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Determinants of rural households' livelihood diversification decision: The case of Didessa and Bedelle District, Bunno Bedelle Zone, Oromia Regional State, Ethiopia

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Beside its greatest contribution to Ethiopian economy, agricultural sector has been highly affected by climate change. Consequently, masses of people have been left food insecure every year. As an option, rural households have been participating in diversifying their livelihood sources. The present study aims to identify the major factors affecting rural household's participation in livelihood diversification activities in Didessa and Bedele woredas. Multinomial Logit model was employed to analyse the data collected through structured questionnaires from 186 sample households of 6 randomly selected rural kebeles. The model result confirms that factors such as marital status, level of education, land owned, livestock holding and access to credit have significant and positive influence on the probability of participating in non-agricultural activities while age of household head and family size have significant and negative influences. The findings imply that rural development policies should consider off-farm and non-farm livelihood sources, in addition to agriculture, so as to boost the income of farming households which in turn will assist them to improve their livelihood.

Key word: Livelihood, diversification, determinants, Multinomial Logit, Southwest Ethiopia.

INTRODUCTION

Non-farm earnings account for a considerable share of farm household's income in rural Africa regions. Previous published works confirm widespread reliance on non-farm income sources by African farm households (Barrett et al., 2001). In this regard, the logical question is that why do households diversify? Farm households are motivated for different reasons in diversifying their assets and non-farm income generating activities (Birhanu and Getachew, 2016). The first set of motives could be in one of the following and usually known as "push factors": risk reduction, response to diminishing returns of factor such as family labor, assets, etc., in the presence of land and liquidity constraints, high transactions costs that induce households to self-provision in several goods and

services, etc. The second set of motives comprise "pull factors": realization of strategic complementarities between activities, such as crop-livestock integration or milling and hog production, specialization according to comparative advantage allowed by superior technologies, skills or endowments, etc (Christopher et al., 2010). The livelihoods of 84% of Ethiopian citizens depend on various agricultural productions with smallholders' domination (Fikremarkos, 2012). However, beside its greatest contribution to rural livelihood, agricultural production has been highly affected by climate change. Consequently, masses of people have been left food insecure every year. Even in Sub-Sahara African countries' farming as a primary source of income has failed to guarantee sufficient livelihood for most farming households (Babatunde, 2013).

Amare and Belaineh (2013) noted that, in Ethiopia at national, regional and household levels the focus of policy is to increase agricultural productivity and farm income to attain food self-sufficiency. Farther more, research and extension activities have not been done adequately on the issues related to off or non-farm employment. In spite of this fact, farmers are engaged in a variety of off and/or non-farm activities to diversify their income with a view to feed and sustain themselves during crop failures. Moreover, the contribution made by livelihood diversification to rural livelihoods is significant and has often been ignored by policy makers who have chosen to focus their activities on agriculture (Ellis, 2000). Therefore, a thorough understanding of factors determining choice of livelihood strategies is important to improve the response mechanisms related to poverty, food security and livelihood improvement. Thus, the current study aimed at analyzing determinants of rural household's choice of livelihood strategies.

Ethiopia lies within one of the most food insecure regions in the world, with a large number of its population living at subsistence levels and dependent on farm production which is highly vulnerable to severe droughts, population growth, and expansion of the cities several times. Moreover, over the past 35 years, Ethiopia's precarious food security has tipped over into full blown famine (Reardon, 2011).

There are numerous factors that determine rural households' ability to diversify their livelihood strategies away from crop and livestock production into off- and non-farm economic activities. These determinants can be identified both as pre-conditions, namely history, social context and agro-ecology, and the influence of ongoing social change linked with external interventions, such as infrastructural and service provision (Hussein and Nelson, 2009).

Rural households in the two woredas are practicing traditional and rain based mixed farming system with low returns. The low return from farming activities together with massive population growth has forced the households in the study area to participate different livelihood activities. Having the facts that livelihood diversification has been practiced over time in both study woredas, the researchers have undertook a comprehensive search of literatures. Even though many researchers have conducted research to assess the determinants of rural diversifications, the results showed that no research has been conducted, on this particular issue, in the selected study sites so far. Thus, the present study was conducted to fills the existing knowledge gap by achieving the objective of identifying the major factors that affect farm household livelihood decision, in particular contextual area of the study woredas.

METHODOLOGY

Study area

The study was conducted in Didessa and Bedelle woredas of Oromia region of Ethiopia, part of the Bunno Bedelle zone. Geographically, Didessa woreda has latitude and longitude of 7° 54'30"- 8° 13'00" N and 36° 17' 15"– 36°30' 47" E respectively with altitude from 1360 to 2340 m above sea level. The woreda has an area of 632 km^2 with 31 rural and 1 urban kebeles. According to 2014 socio-economic profile of the district, the total rural households for Didessa district is 18,208. Bedele woreda has a total area of 2,210.16 km^2 with 41 rural and 2 unban kebeles. The woreda has 14,270 total of rural household heads out of which 12,856 male and 1,414 female household head. Geographically, the woreda falls between 36° 0` 0`` up to 28° 80` 0``N latitude and 20°79` E longitude (CSA, 2007).

Research design

The study used a survey research approach through which cross sectional and observational data were collected and analyzed. Accordingly, Multinomial logit econometric model was employed to identify the factors of livelihood diversification. Furthermore, both qualitative and quantitative data types were in combination applied to support each other in different level of the research analysis.

Data sources and collection methods

The researchers used both primary and secondary data. Secondary data were collected from the kebeles offices, the Woredas Agriculture Office, Books, and internet. The primary data (both quantitative and qualitative data) were collected from sampled rural households though structured questionnaire, key informant interviews and focus group discussions.

Sampling techniques and sample size determination

A three stage random sampling method was used to select the sample households. In the first stage, out of 9 total woredas of the zone, two woredas (Bedele and Didessa woredas) were purposively selected due to the two woredas have potential in diversification relative to the others. In the second stage, kebeles (the smallest administrative unit in Ethiopia), namely: Banshure, Dabena, Mesera, Ogo, Sidisa and Yabala, were randomly selected among 72 total rural kebeles of the two woredas (Bedele 41 and Didessa 31). In the third stage, 202 representative sample households were randomly drawn based on

probability proportionate to size of households of each sampled kebele. The sample size of respondents was calculated using Yamane (1967) formula.

$$n = \frac{N}{1 + N(e)^2} = \frac{32478}{1 + 32478\,(0.07)^2} \approx 202$$

Where: n =Number of sample households head, N = total households in the two woredas and e = level of precision defined to determine the required sample size using 95% confidence level. Therefore, a total of 202 sample households were selected for this particular study. However, due to the questionnaires gathered from some respondents were defective and even had no response at all, 186 effective questionnaires were used in analysis.

Data analysis

In this study both descriptive statistics and econometric model were employed. The descriptive statistics that were used include mean, standard deviation, and percentage. Multinomial Logit model was employed in analyzing the determinants of rural livelihood diversification decision. The model is used because the responses of households for livelihood strategies were expected to be unordered response greater than two categories. Prior to depth analysis, 30 questionnaires were collected and the data is pertained to model, to test its validity.

Model specification and definition of dependent variable of the study

The basic assumption is that in a given period at the disposal of its asset endowment, a rational household head choose, among the different mutually exclusive livelihood strategy, alternatives that offer the maximum utility. Based on the work of Tassew and Oskam (2001), the maximum utility model of households from different livelihood strategies can be specified as follows:

$$U_{ij} = X_{ij}\,\beta_j + \pounds_{ij} \tag{1}$$

Where: U_{ij} = the utility that the i household gets from choosing alternative activity j β_j= the coefficient of covariates which varies across alternatives (j^{th} response category); X_{ij}= the covariates which remains constant across alternatives; and $\pounds_{ij}$= a random disturbance term, and unobserved attributes of alternatives. For an outcome variable with J categories, the jth livelihood strategy that the ith household chooses to maximize its utility could take the value 1 if the ith household chooses j^{th} livelihood strategy and 0 otherwise. Therefore, J category of livelihood strategy of ith household for this study is categorized as follows: 0 = Agriculture only (crop production and livestock rearing) as reference outcome; 1= Agriculture + off-farm activities (activities households perform on their land which includes agriculture plus daily labor work (wage), renting of asset (land, ox), firewood wood sale and trading of livestock; 2 = Agriculture + non-farm activities (activities households perform on their land plus hand craft, small business trade and remittance from abroad; 3= Agriculture + off-farm + non-farm (which includes all the above livelihood strategies. The probability that i^{th} household with characteristics x chooses livelihood strategy j is modeled as multinomial logit. Referring the work of Tassew and Oskam (2001), it can be written as:

$$P_{ij} = \frac{\exp(X'_i\,\beta_j)}{\sum_{j=0}^{J} \exp(X'_i\,\beta_j)} \; j = (0, 1, 2, 3) \tag{2}$$

Setting $\beta_0 = 0$, the multinomial logit model can be written as:

$$P_{ij} = \frac{\exp(X_i\,\beta_j)}{1 + \sum_{j=1}^{J} \exp(X'_i\,\beta_j)} \text{ for } j = 1,2,3 \text{ and } P_{i0} = \frac{1}{1 + \sum_{j=1}^{J} \exp(X'_i\,\beta_j)} \tag{3}$$

This type of discrete model can be estimated by using the maximum likelihood method.

Description of the study variables and Hypotheses

The dependent variable of the study (Yi) is household decision to participate in a given livelihood activities while the independent variables (xi) are factors affecting of livelihood diversification decision. They are presented with their description and expected sign as shown in Table 1. Earlier to model estimation, a test was made for strong assumption of Independence of Irrelevant Alternatives (IIA) using Hausman test (Appendix Table 1). Accordingly, the test results show that the assumption is not violated. That means, odds/probability of choosing one livelihood diversification decision over another does not depend on another's presence or absence. Another important test conducted was whether two outcomes could be combined or not. The test results show that we cannot combine any of the groups (Appendix Table 2).

RESULTS AND DISCUSSION

Description of key household characteristics and diversification rate

Table 2 presents descriptive statistics of some key characteristics of sampled farm households by livelihood diversification strategies. The overall mean age of sample farm households was 41.31 years with 5.65 mean family size. In terms of the farm households' educational level, sample households had attained 6.77 mean grades. The sample household heads' education level in "grade attained" for those who engaged in agriculture only was 5.78, and for those who were engaged in diversified sources (agriculture plus off-farm, agriculture plus on-farm, and agriculture plus off-farm plus non-farm) were 7.18, 6.43, and 8.15, respectively. This trend indicates that sample households, who have more diversified source of livelihood, were those who had achieved more educational grades. The overall average land size of the sample household is 2.06 ha.

The result indicates that for the respondents who participated in pure agriculture the average livestock holding was about 5.67 TLU, whereas for those practicing agriculture plus off-farm, agriculture plus non-farm, and agriculture plus off-farm plus non-farm was about 7.52, 6.35, and 3.94 TLU, respectively. This result implies that sample households who were less diversified have relatively more livestock than those who were highly diversified.

Regarding to credit accessibility status, 62.9% of sampled households had access to credit service, while the remaining 37.1% had no access. The percentage of credit user households engaged in *pure agriculture* and *agriculture plus off-farm* activities as their major

Table 1. Description and expected sign of the study variables.

Study variable	Description	
Dependent Variable (Yi)	Household decision to participate in a given livelihood activities. It is unordered categorical variable (i.e. 0 = Agricultural activities only; 1=Agriculture + Off-farm activities; 2 = Agriculture + Non-farm activity; 3= Agriculture + Off-farm + Non-farm activities)	
Explanatory variables(xi)		Hypothesized relationship with livelihood activities
Sex	Dummy variable (1= male and 0= female)	+/-
Age	Continuous variable measured in years	-
Marital Status	Dummy variable (1 = household get married and 0 = otherwise	+
Level of education	Continuous variable measured in number of grade attained	+
Family size	Continuous variable measured in number	+
Land owned	Continuous variable measured in hectare	+
Livestock holding	Continuous variable measured in tropical livestock unit (TLU)	+
Nearest market distance	Continuous variable measured (km)	-
Number of training	Continuous variable measured in number of training obtained	+
Contact with DA	Continuous variable measured in number of contact with DA (development agent)	-
Access to credit	Dummy, 1 = get credit; 0 = otherwise	+
Cooperative membership	Dummy, 1 = being member; 0 = otherwise	+

Table 2. Summary of mean of key household characteristics by livelihood strategy.

Household characteristics	Agriculture only	Agriculture plus off- farm	Agriculture plus non- farm	Agriculture plus off-farm plus non-farm	Overall
Age	43.27(1.37)	41.36(0.99)	41.83(41.83)	35.35(2.45)	41.31(0.77)
Level of education	5.78 (0.45)	7.18(0.43)	6.43(0.69)	8.15(0.79)	6.77(0.27)
Family size	5.94(0.38)	5.71(0.30)	4.8(0.48)	5.95(0.63)	5.65(0.20)
Land owned	1.71(0.21)	2.42(0.20)	1.73(0.29)	1.97(0.41)	2.06(.13)
Livestock holding(TLU)	5.67(0.48)	7.52(0.78)	6.35(0.87)	3.94(0.67)	6.45(0.43)
Credit user	24.19	20.97	12.9	4.84	62.9
non-user	3.23	24.73	3.23	5.91	7.1

Figures in parentheses are standard errors (of mean), TLU = Tropical livestock unit.
Source: Computed from survey data (2020).

livelihood source is relatively high and is 24.19 and 20.97% respectively. The proportion of credit user households across all strategies declines as diversification increases. This reflects the fact that households who engaged prominently in agricultural activities considerably require credit service to solve liquidity constraints they may face in agriculture.

Econometric model result

The coefficients of multinomial logit model present neither actual magnitude of change nor probability levels. It provides merely the directional effect of independent variables on dependent variables. Thus, the marginal effects or odds ratio or relative risk ratio, which measures the expected changes in probability of a particular choice being made with respect to a unit change in an independent variable, has been employed to examining both direction and magnitude of changes.

To indicate the overall significance of the model likelihood ratio test statistics is employed. The goodness of fit for model fitting information, indicated by Pearson Chi-square statistics is highly significant at 0.0001. This suggests strong explanatory power of the model. To estimate the parameter estimates of the model maximum likelihood method of estimation was employed and statistically significant variables were identified.

As depicted in Table 3, household head age is statistically significant and negatively affects farm households' decision choice of agriculture plus off-farm Plus non-farm implying that an increase in household

Table 3. Factors affecting livelihood diversification decision (multinomial logit model results).

Explanatory variables	coef.	Agriculture plus off-farm		Agriculture plus non-farm			Agriculture plus off-farm plus non-farm		
		p>|z|	rrr	coef.	p>|z|	rrr	coef.	p>|z|	rrr
Sex	0.384	0.614	1.468	1.171	0.277	3.226	0.104	0.930	1.110
Age	0.025	0.219	0.976	-0.013	0.651	0.987	-0.133	0.022**	0.876
Marital Status	0.407	0.135	1.503	0.456	0.299	1.577	0.939	0.007*	2.557
Level of education	0.054	0.375	1.056	0.053	0.452	1.055	0.120	0.091**	1.127
Family size	0.165	0.035**	0.848	-0.200	0.038**	0.818	-0.088	0.461	0.916
Land owned	0.124	0.478	1.133	-0.024	0.922	0.976	0.552	0.035**	1.736
Livestock holding	0.055	0.081***	1.057	0.027	0.580	1.027	0.296	0.004*	0.744
Distance to nearest market	0.037	0.638	0.963	0.029	0.755	1.029	-0.081	0.512	0.922
Number of training	0.001	0.982	0.999	0.001	0.974	1.001	0.008	0.848	1.008
Contact with DA	0.015	0.286	0.985	-0.011	0.516	0.989	-0.025	0.237	0.976
Access to credit	2.035	0.000*	7.654	0.663	0.302	1.941	2.000	0.002*	7.386
Cooperative member	0.482	0.362	1.620	0.042	0.937	1.043	-0.501	0.529	0.606

Source: STATA results from survey data (2020). Number of observation = 186; Prob > chi2 = 0.0001; Log likelihood = -193.53935; Wald chi2 (36) = 77.90; Agriculture only is used as base outcome;***, ** and * implies significant at < 1%, 5% and 10% probability level, respectively; p>/z/ indicates the significance level at which the parameter is different from zero and rrr is relative risk ratio.

age decreases the probability of participation in livelihood diversification activities. That means, in comparison with those who practice only agricultural livelihood options (base case), a year increase in age of household heads will result in the decline of the probability of choices of agriculture plus off-farm plus non-farm activities by 0.87 units. Hence, having other factors constant, younger households are interested to participate more in agriculture plus off-farm plus non-farm activities than agriculture livelihood practices alone. The finding is in line with the study conducted by Amare (2018) and Geremew et al. (2017). The possible explanation is that as the farmer getting older he could not be capable of diversifying as many livelihood activities as possible. Therefore, elder farmers are more likely to concentrate on on-farm agricultural activities just for the purpose of maintaining their subsistence consumption need. Furthermore, younger generation have more education and thus more skills to engage in diversification activities.

Regarding other factors that determine participation in livelihood diversification, it is found that marital status of household head is positive and significantly related to livelihood diversification sources, as hypothesized. This finding implies the probability of individuals diversifying beyond the agricultural practice is likely to be increased by 2.56 units as households being married. This is due to the fact that household heads who get married have more labour hand than those not married. This provides a better opportunity for married younger rural farmers to engage in livelihood diversification than the others. Marriage also comes with more responsibility demands and thus the need for more income to sustain the family and therefore the need for more diversification to get

more income.

With respect to the effects of education levels of household head, the result shows a positive significant effect on livelihood diversification sources through participating in agriculture plus off-farm plus non-farm activities. This means, having other factors constant at their mean, an increase in education level of households by one year increases the probability of households to participate in off-farm plus non-farm activities, in addition to agriculture, by 1.13 units. The positive effect of education may reflect the fact that better educated household heads may get interested in diversification because of education may help households to take part in different livelihood activities. The result supports the finding by Dessalegn and Mogose (2016).

As indicated, households' total family size is found to be negatively and significantly affecting agriculture plus off-farm and agriculture plus non-farm livelihood diversification practices at less than 5% level of significance. This infers that in comparison with those who practices agriculture alone as their livelihood means (base outcome), a unit increase in family size will possibly decrease the probability of engagement in off-farm and non-farm activities by the probability of 0.85 and 0.82 units, respectively than those who engaged in agriculture as their only sources of livelihoods. However, this finding contradicts with the findings of Adugna and Wagayehu (2012), Dessalegn and Mogose (2016) and Amare (2018). The possible justification for this might be the presence of large proportion of dependent families in sampled households which can in turn decreases the availability of an extra labour force

that can be engaged in different livelihood activities.

As hypostasized, total land size was statistically significant and positively affects agriculture plus off-farm plus non-farm. The relative risk ratio reveals that if land holding size increases by one unit (hectare), the probability of involving in agriculture plus off-farm plus non-farm activities increases by 1.74 units. Even if the result contradicts with the finding by Dessalegn and Mogose (2016), it is similar to the one reported by Adepoju and Oweyole (2014) who found that land ownership was positively associated with farmers' livelihood strategies. The result also supports the findings by Geremew et.al. (2017). The intention behind this result could be the households with more land incline to follow livelihood diversification activities beside agricultural practices. An increase in land size of a farm household increases the total agricultural crop production and ranch for livestock which will lead to increase in livestock production that in turn increases on-farm income level. On the other hand, households who have larger land size are expected to rent-out extra land to other farmers to raise their income. These are considered as opportunities for farm households to diversify their livelihood sources among different activities in addition to agricultural activities.

Another important economic factor that influences livelihood diversification decision is livestock holding (TLU). It is significantly and positively affecting household's choice of agriculture plus off-farm and agriculture plus off-farm plus non-farm strategies. This indicates that an increase in livestock endowment increases the probability of households diversifying their livelihood toward the two strategies by 1.06 and 0.74 units, respectively, relative to practicing agriculture only as means of livelihood. This finding supports the finding by Amare (2018). His report indicates that livestock holding (in TLU) is positively influencing household's choice of combinations of pastoral, non-farm and off-farm livelihood strategy. This could be due to the reason that livestock holding provides the opportunity to have other assets, which enable them to diversify their means of livelihood, by selling their livestock and livestock products.

Similarly, access to credit services is found to have significant and positive effect on the probability of selecting livelihood diversification strategies. The result indicated that households who are being access to credit are more likely to engage in agriculture plus off-farm and agriculture plus off-farm plus non-farm livelihood diversification activities than those who likelihood is dependent on agriculture only by 7.65 and 7.38, respectively. The result contradicts with the findings of Geremew et al. (2017) and Amare (2018). However, the result is in line with findings of Dessalegn and Moges (2016). This result reflects the fact that credit service in the short run can solve the subsistence budget constraints of the household and thus, enhances the capacity of rural households, especially those who have limited land, to start and maintain farm and non-farm business. This indicates that the better access for credit services speed up rural livelihood diversification.

CONCLUSION AND RECOMMENDATIONS

The Multinomial logit model estimation shows that factors such as marital status, level of education, land owned, livestock holding and access to credit have significant positive influence on the probability of participating in non-agricultural activity by farm household while age of household head and family size have significant negative influences.

Age of farm household had a negative effect on farm households' decision choice of livelihood diversification activities implying that increasing household age decreases the probability of diversification. It can be concluded that younger households greatly adopt for available livelihood diversification options. On the other hand, though apart from others findings, total family size is found to be negatively affecting livelihood diversification practices. The possible justification for this might be the presence of large proportion of dependent families in sampled households which can in turn decreases the availability of an extra labour force that can be engaged in different livelihood activities. Thus, the researchers have consider the effect of dependency ratio on livelihood diversification decision in their future study.

On top of this, marital status of farm household heads also has significant effects on livelihood diversification activities. Hence, local government needs to design inclusive livelihood strategies that considered the demographic structure of farm households such as age, family size and marital status.

Similarly, the result reveals that education has positive significant effect on household's choice of livelihood strategies. The policy implication is that provision of certain level of education and training particularly skills formation for labour in working age increase the capacity of rural households to diversify their income so as to improve life of farm households.

The effect of land holding on livelihood diversification is significantly positive for agriculture plus off-farm plus non-farm activities. This reflects that greater farmland holdings allow for crop diversification and integration of crop production with cattle rearing. However, additional land for crop diversification is not recommended as there is critical land scarcity. Therefore, it is advisable to practice intensive farming that increases value of output per hectare. In addition, farmland constraints call farm households to allocate their surplus resources, particularly labor, for alternative available off-farm and non-farm opportunities and hence endorse income diversity.

Having access to credit services, rural farm households

had positive and significant effects on likelihood of being in agriculture plus off-farm and agriculture plus off-farm plus non-farm livelihood diversification activities. This implies that credit access was observed as motivating factors in expanding strategic livelihood diversification. Thus, special focus needed from government and non-government agents to increase credit access and strengthen the credit institutional arrangement in the study areas to improve rural households' livelihoods.

Livestock holding was another important factor that positively and significantly affects livelihood diversification strategies. It can be concluded that increasing in livestock endowment creates opportunities for farm households to participate in livelihood diversification options. Particularly, farm households can participate in non-farm activities by selling and rent-out their livestock. Thus, frequent extension contact with veterinary services and offering necessary training for farm households regarding livestock health, production and productivity should get special focus from local government and nongovernment actors who work in the area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Appendix Table 1. Hausman test for IIA assumption.

		Coefficients		
	(b)	**(B)** allcats	**(b-B)** Difference	**sqrt(diag(Vb-VB))** S.E.
		Agriculture + Off-farm activity		
Sex	0.5574415	0.3837887	0.1736528	0.4182102
Age	-0.0205123	-0.024783	0.0042707	0.0053606
Leduc	0.0637353	0.0542987	0.0094367	0.004358
MaritST	0.542237	0.4072839	0.1349531	0.1105669
FamS	-0.1768325	-0.1652514	-0.0115811	0.0192132
LanOwn	0.1289435	0.1244804	0.0044631	0.0047853
LivsN	0.0563856	0.0550947	0.0012909	0.0044458
DistNmarkt	-0.026723	-0.037252	0.0105289	0.0160828
ContcDA	-0.0189884	-0.0147178	-0.0042705	0.0026198
Ntrain	-0.0046676	-0.0006426	-0.0040249	0.0074751
ActCrdt	20.122332	20.035173	0.0871595	0.0908876
CoopMem	0.3998078	0.4824873	-0.0826795	0.0947985
_cons	-0.0064576	0.407422	-0.4138796	0.5266856
		Agriculture + Non-farm activity		
Sex	1.235691	1.171333	0.0643578	0.3385119
Age	-0.0100052	-0.0134071	0.0034019	0.0050832
LEduc	0.0598553	0.0532466	0.0066086	.
MaritST	0.5296398	0.4555587	0.0740811	0.0821819
FamS	-0.2100443	-0.2003969	-0.0096474	0.0156567
LanOwn	-0.0243721	-0.0243025	-0.0000696	.
LivsN	0.0260859	0.0270027	-0.0009168	0.0099202
DistNmarkt	0.0319938	0.0288363	0.0031575	0.0131955
ContcDA	-0.0132417	-0.0107776	-0.0024641	0.0018636
Ntrain	-0.0002664	0.0009194	-0.0011858	.
ActCrdt	0.7550511	0.6632122	0.0918389	0.0739628
CoopMem	-0.0421955	0.0417552	-0.0839507	.
_cons	-10.193448	-10.018178	-0.1752692	0.3970292

b = consistent under Ho and Ha; obtained from mlogit; B = inconsistent under Ha, efficient under Ho; obtained from mlogit; Test: Ho: difference in coefficients not systematic; chi2(25) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 0.88; Prob>chi2 = 1.0000; (V_b-V_B is not positive definite); *It is shown that there is no evidence that the IIA assumption has been violated.

Appendix Table 2. Tests for combining outcome categories.

Categories tested	chi2	df	P>chi2
Agriculture only <=>Agriculture+Off-farm_activity	27.27	11	0.0042
Agriculture only <=> Agriculture+Non-farm_activity	8.10	11	0.0747
Agriculture only <=> Agriculture+ Off-farm +Non-farm_activity	28.74	11	0.0025
Agriculture+Off-farm_activity <=> Agriculture+Non-farm_activity	11.45	11	0.0463
Agriculture+Off-farm activity <=> Agriculture+ Off-farm +Non-farm_activity	16.50	11	0. 1236
Agriculture+Non-farm_activity <=> Agriculture+ Off-farm +Non-farm_activity	20.24	11	0.0421