acquisition on local livelihood. The results showed that the total monthly income of affected households reduced by 50% and only a select few increased their non-farm income. However, results in China may differ from those in other developing countries because of China's unique institutional form of land ownership and political structure (Cao et al., 2018). In recent years, some scholars have studied the livelihood vulnerability of land-lost farmers. For instance, Huang et al. (2017) developed indicators to assess the exposure and the capacity of land-lost farmers in Xi'an to respond to livelihood vulnerability; their findings highlight the need for these farmers to improve their educational level and occupational skills. Li et al. (2018) applied the same approach to discuss the households' livelihood changes before and after land acquisition in Jining. Their results show that the difference in households' degree of vulnerability and livelihood restoration is related to the differences in their capability to build various livelihood capitals. There are two other papers closely related to our study. The first one, by Shi et al. (2011), explores the income effect of land acquisition in Shanghai; they find that the income of the land-lost farmers is higher than that of farmers whose land has not been expropriated. This is mainly because of the availability of diverse employment opportunities, property income, and social security. Li et al. (2015) applied Amartya Sen's theory of welfare functioning and capabilities to construct a research framework that analyzes changes in welfare of the land-lost farmers of Zhejiang Province. Their findings show that the total welfare increased by 11.8% as a result of improvements in their economic condition, dwellings and community surroundings, but their social security and psychological conditions deteriorated. However, these four studies cannot identify the welfare effects of land acquisition because they estimate welfare changes only by between-group comparison or before–after comparison, without considering the cohort differences or year fixed effects. Till now, there has been relatively scarce empirical work that uses an econometric methodology to analyze the effects of land acquisition on farmers' welfare. Our study will supplement the existing literature and provide new empirical evidence on this issue in China.

This study makes four main contributions to the existing literature. First, previous studies on the welfare effect of land acquisition were mainly based on the comparison of welfare changes before and after land acquisition, or between affected and unaffected groups. This study attempts to identify the effects of land acquisition on farmers' welfare by applying econometric methodology to effectively control for, and separate, other factors associated with households' land acquisition experience. The propensity score matching (PSM) method and sensitivity test are also applied to achieve a partial reduction in selection bias, besides testing the robustness of the regression results. Second, previous studies pay more attention to the income effect, but less to the subjective welfare effects, such as happiness, of land acquisition. By looking through the extant literature on the determinants of happiness, we find that scholars have focused on various determinants, such as unemployment and inflation, income and income equality (Alesina et al., 2004; Clark et al., 2008; Jiang et al., 2012), social relations (Haller and Hadler, 2006),education(Cuñado and de Gracia, 2011; Michalos, 2008), housing (Cattaneo et al., 2009; Ren et al., 2016), quality of government (Bjørnskov et al., 2010; Kim and Kim, 2011),environment degradation(Ferrer-i-Carbonell and Gowdy, 2007; Zhang et al., 2017). However, there is lack of empirical work linking land acquisition and happiness. This study tries to augment happiness research by exploring the happiness effect of land acquisition and the underlying mechanisms. Third, most previous studies have used small survey samples limited to a province; this has led to conflicting conclusions that lack external validity. This study uses large sample data from the China Household Income Project (CHIP), which was carried out in 2013; further, it is representative of the population and abundant in land acquisition information. Fourth, this study also explores the mechanisms of land acquisition and its heterogeneities.

The remainder of the paper is organized as follows. Section 2 provides institutional background on China's land acquisition system. Section 3 constructs the theoretical framework. Section 4 describes the

methodology, data and variables. Section 5 empirically studies the income effect of land acquisition. Section 6 empirically tests the effect on the individual happiness and its heterogeneities. We conclude and discuss policy implications in Section 7.

2. Institutional background of China

Many land use problems in Chinese cities are deeply rooted in the land tenure system. According to the 1982 Chinese Constitution, all the land in China is the constitutional property of either the state or the collectives, that is, urban land is state-owned, whereas farmland is collectively owned, with a few exceptions. This type of land ownership remains to the present day and intensifies the so-called dichotomous urban-rural land structure in which rural collectives do not have the right to convert land for non-agricultural usage by selling or leasing land to non-State agencies. Therefore, when socioeconomic development plans call for land development, municipal governments increase their land supply through land acquisition.

Land acquisition is the primary means by which governments meet the growing demand for land that is driven by China's rapid economic and urban growth. Considering the current institutional framework, there are two distinctive features of the Chinese land acquisition system. The first one is that the scope of acquisition is defined in very broad terms. According to the Chinese constitution, the government can use the concept of eminent domain[2] to seize land for public interest, but must compensate farmers for their land; however, there is no clear definition of public interest. Further, there exists a conflict between the legal terms used in the Land Administration Law (LAL) and the Constitution. Article 43 of the LAL says that "any organization or individual needing land for construction purposes[3] must apply for the usage rights of land owned by the State;" further, the "land owned by the State" includes both the land owned by the State and the land originally owned by rural collectives but later expropriated by the State. This suggests that land acquisition is the only legal way to convert collective land into state-owned land and the extensive scope of "public interest" has been extended to various types of developments, such as infrastructure projects, urban renewal, housing development, or industrial cluster zones. The ambiguous definition of "public interest" has created the conditions for the deprivation of farmers' land rights by the State's exercise of power.

The other distinctive feature of land acquisition is that the compensation is based on the agricultural output value of the land, and not determined by market principles. In western countries, where property rights and markets are well developed, there exist constitutions or laws that require the government to compensate farmers based on market values of the land taken. However, in China, just and fair compensation is defined as an amount "sufficient to warrant non-worse-off living standards." According to the current LAL, the affected farmers are entitled to three types of compensation: land compensation; resettlement subsidies; and compensation for young crops and attachments on land. The first two items should be retained in collective communes and appropriated for the development and resettlement of affected labor. The combined amount of resettlement and land compensation may be increased but should not be more than 30 times the derived land productivity necessary to maintain the current living standards of the affected farmers. In recent years, land acquisition has led to several rural conflicts and many disputes stem from delayed compensation and unclear requisition procedures. Undercompensated farmers have become a norm in the process of land acquisition and the authorities sometimes resort to unfair compensation distribution. The current compensation standards make it difficult for the affected farmers to fully capture the value-added benefits arising from the change of land use in the process of urbanization and industrialization.

In the pre-reform era, peasants were compensated with a package that included: job offers, wherein which farmers would work for the enterprises established on the acquired land; housing compensation, referred to as resettlement fees; compensation for the loss of crops and belongings connected to the land; and urban residency license (*hukou*). Granting a city *hukou* to affected farmers made them eligible for social welfare services, such as medical insurance, pension, high-quality schools, and subsidized agricultural goods. Subsequently, the LAL passed legislation in 1998 to increase the level of compensation level. However, except for encouraging the development of village-owned enterprises, the legislation is silent on labor settlement; this has left many of the affected farmers unemployed. The tightening labor market has forced the replacement of job resettlement with cash compensation. Rather than only providing cash compensation to displaced farmers, many cities have recently promised farmers a monthly pension payment if they reach retirement age or given them an opportunity to become a citizen.

Under this legal framework, local governments expropriated land at low cost, and then sold the land to developers at much higher prices. The local governments benefit from their monopoly position in the first-level land market in many ways; for example, they are able to control land prices to guarantee sufficient revenues from land acquisition and leasing, strengthen fiscal conditions, promote economic and industrial development, and encourage urban encroachment into rural areas. However, the fair market value of the land and the impact of land acquisitions on farmers' livelihood have not been sufficiently considered by the government. To remedy the neglect, this study explores the welfare effect of land acquisition and its mechanism to determine ways of reforming the land acquisition system in order to achieve the structural transformation of the Chinese economy and ensure the livelihood of land-lost farmers.

3. Theoretical framework

We construct the theoretical framework to clarify the linkage between land acquisition, income, and happiness. Land acquisition may affect household income through two main channels. The first channel is pecuniary compensation, a kind of cash transfer, which can directly increase household income. The other channel is labor supply; land acquisition may change the household labor allocation between agricultural and non-agricultural sectors and alter their sources of income. Specifically, the labor allocation response to land acquisition may be driven by both the amount of compensation and the ratio of land expropriated. We hypothesized that land acquisition compensation can, on the one hand, generate "income effect" to reduce labor supply in non-agricultural sectors, thereby causing greater consumption of leisure when this kind of "windfall income" increases(Ma and Mu, 2017; Salehi-Isfahani and Mostafavi-Dehzooei, 2018). On the other hand, a household can also use the compensation to: finance productive on-farm activities; shift their labor endowment from on-farm work to the off-farm labor market (Uchida et al., 2009); or cover the upfront migration cost to augment the migration possibilities and migrate outside their hometown (Cai, 2018; Dustmann and Okatenko, 2014). Meanwhile, land acquisition can be regarded as a kind of negative agricultural income shock. As the ratio of land expropriated increases, the land constraints may force households to handle idiosyncratic shocks by "income diversification" strategies, that is, by allocating more labor and time to off-farm activities and rely on off-farm income to supplement the diminishing returns to their farming operations (Barrett et al., 2001; Kwona et al., 2006). Moreover, a larger expropriation of land may also signal the farmers' psychological expectations of land tenure insecurity (Besley, 1950; Mullan et al., 2011); this would reduce farmers'

[2] It is the legal right to acquire property by forced rather than by voluntary exchange.

[3] One exception is that rural collectives can use land they own for community uses, such as township and village enterprises, public infrastructure, or resident houses for collective members.

agricultural productive investment (Jacoby et al., 2002), resulting in the phenomenon of temporary migrant workers in rural areas or encouraging the farmers to seek non-farm employment opportunities (Rupelle et al., 2009; Yang, 1997). The abovementioned mechanisms make the effect of land acquisition on household labor allocation more complicated. Therefore, it remains unclear whether land acquisition has increased or reduced household income. We should not only identify how the household allocates their labor and time when faced with land acquisition, but also identify the income effect of which (agricultural or non-agricultural) is much more dominant in the income structure.

There is vast body of literature on the determinants of happiness that has laid a foundation for our research on how land acquisition affects individual happiness. Easterlin (1974) did the pioneering work in happiness research and came up with the famous "happiness paradox;" this has led to a vigorous debate on why increases in real income do not correspond to an equivalent increase in individual happiness. There have been a number of explanations regarding this paradox and they consider both economic and non-economic factors. A typical one, based on the relative income theory, argues that individuals do not pay much attention to their absolute income, but to their position relative to other people's incomes (Ferrer-i-Carbonell, 2005; Jiang et al., 2012). Brockmann et al. (2009) applied the relative deprivation theory[4] to explain the "China Puzzle" and attributed it to a better perception of unequal income distribution. The depressing effect of relative deprivation on happiness and the importance of comparison effects have been proved in numerous studies (Clark et al., 2008; Clark and Oswald, 1996; Knight et al., 2009). Another important explanation for the paradox is that non-economic factors also play an important role in the level of happiness (Angeles, 2011). Frey and Stutzer (2002)and Winkelmann (2008)found evidence that unemployment had a large negative impact on subjective well-being and unemployed people suffer high non-pecuniary costs; thus, the higher income would not be enough to offset the adverse effect. In recent years, more and more scholars have focused on the happiness effect of air quality (Ferrer-i-Carbonell and Gowdy, 2007; Zhang et al., 2017) and the happiness effect of social insurance and public policy (Tran et al., 2016). These studies imply that non-economic factors are more important in generating happiness after a certain income level has been reached. On the basis of the above explanations, we hypothesized that land acquisition may affect individual happiness through three channels. First, the happiness effect of land acquisition may largely depend on whether land acquisition has increased or reduced household income. Second, considering that the farmland functions as property, employment security, and social insurance in some developing countries, we hypothesized that farmers will feel deprivation of property rights, employment capabilities, and social security if the land acquisition ratio increases; this may result in a reduction in happiness. Third, the various forms of compensation policies may have profound effect on individual happiness. We hypothesized the happiness may be affected by the: size of monetary compensation; fairness of the compensation provided, and provision of jobs, social insurance, and housing arrangements by the government.

4. Methodology, data, and variables

4.1. Method

The main purpose of this study is try to identify the effects of land acquisition on household income and individual happiness. Referring to Rubin (1974) potential outcome framework, we established the basic regression equation as follows:

$$\ln hh\_inc_j = \beta_0 + \beta_1 land\_expro_j + Z_j^{'}\theta + \sigma_k + \mu_{ij} \quad (1)$$

$$happiness_i = \gamma_{0+}\gamma_1 land\_expro_j + Z_j^{'}\omega + \sigma_k + \tau_{ij} \quad (2)$$

The $lnhh\_inc_j$ and $happiness_i$ are the main dependent variables of interest in this study. The dummy variable $land\_expro_j$ indicates whether the household j has experienced land acquisition, which is the core independent variable of interest. Z_j denoting the control variables at the household level; σ_k is the region fixed effects; μ_{ij} 、 τ_{ij} are random error terms. If land acquisition has nothing to do with the potential outcome, the parameters can accurately measure the causal effect of land acquisition on income and happiness. The estimation method for the income equation is OLS since it is a continuous variable. Since happiness is an ordered choice variable, it is more appropriate to choose an ordered *Probit* model for estimation purposes. It is noteworthy that Ada Ferrer-I-Carbonell and Frijters (2004) found that the OLS and the ordered *Probit* model are consistent in the direction and significance of parameter estimation, while OLS is more intuitive and convenient to interpret. Many studies have used OLS to study ordered selection of variables such as happiness (Brockmann et al., 2009; Jiang et al., 2012; Knight et al., 2009).

However, the households with land acquisition experience may be substantially different from those without, making the land-acquisition experience correlated with household characteristics or other unobservable variables. This paper will firstly use the PSM method to partially reduce the endogeneity problems caused by selection bias. The PSM method was originally proposed by Rosenbaum and Rubin (1983) which built a matching estimator based on the conditional probability that an individual enters the treatment group, i.e., propensity scores (p-scores). Compared with the simple linear regression model, PSM has several advantages. On the one hand, this method mainly constructs the propensity score of multidimensional factors that represent individual features through dimension reduction and compresses the information contained in vector X, which can overcome the difficulty of matching caused by the multidimensional problem (Heckman et al., 1997) and improve the accuracy and efficiency of matching. On the other hand, the PSM method does not require prior assumptions about the form of functions, parameter constraints, and distribution of error terms and therefore gives greater flexibility. However, the main limitation of PSM is that it does not address potential selection of unobservables. If there are unobserved variables which simultaneously affect assignment into treatment and the outcome variable, a 'hidden bias' might arise to which matching estimators are not robust. The way to check the reliability of PSM is to conduct a sensitivity analysis (Rosenbaum Bound analysis) proposed by Rosenbaum (2002)[5], which can help indirectly test the sensitivity of estimated results to the assumption of relative importance of unobserved factors to observed factors in the selection process. Rosenbaum's sensitivity analysis relies on the sensitivity parameter Γ that measures the degree of departure from random assignment of treatment and sensitivity to hidden bias. It is suggested that the results are not sensitive if the significance of the PSM result holds when Γ approaches 2[6] (Dillon, 2011).

4.2. Data

The data used in this paper is based on the rural household sample of the China Household Income Project Survey in 2013(CHIP 2013), which was carried out by Beijing Normal University. It covers 10,490 rural households and 39,365 rural individuals in 122 cities in 14

[4] The basic idea is that people compare themselves with other individuals or groups when evaluating their own situation, it is a concept belonging to reference group theory.

[5] Rosenbaum, Paul R. 2002. "*Observational Studies*." 2nd edition. New York.

[6] If $\Gamma = 2$ and our upper bound level of statistical significance remains below 10%, the sensitivity results can be interpreted as follows: for all individuals who are matched on their observable characteristics, a doubling of unobservables, which alters their odds of receiving treatment, would not alter the statistical significance of the impact estimate.

provinces[7] . The survey includes basic information on household time allocation, land endowment and agricultural production, employment, household expenditures, assets, and subjective questions about their living standards. CHIP2013 is more representative to this study mainly because it has detailed information about land acquisition including household land acquisition experience, information on when the latest land acquisition happened, the total acre of land expropriated, the monetary compensation for land acquisition; and the non-monetary compensation such as pension insurance, medical insurance, minimum insurance, housing resettlement, employment arrangement and so on. This data-set provides important support for the in-depth analysis and clarification of welfare effects of land acquisition to our research.

4.3. Variables and summary statistics

(1) Dependent variables: household income and happiness

In the CHIP2013 questionnaire, we define household income as the household's total disposable income (Yuan) in 2013[8], which includes wage income, net operating income, property income, and transfer income. We also define household non-agricultural income as the sum of household wage income[9] and non-agricultural business income in 2013[10] . We use the logarithm of income to make the income variables closer to the normal distribution and reduce the heteroscedasticity.

Another key dependent variable is the subjective happiness, which is measured as self-reported happiness score of the household respondent[11] . The question used in our questionnaire measuring happiness is stated as: "Do you feel happy considering all aspects of life?" We deleted the "do not know" sample (0.6% of the total sample), and redefined happiness using the Likert's five-point scale, "very unhappy = 1″, "not too happy = 2″, "generally happy = 3″, "relatively happy = 4," and "very happy = 5″[12] .

(2) Independent variable of interest: land acquisition

The core variable of interest in this study is whether or not the household j has experienced land acquisition[13] . According to CHIP2013, we defined this as a dummy variable, that is, "land expropriated = 1, land not expropriated = 0.″ At the same time, this study uses the share of farmland expropriated in the total area of land to capture the land acquisition intensity and its impact on the land-lost farmers' welfare. It is statistically concluded that 14.1% of farmers had land acquisition experience. Among them, 24.53% of households experienced complete land requisition, while the remaining 75.47% had their farmland partly expropriated (Fig. 2). We also found that most farmland acquisitions happened since the year 2000, and increased at an accelerate rate in most recent years (Fig. 3).

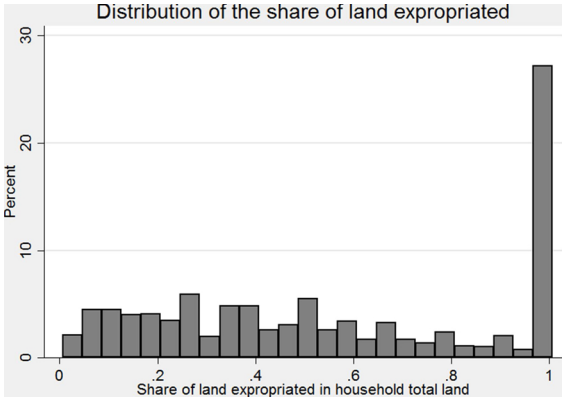

Fig. 2. The distribution of the share of households with land acquisition.

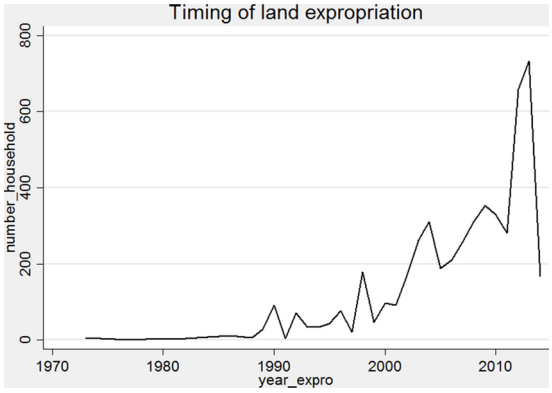

Fig. 3. The timing of land acquisition.

(3) Control variables

Some other variables that are both correlated with land acquisition and welfare outcomes should also be controlled. We firstly considered that urban expansion or urban growth may increase the probability of farmland acquisition and that it can also affect household income and happiness. Therefore, we matched the city-level statistics[14] with the household-level data, and controlled the city GDP per capita to measure urban growth. Then, we also divided sample area into three regions[15], and controlled the region fixed effects to capture region-specific unobservable characteristics. Furthermore, we controlled the household-level variables including elderly proportion, kids proportion, male proportion, married proportion and family members' average years of education. The summary statistics of main variables are reported in Table 1.

Before the baseline regression, we simply compared the differences between the household with and without land acquisition experience in the main variables and carried out *t*-test on the significance of the mean differences. The results are shown in Table 2.

5. Income effect: empirical results

5.1. Results

Table 3 reports baseline results of land acquisition on household total income and non-agricultural income respectively after controlling

[7] Sample provinces includes Beijing, Shanxi, Liaoning, Jiangsu, Shandong, Guangdong, Anhui, Henan, Hubei, Hunan, Chongqing, Sichuan, Yunnan, and Gansu provinces.

[8] The land acquisition compensation is not included in household total income.

[9] We aggregated the wages of family members who engaged in the salaried work at the household level.

[10] It is a pity that there is no detailed information on the amount of agricultural operating income, property income and transfer income in the questionnaire.

[11] According to the questionnaire, the happiness question is answered by the household respondent who stays in rural village only, not for the family members who migrates out. So this paper may underestimate the positive effect of land acquisition on happiness.

[12] According to Frey and Stutzer(2002), single-item reported subjective well-being is a valid and empirically adequate measure for human well-being.

[13] The household may experience several times of land acquisition, but the questionnaire only asks the latest ones.

[14] The city-level data comes from 2014 China City Statistical Yearbook.

[15] We divided sample areas into eastern, middle and western area according to the National Bureau of Statistics of China and we included Liaoning Province into the eastern area. The distribution of samples of eastern, middle and western are 35.09%, 38.68% and 26.22%.

Table 1
Summary statistics.

variables	Definitions	Samples	Mean	SD	Min	Max
hh_inc	household's total disposable income in 2013(yuan)	10424	45755.51	44869.25	0	1600000
log_hhinc	the logarithm of household total income in 2013	10424	10.43	0.81	6.39	14.29
hh_nagrinc	household's non-agricultural income in 2013(yuan)	10424	15552.74	22503.34	0	800000
log_hhnagrinc	the logarithm of household non-agricultural income in 2013	10424	9.86	0.89	0	13.59
happiness	very unhappy = 1", "not too happy = 2", "generally happy = 3", "relatively happy = 4," and "very happy = 5	10294	3.58	0.82	1	5
Land_expro	land acquired = 1, Land not acquired = 0	10050	0.14	0.34	0	1
expro_ratio	the share of land expropriated in the total area of land (%)	1003	0.57	0.33	0.007	1
Comp_total	the total compensation household received at the time of land acquisition(yuan)	1226	115839.8	491578.4	0	4752550
elderly_pro	the proportion of elderly persons who aged 60 and above(%)	10424	0.21	0.33	0	1
kid_pro	the proportion of kids who aged 16 and below(%)	10424	0.14	0.17	0	0.78
male_pro	the proportion of male members(%)	10424	0.53	0.17	0	1
married_pro	the proportion of married persons(%)	10424	0.65	0.25	0	1
aver_yredu	the average years of education of family members	10321	7.34	2.36	0	20
log_GDP	the logarithm of city GDP per capita	114	10.57	0.68	9.04	12.20

Note: The total compensation that household received varies with different years and different counties.

Table 2
Differences between households with land acquisition and without land acquisition.

Variables	Households with land acquisition		Households without land acquisition		differences
	Mean	Std	Mean	Std	
hh_inc	55807.86	1630.57	44137.70	450.60	11670.16***
log_hhinc	10.61	0.02	10.40	0.01	0.21***
hh_nagrinc	47980.55	1176.76	38673.63	456.27	9306.92***
log_hhnagrinc	10.63	0.02	10.45	0.01	0.18***
happiness	3.58	0.02	3.57	0.009	0.01
elderly_pro	0.20	0.009	0.22	0.004	−0.02
kid_pro	0.134	0.004	0.136	0.002	−0.002
male_pro	0.52	0.004	0.53	0.001	−0.01***
married_pro	0.68	0.01	0.65	0.00	0.03***
aver_yredu	7.84	0.065	7.25	0.025	0.58***

Table 3
The impact of land acquisition on household income.

Variables	(1) log_hhinc	(2) log_hhnagrinc	(3) log_hhinc	(4) log_hhnagrinc
land_expro	0.096***	0.105***		
	(0.0208)	(0.0259)		
expro_ratio			0.223***	0.275***
			(0.0355)	(0.0433)
log_GDPpc	YES	YES	YES	YES
household controls	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Observations	9,236	7,612	8,043	6,581

Note: ① *** p < 0.01, ** p < 0.05, * p < 0.1; ② The robust standard error in brackets cluster at the household level.

household characteristics, city-level GDP per capita and region fixed effect. We find that land acquisition contributes to 9.6% increase in household total income and 10.5% increase in household non-agricultural income. Meanwhile, with an increase in farmland acquisition intensity, there are 22.3% and 27.5% increases in household's total income and their non-agricultural income.

We applied the PSM method and the Rosenbum Bound analysis to further test the robustness of the results. We try to match the land-expropriated household with another household whose land has not been expropriated from the same area[16] . The average treatment effect

Table 4
The average treatment effect after PSM.

Matching method	Treated	Controls	ATT	S.E.	T-stat
Nearest neighbor matching(n = 4)	10.610	10.481	0.129***	0.026	4.96
Radius matching(r = 0.005)	10.610	10.501	0.109***	0.029	3.73
Kernel matching(width = 0.01)	10.610	10.492	0.118***	0.023	5.06

Note: ① *** p < 0.01, ** p < 0.05, * p < 0.1; ② The standard error reported in this table does not consider the propensity score as the estimated income. This article uses the solution given by Abadie and Imbens (2016)[18] to correct bias, ATT results are still significant.

is estimated by using three matching methods including the nearest neighbor matching, the radius matching, and the kernel matching (Heckman et al., 1997) and results are shown in Table 4[17] . Comparison of estimated results reveals that using three different matching methods to estimate the significance of ATT is consistent with OLS.

Subsequently, the balance test is used to ensure the effectiveness and quality of propensity score matching. The results in Table 5[19] show that the standard deviations are significantly reduced compared with those before matching[20] . We also report the overall matching quality indicators in Appendix Table A2. The results show that the overall biases have reduced and that there is no significant difference on all the matching variables between two groups after matching, which indicates the matching is of good quality. Then, we perform the sensitivity analysis to check how sensitive the PSM results are to the assumption of relative importance of unobservables to observables, the sensitivity parameter $\Gamma$and corresponding confidence interval at 5% significance level are reported in Appendix Table A3. Results show that the PSM result maintains statistical significance at the 10% level until the sensitivity parameter equals to 1.5, which reveals that the result is not very sensitive to unobserved variables associated with household land loss experience.

[16] We include the household-level variables and region dummies in the logit regression because those from the same area may be identical on the observable household characteristics and could face the same unobservables.

[17] We only report the matching estimates of household total income in this paper, but we did the same work on household non-agricultural income and the results are also consistent.

[18] Alberto Abadie & Guido W. Imbens, 2016. "Matching on the Estimated Propensity Score," Econometrica, Econometric Society, vol. 84, pages 781-807.

[19] The balance test for radius matching and kernel matching is also achieved, but we only report the balance test for nearest neighbor matching in Table 5.

[20] The result shows that the bias of variable kid_pro has increased after matching, we excluded it from logit regression and did the PSM again using three matching methods, the result remains significant and robust.

Table 5
Balance test results.

Variable	Matching status	Mean		bias(%)	Reduct bias(%)	T—test	
		Treated	Control			t	p > |t|
eld_pro	Unmatched	0.197	0.213	−5.0	19.5	−1.72	0.086
	Matched	0.197	0.210	−4.0		−1.04	0.298
kid_pro	Unmatched	0.136	0.137	−0.7	−685.5	−0.24	0.814
	Matched	0.136	0.127	5.4		1.45	0.148
aver_yredu	Unmatched	7.838	7.254	24.5	94.4	8.60	0.000
	Matched	7.830	7.797	1.4		0.36	0.720
male_pro	Unmatched	0.518	0.531	−8.0	82.8	−2.71	0.007
	Matched	0.518	0.520	−1.4		−0.38	0.704
married_pro	Unmatched	0.675	0.651	10.1	53.2	3.43	0.001
	Matched	0.675	0.686	−4.7		−1.29	0.197

Table 6
The effects of land acquisition on household labor allocation.

Variables	(1) The proportion of agricultural labor	(2) The proportion of non-agricultural labor	(3) The proportion of agricultural labor	(4) The proportion of non-agricultural labor
land_expro	−0.140***	0.0844***	0.00774	−0.0305
	(0.00935)	(0.00816)	(0.0518)	(0.0437)
expro_ratio			−0.377***	0.269***
			(0.0298)	(0.0271)
lncomp_total			0.00510	−0.00225
			(0.00543)	(0.00471)
Household controls	YES	YES	YES	YES
ln_GDPpc	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Observations	9,271	9,271	7,765	7,765

Note: ① *** p < 0.01, ** p < 0.05, * p < 0.1; ② The robust standard error in brackets cluster at the household level. ③ lncomp_total is the logarithm of the total compensation.

Table 7
The effect of land acquisition on household labor and time allocation between local off-farm and migration.

Variables	(1) local waged labor proportion	(2) local business labor proportion	(3) migrants outside township proportion	(4) The average month of local waged work	(5) The average month of local business	(6) The average month of migrant work
land_expro	0.0685***	0.0150***	−0.0226***	0.8099***	0.8269***	−0.0888
	(0.00836)	(0.00576)	(0.00652)	(0.1236)	(0.1997)	(0.1357)
Household controls	YES	YES	YES	YES	YES	YES
ln_GDPpc	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Observations	9,271	9,271	9,271	4,348	1,540	4,222

5.2. Mechanism

An important question we are more curious about is what channels through which land acquisition affects household income. According to the theoretical framework constructed above, we infer that both the land acquisition compensation and land acquisition intensity can affect household labor allocation behavior, and then reconstruct income resources. We mainly explore the household labor allocation response to this idiosyncratic shock[21] .

As Table 6 shows, land acquisition leads to a dramatic structural change in labor allocation between agricultural and non-agricultural sectors, which significantly reduces the proportion of household agricultural labor by 14%, and increases the proportion of household non-agricultural labor by 8.44%. In column (3) and (4), we further identify whether land acquisition compensation or land acquisition intensity is the driving force of household off-farm activities. After controlling these two channels, the coefficients of land acquisition on the household labor allocation have been reduced and non-significant whereas compensation effect is not significant but the land acquisition intensity has a more dominant effect. The result may imply that the land compensation is not enough to generate “labor supply effect”, and with the increase in land acquisition intensity, households will allocate more labor into off-farm labor market. Furthermore, we will explore if there are differences in household labor and time allocation behavior between local off-farm and migration activities. As Table 7 shows, land acquisition mainly promotes household allocate more labor and time engaged in local waged work, local non-agricultural business activities rather than the migrant work outside the township.

Then, we will explore the heterogeneities of income effects of land acquisition by regions. We are surprised to find that land acquisition significantly increases household total income and their non-agricultural income only in the eastern part of China (Table 8). We are curious about if there are some regional differences in labor markets or there are some differences in household labor and time allocation behavior between eastern area and other regions. So, we conduct the

[21] We don’t examine the direct effect of land acquisition compensation on household income because the compensation is historically included in the past household income but not included in the current income in 2013.

Table 8
The heterogeneities of income effects by region.

	ln_hhinc			ln_nagr_inc		
Variables	East	Middle	West	East	Middle	West
land_expro	0.188***	0.0351	0.0466	0.1289***	0.0118	0.0121
	(0.0306)	(0.0391)	(0.0388)	(0.0400)	(0.0514)	(0.0592)
Household controls	YES	YES	YES	YES	YES	YES
ln_GDPpc	YES	YES	YES	YES	YES	YES
Observations	3,558	3,464	2,214	2,679	2,599	1,542

Note: ① *** p < 0.01, ** p < 0.05, * p < 0.1; ② The robust standard error in brackets cluster at the household level.

Table 9
The results of impact of land acquisition on happiness.

	happiness		
Variables	(1)	(2)	(3)
land_expro	−0.0563**		
	(0.0245)		
Total expropriation		−0.159***	
		(0.0523)	
Partial expropriation		−0.0361	
		(0.0332)	
High compensation			0.0155
			(0.0493)
Low compensation			−0.000754
			(0.0344)
Household controls	YES	YES	YES
ln_GDPpc	YES	YES	YES
Region FE	YES	YES	YES
Observations	9,120	7,961	9,595

Note: ① *** p < 0.01, ** p < 0.05, * p < 0.1; ② The robust standard error in brackets cluster at the household level. ③ The results reported above are OLS estimation, which is consistent with ordered probit estimation in significance. ④ In the column (2), total expropriation refers to the household whose land had been totally expropriated (exp roratio equals to 1), whereas partial expropriation refers to the household whose land acquisition ratio is more than 0 but less than 1, the base group of regression is the household whose land had not been expropriated. ⑤ In the column (3), we divided samples into three groups according to the levels of compensation per mu, we define the household with no compensation as the base group. We rank the logarithm of compensation per mu from high to low and defined first 50% as the household with high compensation, last 50% as the household with low compensation.

regional heterogeneity analysis of household labor and time allocation behavior among local off-farm employment and migration (Appendix Table A4 and Table A5). Results show that land acquisition significantly increases both the proportion of labors and time engaged in local waged work for all the regions. Concluding with these results, we infer that the drastic increase in household income and household non-agricultural income in the eastern area may be largely because the local off-farm employment opportunities in the eastern area are more diverse, and much higher wages will be paid in the eastern region than in other regions (Appendix Table A1).Then, we also explore how the income effect of land acquisition varies with the human capital of family members. The result reveals that fewer years of education would further weaken the household non-agricultural income improvement caused by land acquisition by 10.2% (Appendix Table A6).

6. Happiness effect: empirical results

6.1. Results

Table 9 reports the impact of land acquisition on farmers' happiness. The results in column (1) show that on average, land acquisition significantly reduce the happiness of farmers by 0.056 at a significance level of 5%. Then PSM methods are also used to test the matching quality and robustness of results[22] .The sensitivity analysis is reported in Appendix Table A9, but the PSM result became insignificant when the sensitivity parameter equals to 1.1. This indicates that the estimated effects are quite sensitive to the unobservables. Thus, the PSM-based negative effects of land acquisition on happiness should be interpreted with caution[23] . Then, we try to explore if there are differences in happiness effect of land acquisition among different expropriated intensities and different levels of compensation. As shown in column (2) and (3) in Table 9, the household who lost all land is much unhappier than the household whose land has been partially expropriated and the household without land acquisition. We are also surprised to find that neither higher compensation nor under-compensation had significant effects on farmers' happiness.

We are more curious about why land acquisition increases household income but reduces their happiness. We firstly add household income and its interaction term with land acquisition to examine if the increase in household income can offset the negative effect of land acquisition on happiness. However, we find no significant evidence on this assumption from Table 10, which indicates that, in the long run, happiness may be primarily affected by some other factors rather than income itself[24] . According to the happiness related theories, we will explore how compensation inequality and other various forms of non-pecuniary compensation received[25] affect farmers' happiness level. We included related variables in the happiness function by only using the subsample of household whose land has been expropriated. There are some noteworthy findings:

First, we find a significant negative effect of land acquisition intensity on land-lost farmers' happiness. This result may imply that with the ratio of expropriated land becoming larger, most of the land-lost farmers who were compensated with only a lump sum cash compensation may not only feel relative deprivation of their land property rights and expect their property income decline but also feel uncertainty about their social security and long-term livelihood, which contributes to a great decrease in their happiness. Second, we find the compensation inequality, which is measured by the gap between household compensation and average compensation within a county, generates a reduced effect on happiness. This finding corresponds to the social comparison theory and relative income theory, indicating that the land-lost farmers may care more about whether the compensation provided is fair by comparing with other households rather than the absolute amount of cash compensation. Third, the results show that only the housing arrangements increase farmers' happiness whereas other forms of non-pecuniary compensation such as employment arrangement, medical insurance provision and endowment insurance provision have no significant effect on happiness improvement. This finding may imply that the government has no incentive to provide cost-consuming welfare so that the compensation system is not

[22] The PSM results using three matching methods, the overall matching quality indicators are reported in Appendix Tables A7, A8.

[23] Although the propensity score matching literature indicates that $\Gamma = 2$ is a high threshold given that the estimates are already matched on household observables, this level of sensitivity is still somewhat subjective. Thus, we cannot deny the existence of the negative relationship between land acquisition and happiness, but we should also take into consideration that there may be some unobservables that may simultaneously affect land acquisition and individual happiness, and thus, we should interpret this result with caution. In future research, we will use panel data to further consider time-invariant unobservables.

[24] This point is further supported by the evidence that negative happiness effects and positive income effects are also found to increase over time. The separate regressions are reported in Table A10.

[25] The proportion of households who received various forms of non-pecuniary compensation is presented in Appendix Table A11.

Table 10
The mechanism of how land acquisition affects happiness.

Variables	(1) happiness	(2) happiness
land_expro	0.152	
	(0.330)	
land_expro × ln_hhinc	−0.0211	
	(0.0309)	
ln_hhinc	0.144***	
	(0.0134)	
expro_ratio		−0.270***
		(0.0818)
compen_inequality		−0.00129*
		(0.000723)
empl_arra		0.121
		(0.149)
hous_arra		0.298**
		(0.150)
medi_insur		0.055
		(0.074)
endow_insur		0.091
		(0.080)
Household controls	YES	YES
ln_GDPpc	YES	YES
Region FE	YES	YES
Observations	9,085	885

Note: ① *** p < 0.01, ** p < 0.05, * p < 0.1; ② The robust standard error in brackets cluster at the household level. ③ compen_inequality refers to the gap between household total compensation and average compensation within a county, which is measured by the ratio of average compensation of all the households within a county to the total compensation of every household. ④ empl_arra and hous_arra are dummy variables which stand for whether the government provide the employment and housing resettlement. Medi_insur and endow_insur refer to whether the household participate in the medical insurance or endowment insurance at the time of land acquisition.

sufficient to take full account of land-lost farmers' occupation change, social security, and their long-term livelihood.

6.2. Heterogeneity effects

The heterogeneity analysis is reported in Table 11. We assume that the livelihood and labor supply decisions of the older farmers are more attached to farmland, thus the land acquisition may have heterogeneous effects among age cohorts. We divided the whole sample into two subsamples, farmers aged 16–44 and farmers aged 45 and above. From columns (1) and (2) in Table 11, we find that happiness effect is significant lower for older farmers who experienced land acquisition. This indicates that older farmers may have special emotional dependence on farmland and farmland is still an important safety net and a major source of income for the elderly farmers living in rural areas due to the lack of social security in rural China (Cai et al., 2012). Compared to the younger farmers, older farmers who are physically incapacitated may care more about whether their livelihood would be ensured.

We further find that land acquisition has significantly reduced happiness for farmers who received less than 9 years' education. In fact, since 2000, the local governments and stakeholders are silent on labor settlement, and leave many affected farmers to seek employment opportunities themselves. Many land-lost farmers are involved in temporary and part-time jobs with harsh working conditions (Wang and Fan, 2012) due to their limited educational attainment, training opportunities, as well as the lack of job skills in labor market (He et al., 2009), which may constraint their ability to obtain higher income.

7. Conclusion and discussion

In recent years, the low-cost land acquisition system has become the fundamental cause of land-related distortions that have occurred during China's urbanization. Therefore, the interests and welfare of land-expropriated farmers has drawn much attention. This study uses CHIP2013 rural household data to empirically study the income effect and happiness effect of land acquisition. Results show that land acquisition improves household income but reduces individual happiness. Then we try to explore the mechanisms and find some interesting results. (1) land compensation is not enough to generate "labor supply effect", whereas land acquisition intensity has a dominant effect which promotes households allocate more labor on off-farm labor market, especially on local off-farm activities. The positive income effect is significant only in the eastern region of China. (2) The increase in household income cannot offset the negative effect of land acquisition on happiness, and the negative happiness effect is not due to compensation standards but largely due to the compensation system which has not provided fair compensation and not sufficiently take full account of land-lost farmers' long-term livelihood. (3) The happiness effect is much lower for farmers aged 45 and above, which implies that older farmers may have special emotional dependence on farmland and compared to the younger farmers, they care more about whether their livelihood would be ensured rather than merely income. (4) We also find the important role of human capital in income generation and happiness improvement of land-lost farmers. These findings imply that inequality and non-economic factors would be more important in providing happiness after the income level has been reached.

Our study may have some policy implications. Local governments should be prepared to adjust land use policies and programs to achieve their goals of people-centered urbanization. Properly addressing the issues associated with land-lost farmers and guaranteeing the livelihood of farmers are fundamental to the success of China's urban-rural development (Liu et al., 2014). First, it is necessary to clearly define farmers' land property rights, carry out comprehensive rural land rights registration and certification, and enhance their bargaining power to obtain higher level of compensation. Second, provide fair and reasonable compensation. Determine the compensation standard by considering land market value, resettlement population, location and economic conditions, and the social security expenses of the land-

Table 11
The heterogeneity analysis of happiness effect.

	Happiness			
Variables	Age 16-44	Age 45 and above	Years of education more than or equal to 9 years	Years of education less than 9 years
land_expro	−0.0587	−0.0615**	−0.0439	−0.0877*
	(0.0411)	(0.0294)	(0.0288)	(0.0451)
Household controls	YES	YES	YES	YES
ln_GDPpc	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Observations	2,490	6,138	5619	3501

Note: ① *** p < 0.01, ** p < 0.05, * p < 0.1; ② brackets are cluster standard error clustered at the household level; ③ 9 is the years of compulsory education.

expropriated farmers shall also be arranged. Third, more attention should be paid to the welfare of older farmers and those with limited human capital, giving them more job training, and exploring a variety of resettlement approaches to improve the living conditions of farmers and include them in the urban pension and medical insurance programs.

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Appendix A

Table A1
The summary statistics by regions.

Variables	East region		Middle or West region		differences
	Mean	Std	Mean	Std	
hh_inc	58244.56	988.14	38973.35	393.21	19271.21***
log_hhinc	10.66	0.014	10.30	0.009	0.36***
hh_nagrinc	19381.81	472.75	13482.71	217.90	5899.10***
log_hhnagrinc	10.03	0.017	9.75	0.015	0.28***
happiness	3.67	0.016	3.49	0.013	0.18***
elderly_pro	0.23	0.006	0.21	0.004	0.02***
kid_pro	0.12	0.003	0.14	0.002	−0.02***
male_pro	0.52	0.003	0.53	0.002	−0.01***
married_pro	0.68	0.004	0.64	0.003	0.04***
aver_yredu	7.79	0.040	7.09	0.028	0.70***
The proportion of local waged labor	0.27	0.005	0.17	0.003	0.10***
The proportion of migrants	0.15	0.004	0.19	0.003	−0.04***
Average month of local waged work	9.37	0.068	7.51	0.070	1.86***
Average month of migration	9.73	0.073	8.93	0.049	0.80***
Land acquisition	0.17	0.006	0.13	0.004	0.04***
City-level average wage	52870.87	264.22	41384.61	87.55	11486.27***
Registered unemployment rate	0.033	0.0003	0.055	0.0004	−0.022***
The ratio of non-agricultural output value	0.92	0.0009	0.86	0.0008	0.06***

Note: ① The samples percentage of eastern, middle and western region are 35.09%, 38.68% and 26.22% 2 The cases of land acquisition in the East, middle and west are 16.5%, 11.4% and 14.8%.

Table A2
Test for overall matching quality by matching methods for household income.

Matching methods	Paeudo-R^2	LR Statistics (P value)	Bias of Mean	Bias of Median
Unmatched	0.013	101.67(0.000)	9.2	7.5
Nearest neighbor matching(n = 4)	0.001	3.22(0.781)	2.9	2.7
Radius matching(r = 0.005)	0.001	3.31(0.769)	2.4	1.3
Kernel matching(width = 0.01)	0.000	0.25(1.000)	0.6	0.8

Table A3
Rosenbaum bound analysis of (household income).

Gamma	upper bound significance level	lower bound significance level	upper bound Hodges-Lehmann point estimate	upper bound Hodges-Lehmann point estimate	upper bound confidence interval	lower bound confidence interval
1	0	0	0.139633	0.139633	0.097838	1.81E-01
1.1	0	0	0.106866	0.172565	0.06503	0.214035
1.2	9.3e-13	0	0.077125	2.02E-01	0.034783	0.243984
1.3	2.5e-06	0	0.049375	0.229275	0.007135	0.270973
1.4	0.011239	0	0.023827	0.254597	−0.018827	0.296094
1.5	0.437598	0	0.000271	0.277723	−0.043264	0.319534
1.6	0.966422	0	−0.022229	0.299209	−0.065652	0.341552
1.7	0.999892	0	−0.043298	0.319573	−0.087086	0.362039
1.8	1	0	−0.062798	0.338701	−0.10718	0.381403
1.9	1	0	−0.081563	0.356634	−0.12611	0.399346
2	1	0	−0.099416	0.373764	−0.144041	0.416075

Table A4
The effects of land acquisition on household labor allocation (by region).

	(1) East	(2) Middle	(3) West	(4) East	(5) Middle	(6) West
VARIABLES	Proportion of wage labor	Proportion of wage labor	Proportion of wage labor	Proportion of migration	Proportion of migration	Proportion of migration
land_expro	0.0837***	0.0563***	0.0565***	−0.0106	−0.0592***	0.00235
	(0.0136)	(0.0139)	(0.0161)	(0.00985)	(0.0112)	(0.0136)
Household controls	YES	YES	YES	YES	YES	YES
Ln_GDPpc	YES	YES	YES	YES	YES	YES
Observations	3,561	3,493	2,217	3,561	3,493	2,217
R-squared	0.132	0.085	0.075	0.102	0.125	0.103

Table A5
The effects of land acquisition on household time allocation (by region).

	(1) East	(2) Middle	(3) West	(4) East	(5) Middle	(6) West
VARIABLES	aver_month local waged_work	aver_month local waged_work	aver_month local waged_work	aver_month migration	aver_month migration	aver_month migration
land_expro	0.509***	1.087***	1.252***	−0.324	0.0761	0.0230
	(0.156)	(0.233)	(0.338)	(0.227)	(0.232)	(0.246)
Household controls	YES	YES	YES	YES	YES	YES
ln_GDPpc	YES	YES	YES	YES	YES	YES
Observations	2,001	1,563	784	1,333	1,821	1,068
R-squared	0.104	0.076	0.078	0.044	0.017	0.036

Table A6
The heterogeneous effects of land acquisition on income (by years of education).

Variables	(1) log_hhinc	(2) log_hhagrinc
land_expro	0.111***	0.140***
	(0.0253)	(0.030)
Land_expro×low_edu	−0.0382	−0.102*
	(0.0429)	(0.0569)
low_edu	−0.0114	0.0064
	(0.0236)	(0.0325)
Household controls	YES	YES
ln_GDPpc	YES	YES
Region FE	YES	YES
Observations	9,236	7,612

Note: ① *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; ② The robust standard error in brackets cluster at the household level. ③ low_edu is a dummy variable which is defined according to the mean of average years of education of family members (7.34), we define low_edu equals to one if average years of education of family members are less than 7 years, and it equals to zero otherwise.

Table A7
The average treatment effect after PSM.

Matching method	Treated	Controls	ATT	S.E.	T-stat
Nearest neighbor matching(n = 4)	3.582	3.644	−0.062**	0.026	−2.35
Radius matching(r = 0.005)	3.582	3.648	−0.066**	0.029	−2.23
Kernel matching(width = 0.01)	3.582	3.623	−0.040*	0.024	−1.68

Table A8
Test for overall matching quality by matching methods for happiness.

Matching methods	Paeudo-R^2	LR Statistics (P value)	Bias of Mean	Bias of Median
Unmatched	0.012	94.62(0.000)	9.0	7.8
Nearest neighbor matching(n = 4)	0.001	3.94(0.685)	3.1	2.9
Radius matching(r = 0.005)	0.001	5.51(0.480)	3.3	2.6
Kernel matching(width = 0.01)	0.000	0.23(1.000)	0.6	0.7

Table A9
Rosenbaum bound analysis of (happiness).

Gamma	upper bound significance level	lower bound significance level	upper bound Hodges-Lehmann point estimate	upper bound Hodges-Lehmann point estimate	upper bound confidence interval	lower bound confidence interval
1	0.008132	0.008132	−0.057316	−0.057316	−0.118056	−4.70E-07
1.1	0.000042	0.18934	−0.102941	−0.013158	−0.134286	0.02027
1.2	4.80E-08	0.694229	−0.125	4.70E-07	−0.175	0.0625
1.3	1.60E-11	0.962925	−0.157143	0.043478	−0.208333	0.1
1.4	2.10E-15	0.998517	−0.192308	0.078703	−0.25	0.125
1.5	0	0.999977	−0.221154	0.107143	−0.25	0.147059
1.6	0	1	−0.25	0.125	−0.285715	0.175831
1.7	0	1	−0.25	0.145834	−0.313793	0.203704
1.8	0	1	−0.283333	0.175	−0.339286	0.232143
1.9	0	1	−0.3	0.2	−0.373737	0.25
2	0	1	−0.326923	0.222222	−0.375	0.253846

Table A10
The timing effects of land acquisition on household income and happiness.

	(1)	(2)	(3)
Variables	ln_hhinc	ln_hhnagrinc	happiness
expro_dur	0.00954***	0.0104***	−0.00580***
	(0.00173)	(0.00193)	(0.00216)
Household controls	YES	YES	YES
ln_GDPpc	YES	YES	YES
Region FE	YES	YES	YES
Observations	35700	31101	9342

Note: expro_dur stands for the duration of land acquisition, which is measured by the difference between year 2014 and the year when the land acquisition happened.

Table A11
The proportion of households who receive non-pecuniary compensation.

Compensation	Yes	No
Endowment insurance	30.53%	69.47%
Medical insurance	35.42%	64.58%
Housing resettlement	5.37%	94.63%
Employment arrangement	1.02%	98.98%

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