Can Migration Decisions Be Affected by Land Resource Endowment? A Heterogeneity View

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Abstract: Migration of rural residents into urban areas accelerates the rural-urban economic integration. Current researches on the impact of the land endowment on labor migration consist of conflicting results and these disagreements exist because of the heterogeneity of migrant workers. This paper contributes the literature by expanding the research view of the heterogeneity of migration workers. In the empirical research, this paper first applied the LC Cluster model to classify the migrant workers' group into two groups: *safe tenure group* and *unsafe tenure group* and explore how land endowment affect household labor distribution as well as individual migration decision with a conditional comparative status. The results show "inverse-U shape" between land endowment and household labor distribution as well as individual migrant decisions. Among all variables, the income gap between the non-agricultural sector and agricultural sector affects labor distribution most. Differentiation land policies which target different households should be addressed in the future.

Key Words: Land endowment; Migration decision; Heterogeneity; LC Cluster Model

1 Introduction

Urban-rural dual economic structure is usually perceived as the major obstacle for urbanization in less developed countries (LDCs) (Berg, 1961; Wellisz, 1968). In China, the different growth patterns in cities and rural areas have leaded to a wide urban-rural gap and income inequity(Cheng, 2007). According to China's National Bureau of Statistics, three-fold difference in the per capita disposable income ratio between urban residents and rural residents has consistently existed during the past decade. Migration of rural residents into urban areas is usually believed as a critical way to increase rural residents' income, optimize labor resource allocation and eventually lead to the gradual structural transformation of the dual economy (Bharati, 2000).

China has experienced the most extensive internal migration for more than 30 years and had a total of 277 million rural migrant workers by the end of 2015. The paradoxical fact is that such a large size of migration in China does not transform the urban-rural dual economic effectively. The significant gap is still dominated between urban are and rural area in development pattern and economics level as well. In fact, the majority of migrant workers in China migrates into urban area temporarily and travels between urban and rural areas like "migratory birds". Such kind of labor mobility fails to reduce the excessive agricultural population and inevitable impede the process of urban-rural integration.

To date, most research on the impacts of rural labor migration in China context has focused on the social-economics institutions like household registration system (hukou) (Johnson,1995; Mullan *et al.*, 2010) and labor market segmentation and discrimination (Zhang *et al.*, 2002; Liu *et al.*, 1998) which formed the institutional obstacles to the citizenization of migrant workers. In contrast, the impact of land tenure arrangement in rural area on migration decision as well as citizenization has received little attention. The land tenure system determines the social structure as well as the resource allocation in rural societies. Dixon (1950) pointed out that human migration is a function of land and without land, there will be no population flow. Despite growing interest in the impact of rural land tenure on rural-to-urban labor migration in China, there is a lack of systematic research on the mechanism behind this impact. The comparison of such studies, however, often reveals conflicting. Some researchers believe that land endowment has a negative impact on migration probability and the number of migrant workers in a household (Cain,1985; Cai *et al.*, 2002). On the contrary, Gray (2009) argued that larger land endowments increased the probability of migration because the

endowment could finance rural workers' settlement in the city. It is worth noting that there is a disputable issue on the "U-Shape" relationship between land area and migration probability. Namely, part of researchers found that there is a "U-Shape" relationship between land endowment and probability of migration (Chen *et al.*, 2006; Yang *et al.*, 2009), whereas other researchers found an inverted "U-Shape" relationship (Feng *et al.*, 2008; Bhandari, 2004). In terms of land reallocation, Liu *et al.* (2008) indicated that the expectation of land reallocation resulted in the uncertain and unsafe tenure, which decreased the probability of labor migration eventually . Although land reallocation decreased the stability of land property, the resulting egalitarian land distribution deterred labor migration (Yao,2001;Chen *et al.*, 2012;Tian *et al.*, 2004). Besides, land fragmentation resulted in more labor in agricultural production (Qing *et al.*, 2011) and therefore decreased the prevalence of rural-urban migration. In contrast, Chen *et al.* (2013) found that land fragmentation pushed rural households to allocate more labor into the nonagricultural sector and therefore promoted the probability of migration.

The conflicting evidence above implies that the impact of land tenure arrangement on migration is not straightforward. In this paper I introduce a new perspective on the relationship between land and labor to theoretically explore the impact of land tenure arrangement on migration decision. The framework of man-land relationship in this paper refers to the way humans utilize their agricultural land and the impacts generated by land institution arrangement towards human behavior rather than the geographical concept as many geographers did (Fang, 2004). In fact, the migration of rural labor as well as other social-economics institutions has changed the man-land relationship in rural society for the past thirty years. Chen and Liu (2012, 2013) indicated that land function has been developed from single production function into the coexistence of the function of resources endowment and the function of social security. Meanwhile, the development of rural labor migration created several subsets of peasant farmers like pure farmers, migrant workers who are engaged in both agricultural and non-agricultural production and migrant workers who completely divorced themselves the from rural area and agriculture. Obviously, the impacts of land endowment on migration decisions are quite different for different types of migrant workers, which could potentially explain the conflicting findings discussed above. By focusing on the framework of heterogeneity of migrant workers, this paper can contribute to the literature on labor migration, which has mainly treated the migrants as a homogeneous entity.

In addition, the current research usually selected the variable of land area

as the index of land endowment. The difference among them are the specific indexes they used like land area (Vanwey, 2003), land area per household (Yao, 2001) or land area per worker (Long *et al.*, 2007). Land endowment, actually, is a comprehensive label which reflects the certain land institution and man-land relationship. It not only contains land area, but also spatial patterns like land fragmentation as well as a series of land institutions which affect the change of land endowment and the security of land endowment like land transfer, land reallocation and land property rights. Thus this paper may fill a gap in the literature on the discussion of land endowment as well as the impact of land endowment on migration decision.

The structure of this paper is following: Part 2 is a simple model of household migration and land tenure which provide testable hypotheses. Part 3 introduce the data set as well as descriptive analysis. Part 4 focuses on cluster classification by LC cluster model. Part 5 provides the results of estimation and then conclusion.

2 Theoretical Model and Hypotheses

2.1 A simple model of household migration and land tenure

Consider a household in rural economy with two available resources: labor forces and farming land. The household can allocate household labors into agricultural sector like farming activities and non-agricultural sector. Suppose there is no local labor market for both off-farm activities and farm activities. The household surplus labors will migrate from rural area to urban area to be employed once they are allocated into non-agricultural sector. Let the household has a fixed total labor resource normalized to size *one*,and donates by l of labor force to rural-to-urban migration and $1 - l$ to farming activities.

The household has land endowment of A which is an exogenous variable. Farming land can be used to generate income or leave to underutilization which depends on the development of land rights [1]. For households with more developed land rights system, more production factors, such as labor forces and fertilizers will be invested into farming land because of safe and protected expectation of income. Otherwise, farmers rather leave land to be

[1]The development of land rights includes the security of land tenure, the well-behaved land rent market and efficient land allocation.

underutilized to avoid risk of loss from land management or investment.

Let the development of land rights be given by $\lambda \in [0, 1]$. The more developed the land rights, the higher λ is. Thus, the scenario of $\lambda = 0$ indicates the public and unprotected land rights system while $\lambda = 1$ represents the well-defined and protected land regimes. Any situations between these two regimes are imperfect land rights system. How well-developed of the land tenure determines the household's land distribution. Donate by A^p the amount of land available to each household labors remaining on farm sector and A^e the amount underutilized land to each migration labor. We assume,

$$A^p = A^p(l, \lambda) \tag{1}$$

$$A^e = A^e(l, \lambda) \tag{2}$$

where $A^p_\lambda(l, \lambda) > 0$, $A^p(l, 0) = 0$ and $A^e_\lambda(l, \lambda) < 0$, $A^e(l, 1) = 0$. $A^p_\lambda(l, \lambda)$ and $A^e_\lambda(l, \lambda)$ are derivatives of $A^p(l, \lambda)$ and $A^e(l, \lambda)$ with respect to λ, receptively. The positive derivatives indicate that the more developed of land tenure, the more land resources will be allocated into farm activities to generate income rather than be underutilized. If the land tenure is well-defined and protected, all farming land will somehow be utilized and there is no underutilized land, that is $A^e(l, 1) = 0$. On the other hand, more household labors migrate into urban area for non-agricultural employment leads to the larger amount of land available to each remaining household members, which can be expressed as $A^p_l(l, \lambda) > 0$. Without loss of generality, we have two simplified expressions for land distributions between farming production and underutilization:

$$A^p(l, \lambda) = \frac{\lambda}{1 - l} A \tag{3}$$

$$A^e(l, \lambda) = \frac{1 - \lambda}{l} A \tag{4}$$

Each household labor force generate income from off-farm activities and farm activities. Let P_a be the agricultural production while P_{na} be the non-agricultural production. Both of them are the functions of labor forces and land distribution:

$$P_a = f(l, A^p(l, \lambda)) \tag{5}$$

$$P_{na} = g(l, A^e(l, \lambda)) \tag{6}$$

where $f_l < 0$,$f_{ll} > 0$ and $g_l > 0$,$g_{ll} < 0$. The derivative expressions show that the agricultural production is a continuous and convex function in term of labor for off-farm activities while non-agricultural production function is a continuous and concave in term of labor for off-farm activities.

2.2 Land property and labor migration

2.2.1 Local stable equilibrium condition

Labor forces in a household have binary choices to migrate or farm on land. The equilibrium status is the situation that household labors have no incentive to switch activities between non-agricultural sector and agricultural sector, that is

$$pP_a = wP_{na} \tag{7}$$

where p and w are exogenous price for agricultural products and employment respectively. Intuitively, if all household labor migrate into urban area, we have $wg(1, A^e) > pf(1, A^p)$. Similarly, all household labors remain in farming land will leads to the condition of $pf(0, A^p) > wg(0, A^e)$.These conditions indicates that there is no corner solution of labor distribution for equilibrium. Another requirement for a stable equilibrium is the negative income feedback for marginal labor movement. Specifically, a stable equilibrium requires that any movement for household labor to non-agricultural sector should lead to a greater marginal income from off-farm activities than from farm activities. Otherwise, this direction of movement will persist until all labor forces from a household migrate into non-agricultural employment. Mathematically, we have the following two conditions:

Condition 1: $wg(1, A^e) > pf(1, A^p)$ and $pf(0, A^p) > wg(0, A^e)$;

Condition 2: $pf_l + pf_A \frac{\lambda}{(1-l)^2} A > wg_l - wg_A \frac{1-\lambda}{l^2} A$;

The conditions for stable equilibrium can also be indicated from a graph. Figure 1 shows the income curves from agricultural sector and non-agricultural sector. The two interaction points are not stable equilibrium because the slope of non-agricultural sector is larger than agricultural income's slope, which stimulates the movement of labor forces into off-farm activities. Only the interaction point in the middle sacrifices both two conditions.

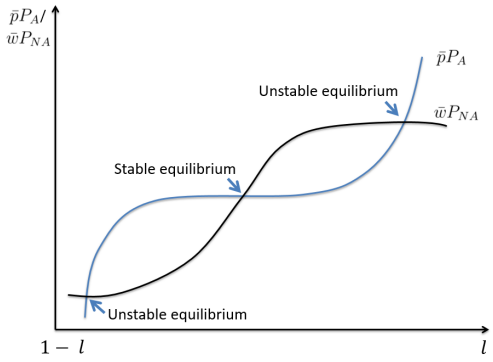

Figure 1: Equilibrium of off-farm activities and farm activities

2.2.2 Land tenure and non-agricultural labor supply

The key causality effect for this study is the impact of land endowment on rural labor migration. We first focus on the overall impact when we assume a homogeneous migrant group. That is, we explore how land endowment affect household labor distribution, holding other factors same. We can have the first order condition of production functions with respect of labor and land tenure index:

$$\frac{\partial P_a}{\partial l} = f_l + f_A \frac{\lambda}{(1-l)^2} A \tag{8}$$

$$\frac{\partial P_{na}}{\partial l} = g_l - g_A \frac{1-\lambda}{l^2} A \tag{9}$$

$$\frac{\partial P_a}{\partial \lambda} = f_A \frac{1}{1-l} A \tag{10}$$

$$\frac{\partial P_{na}}{\partial \lambda} = -g_A \frac{1}{l} A \tag{11}$$

Under the stable equilibrium status, we have:

$$\frac{\partial l}{\partial \lambda} = \frac{p f_A \frac{1}{1-l} A + w g_A \frac{1}{l} A}{p f_l + p f_A \frac{\lambda}{(1-l)^2} A - w g_l + w g_A \frac{1-\lambda}{l^2} A} > 0 \tag{12}$$

Hypothesis 1: *The development of land tenure impels rural labor to migrate from rural area to urban area for non-agricultural employment.*

2.2.3 Land endowment and non-agricultural labor supply: heterogeneity of land tenure

We then move further to the questions: will households have different expectation of land tenure? How will households distribute labor forces differently under different regimes of land tenure system? To answer the questions, we now release our assumption of homogeneity and discuss the conditional comparative statuses. We will focus on two extreme regimes with $\lambda = 1$ and $\lambda = 0$.

(1) $\lambda = 1$ This is the perfect land tenure system with well-defined land property and legislation protection. Together with equation (5),(6) and (7), we have:

$$\frac{\partial l}{\partial A} = \frac{f_A \frac{1}{1-l}}{f_l + f_A \frac{A}{(1-l)^2} - g_l} > 0 \tag{13}$$

(1) $\lambda = 0$

$$frac \partial l \partial A = \frac{-g_A \frac{A}{l}}{f_l - g_l + g_A \frac{A}{l^2}} < 0 \tag{14}$$

Hypothesis 2:*Large land endowment stimulates migration decision into urban area when household has an expectation of safe land tenure; Large land endowment prevents migration decision into urban area when household has an expectation of unsafe land tenure;*

3 Data

3.1 Data

The data of 1474 observations used in this paper comes from the survey on migrant workers' household situation in 2011 in Nanjing City, Jiangsu Province. Nanjing is the one of the most developed regions in China, which is located in Yangtze river delta economic zone. According to Nanjing Statistics Bureau' data, it has more than 1.78 million of migrant worker by the end of 2013. The migrant workers come from almost throughout the country. The survey was designed to study the impacts of China's current land tenure on migration decision. This questionnaire used in this survey includes closed and partially closed questions. The contents of questionnaire include: (1) future plan of migration, namely returning to village or staying in the urban area; (2) the income gap between urban and rural area; (3) personal characteristics,

such as gender, age and education, etc. (4) land rights and interest, such as land endowment, land transfer, land fragmentation and land adjustment, etc. (5) the situation in working place, such as labor contract, job training and unpaid wages, etc. After data cleaning, we have 866 observations.

3.2 Descriptive analysis

Table 1 provides the description of data from three aspects: demographic factors, off-farm activities and land factors. The demographic factors include household and individual information. The household size is about 3.74 and the 54% of household labor forces engaged into non-agricultural activities. Thus, most households have diverse income sources from farm and non-farm activities. The survey shows that the average difference of annual incomes between non-agricultural and agricultural sectors for household is 55,200 Yuan [2]. For individual factors, Table 1 shows that most respondents are male and their average education is between middle school and high school. The average age is about 42. The variable of *idiff1000* indicates the difference of annual income between non-agricultural and agricultural sectors for individual is about 36,060 Yuan[3].

The average land endowment for a household is about 5.47 *mu* (which is 0.90 acre). Since the land distribution was based on household size as well as the combination of different land quality, each household has a average of 3.96 pieces of land. Most migrant workers are not willing to give up their land rights and return their contracted land back to the collective, which occupies about 84% in our sample. We also ask their attitude towards land readjustment. The average category is 2.34, which means that more than half of respondents do not want land adjustment regularly or irregularly. The variable of *landprivate* records the land ownership and property that they believe. It is a category variable which range from public property (State ownership which is *0*) to private ownership (which is *3*). The survey shows that the mean of land ownership is between county government and the collective. Besides, about 64% of respondents declare that they possess land certification and only 18% indicates that there exists a land rent market in their village.

Since the respondents for this survey are migrant workers in urban area, we asked them how do they fit into city life. The results show that about 69%

[2]USD:7934 with the currency rate of 1:6.957
[3]USD:5183 with the currency rate of 1:6.957

of migrant workers believe that they have integrated into city life. Others do not because of high living cost, high housing cost or they believe their migrations are temporally. They have to go back to their village when they are old. Half of respondents believe that they will stay in urban area for employment in the foreseeable future while others prefer to return their villages.

4 Classification and LC Cluster Models

4.1 LC Cluster Models

Kaufman and Rousseeuw (1990) define cluster analysis as the classification of similar objects into groups, where the number of groups, as well as their forms are unknown. Objects which belong to one of K latent classes are similar with respect to the observed variables in the sense that their observed scores are assumed to come from the same probability distributions, whose parameters are, however, unknown quantities to be estimated.

The advantages of LC Cluster model over traditional types of cluster analysis are that the former is a model-based clustering approach. More specifically, samples used in this methods is assumed to come from a mixture of underlying probability distributions. Maximum likelihood is used to estimate parameters and the criteria involves the minimization of within-cluster variation or maximizing the between-cluster variation. LC Cluster model is very flexible in the sense that both simple and complicated distributional forms can be sued and the the indicator variables could be continuous, categorical or any combination of these.

$$f(y_i|\theta) = \sum_{k=1}^{K} \pi_k f_k(y_i|\theta_k) \tag{15}$$

where y_i is the object's socres on a set of indicator variables, K is the number of clusters and π_k denotes the prior probability of belonging to latent cluster k. Here, the distribution of y_i, given the model parameters θ, $f(y_i)|\theta$, is assumed to be a mixture of cluster-specific densities, $f_k(y_i|\theta_k)$.

Probabilistic parameterization is the first step for LC Cluster model. The LC Cluster model constructs the function in which the correlation among manifest variables could be expressed by the latent variables. Model evaluation is to identify a model with less parameters and higher goodness of fit. The most common methods are Akaike information criterion (AIC) and

Bayesian information criterion (BIC). The classification is the final object for LC Cluster model. Each observation would be classified into different latent variables based on the percentage. Many software can complete the calculation automatically. We use *Latent GOLD* which improves over traditional ad-hoc types of cluster analysis methods by including model selection criteria and probability-based classification.

4.2 Indicator Variables

The key step of this study is to group migrant workers based on their perception of land tenure. All variables which are selected as the cluster indexes should be significantly different between potential subgroups. In this paper, we select 4 land factors which reflect households' perception and willingness of land tenure, as well as legislation and market development and land system. The first variable is their judgment of land ownership (*landprivate*). Based on our definition of λ, the more developed of land tenure system, the stronger belief that the contracted lands are privately owned. Next variable is land adjustment attitude (*landadjattu*). Theoretically, households with a safe and protected perception of land tenure prefer to refuse land readjustment to avoid the risk of land endowment loss. This is especially true when we consider the factor that household size decreased after one-child policy which introduced in 1979. For most households in rural area, land readjustment which addresses egalitarianism according of household size will leads to a potential loss land endowment. The third variable is the land contracted certification (*landcerti*) which indicates a legislative protection. The (*landrent*) is an index for development of land rent market. The well-developed of land rent market indicates the well-defined land property.

4.3 Classification and Identification

When Latent GOLD completes the estimation, the model L^2, which assesses how well the model fits the data. Several kinds of output are available in Table 2. L^2 is the amount of the association among the variables that remains unexplained after estimating the model. Thus, the lower the values, the better the fit of the model to the data. The p-value determines the number of clusters because it provides the p-value for each model under the assumption that L^2 statistic follows a χ^2 distribution. Generally, among models for which the p-value is greater than 0.05 (providers an adequate fit), the one that is most parsimonious (fewest number of parameters - Npar) would be selected.

The this criteria, the best model is given by Model 2, which indicates the 2 potential clusters.

Table 3 shows the number observations in each of two groups as well the t-test. There are 507 observations (58%) in group 1 and 359 (42%) in group 2. The means of all four variables are larger in group 1 than group 2. Especially, respondents in group 1 have a higher perception of private land ownership, higher willingness to avoid land readjustment, higher percentage of land certification possession and higher percentage of land rent market development than group 2. Thus, we name the group 1 as *safe tenure* group and group 2 as *unsafe tenure* group.

To identify the causality effect of land endowment and household labor distribution, we should rule out omitted variable bias. Table 4 indicates the descriptive analysis for variables after classification. The table shows that the household labor distribution does not have a significant difference between these two groups. All the household and individual characteristics also do not different with each others. There are two significantly different variables: future plan and the willingness to abandon land property.

5 Empirical Analysis

5.1 Empirical models

We then move to the empirical study to explore how does land endowment affect household labor distribution as well as individual migration decisions. Frist, we have the household labor distribution model:

$$y_{ik} = \beta A_{ik} + \gamma H_{ik} + \epsilon_{ik} \tag{16}$$

where y_{ik} is the percentage of labor in non-agricultural employment over total labor fores in household i and group k.A_{ik} denotes land endowment in household i and group k and H_{ik} denotes a vector which are household characteristics in household i and group k. ϵ_{ik} is the error term.

Beyond on household labor distribution, we are also curious about how land endowment affect individual's migration decision. Thus, we have an individual migration decision model:

$$d_{jk} = \beta A_{jk} + \gamma X_{jk} + \mu_{jk} \tag{17}$$

Here, d_{jk} is the migration decision for individual j in group k. In our sample, the decision is a binary variable which includes stay in urban area and return back to rural area. X_{jk} is a vector which contains individual characteristics and μ is the error term.

5.2 Household labor distribution

Table 5 shows the estimation for household labor distribution. The first three columns are estimations without control variables while the last three columns are models with control household characteristics variables such as land parcel, householder's education, household income difference as household non-labor members number.

Without control variables, the percentage of non-agricultural labors overall has a "inverse-U shape" relationship with household land endowment. The trend also exists in *safe tenure* group. For *unsafe tenure*, land endowment decreases household labor distribution into migration, although the effect are not significant for both land area and land area squared term. Once household characteristics variables are controlled, the land endowment has significant impact on labor distribution and the impacts display a "inverse-U shape". If a household has a higher perception of safe land tenure (namely for group 1), land endowment also has a "inverse-U shape" impact towards non-agricultural labor forces. For group 2, land endowment only has a significant negative impact on non-agricultural labor forces. Thus, with a estimation of household level, we justify our hypothesis 2 that land endowment stimulates household to distribute more labor forces into off-farm activities if they perceive a safe and well-defined land property. Otherwise, more land endowment only limits household labor migrations.

We also have some other interesting results from Table 5. The household income difference between non-agricultural employment and agricultural employment has significant positive impact on labors in off-farm activities. This shows that TODARO model. The number of non-labor forces in a household prevents the non-agricultural labor distribution. The kids and the elder need to be taken care of which limits the labor mobility flexibility.

5.3 Individual migration decision

Then we move to individual migration decision. Now the dependent variable is whether stay in urban area for non-agricultural employment or return to rural area for agricultural activities. We run a logit regression because of

the binary dependent variables. The first three columns of Table 6 are the estimations without control variables, while those variables are included into the last three columns.

In the uncontrolled model (First three columns in Table 6), the land endowment does not have a significant impact on individual migration decision. The sign of land endowment and its squared term show the "inverse-U shape" in overall sample as well as *safe tenure* group. For *unsafe tenure* group, both terms have negative signs. When individual characteristics are controlled, "inverse-U shape" still exists for both overall sample and *safe tenure* group and the impact is statistically significant. Land endowment has a negative impact on individual migration decision if they expect an unsafe land tenure. Compared with household labor distribution, land endowment has a less impact on individual migration decision.

Land parcel has a negative impact on migration decision: the more parcels of land migrant workers have, the higher probability they migrant back to their village. Once they have a willingness to abandon their rural land tenure, they are more likely to migrate into urban area for non-agricultural employment. This effect is statistically significant for *safe tenure* group. As the impact for household labor distribution, difference income between non-agricultural sector and agricultural sector affects migrant workers' decision significantly. We also find that the female are more willing to stay in urban area rather than male labor. More education helps migrant workers to compete in urban labor market and thus increases their probability to stay in urban area. This could also be justified from the variable of *integration*. Higher level of integration into urban life increases the probability that migrant workers choose to stay in urban area.

6 Conclusion

Land endowment, labor migration and their relationship are always the key issues of agricultural economics in China. Understand the relationship could help policy-makers to formulate more efficient policies to push the migration processes to realize the urbanization of population. This paper contributes the literature by expanding the research view of heterogeneity of migration workers. In the empirical research, this paper first applied the LC Cluster model to classify the migrant workers' group into two groups: *safe tenure group* and *unsafe tenure group* and explore how land endowment affect household labor distribution as well as individual migration decision with a con-

ditional comparative status. The indicator variables selected in this paper for classification are comprehensive which reflect households' perception and willingness of land tenure, as well as legislation and market development and land system.

This paper confirms two "inverse-U shape" relationships between land endowment and household labor distribution as well as land endowment and individual migration decision. Land endowment has a much significant impact on household labor distribution rather than individual migration decision probably because land endowment is a key factor for a household decision rather than a individual input factor, especially for non-householders. Besides, individual decisions are sensitive economic factors such as income and living experiences such as integration.

Among all factors, income difference is the most important variable to induce household labor to distribute labor forces into non-agricultural sector. This indicates that economic gap is the most important factor to induce rural labor to migrant from rural area to urban area. Our finding is consistent with Todaro Model (or Harris-Todaro Model). Besides, the living standard and integration into urban lifestyle also attract migrant workers to stay in the cities.

The policy implementation from this paper is obvious. Differentiation land policies should be the targets for rural policy designs in the future. Specifically, for the migrant workers who have an unsafe expectation of land tenure, the land reform should focus on protecting their land rights. For household with higher perception of land tenure, policy design should improve their social welfare in cities and first induce them to the process of citizenization as well as guiding them to abandon their contracted land and homestead with compensation.

7 Reference

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8 Appendix

Table 1: Descriptive anaylysis for variables

Variables	Explanation	N	Mean	Std.dev	Min	Max
Demographic factors						
sex	Respondent's sex	866	0.80	0.40	0.00	1.00
edu	Education (category)	866	2.70	0.88	1.00	5.00
age	age (years)	866	42.32	10.51	14.00	72.00
hhsize	household size	866	3.74	1.10	1.00	7.00
percentage	ratio of off-farm labors	866	0.54	0.24	0.00	1.00
hdiff1000	household level	864	55.23	2593.75	-20.00	780.00
idiff1000	individual level	831	36.06	30.48	2.40	480.00
Off-farm activities						
integration	integration of city	866	0.69	0.46	0.00	1.00
plan	future plan	866	0.50	0.50	0.00	1.00
Land factors						
area	land area	866	5.47	4.21	0.20	40.00
parcel	land parcels	866	3.96	2.97	1.00	30.00
abandon	abandon land rights	866	0.16	0.37	0.00	1.00
landadjattu	attitude	866	2.34	1.33	1.00	5.00
landprivate	privatization	866	1.12	1.42	0.00	3.00
landcerti	certification	866	0.64	0.48	0.00	1.00
landrent	land rent market	866	0.18	0.38	0.00	1.00

Table 2: Model summary

Model	Cluster #	BIC(LL)	Npar	L^2	df	p-value
Model1	1-Cluster	5842.34	9	127.42	70	3.3e-5
Model2	2-Cluster	5830.43	14	81.69	65	0.08
Model3	3-Cluster	5843.39	19	60.81	60	0.45
Model4	4-Cluster	5869.51	24	53.11	55	0.55

Table 3: Land indicator variables by group after classification

Variable	Group 1 obs	Group 2 obs	N t-test	Group 1	Group 2	P-value
landadjattu	507	359	359	3.30 (0.90)	1.00 (0.00)	0.00***
landprivate	507	359	359	1.15 (1.42)	1.08 (1.42)	0.51
landcerti	507	359	359	0.66 (0.48)	0.62 (0.49)	0.32
landplantm	507	359	359	0.25 (0.43)	0.08 (0.27)	0.00***

Std.dev in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Variables summary by group after classification

Variable	N t-test	Group 1	Group 2	P-value
sex	359	0.79 (0.41)	0.81 (0.40)	0.66
edu	359	2.74 (0.89)	2.65 (0.87)	0.14
age	359	42.03 (10.79)	42.75 (10.12)	0.32
hhsize	359	3.73 (1.12)	3.75 (1.08)	0.79
percentage	359	0.54 (0.24)	0.53 (0.24)	0.43
hhdiff1000	359	55.34 (57.20)	55.09 (40.57)	0.94
idiff1000	347	35.85 (34.52)	36.36 (23.77)	0.81
integration	359	0.68 (0.47)	0.69 (0.46)	0.79
plan	359	0.55 (0.50)	0.44 (0.50)	0.00**
area	359	5.55 (4.06)	5.36 (4.41)	0.51
parcel	359	3.99 (3.12)	3.93 (2.74)	0.77
abandon	359	0.18 (0.39)	0.13 (0.33)	0.03*

Std.dev in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Estimation for impact of land endowment on migration for household

Variables	Overall percentage	Group 1 percentage	Group 2 percentage	Overall percentage	Group 1 percentage	Group 2 percentage
area	0.0042	0.0105*	-0.0028	0.0068*	0.0096*	0.0049
	(0.0039)	(0.0060)	(0.0057)	(0.0035)	(0.0057)	(0.0049)
area2	-0.0003**	-0.0006**	-0.0001	-0.0004***	-0.0005**	-0.0003**
	(0.0001)	(0.0003)	(0.0002)	(0.0001)	(0.0003)	(0.0002)
parcel				-0.0007	0.0006	-0.0011
				(0.0029)	(0.0039)	(0.0039)
hhdiff1000				0.0995***	0.0655**	0.1893***
				(0.0313)	(0.0320)	(0.0317)
hhedu				-0.0222**	-0.0181	-0.0259*
				(0.0091)	(0.0119)	(0.0137)
hhsizenl				-0.1166***	-0.1129***	-0.1190***
				(0.0074)	(0.0098)	(0.0115)
Constant	0.5282***	0.5112***	0.5478***	0.6037***	0.5993***	0.5664***
	(0.0176)	(0.0246)	(0.0269)	(0.0364)	(0.0457)	(0.0484)
Observations	867	508	359	865	506	359
R-squared	0.0059	0.0070	0.0097	0.2133	0.1826	0.2902

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Logit Estimation for impact of land endowment on migration for individual

VARIABLES	(1) plan	(2) plan	(3) plan	(4) plan	(5) plan	(6) plan
area	0.0413	0.0851	-0.0367	0.0636	0.0990*	-0.0081
	(0.0386)	(0.0554)	(0.0533)	(0.0458)	(0.0596)	(0.0736)
area2	-0.0026	-0.0041	-0.0001	-0.0031	-0.0039	-0.0012
	(0.0017)	(0.0028)	(0.0019)	(0.0021)	(0.0028)	(0.0032)
parcel				-0.0273	-0.0236	-0.0338
				(0.0261)	(0.0311)	(0.0511)
abandon				0.5253**	0.6770***	0.1912
				(0.2045)	(0.2552)	(0.3563)
idiff1000				0.0066**	0.0068*	0.0088*
				(0.0028)	(0.0035)	(0.0050)
sex				-0.4933***	-0.3347	-0.6942**
				(0.1896)	(0.2486)	(0.3010)
edu				0.2113**	0.1478	0.2833**
				(0.0866)	(0.1091)	(0.1419)
integration				0.8392***	0.6733***	1.1306***
				(0.1562)	(0.2016)	(0.2627)
Constant	-0.0958	-0.0920	-0.0415	-1.1705***	-1.0439**	-1.3744***
	(0.1571)	(0.2144)	(0.2330)	(0.3208)	(0.4236)	(0.5074)
Observations	866	507	359	831	484	347

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1