Chapter 9

Determinants of Farmers' Participation and Willingness of Training: Evidence from Autonomous Minority Nationality Areas in Southwestern Frontier Region of China

Jiachun Xie[1] and Xingxu Li[2] and Songsak Sriboonchitta[3]

[1] *Faculty of Economics, ChiangMai University*
E-mail: springchinathai@hotmail.com

[2] *Faculty of Statistics and Mathematics*
Yunnan University of Finance and Economics
E-mail: xingxu1967@sina.com

[3] *Faculty of Economics, ChiangMai University*
E-mail: Songsak@econ.cmu.ac.th

Facilitation of rapid poverty alleviation in rural farming communities was implemented in 2004 when the Chinese government adopted the Rural Labor Force Migration Training Plan. Sample survey data was obtained from 3365 households in 348 villages in the autonomous minority nationality area in Yunnan province of the southwestern frontier region of China. Multilevel logit regression models were used to analyze the determinants of farmers' participation willingness of training. Empirical results primarily indicate the household level predictors of income, highest education level, ratio of man labor, ratio of young labor, existing cadre, land scale per capita, capital assets of farming per capita, and the scale of agricultural labor force transferred all have positive correlation with regards to the willingness of farmers to participate in training initiatives. Ratio of man labor, ratio of young labor, and land scale per capita were not statistically significant. Index of labor force burden was found to have negative influence. At the village level, the following variables were statistical significant: minority village, geographic position, and village average ratio of labor force participating in training.

1. Introduction

In 2009, the autonomous minority nationality rural regions of China had 19.54 million people in poverty, which accounted for 54.3% of all rural poverty in the country. The poverty incidence was 16.4% in these areas, and 12.6% higher than the country poverty incidence. The autonomous minority nationality rural areas are more much poorer than any other areas of the country during the same period. It is crucial to refine the anti-poverty policy in our western poverty areas so as to improve the farmers' employment ability in western minority areas, thereby increasing incomes. In 2004, the government initiated the Rural Labor Force Migration Training Plan in order to accomplish those goals. A subset of the national program is the Rural Labor Force Migration Training Sunshine Project. This program has been set up under the umbrellas of the Ministry of Labor and Social Security, the Ministry of Agriculture, the Ministry of Finance, and the Ministry of Education.

Our two research areas are the Honghe Hani Nationality and Yi Nationality Autonomous Prefecture and the Dehong Dai Nationality and Jingpo Nationality Autonomous Prefecture. They are typical of national autonomy prefectures in China. Many special policies have been established by the government with respect to these villages; furthermore, with their own cultural customs and differing economic status, degree of opening, and topography, this leads to homogeneity in the same village versus different villages. If we take the peasant households at the micro-level which is nested within villages at the macro-level, the macro-level elements will affect the decision behavior of the households (Iversen, 1991; Huber, 1991; DiPrete and Forristal, 1994; Karsten Hank, 2002). In other words, the characteristics of a household may influence the behavior under investigation, but also the household's choice of the environment where they live in (Karsten Hank, 2002; Olalekan A Uthman and Eugene J Kongyuy, 2008; Yuehen Zhao et al., 2011).

In this paper, we are interested in what are the determinants of farmer household's willingness of participation in training, especially in the national autonomy prefectures. The traditional signal level model may have some disadvantages when applied to the household level and village level hierarchical data. So a multilevel perspective is taken to investigate whether and how village social contexts influence the willingness of participation in training of farmers.

2. Literature review

Since from the training policy has been adopted, domestic scholars have mainly focused on the outcomes of training policy (Ren Guoqiang, 2009; Gao Cuiling, 2010). Relatively few studies have been carried out on what are the determining factors of farmers' willingness in participation in training (Gao Sheng, 2011). There has been a common thesis in prior research of focusing on the characteristics of individual and not household level factors such as how the farmers' behaviors affects his family members upon participation in training and his overall environment. Furthermore, remote

autonomous minority nationality rural areas have even less research, and these areas exhibit characteristics of the village as the basic communal unit.

3. Methodology

Several statistical problems rule out the application of traditional single-level regression models to the analysis of multilevel data. Clustering of households within the same village results in a hierarchically structured data set and is likely to cause dependency among observations (Hox and Kreft, 1994; Karsten Hank, 2002). Ordinary least squares (OLS) models applied to such data can produce inefficient estimates of the parameters and downwardly biased estimates of their standard errors, because the assumption of independent disturbances-on which OLS is based and is critically violated(Moulton, 1990; Snijders and Bosker, 1994).

In our research the outcome variable is a binary variable T, 1 indicates the participation in the training, so the *Multilevel Logit model* has been adopted. Random effect is also taken into consideration in this model to solve the Intra-Class Correlation (ICC) problem. Due to our data set structure is in the form of household being nested within village, our *two-level Logit model* can be expressed as (Wang Jichuan., 2008):

$$\text{Level}-1: \quad \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_{0j} + \sum_{p=1}^{p} \beta_p x_{pij} \qquad (1.0)$$

$$\text{Level}-2: \quad \beta_{0j} = \gamma_{00} + \sum_{m=1}^{M} \gamma_{0m}\, \omega_{mj} + u_{0j} \qquad (1.1)$$

where, β_{0j} represents random intercept, x_{pij} is the household level explanatory variable which we assume have fixed effect. In the Level-2 formula, β_{0j} can be expressed in the form of linear function of ω_{mj} which is the village level explanatory variable. All u_{0j} are assumed to be independent with expectation zero and variance σ_{u0}^2. If the variance of u_{0j} turns out to be statistically significant from zero, the village context effects can present (Kreft and De Leeuw, 1998).

4. Data

The data for the aim of our study were obtained from The Rural Household Survey of Honghe Prefecture and Dehong Prefecture in Yunnan province. Two-stage sample was selected in each prefecture. The first stage involved the selection of 348 villages from 13 counties of Honghe Prefecture and 5 counties of Dehong Prefecture. In the second stage, it was involved the stochastic sampling of households from the selected villages, totally 3365 households have been selected. This Rural Household survey project, which research started since 2005, contained lots of detailed information of rural households, such as income, consumption, production and operation behaviors, education and training, but the training information enrolled into this survey only from 2006 to 2008. Rural Household Survey of 2006 period has been adopted as our research

sample in consideration of the training effects may affect the farmer's training decision behavior of the following years.

A total of 3365 households nested within 348 villages have engaged in this survey. For further descriptive sample statistics and information, go to the displayed Table 1.

Table 1. Descriptive sample statistics: T=1, participating in training

		Total Sample		T=1		T=0	
		Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
	Variable	Obs=3365		Obs=1125		Obs=2240	
Outcome Variable	T	0.33	0.47	1.00	0.00	0.00	0.00
Level-1: Household	Inco	2.18	1.17	2.50	1.25	2.03	1.09
	Edu	2.80	0.78	3.05	0.70	2.68	0.79
	Manlabor	0.52	0.16	0.53	0.14	0.52	0.17
	Youth	0.33	0.21	0.33	0.21	0.33	0.21
	Burden	0.62	0.61	0.57	0.57	0.65	0.62
	Cadre	0.10	0.30	0.13	0.34	0.08	0.27
	Avland	1.62	1.56	2.05	2.08	1.40	1.16
	Lnassets	6.77	2.29	7.55	1.89	6.38	2.37
	Emlabor	0.15	0.47	0.21	0.52	0.11	0.43
Level-2:Village	Min	0.76	0.43	0.68	0.47	0.80	0.40
	Geo	2.44	0.82	2.14	0.91	2.59	0.73
	Trlamean	0.26	0.37	0.69	0.32	0.00	0.00

Measures

Outcome variables

The household-level binary outcome variables equals 1 in case of the household has at least one member participate in the training; equals 0 in case that there is no participation in the training.

Household-level characteristics

Income means per capita annual net income and is categorized into five groups: Inco1, 2000 RMB and less than; Inco2, above 2000 RMB to less or equal than 4000 RMB; Inco3, above 4000 RMB to less or equal than 6000 RMB; Inco4, above 6000 RMB to less or equal than 8000 RMB; Inco5, above 8000 RMB.

Education level means the highest education attainment level of the household member; to the purpose of this research it is been grouped into five bands: Edu1, illiteracy; Edu2, primary school; Edu3, junior high school; Edu4, senior high school or special [technical secondary] school; Edu5, junior college.

Manlabor is defined as the ratio of man labor force. It is not clear about that whether the more man labor forces the more willingness of the household participating in training.

Youth is defined as the ratio of young labor force whose age is between 21 and 40 years.

Burden is calculated as (residents-labor force)/labor force.

Cadre household is satisfied when someone of the family members is village official. The village official plays an important role in our rural areas. Normally, village official have positive leading role in taking part in government activities.

Avland means land scale per capita. The household may too busy to participate in training if they have abundant land resources. Or they take part in training in order to improve their production efficiency.

Lnassets means the capital assets of farming per capita, and we take logarithm of it.

Emlabor is the scale of agricultural labor force that is migrating into other sectors or other areas. The main target of our training program is to help rural labor force to transfer to the nonagricultural sectors, as well as improving their income. Villagers also expect to obtain some special skills through this training project.

Village-level characteristics

Min, minority nationality village, respondents region is stratified into minority village and non-minority village. Totally, there are 2565 households from minority nationality villages in our survey sample, which represents to the total of 76 percent.

Geo, geographic position is been grouped into plain position, hill position and mountain position.

Trlamean is an aggregation variable, and indicates the average ratio of the labor force of who is participating in this training project from each own village.

Finally, a four-step modeling strategy is adopted in our research.

Model 1 : no explanatory variable included (empty model) which contains a intercept term in the fixed and the random part. The γ_{00} is shared by all villages while the random effect u_{0j} is specific to village j.

Model 2 : as model 1, but only household level explanatory variables included in the fixed effect.

Model 3- Model 4 : as model 2, but consider village level explanatory variables.

The results of regression are shown in table 2.

The R software, version 2.13.2 is used for our analysis. R's main command for fitting multilevel models for binary and other discrete response variables is the *glmer* command which is part of an additional *lme4* library. The estimation procedure optimizes a function of the log-likelihood using penalized iteratively re-weighted least squares. The log-likelihood is evaluated using the *Laplacian* approximation.

5. Results

As is shown in Table 2, we run Model 1 for the sake of estimating heterogeneity among villages. From the model estimates, we can say that: 1) There is a strong evidence that the between-village variance is non-zero ($\hat{\sigma}^2_{u0}$=29.48 , P=0.000), which means significant heterogeneity among villages. 2) $\mathrm{ICC} = \frac{\hat{\sigma}^2_{u0}}{(\hat{\sigma}^2_{u0}+\pi^2/3)} = \frac{29.48}{(29.48+3.29)} = 89.97\%$, almost 90% grand variance caused by village level. This large heterogeneity among villages supports the use multilevel model to analysis. 3) The log-odd of participating in training in an `average` village is estimated as $\hat{\gamma}_{00} = -3.0899$(P=0.0000). The intercept for village j is -3.0899+u_{0j}, where the variance of u_{0j} is estimated as $\hat{\sigma}^2_{u0}$=29.48.

After the household level explanatory variables are taken into account, it is clear that: 1) Income has significant effect on farmers' participation willingness of training. The households whose income is above 6000 RBW have more positive willingness of participating in training. Compared to the lowest income group, the odd-ratio of participating in training is 3.25 of the fourth income group, whose income is between 6000 RMB and 8000 RMB and has the highest positivity. For the highest income group households, their odd-ratio of participating in training is 2.45 which is not as high as the positivity of the fourth group. 2) Education also has significant effect, the log-odds of training increases with education level.

We now explore the relationship between the probability of training and education level. Shown in figure 1 is a monotonic increasing relationship. 3) The ratio of man labor force, young labor force, and per capita land scale are not statistic significant. 4) Peasant household incline to not participating in training if the labor forces are burdened with more of the responsibility to take care of the other non-labor force. 5) Compared to the households whose family members do not include a village official versus those with a family member who is a village official, the odd-ratio is 2.83 .6) Produced assets of farming and migration labor force have significant effect. 7) Compared to Model 1, the LR test is significant, AIC and BIC decreased, suggesting that adding level-1 explanatory variables can make the model better fitted. 8) The between-village variance increased from 29.43 to 36.12.

Table 2.Two-level Logit estimates results [a),b)]

	Model 1			Model 2			Model 3			Model 4		
Explanatory variables	β	s.e.	P>|z|	β	s.e.	P>|z|	β	s.e.	P>|z|	β	s.e.	P>|z|
Level-1												
Inco2				0.1341	0.2333	0.5654	0.1040	0.2320	0.6541	-0.0187	0.2195	0.9321
Inco3				0.3551	0.2983	0.2339	0.2622	0.2956	0.3751	0.1312	0.2719	0.6294
Inco4				1.1790	0.3937	0.0027 **	1.1294	0.3892	0.0037 **	0.7316	0.3601	0.0422 *
Inco5				0.8946	0.4272	0.0362 *	0.8328	0.4212	0.0480 *	0.3135	0.3751	0.4034
Edu2				4.0926	1.5307	0.0075 **	2.6459	1.0821	0.0145 *	4.9180	0.9880	0.0000
Edu3				5.2670	1.5271	0.0006	3.7964	1.0778	0.0004	6.0518	0.9905	0.0000
Edu4				6.2266	1.5402	0.0001	4.7228	1.0960	0.0000	6.8760	1.0107	0.0000
Edu5				6.8832	1.7924	0.0001	5.2626	1.4137	0.0002	7.2896	1.2164	0.0000
Manlabor				0.2185	0.5938	0.7129	0.3663	0.5867	0.5324	0.0884	0.5840	0.8797
Youth				0.1085	0.4367	0.8039	0.2232	0.4305	0.6041	0.0662	0.4166	0.8738
Burden				-0.3773	0.1828	0.0390 *	-0.3722	0.1821	0.0409 *	-0.2601	0.1740	0.1349
Cadre				1.0397	0.3238	0.0013 **	1.0700	0.3201	0.0008	0.8319	0.2634	0.0016 **
Avland				0.1547	0.1547	0.1453	0.1475	0.1046	0.1584	0.0171	0.0805	0.8313
Lnassets				0.2956	0.0684	0.0000	0.2477	0.0659	0.0001	0.1986	0.0520	0.0001
Emlabor				0.8665	0.2105	0.0000	0.7899	0.2046	0.0001	0.6501	0.1580	0.0000
Constant	-3.0899	0.3257	0.0000**	-11.4336	1.6602	0.0000	-4.7444	1.4867	0.0014 **	-11.3538	1.1364	0.0000
Level-2												
Min							-1.9196	0.8662	0.0267 *	-0.0479	0.2766	0.8625
Geo2							-2.2386	1.1698	0.0557 .	-0.4161	0.4064	0.3059
Geo3							-4.3083	0.8848	0.0000	0.2353	0.2884	0.4147
Trlamean										11.6121	0.5934	0.0000
Random effect												
σ_u^2	29.4830	5.4298		36.1240	6.0103		32.7290	5.7209		0.9188	0.9585	
Loglikelihood	-1000			-893.2			-875			-601		
LR				213.60	***		35.80	***		548.60	***	
AIC	2005			1820			1791			1244		
BIC	2017			1924			1913			1373		

Note: a): Significance: '***' 0.001; '**' 0.01 ; '*' 0.05 ; '.' 0.1 ; ' ' 1. b): Significance test for -2Loglikelihood compared to the previous model.

Generally, if in a continuous response model, the addition of level-1 explanatory variables will lead to reductions in the level-1 residual variance and in the total residual variance. But if in a binary response model, however, we see that the level-1 residual variance σ_e^2 is fixed to $\pi^2/3$ and can therefore not decrease, only the level-2 residual variance σ_{u0}^2 can change. Rather than decrease σ_e^2, the addition of level-1 explanatory variables will tend to increase the proportion of the total residual variance that is at level 2. Some scholars demonstrate that in analyzing real data, this case arises only in the unusual situation where the added variable is uncorrelated with the other explanatory variables and is evenly distributed across level 2 units (Snijders and Bosker, 1999).

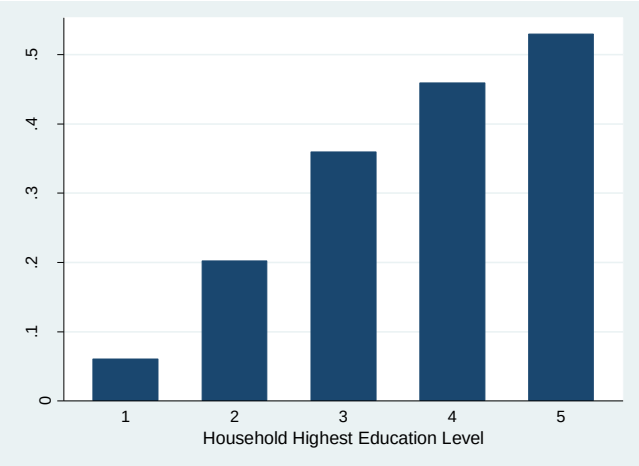

Figure1. Education Level and Predicted Probability of Training

Based on Model 2, village level variables are introduced in Model 3, minority nationality village and the hypsography distribution. 1) All level-1 explanatory variables are not changed significantly as compared to the previous model. Compared to farmer household who live in non-minority nationality village, the minority nationality households have lower willingness to take part in training and the odd-ratio is 0.15. 2) Compared to plain region household, the odd-ratio of participating training is 0.11 for the hill region household and 0.01 for the mountain region people. 3) After village level predictors have been taken into consideration, between-village variance decreases to 32.73, as well as LR test, AIC and BIC decreases which illustrate that adding village level variables to the regression can increase the explanatory power of the heterogeneity among villages.

Another village level explanatory variable, Trlamean is included in Model 4. It is interesting to note, living in minority nationality village and hypsography distribution change to not statistic significant, and between-village variance decreases to 0.92, as well as LR test, AIC and BIC reduce significantly, that means the famer households willingness of training is seriously affected by the average training ratio of the other labor force in their own village. We analysis the reasons for this situation can be induced in the way of training. In our sample survey areas, there are two ways of training adopted mainly. The first is farmers going to the special training agencies

which have the training qualifications, and then training teachers to teach a class of farmers. The second method is organized by the Agricultural Management Schools (AMS). Their training experts go to villages, and present training service directly to farmers at their places or residence. This situation is better suited for the farmers who do not like go to training agency or find it inconvenient to go. The training programs are almost free of charge in the sample survey areas. Also, farmer household get easier to participate in training if their neighbors also participate in.

6. Concluding remarks

The study demonstrates households with these characteristics have more positive willingness to participation: higher income, higher education level, low labor force burden. At the village level, farmers living in non-minority nationality village and mountain areas have relative negative willingness to participation in training. However, if the number of AMS is sufficient, farm households would participate in training.

In this study we focus on what are the determinants of farmers' training willingness with a multilevel perspective. Other literature tends to ignore this facet since survey data is hierarchical. With the context variables having been taken into consideration, this study should highlight which factors are the determinants of farmers training willingness literature. This would be of interest to scholars who are focused in minority nationalities and need to understand whether agricultural training programs are effective. Future research should explore whether the training program improve farmers' income or enhances their ability to migrate to other non-agricultural sectors.

From a policy perspective, if the training program does improve farmers' income and promote mobility, we suggest the program principal should focus on the farmers who are at the lowest income levels. In addition, farmers with lower education and whom live in the remotest mountain minority nationality area, deserve extra attention. Finally, the AMS should be revamped and scaled up to allow more farmers to receive the training opportunities.

ACKNOWLEDGMENT

This research was supported by Yunnan University of Finance and Economics Research Foundation Project to the project of "Farmers' Income Differential and Anti-Poverty Policy Reach in Autonomous Minority Nationality Areas in Southwestern Frontier Region of China "(NO.YC10A001)

REFERENCES

DiPrete,T and Forristal,J.,1994. Multilevel models – methods and substance, *Annual Review of Sociology*, 20:331-357.

Gao Cuiling, 2010. Framework of Evaluation Index System for Farmers' Training under the New Situation, *Journal of Anhui Agri. Sci.* , 2010'38(28).

Gao Sheng, 2011. Factor Influencing Farmer's Decision of Attend Technical Training, Based on Investigation of 1040 Households in Hunan Province, *Journal of Hunan Agricultural University (Social Sciences)*,Vol.12 No.4, Aug.

Household Survey Department of National Bureau of Statistics, 2010. *POVERTY MONITORING REPORT OF RURAL CHINA 2010*. China Statistics Press.

Hox, J. and Kreft, I.,1994. Multilevel analysis models, *Sociological Methods & Research*, 22:283-299.

Huber,J.(ed).,1991. *Macro-Micro Linkage in Sociology* .Sage, Newbury Park.

Iversen, G.R.1991. *Contextual Analysis*. Newbury Park, CA: Sage Publications.

Karsten Hank, 2002. Regional Social Contexts and Individual Fertility Decisions: A Multilevel Analysis of First and Second Births in Western Germany. *European Journal of Population*, 18: 281-299, 2002.

Kreft, I and De Leeuw,J., 1998. *Introducing Multilevel Modeling*. Sage Publications Ltd,London.

Olalekan A Uthman and Eugene J Kongnyuy,2008. A multilevel analysis of effect of neighbourhood and individual wealth status on sexual behavior among women: evidence from Nigeria 2003 Demographic and Health Survey. *BMC International and Human Rights*, 8:9.

Ren Guoqiang, Xue Shougang, 2009. Impact of Rural Household's Training Level to Employee Selection and Income. *Chinese Agricultural Mechanization*, No.6.

Snijders, T.A.B & Bosker R.J.,1994. Modeled variance in two-level models. *Sociological Methods & Research*, Vol.22:343-363.

Snijders, T.A.B & Bosker R.J.,1999. *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Sage Publications Ltd,London.

Wang Jichuan, Xie Haiyi, Jiang Baofa, 2008. *Multilevel Models: Methods and Applications*. HIGHER EDUCATION PRESS.

Wollni, M. and Zeller, M. (2007). Do farmers benefit from participating in specialty markets and cooperatives? The case of coffee marketing in Costa Rica. *Agricultural Economics*, 37: 243–248.

Yuehen Zhao, Jiqiong You, Steven L Guthridge and Andy H Lee,2011. A multilevel analysis on the relationship between neighborhood poverty and public hospital utilization: is the high Indigenous morbidity avoidable? *BMC Public Health*, 11:737.