China's Employment and Rural Labor Migration

Agapi Somwaru
Economic Research Service, U.S. Department of Agriculture

Xinshen Diao
International Food Policy Research Institute

Fred Gale
Economic Research Service, U.S. Department of Agriculture

Francis Tuan
Economic Research Service, U.S. Department of Agriculture

Selected Paper
American Agricultural Economics Association Annual Meeting
Chicago, IL, August 5 – August 8, 2001

Abstract: This study examines the rural labor market in China based on the country's first national agricultural census. The analysis highlights distinct differences of employment by age, gender, educational level, size of the household, and size of land holdings. We use a generalized polytomous logits (GPL) framework to analyze the patterns of rural labor employment, capture the dynamic trends of the rural labor force, and gauge rural migration. The estimation results, based on more than 4 million records of rural persons, indicate that the land size followed by the education level and age are the main factors affecting the chances of rural labor force by employment categories.

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Keywords: rural labor force, labor migration, generalized polytomous logit.

1. Introduction

Given limited per capita cultivated land in China and low rural incomes, the reduction of surplus agricultural labor is an important goal of China's economic development policy. Growing employment opportunities in industrial and service sectors are expected to absorb surplus agricultural labor, raising agricultural labor productivity, improving rural incomes and reducing rural poverty. Since the start of economic reforms in 1978, China has experienced the largest labor flow from primary industries to other sectors of the economy. As China's economic development advances further, migration of rural labor to urban industrialized areas is certain to occur. Large income differentials between agricultural and non-agricultural employment provide strong incentives for labor to move to the non-agricultural sector, but a number of barriers to non-agricultural employment prevent the movement. Among the barriers are the lack of non-farm industry in rural areas, the household registration system that constrains migration to urban areas, low education of rural residents, and a land tenure system that prevents efficient reallocation of land to take advantage of size economies and other efficiencies.

Many studies have been conducted and much research effort has addressed these arguments. Carter (1997) argues that the proportion of China's rural labor force engaged in agriculture is rather high when examining its agriculture share of GNP. He argues that institutional and policy-influenced restrictions prevent rural workers from engaging in non-agricultural employment. Rozelle, et al. (1999), however, find no evidence of policies preventing rural labor migration. Instead, they argue that there is evidence of tremendous labor movement out of agriculture over the period 1988-98. Also, Parish, et al. (1995), remarks that a rural labor market is clearly emerging in China. They state that the rural labor market transformation is on its way, but its speed is slow given the complexities of the marketization process.

This study examines the rural labor market in China, its characteristics, possible restraints, and potential for migration using newly available data the first national agricultural census conducted since the founding of the People's Republic of China. Previous studies on these issues are either based on aggregate statistical data or on small sample surveys that cover limited geographic areas. This study is based on 1% sample of the 200 million households enumerated by the census.

The paper is organized as follows. The next section presents an overview of the rural labor force and its characteristics, followed by an analysis of rural persons and households. The following section concentrates on the distribution of rural persons by the type of their economic activities. Section 3 associates land scale and its relationship with labor migration. Section 4 uses a statistical procedure, a generalized polytomous logit model, to analyze and predict future movements of rural workers from agricultural to non-agricultural activities. Finally, the paper concludes with a summary.

2. Rural labor force

In this section we present the main features of rural persons between the ages 15 to 60 for males and 15 to 55 for females who are engaged full-time either in agricultural or non-agricultural activities. These two distinct groups represent the two polar groups that our analysis is centered upon. According to the Census, persons who worked full time in agricultural activities and were not engaged in any non-agricultural activities account for 52% of all rural persons. On the other hand, only 11.4% of rural persons are engaged in non-agricultural activities full time (worked more than 6 months) and are not engaged in any agricultural activities. We also distinguish a third group, which includes persons who work full-time but part-time in agricultural and part-time in non-agricultural activities. We label this group "full-time, part-time agricultural & part-time non-agricultural" activities and this group accounts for 10.3% of all rural persons.

2.1 Age composition

The distribution of rural labor employed full-time in agricultural and non-agricultural activities is depicted in figure 1. Figure 1 clearly indicates that rural persons engaged in non-agricultural activities are much younger, between 16 and 30 years of age, compared with full-time rural persons engaged in agricultural activities. Taking into account the time when the rural reforms were established in China, it comes as no surprise that the distribution of full-time non-agricultural persons is dominated primarily by young persons who capitalized on the opportunities offered by the reforms. This also reflects the economic climate and stimulus generated by the rural reforms, which increased non-agricultural employment opportunities for rural persons, especially for the younger rural economically active population.

2.2 Does education matter?

In order to increase our understanding of the relationship between employment and age (or education) we examine the characteristics by age and education level. The distribution of rural labor force employed full-time in agricultural and non-agricultural activities by age group and education level (see figure 2) clearly supports the hypothesis that the education level of a person is strongly associated with non-agricultural activities. For reasons of simplicity we classify the education level into four categories: the first category is the *primary or elementary* level, which includes literate, illiterate, and primary education levels as reported by the Census. The second category includes the *junior middle* level *or middle school*, and the third category is the *senior middle* level or *high school*. Finally, the fourth category includes the *special secondary school and college* levels, which combines these two levels as reported by the Census.

2.3 Gender

There are 307.1 million male rural workers (51.5 percent) and 289.1 million female rural workers (48.5 percent) between the age of 16 and 60 years old engaged in economic activities in rural China. According to the Census, the economically active male population includes ages from 16 to 60 while for females the range is between 16-55 years old.

In order to enhance our understanding of the rural labor force in China we depict the distribution of rural persons by gender and age groups. Figure 3 presents the distribution of rural labor force by age, gender, and by categories of economic activities. The distributions clearly indicate that rural young males are more likely to be involved in non-agricultural activities than are females. This might be due to preferential treatment extended towards boys by many farmers in providing educational and other opportunities that lead to employment outside agriculture in rural China.

2.4 Education and Gender

The distribution of rural labor force by gender, educational levels, and categories of economic activities (see figure 4) supports the notion stated above that males in the three employment groups are more educated than females. Full-time employed males in agricultural activities are more educated than females. Also, in this group, 60% of primary educated persons are females. When it comes to full-time agricultural and non-agricultural group and full-time non-agricultural employment, males dominate in all levels of education (65%-75%).

In sum, younger rural persons employed full-time are more educated than older persons (whether they are in agricultural or non-agricultural work). Also, males are more educated than females while females are largely consigned to the full-time agricultural activities.

3. Households and land distribution

Over the last two decades, China has carried out a series of successful economic reforms in agriculture and its rural economy. Since the collective production system was replaced by the rural household responsibility system (HRS) in the early 1980s, farmland has been mainly cultivated by individual households who make decisions about planting as well as the use of inputs. (Ownership rights of land are still nominally held by collective organizations.) The Census shows that there were about 200 million rural households engaged in agricultural activities in 1996 and the cultivated land area per household was often quite small.

3.1 Land size affects household's agricultural employment

Family members are the dominant source of labor for China's agriculture, regardless the size of land held in each household. We found that in households with small holdings (less than 0.07 hectare, or 1 mu, of cultivated land) only 29% of family workers are engaged full-time in agricultural activities. In this group, non-agricultural employment is high, as more than 54% of family workers are mainly involved in non-agricultural activities. However, in households with larger holdings of more than 2 hectares (30 mu), 72% of family workers are engaged full-time in agriculture, and only 5% are engaged in non-agricultural employment.

Surprisingly, the Census shows that the size of land holdings varies among households, whether measured per household or per worker. We developed a land Gini coefficient using the average land holdings for 10 land size categories versus the percent of the households and the percent of workers in each land size group to describe the disparity in land distribution. The Gini coefficient for the households is 0.51 while the Gini coefficient for the workers 0.46, indicating that land is not equally distributed among either households or workers but is relatively more equally distributed for workers than households.

4. Rural Labor Migration

We investigate the rural labor migration empirically by applying a Generalized Polytomous Logit (GPL) function to handle the three discrete non-ordered choices of employment: full-time agriculture, full-time non-agriculture, and part-time agriculture/part-time non-agriculture (Greene, 1990; Kennedy, 1992; Long, 1997; Stokes et al., 1998). Since the response variable, the categories of employment, has no inherent ordering, we estimate the model as a generalized logit function. The generalized logits for a three-level nominal response where the rural person chooses among three different employment categories can be specified as follows:

$$logit_{hij1} = \frac{log(\eta_{hij1})}{log(n_{hij3})} \tag{1}$$

$$logit_{hij2} = \frac{log(\eta_{hij2})}{log(n_{hij3})}$$

where category 3 is the reference categories. The model that applies to all logits *simultaneously*, accounting for every combination of the explanatory variables is as follows:

$$\text{logit}_{\text{hijk}} = a_k + X_{hij}\beta_k \quad (2)$$

where k indexes of employment categories. The matrix $\mathbf{X}_{\text{hij}}$ is the set of explanatory variables for the hijth group. This model accounts for each response by estimating separately the intercept (α_k) and the set of regression parameters (β_k) for all explanatory variables. That is, in the GPL model specification, we estimate simultaneously as a panel multiple sets of parameters for both the intercept and the explanatory variables.

The interpretation of GPL parameter estimates is not very straightforward, as both dependent and explanatory variables are mostly categorical. To facilitate the interpretation of the model parameters, we estimate probabilities.

For the GPL model, we group the explanatory variable age into three categories of rural persons: group1 including persons between 16-22 years old, group2 persons between 23-35 years old, while group3 all rural persons older than 35 years of age. The explanatory variable land is grouped into four categories according to the land distribution by persons: group1 including land less than 1.0 mu, group2 land between 1.1-3.0 mu, group3 land between 3.1-5.0 mu, while group4 land area greater than 5.0 mu. Similarly, we create three groups for the explanatory variable number of persons in each household as follows: group1 including households with 2 persons, group2 includes households with 3 persons, and group3 includes households with 4 persons and more. We also categorized rural persons by their education level into three groups as follows: group1 including illiterate, literate, and primary education, group2 middle junior and senior education, while group3 primary and college education. Finally, the rural persons are distinguished into two groups according to their gender.

4.1 Empirical Results

Table 1 presents the maximum likelihood analysis of variance results, which summarize the main effects of the GPL model that was estimated using 4,232,913 observations. The likelihood ratio statistic indicates the goodness of fit of the model, while the chi-square values indicate the significance of the explanatory variables. The likelihood ratio statistic for the model has a value of 60,104 and 408 degrees of freedom, indicating a good fit.

The hypothesis to be tested is that employment and labor migration is affected by the gender, age, education, the size of household, and land size of rural persons. The results presented in Table 1 reveal a strong relationship between these variables and categories of work as captured by the Wald Chi-Square values. Age, gender, education, size of households, and land size are also significant factors in determining the type of

employment (Table 1) as indicated by the Wald Chi-square values of 141,737 (4 degrees of freedom), 96,986 (2), 175,859 (4), 26,905 (4), and 493,121 (6), respectively.

Table 2 presents the parameter estimates for the models, along with the standard error values to indicate the statistical significance of the estimated parameters. The size of the estimated coefficients suggest that the land size variable has the largest effect on both logits.

4.2 Rural Labor Employment and Migration--Estimated Probabilities

Table 3 presents the results of the predicted probabilities for gender, age groups, education levels, household size, and two land sizes. We include only the smallest and largest land size, LS1 and LS4, respectively. For example, the probability that a young male with elementary education in the smallest household group and land size will be engaged in full-time agricultural activities is 0.26; the probability of engagement in non-agricultural activities is 0.62. When the land size increases the probability of engagement in full-time agricultural activities for young males rises to 0.91. For young males, probability of full-time agricultural employment decreases by half (.12) as the education level increases to middle and high school, holding household size and land size constant in the smallest groups. For young males with these characteristics, the probability of full-time agricultural employment decreases by 14 percent if the land size increases (LS4). As the education level increases, the probability of full-time agricultural employment for young males in the first group of household size and land size decreases to 0.02. The effects of education, household size and land size on full-time agricultural employment diminishes as age increases.

The estimated probabilities for females follow a similar pattern to that for males. However, the estimated probabilities for females engaged in full-time agricultural activities are larger than that for males with the same characteristics, indicating that probabilities for females to migrate to non-agricultural work are smaller than that of male. When it comes to non-agricultural activities, the probabilities for females are almost the same as that for males only for those with a college education.

Increasing age, holding constant education level (elementary), household size (household group 1), and land size (land size 1), leads to a higher probability to be engaged in full-time agricultural activities of almost .60 for males and 0.76 for females (see table 3). The age level lowers the probabilities for labor migration with increase in education level for both male and female to 0.16 and 0.08, respectively. The effect of land size dominates and even dampens the effects of the education level, especially for females. For example workers with college education and land holdings in the first group have a probability of full-time employment in agricultural activities of 0.02 for males and 0.04 for females. As land size increases to 5.0 mu and more the probability for full-time employment in agricultural activities increases to 0.40 for males and 0.44 for females.

In sum, the estimated probabilities indicate that land size holdings and education level play important roles in labor migration, suggesting that institutional changes on land holdings and increase in educational opportunities can greatly increase migration of rural labor from agricultural to non-agricultural activities. Younger persons appear to be more responsive to non-agricultural work opportunities than older rural persons.

5. Summary

This study examined the rural labor market in China, its characteristics, possible constraints, and potential for migration using the country's first national agricultural Census. The national Census provides us with unique opportunity to study the structure of rural labor in China its entire.

We analyzed demographic characteristics of the rural labor force and how those characteristics were associated with agricultural and non-agricultural employment. The descriptive statistics highlighted distinct differences in three types of sectoral employment choices by age, educational level, size of the household, and size of land holdings. A generalized polytomous logit (GPL) model was estimated to analyze the patterns of rural labor employment and predict the likelihood of migration from agricultural to nonagricultural work. The effects of land size followed by the education level and age group are the main factors affecting the estimated probabilities of rural employment and hence, the trends and dynamics of rural labor migration to non-agricultural activities even part-time or full-time basis.

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Figure 1: Engagement of Rural Labor Force, by Age

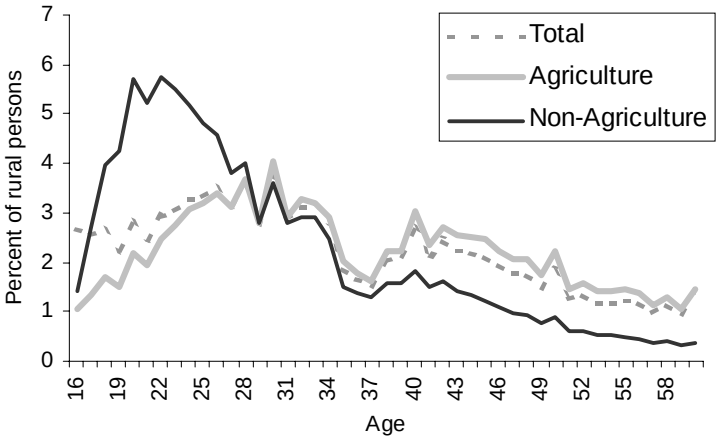

Figure 2: Distribution of Rural Labor Force by Sector of Engagement, Education, Under Different Age Groups

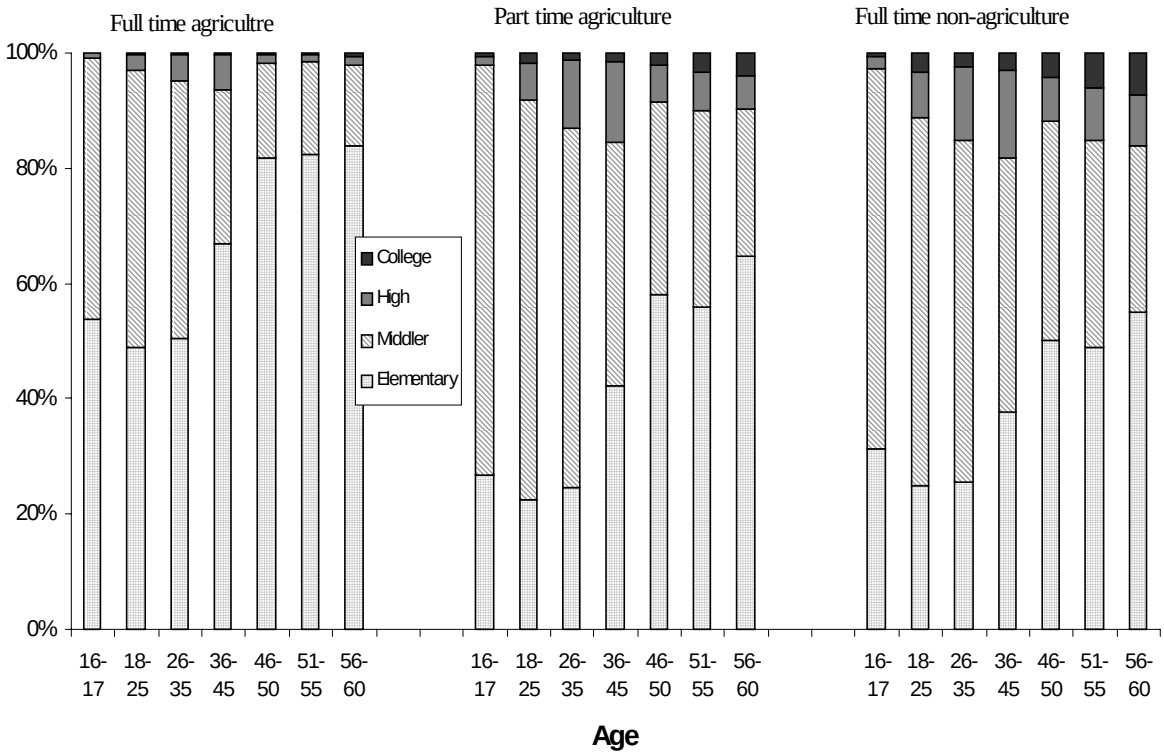

Figure 3: Gender Composition of Rural Labor Force by Sector of Engagement and Age Group

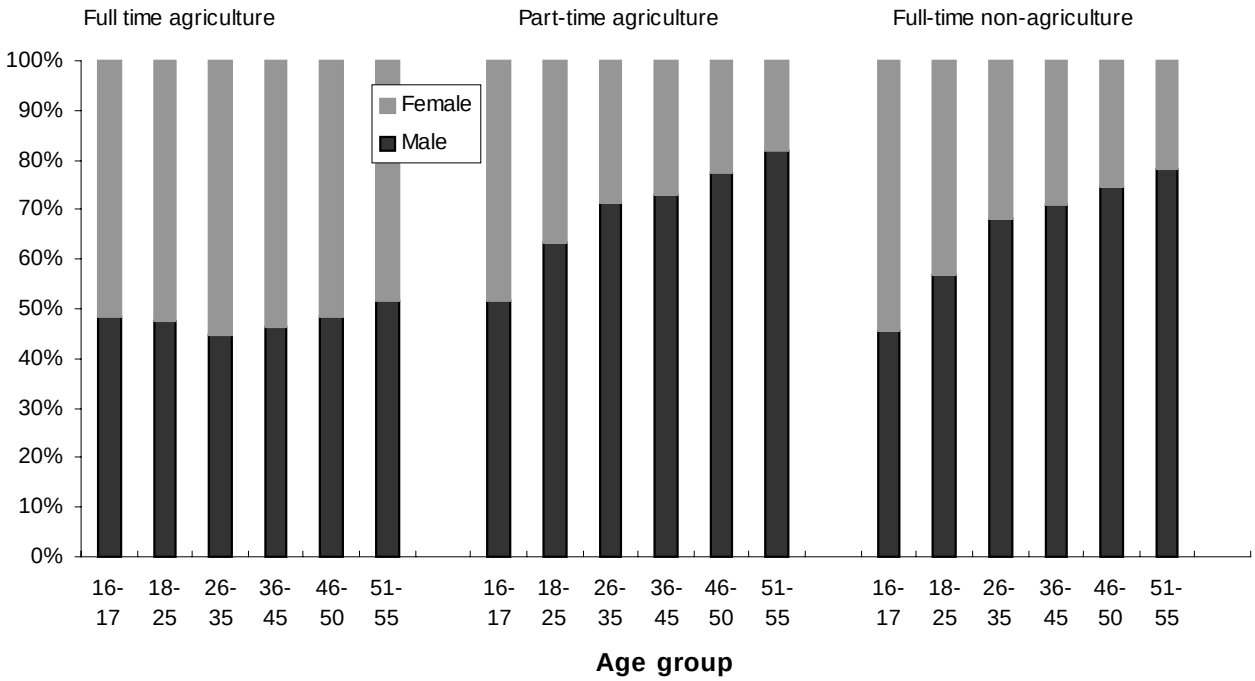

Figure 4: Gender Composition of Rural Labor Force by Sector of Engagement and Education

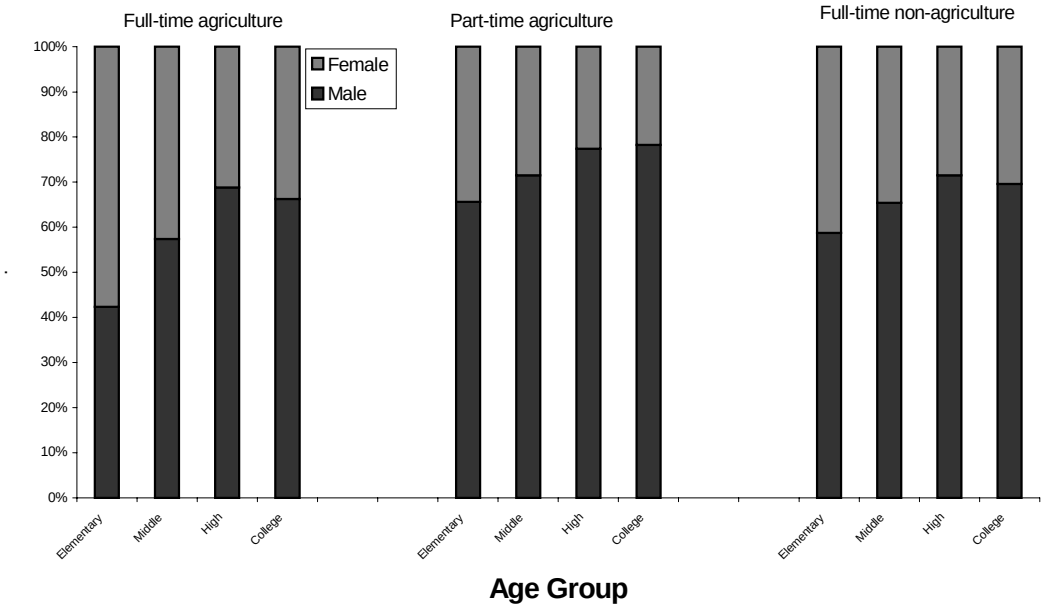

Table 1: Maximum Likelihood Analysis of Model Fit and Significance of the Variables

Variable	Degree of freedom	Chi Square	Probability
Intercept	2	54709.79	<0.001
Gender	2	96986.64	<0.001
Age groups	4	141737.6	<0.001
Education groups	4	175859.6	<0.001
Size of household	4	26905.21	<0.001
Land size	6	493121.3	<0.001
Likelihood ratio	408	60104.29	<0.001

Table 2: Generalized Multinomial Logit (GPL) Model, National Level

Model 1	Logit (Part-time agr. & part-time non-agr.			Logit (Full-time non-agr. / Full-time agr)		
Variable	Coefficient		Std. Error	Coefficient		Std. Error
Intercept	α_1	0.9606*	0.0056	α_2	-0.3615*	0.0058
Gender(male)	β_1	-0.3626*	0.0017	β_2	0.0850*	0.0021
Age Group1	β_3	-0.9369*	0.0027	β_4	-0.6533*	0.0033
Age Group2	β_5	0.1213*	0.0022	β_6	0.0968*	0.0027
Educ. Group1	β_7	1.3289*	0.0052	β_8	0.2258*	0.0052
Educ. Group2	β_9	0.3262*	0.0051	β_{10}	0.2469*	0.0050
Size of Household 1	β_{11}	0.5232*	0.0051	β_{12}	0.2098*	0.0059
Size of Household 2	β_{13}	-0.0372*	0.0036	β_{14}	0.0862*	0.0041
Land size1	β_{17}	-2.3846*	0.0038	β_{18}	-1.0917*	0.0044
Land size2	β_{19}	0.2065*	0.0025	β_{20}	0.5738*	0.0031
Land size3	β_{21}	0.8491*	0.0034	β_{22}	0.4263*	0.0043

*significance at 1% level; ** significance at 5% level.

Table 3: Predicted Probabilities of Labor Employment by Categories

				Full-time agriculture		Part-time agriculture & part-time non-agriculture		Full-time Non-agriculture	
Gender	Age	Education	Size of Houshold Number of persons	Land Size LS1	LS4	LS1	LS4	LS1	LS4
Male	Group1	Elementary	1-2	0.26	0.91	0.12	0.04	0.62	0.05
			3	0.17	0.86	0.13	0.05	0.70	0.09
			4 and more	0.12	0.82	0.10	0.05	0.78	0.13
		Middle+High	1-2	0.12	0.78	0.15	0.09	0.73	0.13
			3	0.07	0.69	0.14	0.12	0.79	0.19
			4 and more	0.04	0.62	0.11	0.11	0.85	0.27
		College	1-2	0.02	0.40	0.09	0.15	0.89	0.45
			3	0.01	0.28	0.08	0.16	0.91	0.56
			4 and more	0.01	0.21	0.06	0.13	0.94	0.66
	Group2	Elementary	1-2	0.46	0.95	0.16	0.03	0.38	0.02
			3	0.34	0.93	0.18	0.04	0.48	0.03
			4 and more	0.26	0.91	0.15	0.04	0.59	0.05
		Middle+High	1-2	0.23	0.88	0.24	0.07	0.53	0.05
			3	0.15	0.82	0.24	0.10	0.61	0.08
			4 and more	0.11	0.78	0.19	0.10	0.70	0.12
		College	1-2	0.05	0.60	0.17	0.16	0.78	0.24
			3	0.03	0.47	0.15	0.21	0.82	0.32
			4 and more	0.02	0.39	0.12	0.18	0.87	0.43
	Group3	Elementary	1-2	0.59	0.97	0.17	0.02	0.24	0.01
			3	0.46	0.95	0.20	0.03	0.34	0.02
			4 and more	0.38	0.94	0.18	0.03	0.44	0.03
		Middle+High	1-2	0.34	0.91	0.27	0.06	0.39	0.03
			3	0.23	0.87	0.30	0.09	0.47	0.04
			4 and more	0.19	0.85	0.24	0.09	0.57	0.06
		College	1-2	0.08	0.71	0.24	0.16	0.68	0.14
			3	0.05	0.60	0.22	0.20	0.73	0.21
			4 and more	0.04	0.52	0.16	0.19	0.80	0.29
Female	Group1	Elementary	1-2	0.42	0.96	0.09	0.01	0.49	0.03
			3	0.31	0.93	0.08	0.03	0.61	0.04
			4 and more	0.22	0.91	0.08	0.02	0.70	0.07
		Middle+High	1-2	0.21	0.89	0.12	0.04	0.67	0.07
			3	0.13	0.83	0.04	0.06	0.83	0.11
			4 and more	0.09	0.77	0.09	0.07	0.82	0.16
		College	1-2	0.04	0.44	0.08	0.16	0.88	0.40
			3	0.02	0.45	0.07	0.11	0.91	0.44
			4 and more	0.02	0.36	0.04	0.09	0.94	0.55
	Group2	Elementary	1-2	0.65	0.98	0.09	0.01	0.26	0.01
			3	0.52	0.97	0.12	0.01	0.36	0.02
			4 and more	0.43	0.96	0.10	0.01	0.47	0.03
		Middle+High	1-2	0.40	0.94	0.16	0.03	0.44	0.03
			3	0.28	0.91	0.18	0.05	0.54	0.04
			4 and more	0.21	0.89	0.15	0.04	0.64	0.07
		College	1-2	0.10	0.77	0.14	0.08	0.76	0.15
			3	0.06	0.66	0.13	0.12	0.81	0.22
			4 and more	0.04	0.58	0.09	0.11	0.87	0.31
	Group3	Elementary	1-2	0.76	0.98	0.09	0.01	0.15	0.01
			3	0.65	0.98	0.12	0.01	0.23	0.01
			4 and more	0.57	0.95	0.11	0.03	0.32	0.02
		Middle+High	1-2	0.97	0.96	0.02	0.03	0.01	0.01
			3	0.40	0.94	0.21	0.04	0.39	0.02
			4 and more	0.33	0.93	0.17	0.04	0.50	0.03
		College	1-2	0.16	0.84	0.19	0.08	0.65	0.08
			3	0.10	0.77	0.19	0.10	0.71	0.13
			4 and more	0.07	0.71	0.14	0.10	0.79	0.19