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Factors influencing poverty levels in rural households in Southwest China

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Factors influencing poverty levels in rural households in Southwest China

This paper examines factors behind poverty in Kelang and Haizi, rural villages in Yunnan province in the South West China. Determinants of household income per capita, off-farm employment choice and off-farm income levels were investigated using seemingly unrelated regression, probit model and Heckman selection model, respectively. Farm household survey data collected in 2003, were used for estimation. The analytical results indicate off-farm employment, land productivity, land area per labour units, education and proximity to a large city play an important role in determining the level of household income per capita.

1. Introduction

The economic development of China has been outstandingly successful by any international standards since the start of reforms in 1978. The annual average growth rate of Gross Domestic Product during 1978-2006 was 9.7 per cent (NSB, 2007). Accompanying this economic growth in China, the national wealth has been strengthened, people's living standards have been enhanced and the provision of public services such as health, social welfare and education has been improved. Yet, despite these remarkable achievements, some problems have emerged, which constrain the future development of China. For example, the unbalanced development between different regions and between urban and rural areas has deteriorated; bringing about structural change in the different economic sectors has proved difficult; the limited supply of economic resources and the imperative of ameliorating the much damaged environment are serious constraints on future economic development.

China is primarily an agricultural country, as seen from a demographic perspective, with 737.42 million of a rural population or 60 percent of the national total and nearly 63 percent of the national labour force, in 2006 (NSB, 2007). While the development of rural areas is lagging considerably behind that of urban areas, the living standards of farmers, who make up over 90 per cent of rural households, are much lower than those of urban residents. Indeed, the income of urban residents in 2006 was 3.28 times that of rural residents, up from 3.11 in 2002 (*China Daily* December 26, 2007). By 2006, 21.48 million rural people were living in absolute poverty, not obtaining adequate food or clothing, and another 35.5 million, although obtaining adequate food and clothing, had a very low level of development with very low income (Fan, 2007). These two groups together account for 8 per cent of total rural population and this in fact is an under estimate of the real situation from a global perspective due to the lower poverty line in China. If the "a dollar a day" standard of the World Bank was applied, the poor population in China would exceed 100 million (Fan, 2007). This would place China in second place in the world behind India as the country with the largest number of poor people. A key issue for the Chinese central government, therefore, is to increase farm household income in order to reduce the development gap between sectors and regions in China.

The focus of this paper is the level of farm household income, the factors influencing that level and the process through which household decisions are made in respect to household earnings. Since low household incomes are synonymous with poverty, the determinants of household income simultaneously determine the level of poverty. It is believed that policy measures addressing the determinants of farm household income will reduce poverty levels.

The analysis carried out in this paper is based on data collected from samples of farm households in two villages in Yunnan province. One village is a mountain village with traditional agriculture and the other one is a semi-mountain village with modern agriculture. The key findings in this paper are that land area and its productivity are still very important in increasing household income per capita but off-farm income is also very important. Farm

households choose off-farm participation, not necessarily because they have small land area but because of low land productivity. Off-farm employment in highland circumstances, where markets are not available for high value farm produce, is a substitute for land productivity in combating rural poverty.

This paper is organized as follows: section 2 is a literature review of the factors which influence farm household incomes and the off-farm participation, the relationship between household income and the off-farm participation in China. Section 3 introduces the basic situation of two villages in Yunnan province, the data collection and some descriptive statistics. Section 4 elaborates the models used to analyse the farm household behaviour in its labour deployment decision-making and presents the results of this analysis. The final section provides some conclusions and policy recommendations.

2. Literature Review

2.1 Factors which influence farm household incomes

Farm household income in China consists of household productive income (mainly agriculture), wage income, property income and transfer income. Average farm household income was 3,616 in 2006, with 42 per cent coming from agriculture and 38 per cent coming from wages (NSB, 2007). The share of agriculture in household income dropped by 24 per cent between 1990 and 2006. On the other hand, during this period, the share of wage income has increased by 18 per cent.

Many scholars have studied the factors influencing farm household income. The positive influences include industrial restructuring (Li, 2005; Yang et al, 2007); government subsidies (Zhang, 2005); the increasing wage income from non-agricultural activity (RCSC, 2006; Yang et al, 2007); the investment in modern production methods (Wang, 2004). The negative influences include land limitations (Wen, 2005), rural labour quality (Zhu and Cai, 2004) and the increasing price of production inputs (Tang, 2006).

2.2 Off-farm income

Off-farm income is one of the main contributors to farm household income. The literature suggests that factors influencing participation in off-farm employment are divided into individual characteristics, household characteristics and village characteristics (Liu, 2007). The individual characteristics include gender, marital status, educational level, age and age squared. Male members of the household are more likely than females to be engaged in the off-farm employment (de Brauw, et al, 2002); marital status has a negative effect on the off-farm participation (Zhu, 2002; Xia and Simmons, 2004); educational level has a positive effect on off-farm participation (Rozelle, et al, 2002; Xia and Simmons, 2004); age has a positive effect and age squared has a negative effect on off-farm participation (Zhu, 2002; Zhao, 2005).

Among farm household characteristics, the amount of household labourers has a positive effect on off-farm participation (Fan, et al, 2002; Xia and Simmons, 2004); land area available per labour unit did not appear to affect participation in off-farm activity (Xia and Simmons, 2004; Liu, 2007); the number of children in school has a positive effect and the number of children in preschool has negative effect on off-farm work (Zhao, 1999a, 1999b). Farmers in villages that have higher than average agricultural productivity tend to remain on their farms rather than engaging in off-farm work (Zhao, 2001; Chen, et al., 2004).

2.3 Relationship between farm household incomes and off-farm employment

The literature suggests that off-farm employment helps to solve the problem of low income that appears as a result of small farm units by raising income directly as well as through raising the productivity of the farm unit, thus improving overall household income. Most studies concluded that the off-farm employment of rural workers provides better income opportunities as compared to farm activity only (de Bruaw and Rozelle, 2002; de Bruaw et al., 2002; Liu and Xie, 2004).

Zhang et al. (2004) showed that increase in rural income during 1990s was, by and large, realized from off-farm employment.

The results from the literature demonstrate that farm households in China behave in a very rational way in maximizing household income through the efficient allocation of their human resources between the available competing activities. The results from various previous studies presented above are generally in accordance with expectations based on this rational approach. This study replicates some of the previous studies. However, it also uses information from two villages with differing economic opportunities as well as looking behind these decisions to investigate the choice processes.

3. Some features of Kelang and Haizi

3.1 The data

Most research on the household income and off-farm participation are based on the national statistics or county data. Here, household data, collected at the village level is used to analyze the factors, which influence household income and participation in off-farm economic activity. The sample data, collected at village level in 2003, was from two different villages with on-farm and off-farm economic opportunities. The total sample size is 200 households, 100 from each village. The two villages are Kelang and Haizi in Yunnan province. The labour force represented by these households is 263 and 244, respectively, or a total of 507.

3.2 Location, household and farm characteristics

Kelang village is a mountainous village with altitude from 1860 to 2473 metres, and is located 60 kilometres (about 2 hours by bus) from the provincial capital city Kunming. The other village, Haizi, is a semi-mountainous village with altitude of 1840 to 2123 meters. It is only 10 kilometres (about 20 minutes by bus) from Kunming city centre. Kelang village consists of 17 natural villages and 869 households with a population of 3671 with cultivated land area 162 hectares (KVC, 2002). In comparison, Haizi village consists of 5 natural villages and 413 households with a population of 1538 and cultivated land area of 174 hectares (HVC, 2002).

Thus the land area per capita in Kelang is only 0.04 hectares, while in Haizi it is 0.11 hectares (Table 1).

The mean household size in Kelang is 4.62, while in Haizi it is 3.97. The living condition of the two villages is obviously different. The mean house size in Kelang is 81.72 square metres and in Haizi is 171.15 square metres. The mean value of houses in Kelang is 18,618 Yuan; in Haizi, this figure is 43,788 Yuan. In Kelang, the share of farming income in total household income is less than 40 percent, while it is 51 per cent in Haizi. The greater importance of agriculture in Haizi derives from the different agriculture structures, higher land area per capita and greater land productivity.

Table 1: Arable land area (ha) in Kelang and Haizi

	Paddy	Upland	Area with Slope >25°	Area per household	Area per person
Kelang	62.80	99.20	48.40	0.19	0.04
Haizi	93.09	80.60	0.00	0.42	0.11

Source: KVC (2002) and HVC (2002)

The land productivity of Haizi is greater than that of Kelang. Table 2 indicates that the unit area yield of crops in Haizi is generally higher than that of Kelang. Moreover, there is considerable difference between the type of cash crops grown in Kelang and Haizi. Tobacco is the only cash crop in Kelang village and vegetables are grown for home consumption; they are not sold for cash. In contrast, farmers in Haizi grow vegetables, flowers and fruit to sell for cash in the Kunming market. The upshot of this is that whereas Haizi has only 7 per cent more land area than Kelang, the value of its agricultural output is 58 per cent higher (derived from Tables 1 and 3).

Table 2: Unit yield of crops in Kelang and Haizi (kg/mu)

	Rice	Maize	Wheat	Broad-bean	Barely & Pea	Cash crops	
						Vegetable	Tobacco
Kelang	453.00	387.00	187.00	140.00	93.00	-	127.00
Haizi	480.00	480.00	220.00	180.00	220.00	80.67	-

Source: Calculated from KVC (2002) and HVC (2002)

3.3 Household income in the two villages

The economy of the villages is made up of income from the village collective and household productive income. Collective income[1] is not significant in Kelang village; however, in Haizi village, nearly half of the total income is from collective sources (Table 3), because there are several collective enterprises in Haizi. In Kelang village, 30 per cent of household productive income is generated through farming work. This figure is 89 per cent in Haizi village. The per capita income of Kelang is 1481 Yuan, which is 7.9 per cent below the average level of Yunnan province (1608.8 Yuan) in 2002, whereas it is 3127 Yuan in Haizi, which is close to double that of Yunnan province in 2002.

3.4 Prevalence of off-farm employment

The rural labourer resource of Kelang village is 1798 people and in Haizi village it is 1173. On the other hand, the number of people employed was 1716 in Kelang village and 1136 in Haizi village in 2002 (Table 4). In Kelang village, 61 per cent were engaged in the primary sector, 18 per cent were in the secondary sector and 21 per cent were engaged in tertiary sector, whereas in Haizi village, 88 per cent were engaged in the primary sector, 4 per cent in the secondary sector and 8 per cent in the tertiary sector.

Table 3: Total household income and its components in Kelang and Haizi (10,000Yuan)

	Total income of village	In which: Collective income of village	Household productive income		Per capita income (Yuan)
			Farm	Off-farm	
Kelang	544.00	4.00	160.00	380.00	1481.00
Haizi	506.00	223.00	253.00	30.00	3127.00

Source: KVC (2002) and HVC (2002)

Table 4: Rural labour force and numbers employed by sector in the two villages in 2002

	Rural labour work force[2]	Employed labour[3]	In which: Primary industry	Secondary industry	Tertiary industry
Kelang	1798	1716	1048	311	357
Haizi	1173	1136	1002	49	85

Source: KVC (2002) and HVC (2002)

Insufficient land area and low productivity forced Kelang labourers to seek off-farm employment, 21 per cent of whom were forced to move away from the village itself. The corresponding figure for Haizi is only 3 per cent. Among the migrant labourers, about 71 per cent from Kelang and 46 per cent from Haizi had migrated for at least one year.

3.5 Off-farm employment and income levels (Sample households)

The results from the household sample, with respect to participation in off-farm employment and income sources, are quite comparable to those obtained from the official statistics. This suggests that there has been a relatively high level of randomness in the sampling, which in turn implies that the sample is a fair representation of the population under consideration. The average participation of households in off-farm employment is 61 per cent overall, with 77 per cent in Kelang and only 44 per cent in Haizi (Table 5). The participation of the sample labour force sheds some additional light on the deployment of the total household labour between on-farm and off farm (Table 6). Participation of the Kelang labour force on-farm is much higher (38 per cent), than is suggested by the on-farm participation of the household, whereas household and labour force on-farm participation in Haizi are similar. Nevertheless, the percentage of the labour force engaged full-time on the farm is considerably higher in Haizi than in Kelang. The participation in off-farm employment is quite comparable between the two villages in terms of the percentage of the labour force engaged in off-farm employment on a full-time basis. However, the percentage of the workforce engaged in off-farm employment on a part-time basis in Kelang is twice that in Haizi. Given the high level of substitutability between part-time off-farm employment and part-time on-farm employment (relative to full-time employment on and off-farm), the opportunity cost of off-farm part-time employment in Haizi is higher than in Kelang, due to the higher value added production activity in Haizi compared to Kelang.

It may be noted that the overall mean income of households with off-farm income is less than over all mean income of households with on-farm income, despite the fact that the opposite is

true at the individual village level. This is a mathematical result, arising from the differing percentage of households in the two villages with off-farm income and the very significant difference of income levels both with and without off-farm income. However, this result does point up the different outcomes, which emerge depending on the size of the geographic area under consideration. If this study had ignored the fact that we were dealing with two quite different rural villages and simply treated the two villages as one geographic area, then our results, with respect to the importance of off-farm income, would have been reversed.

Table 5: Household engagement on farm and off-farm activities

			Employment Status		
			On-farm	Off-farm	Total
Village	Kelang	Frequency	23.00	76.00	99.00
		Per cent	23.23	76.77	100.00
	Haizi	Frequency	55.00	44.00	99.00
		Per cent	55.56	44.44	100.00
	Total	Frequency	78.00	120.00	198.00
		Per cent	39.39	60.61	100.00

Table 6: Labour force engagement on farm and off-farm activities

			Employment Status			
			Full-time on-farm	Full time off-farm	Part-time off-farm	Total
Village	Kelang	Frequency	99.00	45.00	119.00	263.00
		Per cent	37.64	17.11	45.25	100.00
	Haizi	Frequency	143.00	47.00	54.00	244.00
		Per cent	58.61	19.26	22.13	100.00
	Total	Frequency	242.00	92.00	173.00	507.00
		Per cent	47.73	18.15	34.12	100.00

Table 7: Household Income per capita

			All Households	Households with no off-farm income	Households with off-farm income
Village	Kelang	Mean	1577.50	1353.88	1645.18
		Number	99.00	23.00	76.00
	Haizi	Mean	3941.59	3366.95	4659.89
		Number	99.00	55.00	44.00
	Total	Mean	2759.55	2773.36	2750.57
		Number	198.00	78.00	120.00

The household sample data shows that the income per capita in Haizi village is, approximately, 2.5 times that in Kelang. Incomes of those households in Kelang which have some off-farm income is 22 per cent greater than those who have no off-farm income, while in Haizi the increase in income due to off-farm activity is 38 per cent (Table 7). The difference in the impact of off-farm activity in the two villages arises from the differing nature of the off-farm activity; there is a far greater preponderance of off-farm part-time activity in Kelang compared to Haizi.

4. The Model

The focus of this research has two strands: (i) Estimating the influence of off-farm employment on farm household income per capita and (ii) Evaluating the process of decision making of farm household members in choosing to work off-farm. Based on theoretical assumptions and previous empirical analysis, the household income equation was specified initially in a log-linear form, where log-household income is a function of a number of explanatory variables, including off-farm employment. The choice of a household labour unit to work off-farm was specified as a probit function, with the choice of off-farm employment dependent on a number of explanatory variables. The level of off-farm income is an important element in the decision process to work off-farm, so explaining the level of off-farm income becomes an object of interest. Off-farm income is also dependent on a number of explanatory variables, which can be written in log-linear form. However, since there is "censored" data due to the non-representation of full-time on-farm workers, the Heckman two-stage procedure is used.

A single equation model is, initially, specified to investigate the determinants of household income per capita in Kelang and Haizi, as equation [1].

$$y_j = \sum_{i=2}^{12} \beta_i x_{ij} + \varepsilon_j \qquad [1]$$

Where y_j is log of household income per capita, β_i's are coefficients, X_{ij}'s are explanatory variables, ε_j's are stochastic terms, i=2,3,…12 are log of land productivity, household off-farm days/365, dependency ratio, log of number of labour units, dummy variables for primary level education, junior level of education and senior level of education, dummy variable for Kelang village, log of cultivated land per labour unit, age of household head and constant, respectively.

The OLS estimation result indicates that the estimated model explains about half of the variation the in log-income per capita ($R^2 = 0.501$). The F-statistics that tests the goodness of fit rejects the null hypothesis that states none of the explanatory variables explain the log-income per capita, $F(10, 183) = 20.55$, $p=0.000$.

However, White's test for the null hypothesis that states the error terms have spherical distribution rejects the null hypothesis, implying that there is unrestricted heteroskedasticity in the error terms, $\chi^2_{(58)} = 97.87$, $p=0.001$. Under this non-spherical distribution of the error terms, the estimates are expected to be inefficient and the t-test for the significance of the coefficients may not be reliable. A reasonable explanation of the problem is that it is mistakenly assumed that all the explanatory variables are exogenous, and on the grounds of this assumption we specified the model as a single equation, while at least one of them is an endogenous variable. Indeed, in the case of hetroschedasticity problem, Greene (2003, p.219) notes that if the error terms are not correlated with a variable in the model, the OLS estimator, although not optimal, will not be misleading, at least in the large samples. Therefore, in order to improve the efficiency of the coefficient estimates through imposing some structure on the error terms, the log land productivity was treated as an endogenous variable, and a simultaneous equation system was specified as equation [2].

$$y_{1j} = \sum_{i=3}^{12} \beta_i x_{ij} + \beta_2 y_{2j} + \varepsilon_{1j} \qquad [2.1]$$

$$y_{2j} = \sum_{i=3}^{12} \alpha_i x_{ij} + \alpha_1 y_{1j} + \varepsilon_{2j} \qquad [2.2]$$

Where β_i's and α_j's are coefficients, y_{1j} and y_{2j} are log of household income per capita and log of land productivity, respectively; x_{ij}'s are explanatory variables, 3,…12 are households off farm days/365, dependency ratio, log of number of labour units, dummy variables for primary level education, junior level of education and senior level of education, dummy variable for Kelang village, log of cultivated land per labour unit, age of household head and constant, respectively.

In this system of equations, the underlying assumption is that the two equations interact either through their explanatory variables or through their error terms, or through both at the same time. To estimate the equations simultaneously, three-stage least square was employed. However, a look at the standard errors of the coefficients as well as the size and sign of the coefficients given for the log of household income per capita equation indicates that there is not a very considerable improvement over the OLS estimator. Rather for some variables the estimator gave implausible coefficients signs, like in the case of dummy for primary education, and size of coefficients, as in the case of log of land productivity. To search for a better estimator, we made some assumptions regarding the household behaviour and the way the two equations interact. Following Zellner, Kementa, and Dreze (1966), we assumed that households follow a stochastic profit maximization scheme rather than the, traditionally assumed, deterministic approach, since output is stochastic. Moreover, we assumed that the two equations interact mainly through their stochastic terms rather than through their explanatory variables. In such circumstances Zellner, Kementa, and Dreze (1966) indicate that interaction of equations through their variables may not cause a serious problem in efficiency of the coefficient estimates. On this ground we employed Seemingly Unrelated Regression Estimator (SURE). This estimate, it is argued, exploits the information in the error terms to improve the efficiency of the coefficient estimates rather than assuming it away.

The SURE estimation results indicate that the workdays the households devote to off-farm work is among the variables that play important role in determining the level of household income per capita. To trace the factors influencing individual's off-farm work choice as well as income earned from such type of activity, the Heckman selection model is chosen. The model corrects

the selection bias that arises as a result of the censored full time on-farm workers. It makes use of the inverse Mills ratio, derived from the probit model, to control for the selection bias. The model was specified as equation [3.1] and [3.2].

$$Off-farm\ employment\ choice\ equation \quad (probit\ model)$$

$$y_j^* = \sum_{s=1}^{17} \omega_s z_{sj} + u_j;\ D_j = \begin{cases} 1\ if\ y_j^* > 0 \\ 0\ otherwise \end{cases};\ and\ p_j = F\left(\sum_{s=1}^{17} \omega_s z_{sj} + u_j\right) \qquad [3.1]$$

$$Off-farm\ income\ equation\ (OLS)$$

$$m_j = \sum_{s=1}^{7} \pi_s z_{sj} + \sum_{k=1}^{6} \lambda_k h_{kj} + v_j \qquad [3.2]$$

Where m_j is log of off-farm income per labour unit, π_s's, λ_k's,ω_i's are coefficients, z_{sj}'s, h_{kj}'s, are explanatory variables, s=1,2…17 are log of land productivity, dependency ratio, amount of labour, dummy variables for primary school education, junior school education and senior school education, dummy variable for Kelang village (Kelang=1 Haizi=0), cultivated land per labour, age of labour, dummy variable for male labour, number of children in preschool, number of children in school, number of off-farm labour, dummy variables for the first quartile, third quartile and fourth quartile of household income and constant term, respectively. k=1,2,..6 are dummy variables for off-farm employment types-construction, commerce, services, industry and others and constant, respectively. y_j* is latent variable of off-farm and on farm work choice, D_j- dummy variable for off-farm work, P_j- is a probability that a respondent belongs to off-farm work group, F(.) –cumulative density function of normal distribution

5. Econometric results

The SURE estimation results for Equation [2.1] are given in Table 8. The Breusch-Pagan test for independence, rejects the null hypothesis of independence of the two equations, $\chi^2_{(1)} = 8.219$, $p=0.0041$, suggesting the presence of statistically strong interaction between the two equations through their error terms. A look at the standard error of the coefficient estimates, as well as the sign and size of the coefficients given by OLS, three-stage least square, and SURE indicates that SURE performs better than the former two estimators. The overall explanatory power of the SURE specification is quite high with an R^2 of 0.425.

Land productivity is highly significant in explaining household income per capita (Table 8). Although land area per labour unit is also significant at the 5 per cent level, it is statistically less significant and quantitatively less important than land productivity in explaining household

income per capita. We observed that the elasticity of income per capita with respect to land productivity (0.291) is more than double that of land area per labour (0.144). Thus high value output is more important in contributing to household income per capita than land area. This has important policy implications for agricultural rural households.

The days worked off-farm is highly significant in explaining household income per capita (Table 8). Clearly the more days worked, the higher the household income per capita. Indeed, this is evident from previous tables, and in particular the income from full-time off-farm employment brings the greatest returns in terms of household income per capita. This result accords with previous research in China and internationally. It is clear that one of the most important contributors to raising household income per capita is the availability of off-farm income. This result is also important from a policy point of view. The availability of off-farm income is an important means of overcoming rural poverty.

Table 8: Seemingly Unrelated Regression Estimation Results

Equation	Number of observations	Parameters	RMSE	"R-sq"	Chi2	P
Log of income per capita	194	10	0.543	0.483	219.260	0.000
Log of land productivity	194	10	0.737	0.178	75.240	0.000

Log of income per capita	Coefficient	Std. Error	Z	P>|z|
Log of land productivity	0.291	0.051	5.740	0.000
Household off-farm time (days worked/365 days)	0.379	0.057	6.650	0.000
Dependency Ratio	-0.174	0.102	-1.710	0.088
Log of amount of Labour	-0.382	0.165	-2.320	0.021
Dummy for primary school education	0.110	0.125	0.880	0.377
Dummy for junior school education	0.182	0.138	1.320	0.187
Dummy for senior school education	0.378	0.181	2.090	0.036
Village dummy - Kelang (Kelang≡1 Haizi≡0)	-0.696	0.099	-7.040	0.000
Log of cultivated land per labour	0.144	0.069	2.090	0.037
Age of household head	0.004	0.005	0.780	0.434
Constant	6.012	0.481	12.500	0.000

The household income per capita is negatively related to the dependency ratio, as expected, and to the number of labour units, which is not as expected in a competitive labour market. The latter

result may be explained by imperfections in the labour market, where there are unemployed labour resources. On the other hand, the different levels of education have different impacts. The estimation results indicate that only education at senior school level makes a statistically significant contribution to household income per capita. The estimation result also suggests that location makes a difference on household income. There is a clear negative impact of the Kelang location on the level of household income per capita compared with Haizi; the average household income per capita unexplained by the various other parameters included in the model and picked up by the location factor is highly significant.

The estimation results of equation [3.1] and [3.2] are given in Table 9 and Table 10, respectively. Table 9 reports the determinants of the likelihood of working off-farm. Table 10 reports the OLS estimation results for determinants of off-farm income per capita after correcting for the selection bias. The estimate of Mills lambda, $\lambda = -0.344$, given at the bottom of Table 9 was found to be statistically significant, $Z=2.68$, $p=0.007$, that suggests the selection bias, had it not been corrected for the Heckman selection model, is beyond the level that one can ignore. The rho estimate, $\rho=-0.404$, given in Table 9 again, suggests that there is a negative correlation between the error terms of the choice selection equation and the log of off-farm income equation, which may mean that those factors which increase the likelihood of working off-farm tend to reduce off-farm income levels.

The choice of working off-farm throws up some interesting results, which may be due to the model specification. The number of household labour units was considered to be an important explanatory variable, which is quite logical. However, the number of household labour units already engaged in off-farm activity was also included on the assumption that once a household labour unit was already engaged off-farm there would be information feedback. This information feedback would appear to be an important stimulus to other household labour units to work off-farm as well. Also, it was felt that the existing level of income would be a stimulus to engagment in off-farm activity, once some threshold of income was reached. This was tested for, by

including quartile income levels, using the second quartile as the comparator. This latter was chosen automatically since it had the highest correlation with the other explanatory variables. Having this variable as the comparator reduces the level of multicollinearity.

The estimation results in table 9 suggest that land productivity reduces off-farm participation; male labour is more likely to participate than female labour; the higher income classes are more likely to participate; and younger labourers are more likely to participate in off-farm activity. These are all statistically highly significant, as theory would predict. Numbers of labourers engaged in off-farm work has a positive and statistically significant impact on off-farm participation, supporting the importance of the hypothesised information feedback. The negative and significant impact of household labour units is not plausible, but may be due to statistical complications due to the inclusion of off-farm labour as an explanatory variable[4]. The negative impact of the dependency ratio is also counter intuitive. Education level does not appear to play a role in off-farm participation nor does the location variable. One would expect that all other things being equal that proximity to a large city would be a significant pull factor in off-farm participation. An explanation for this may lie in the fact that proximity to a city provides a market for high value added perishable produce, which consequently counters the off-farm employment opportunity. Here we note the highly significant land productivity variable. The conclusion must be that the opportunity cost of working off-farm, namely the income from the land, is higher than can be earned off-farm.

The off-farm income equation has been adjusted for selection bias via the Mills ratio calculated from the probit model in step one of the Heckman two stage estimation. Land productivity, dependency ratio and household labour all have a positive and statistically significant (at 10% level of significance) impact on off-farm income. This is likely through the positive indirect impact on off-farm participation. The higher education level has a significant impact due to being able to obtain more high paying employment as well as being able to gain full-time employment off-farm. The location variable for Kelang has a negative and highly significant

impact on off-farm income, that is, the Haizi labour force is able to obtain higher income from off-farm employment than Kelang workers. This phenomenon is already evident from Table 6, which shows that off-farm labour participation in the case of Kelang is predominantly part-time (73 per cent) compared with Haizi (53 per cent). This stems from the fact that the opportunity cost of off-farm employment in Haizi is much higher in Kelang due to the higher value produce in Haizi. The best employment opportunity in terms of income is offered by transport (comparator), while construction, service and other industries offer significantly lower income returns.

Table 9: Choice of off-farm employment (probit model)

	Coefficient	Std. Error	Z	P>|z|
Log of land productivity	-0.395	0.124	-3.200	0.001
Dependency Ratio	-0.521	0.245	-2.120	0.034
Amount of Labour	-0.595	0.125	-4.750	0.000
Dummy for primary school education	0.069	0.233	0.290	0.768
Dummy for junior school education	0.015	0.244	0.060	0.950
Dummy for senior school education	0.390	0.331	1.180	0.239
Village dummy - Kelang (Kelang =1 Haizi º 0)	0.233	0.220	1.060	0.290
Cultivated land per labour	-0.042	0.052	-0.800	0.423
Age of labour	-0.059	0.008	-7.350	0.000
Dummy for male labour	1.308	0.154	8.510	0.000
Number of children in preschool	0.192	0.197	0.980	0.329
Number of children in school	0.168	0.130	1.290	0.197
Number of off-farm labour	0.803	0.094	8.530	0.000
Household income dummy - First quartile	-0.028	0.357	-0.080	0.937
Household income dummy - Third quartile	0.613	0.190	3.230	0.001
Household income dummy - Fourth quartile	1.106	0.509	2.170	0.030
Constant	4.154	1.029	4.040	0.000
Mills Lambda	-0.344	0.129	-2.680	0.007
Rho	-0.404			
Sigma	0.854			
Lambda	-0.344	0.129		

Table 10: Heckman Two-stage Selection Model: log of off-farm income per capita

Number of obs 490;
Censored obs 237;
Uncensored obs 253;
Wald chi2(19) 172.97,
Prob > chi^2 0.000

	Coefficient	Std. Error	Z	P>|z|
Log of land productivity	0.133	0.069	1.940	0.052
Dependency ratio	0.228	0.136	1.680	0.093
Amount of labour	0.130	0.061	2.120	0.034
Dummy for primary school education	0.069	0.171	0.410	0.684
Dummy for junior school education	0.257	0.168	1.530	0.126
Dummy for senior school education	0.404	0.223	1.810	0.070
Village dummy for Kelang - (Kelang≡1) Haizi≡0)	-0.730	0.143	-5.120	0.000
Dummy for off-farm type-construction	-0.768	0.206	-3.740	0.000
Dummy for off-farm type-commercial	-0.714	0.211	-3.380	0.001
Dummy for off-farm type-service	-0.636	0.202	-3.160	0.002
Dummy for off-farm type-industry	0.017	0.228	0.070	0.941
Dummy for off-farm type-others	-0.860	0.230	-3.750	0.000
Constant	7.561	0.499	15.160	0.000

6. Conclusions and policy consideration

The central focus of the paper is to identify what factors contributed to raising farm household incomes to a level, which is above the poverty threshold. This translated into a two-fold objective, namely, to identify the factors, which influence the level of farm household income, and to elucidate the process of household labour choice of off-farm employment, one of the principal sources of alternative farm household income. Initially, two equations were specified, explaining household farm income and the choice of household labour in participating in off-farm work. Since one of the variables, land productivity, in the household income equation was endogenous, the Seemingly Unrelated Regressions Estimator was used to estimate the parameters of the household income per capita equation and the land productivity equation. The Heckman two-stage method was used to estimate a probit model for the decision to work off-

farm and to estimate the off-farm income model, after correcting for selection bias. The analysis was carried out on two mountain villages in the foothills of the Himilayas, one village, Kelang, located beyond commuting distance from a large city and practicing traditional agriculture and another, Haizi, located close to the provincial capital city, with well developed agricultural structures and producing high value output for the local market.

The results of the analysis were interestingly perverse. It was expected that the village (Haizi) located near the urban centre would take advantage of the opportunity of off-farm employment to raise income levels in contrast to the village (Kelang) located beyond commuting distance of the city, which was denied this opportunity. In fact the opposite is the case: while only 38 per cent of household labour in Kelang worked full-time on the household farm, 59 per cent of household labour in Haizi worked full-time on the household farm. On the other hand, whereas a comparable percentage of household labour from both villages worked full-time off farm, the percentage of household labour from Kelang working off-farm part-time was twice that of Haizi. This suggests that part-time off-farm employment is a substitute for on-farm employment and that the opportunity cost of off-farm employment is higher in Haizi than in Kelang due to the higher value of farm product produced there. The opportunity for higher value produce is available for Haizi because of its proximity to the city.

The econometric analysis shows clearly that land productivity, days worked off-farm and proximity to a large city are highly significant in raising household income per capita. Area farmed per labour unit, and the higher education level, are also significant. The more interesting significant factors influencing the decision to work off farm are land productivity (negative), the number of household labour units working off-farm (positive), the age of the worker (negative) and the income level of households (positive). This suggests that land productivity is a substitute for off-farm employment: labour units are rational in their behaviour and if the opportunity cost of working off-farm, in terms of earnings foregone on the farm, is too high, then they will continue to work on farm, rather than working off-farm. It also suggests that the existing

household labour units working off-farm have a positive impact on influencing additional members of the household to work off-farm. Information feedback to the household on off-farm employment opportunities and conditions is a positive encouragement to other members of the household to join the off-farm work force. The younger the worker the more likely they are to participate in off-farm employment. Looking at the factors influencing the level of off-farm income, it is clear that the higher education level has an important positive effect. Finally, the better off (income-wise) the farm household the more likely the members of that household are to participate in off-farm activity. This can be as a result of direct consequences, namely, that as basic needs are met the household has the financial capacity to engage in off-farm work (entering into the off-farm labour market is not costless) and can have the indirect consequences of raising the quality of other attributes like education levels which enhance the propensity to obtain off-farm employment. This has serious implications for rural poverty, it suggests that those households, which are already rich can get richer but the poor are unable to lift themselves out of poverty!

These results have very clear implications for policy measures to address rural poverty. Land productivity can be enhanced by better management, which can be improved by training measures, better fertiliser and pest and disease control. This can be assisted by public subsidy, and higher value added produce. The latter is clearly evident in the contrast of land productivity between Kelang and Haizi. One of the problems is Kelang's distance from the market place. Improvement in production know-how and market organisation, which can deliver produce at a reasonable cost to distant market outlets, could facilitate the production of higher value produce in remoter rural areas like Kelang. Enlarging the area farmed per labour unit can be addressed by creating greater land mobility, which can be facilitated by addressing the appropriate institutional structures and legislation. Off-farm employment is one of the most important contributors to farm household income. Access to off-farm employment (primarily in the larger towns and cities) can be facilitated by increased education, enhanced information flow and improved transport. In the knowledge society, communication through internet is a very

powerful information vehicle that gives considerable advantage to those communities which have it. Expansion of internet access to rural areas becomes an imperative in order to stem the growing divide between urban and rural areas. Targeting young people, raising their educational levels and providing information access is a critical policy measure in addressing rural poverty.

In a wider perspective, given the very small land area per labour unit in Chinese agriculture, raising income per capita in rural society can only come, eventually, from off-farm economic activity. This is to be found primarily in urban centres. Rather than encouraging out-migration to the larger cities in the East and South, with its social consequences both for the areas of origin and areas of destination of these migrants, a long term spatial policy is required, which creates an urban hierarchy, which extends relatively proximate urban access (with a high level of practical realism) to all geographic significantly populated areas of China.

Endnotes

1 Collective income is the income derived from collective enterprises, collective land, water sources, forestry and other collective sources

2 Rural labour work force includes full-labour force and half-labour force. Full-labour force refers to labourers between 16 years and 60 years old who are capable of engaging in employment. Half-labour force refers to labourers who are less than 16 years old or over 60 years old but still engage in employment.

3 Employed labour refers to the section of the labour force actually engaged in employment. It excludes students, soldiers and the unemployed.

4 A number of interesting statistical anomalies arose in the course of this work, which must be further investigated.

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