OCCUPATION DIVERSIFICATION IN A UNITARY HOUSEHOLD MODEL: EVIDENCE FROM SURVEY DATA

Adugna Lemi*

Abstract

The aim of this study is to investigate the demographic, social and economic determinants of household occupation diversification in rural Ethiopia. To analysis the determinants of overall occupation diversification, Heckman two-stage technique that corrects for selectivity bias is estimated. Seemingly unrelated regression model is also estimated for all occupation categories simultaneously. To take advantage of the count nature of the data, for each occupation category appropriate count data models are also estimated. Six occupation categories are considered in this study: Farming, domestic work, skilled professional activity, schooling, trading and unemployment. The results of the study show that for a representative household most demographic factors, except number of male adults and working adults, lower the number of family members engaged in farming. Similarly, for domestic work, except number of female adults and family size, most demographic factors lower number of household members participating in this activity. Number of family members who can read and write, and agricultural risk factors promote households to engage in skilled professional activities and to send more kids to school. There is also evidence that agricultural activities compete for family labor in trading, schooling and skilled professional activities. Unobserved regional factors are also the major determinants of schooling, trading and skilled professional activities. The argument that households tend to send more males to school than females is not supported in this study.

Key Words: Occupation, diversification, rural Ethiopia, Count data models
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* Department of Economics, Western Michigan University, Kalamazoo, MI 49008
Email: adugna.lemi@wmich.edu, Tel: (616) 387-1945, Fax: (616) 387-3999

1. INTRODUCTION

In most developing countries, where agricultural production is the dominant source of income, risk that emanates from economic and natural causes necessitates occupation diversification for farm households not only across different farm activities but also across non-farm activities. Opportunities and access to different alternative occupation activities, farming proper or non-farming, are one of the sources of income inequality in rural Ethiopia. The two major resources at the disposal of a rural farm household for diversification are labor and land. Land can be divided into plots to grow different crops to spread risk of crop failure. However, to diversify activities and income sources outside of farming, labor is the only mobile resource for rural families in agrarian economies.

In rural Ethiopia, where the livelihood of the population is mainly crop production and livestock rearing, families tend to diversify occupation to buffer the risk of bad weather that affect both crops and livestock. In situations where the opportunities to get wage employment is slim, families try to exploit opportunities of rural non-farm activities. Although the dominant activity is mixed farming[1], farmers also tend to diversify to other occupations through other family members to non-farm handcrafts and professional activities.

The focus of this paper is to investigate households' occupation diversification through allocation of household members to different occupational choices in a unitary household setting. The question that this paper seeks to answer is that what motivates or constrains a household to choose one occupation over another. What are the social, demographic and economic factors that affect occupation choice of a household? As most governments of developing countries are struggling to modernize their agricultural sector and at the same time to promote small-scale rural non-farm activities, the result of this study may provide useful insight to policy makers in these countries.

The next section presents review of theoretical and empirical literature. Econometric methodology and data used in the study are discussed in section three. The fourth section provides empirical results of the study. The last section concludes and presents policy implications and extensions of the study.

2. LITERATURE REVIEW

Households may diversify to different occupations such as farming, trade, professional service, and domestic work, given the resource endowment and human capital of household members. There are also some households who decide to send

[1] Mixed farming is combined operation of both crop production and livestock rearing.

their children to school; some other members of the household may still remain unemployed. The decision to send children to school may be interpreted in dynamic sense based on future earning potentials. Dynamic household models that incorporate household decision with a given resource endowment and access to farm and non-farm activities may explain the number of children in school and the number of unemployed household members.

Household decision process is often modeled in either unitary or collective representation of a household. The debate as to whether household decision process should be modeled by collective or unitary representation of a household is not yet settled. Proponents of unitary household model argue that household decision is the result of maximization of a single household utility (Rosenzweig, 1990). These kind of models can explain why parents prefer to send boys to school because returns to education are higher than for girls; why food, when it is scarce, goes to adult males because they are the prime income earners of the household; or why women concentrate on domestic household activities because their wage outside the household is lower than that of men (Fafchmps, 1998).

One of the criticisms to these models is that it contradicts the neoclassical starting point that every individual should be characterized by his/her own preferences. These models also ignore intra-household inequality, which may lead to wrong welfare implications (Aronsson, et. al., 2001). The criticism on unitary models originated from the transformation of life that resulted in marketability of some of the household goods[2]. Behrman (1990) also questioned the validity of unitary models on at least three issues: first, the assumption that there is stable preferences in situations where tastes and preferences change, second, only economic constraints are considered but in reality households are constrained by cultural and social norms, and third, dynamic interpretation of cross-section estimations is often made. The last one is a widely recognized problem in most static models.

Proponents of collective household models, on the other hand, argue that individual members utility maximization can result into Pareto optimal allocation of resources in the household (Daunfeldt, 2001; Aronsson et. al. 2001). In these models, it is shown that household members bargain over the distribution of income and consumption among themselves and the bargaining power of individuals depends on the resources they command, and thus their income.

It is believed that in agrarian rural economies like Ethiopia, unitary household models may better represent the decision process of households. This is because most often the main source of income is one or two members of the household and all other members provide supportive activities. In this setting it may become unfair to bargain

[2] For instance, meal preparation and childcare services are increasingly purchased on the market instead of being self-provided.

over the allocation of the outcome of work. Moreover, ownership over the assets and resources in the household cannot easily be assigned to individual household members. Activities that are generating no income, at least in the short term, like children schooling, can easily be interpreted in the context of unitary household models.

Most third world countries are far behind takeoff point of the transformation that resulted in marketability of some of the household goods, unlike the predictions of collective models (Fafchamps, 1998; Quisumbing and Maluccio, 2000). Fafchamps argued that third world households are quite different from present-day households in developed countries. Ellis (1998) also argued that these models, although they ignore social institutions and risk factors, yield economic proposition that the household will allocate its labor time so that the marginal returns per unit of labor are the same across different activities, whether on-farm, off-farm or non-farm. Hence, in this paper unitary model developed by Rosenzweig (1990) is used as a base to specify estimation model and interpret results.

Empirical studies for the cases of developing countries that focus on the determinants of household occupation diversification are rare. There are a few exceptions that raise the issue of livelihood diversification[3]. Studies by Unni (1994, 1997) and Basant (1995) deal with the determinants of economic diversification of households in Gujarat, India. They assessed the interaction between poverty and labor market participation of households. Dercon and Krishinan (1996) also addressed the determinants of occupation diversification for the case of Ethiopia and Tanzania using multinomial logit approach for the categories of occupations[4]. These studies identified economic and demographic factors as the major determinants of occupation diversification.

In his survey article Ellis (1998) summarized the literature on livelihood diversification. He indicated that the main focus of previous studies has been income portfolio not occupation diversification, which cannot be used interchangeably as occupation may include some activities that are not income generating (voluntarily or involuntarily). In general the reasons behind livelihood diversification are grouped into two: Desperation (poverty, lack of assets, vulnerability, disaster), and choice and opportunity (Ellis, 1998). Controlling for other factors, Ellis argued that some of the specific determinants of diversification are seasonality, differentiated labor markets, risk strategies, coping behavior, credit market imperfections, and inter-temporal savings and investment strategies.

[3] There are studies that simply discuss and present description of economic diversification and its role in transformation of rural economy (Dharmawan, 1999; Carswell, 2000; Moller, 1998).

[4] Other studies also focus on intra-household allocation of specific resources and to specific members of the household [Basu et. al. (2001) for sharing of literacy, Rosenweig and Schultz (1982) for resource allocation to children].

Other family specific factors may also contribute to the decision on family occupation diversification such as social factors (religion, ethnicity), education, and family age composition. In some instances, occupation is not the choice of the household rather it is imposed due to the regional and environmental factors. These location and environmental factors are out of the control of family members and play significant role in affecting the decision of family members to choose one occupation over the other.

The gap in empirical literature is two fold. First, most studies address only income diversification within agricultural activities and no attempt is made to analysis determinants of family labor allocation to non-agricultural and non-income earning activities (voluntarily or involuntarily). Second, given the decision behavior of households and the count nature of the data that represent number of family members in each occupation, estimation techniques that account for this behavior and nature of data has not been used. This is mainly because most studies use occupation dummies for estimation purpose.

This study attempts to fill the gap in empirical literature by using survey data from rural Ethiopia. Seemingly unrelated regression model is estimated to account for joint decision behavior of households. Count data estimation techniques are also used to take advantage of the nature of the data. Finally, variables that are believed to play significant role in affecting family labor allocation, which most previous studies omit including demographic composition of a family, risk and regional factors are used in explaining the determinants of occupation diversification.

3. METHODOLOGY AND DATA

Data

This paper explores the questions posed above by using survey data collected from rural Ethiopia in 1994. The data was collected at the household level and covers fifteen representative sites in rural Ethiopia. The questions in the survey cover socio-economic aspects of rural life ranging from ethnicity and religion to health and anthropometrics measurements. The data used in this study is the first round of five consecutive rounds of Ethiopian socio-economic survey. This paper incorporates demographic, social, economic and risk factors to assess determinants of occupation diversification. Stefan and Krishnan (1998) have used the similar data set to analysis dynamics of poverty and presented a detailed description of the survey sites and data. Summary statistics of model variables are presented in Table 1 in the Appendix. Six occupation categories are identified in the data after merging some detailed classifications to get adequate observations in each occupation category. The categories are: Farming, domestic activities, trading activities, skilled professional activities, student schooling and unemployed family members.

On the average, more household members engage in domestic work (1.35 persons) and farming (1.23 persons) compared to other occupations. Next in the ladder is number of students in school sent by the households which averaged 0.48 students per household followed by number of members who engage in trading (0.11 persons per household). Number of skilled professionals including craft workers, potters, teachers and health service providers as well as number of unemployed household members each averaged at 0.07 persons per household.

There are about 22 % female-headed households in the sample. 23% of the sampled households are ethnic oromos and 21% of the households are orthodox Christians. The regional distributions are also shows that the focus of the survey was on the mixed farming households living in the highlands of Ethiopia. Region 3 and region 4, which are the major crop and livestock producing regions located in the central highlands of the country accounts for 32% and 27% of the total sample, respectively. All the other regions account for 41 % of the total sample, southern regions account for 30 % and region 1 for 11% of the total sample.

The question that asks for the susceptibility of crops to adverse weather shows that most households report moderate or no crop failure during the 1994 survey year. The crop season 1994/95 was not a bad harvest season compared to other years. Hence, one of the limitations of this study is that the sample period may not be representative to see household occupation diversification with respect to crop failure. Nevertheless, it is still reasonable to assume that there are areas that are historically susceptible to crop failure and tend to diversify even during relatively better seasons. The other limitations of the study are the fact that the study covers only one time period where it is difficult to see the dynamic nature of household decision process and the fact that the survey covers only crop producing regions in the country.

Estimation

Estimation procedure follows three different methods. First the diversification index is computed from the share of each occupation. For each household the share of each occupation is squared and added to get concentration index (HHI)[5], then diversification index is computed by subtracting the HHI from 1[6]. Determinants of diversification at household level are investigated by regressing diversification index on household characteristics and other social, as well as regional factors. It is suspected that there may be selection bias, due to the fact that some households may report only one occupation even though they have the chance to participate in other activities. Determinants of overall diversification index are analyzed by estimating Heckman (1979) two-stage technique and simple OLS for purpose of comparison. Heckman two-stage technique is used to account for suspected

[5] This is same as Herfindahl Concentration index.

[6] I would like to thank Bedassa Tadesse and Alex Balan for their comments on the construction of the index.

presence of selectivity bias in sampling and reporting, where some households may have zero values for diversification but they have had the chance to participate in diversification practice. In the probit (first stage of Heckman model) only selected variables that influence participation are included. The variables used in the probit estimation are the major demographic factors, agricultural inputs and outputs and regional factors. Heckman two-stage estimates participation and intensity of diversification simultaneously assuming that the decision to participate and how much to diversify (intensity of diversification) is a joint decision.

However, one cannot tell from Heckman estimation to which occupation categories households diversify. To investigate the determinants of each occupation categories, estimation for each occupation categories either jointly or separated is warranted.

In a unitary household model, it is also true that households decide jointly not only participation and intensity of diversification but also as to how many family members they should allocate to each occupation. Given the joint decision of a household in allocating household members across occupation, joint estimation of all occupation categories is also worth considering. To this effect seemingly unrelated regression model is estimated for the six occupation categories. The assumption here is that there is cross-sectional correlation between the error terms of each occupation model and hence there is gain in efficiency.

To take advantage of the count nature of the data, count data models are also estimated for each occupation category. The variables that represent occupation in a household are counts of household members who participate in a given activity in 1994. Count data techniques are appropriate to estimate the determinants of the number of household members in each occupation category. There are, at least, four different ways to estimate count data models for cross-sectional data: Poisson Regression Model (PRM), Negative Binomial Regression Model (NBRM), Zero Inflated Poisson Regression (ZIP) and Zero Inflated Negative Binomial Regression (ZINB) (Long, 1997). In the data set it is expected that in some occupation categories only few households may participate (report), in which case the Zero Inflated models may fit better than others. Each estimation techniques are elaborated in detail below.

Let y be a random variable indicating the number of times that an event has occurred. y has a Poisson distribution with parameter μ >0 if

$$\Pr(y/\mu) = (\exp(-\mu)\mu^{y_i})/y! \qquad \text{for y=0, 1, 2.} \qquad \textbf{(1)}$$

μ is the expected number of times that an event has occurred per unit of time. The variance equals the mean. In the Poisson Regression Model (PRM), the number of events y has a Poisson distribution with a conditional mean that depends on an individual's characteristics (X_i),

$$\mu_i = E(y_i / X_i) = \exp(X_i \beta) \quad (2)$$

This suggests that by taking the log of equation (2), PRM can be approximated by,

$$\ln y_i = \beta_0 + \beta X_i + \varepsilon_i \quad (3)$$

It is argued however, that the PRM rarely fits in practice since in most applications the conditional variance is greater than the conditional mean (over-dispersion). NBRM adds a parameter that allows the conditional variance of y to exceed the conditional mean. In the NBRM, the mean μ is replaced with the random variable $\tilde{\mu}$:

$$\tilde{\mu} = \exp(X \ \beta + \varepsilon_i) \quad (4)$$

In PRM, variation in μ is introduced through observed heterogeneity (like individual characteristics). All individuals with the same X have the same μ. In NBRM, variation in $\tilde{\mu}$ is due both to variation in x among individuals but also to unobserved heterogeneity introduced by ε. The significance of this unobserved heterogeneity implies presence of over-dispersion and justifies use of NBRM. Over-dispersion is often tested by the significance of the parameter that proxies the existence of unobserved heterogeneity (alpha test).

NBRM responds to the under-prediction of 0's in the PRM by increasing the conditional variance without changing the conditional mean. Zero modified count model on the other hand, changes the mean structure to explicitly model the production of zero counts, by assuming that 0's can be generated by a different process than positive counts. For some individuals or households the probability of zero is 1 while for others it may be less than 1. Hence, two different processes generate zero counts, depending on the characteristics of the households. This estimation technique has similarities with that of Tobit model in incorporating zeros. Estimation is first by computing the probability of zero counts and then incorporate the households, which have less than one probability of zero in the count models.

In a population consisting of two groups, the first group consists of people who always have zero counts and the second group consists of people who had the chance to have non-zero counts and tried to have non-zero counts. Let a person in group 1 with probability ψ and in group 2 with probability 1-ψ. In the second group, counts are governed by a PRM or a NBRM. In both cases, ψ is a function of the characteristics of the individual. In the zero inflated models, ψ is determined by either a logit or a probit model and may take the form of equation 5.

$$\psi_i = F(Z_i\gamma) \qquad (5)$$

The Z's can be the same as the x's.

Zero Inflated Poisson (ZIP) Model combines the Poisson count model and the binary process:

$$\Pr(y_i = 0/X_i) = \psi_i + (1-\psi i)\exp(-\psi_i)$$

$$\Pr(y_i/X_i) = (1-\psi_i)\frac{\exp(-\psi_i)\psi_i^{y_i}}{y_i!} \qquad \text{for } y_i > 0. \qquad (6)$$

Whereas, Zero Inflated Negative binomial (ZINB) model combines the Negative Binomial model and the binary process, which simply is substituting in the above ZIP model the NBRM version of μ. In effect the estimation technique of these two models are similar to that of tobit model since they combine two different distributions to estimate the coefficients.

Taking into account by how much the Zero inflated models predict zeros, Vuong test compares the Zero inflated models with PRM or NBRM. Significance of the test favors zero inflated models over PRM or NBRM.

One of the difficulties of using count data models, and for that matter any nonlinear models, is the interpretation of the coefficients. This is because the value of the marginal effect depends on both the coefficient of the variable of interest and the expected value of *Y*; hence the partial derivatives cannot be interpreted as change in the expected count for a unit change in the variable of interest. To ease interpretation often factor changes are reported, by explicitly factoring out only the coefficient of the variable of interest.

The other problem is measure of goodness of fit, in that the traditional coefficient of determination is not applicable. In most cases Psuedo-R^2 s are computed to show explained variations. For the count data models Long and Freese (2000) incorporated goodness of fit statistics that proxies the traditional R^2, MacFadden's adj. R^2; Maximum Likelihood R^2 and Log-Likelihood tests are reported in this paper. After plotting the data and running appropriate tests, it is only skilled professional occupation category that has no over-dispersion; all other occupation categories (domestic activities, farming, trading, schooling and unemployment) have over-dispersion. This implies that PRM or ZIP is best represent only one of the occupation categories, skilled professionals whereas all the other categories are reasonably better explained by Negative Binomial Regression (NBRM) or Zero Inflated Negative Binomial (ZINB).

4. RESULTS AND DISCUSSION

The results of the determinants of decision to engage (participate) in diversification show that households with more number of members who can read and write (NURWLHH), more male adults (AGM4) and more income from main season crop production (VMCROPS) tend to participate in occupation diversification (see Table 2). On the other hand, age of household head (AGEHHH) is a deterrent to occupation diversification. The older the head of the household the less likely that households engage in occupation diversification. Households with more total land holdings (TOTLAND), and more income from livestock products (LIVESTOY) also participate less in different occupations. For these households the opportunity cost is higher than other households with no fixed assets that suite farming or livestock rearing. Risk of crop failure, which is proxied by how much crops are affected by bad weather (HBAFFCR), unexpectedly does not lead to participation in occupation diversification. This may be due to two reasons, first the crop season was not that bad and farmers had good harvest and second households those report crop failure may be in a situation where they can not engage in other activities due other reasons beyond their control, like regional and environmental factors.

The test for the presence of joint decision of participation in and intensity of diversification is significant implying that the joint estimation is warranted. The test for the presence of selectivity bias (lamda test) is also significant, which confirms that there is selectivity bias in the data. The Heckman second stage that corrects for selectivity bias and OLS are comparable. Results in both estimations confirm that the diversification intensity of female-headed households (FEHHH) is less. Similar to the probit mode that estimates participation decision, in second stage estimation, the intensity of diversification is high among households with more members who can read and write (NURWLHH) as well as with more male adults (AGM4). However, the role of livestock income (LIVESTOY) changes sign in the second stage estimation, where households with more income from livestock increase intensity of diversification. Although these results provide overall picture of what matters to participate and diversify occupations, they hide important information in that it is unclear to which occupation categories households diversify and which of the factors are important to diversify to each of the categories. Joint estimation of each category reveals even more in terms of the significance of each factor to each occupation.

The results of joint estimation reveals that presence of household member who can write and read (NURWLHH) decreases number of household member who participate in domestic work and farming activities, but increases number of students, unemployed household members, and skilled professional activities. Female-headed households (FEHHH) tend to diversify their occupation into domestic work, skilled professional and trading activities. A household with a large family size (FAMSZ) tends to have more household members engaged in domestic work and send less number of family members to school (Table 3). This probably has to do with the cost

of sending the kids to the school, where for a large family it is difficult to send all kids to school at the same time. Having more adult female (AGF4) household members leads to allocation of more members in domestic activities, less in farming, schooling and skilled professional activities. On the other hand having more adult male (AGM4) members leads to allocation of less members in domestic activities and schooling, but more in farming, skilled professional activities and also most remain unemployed. An interesting result is that of the impact of income from crop production during the main harvest season (VMCROPS). A household that harvests more or earns more income from main season crop production tends to have more domestic workers and farmers but less students and traders. Sending less number of family members to school may be due to competition for labor, so that opportunity cost of sending students to school is high in a household with such a large income from crop production.

Almost all social and regional factors hinder households from sending kids to school. Ethnic oromos and orthodox Christian households tend to send less number of students to school compared to other ethnic groups and religion. Unobserved regional factors in regions 3, 4 and southern regions promote farming and trading but limit number of students that households send to school and skilled professional activities compared to region 1. Amount of loan in 1994, number of bulls and crop income from the slack season (*belg*) also helps families to send more kids to school.

Explanatory variables are also tested for joint significance across each model to see importance of the variables that influence households in allocating family labor across each occupation category. The result shows that almost all demographic factors, agricultural land holding and income as well as regional factors are the major determinants of household decision to allocate family labor. This again entails the role that demographic composition and regional factors play in decision process as well as the fact that agricultural activities compete for family labor in rural Ethiopia.

Similar to the results in the Heckman two-stage estimation, agricultural risk indicator (HBAFFCR) that captures risk factors has no impact on any of the occupation categories. This may be due to the same reasons indicated above.

Even though the significance and the sign of some of the variables in the count data estimation is similar to that of the joint estimation, there are some changes in the significance and even sign of some of the coefficients (see Tables 4-9).

One of the differences in the count data models is that agricultural risk indicator (HBAFFCR) turn out to be significant determinant in promoting three of the six occupations: skilled professional activities, schooling, and trading. Female-headed households (FEHHH) have less number of unemployed household members and unlike the results from joint estimation, agricultural risk (HBAFFCR) as well as income from livestock products (LIVESTOY) leads to more unemployed household members

and total agricultural land holdings lower number of unemployed family members as expected.

In count data estimation, the factor change of the coefficients makes interpretation easier. The factor changes imply that for a unit change in the explanatory variables by what factor the number of family members allocated to each occupation category changes. Most of the factor changes are close to one. For instance, for farming, increasing female-headed households (FEHHH), male and female below age 8 and between age 8-14, and income from *belg* cropping season (VBCROPS) by one unit decreases the allocation of household members to farming activities by a factor close to one. On the other hand, increasing male between age 14-24 (AGM3), working adults (AEQU), and income from main cropping season (VMCROPS) by one unit increases allocation of household members to farming activity by the same factor. The same can be said for domestic activities and unemployed family members. But lets focus on the other three occupation categories on which policy makers have focused on and are the interests of this paper: trading, skilled professional activities and schooling.

Regional factors are the most important determinant to participate in trading activities. Households in region 4 (REGIO4) and southern region (REGIOSO) compared to Region 1 (Tigray region) increase allocation of household members to trading activities by a factor of 55 and 35, respectively. Region 3 (REGIO3) increases only by a factor of 7. Increasing female-headed households (FEHHH) and ownership of radio (RADIO) by one unit also increases members in trading activities by a factor of 1.6 and 2.5, respectively. As the head of the household gets older, households also tend to increase family members in trading activity by a factor of 1. On the other hand, increasing agricultural land holding size (TOTLAND), income from main cropping season (VMCROPS) and being an ethnic Oromo (ETHNICIT) household lowers number of members engaged in trading activities by less than one factor.

Unobserved regional factors are deterrent to allocate more members of the household in the skilled professional activities. However, these regional characteristics deter only by less than a factor of 0.13. The other deterrent factors to allocate family members to skilled professional activities are number of female members between age 14-24 (AGF3) and males less than 8 years of age (AGM1) where allocation to skilled professional activities is declined by a factor of 0.5 and 0.7, respectively. Income from main crop seasons (VMCROPS) also lowers allocation of family members to skilled activities by a factor of 1 due to competition over family labor. Three factors that have demographic, risk and social nature promote allocation of labor to skilled professional activities. These factors are numbers of household members who can read and write, agricultural risk indicator for crop failure, and religion. Increasing number of household members who can read and right (NURWLHH), and orthodox Christian (RELIG) households by one unit increase participation in skilled professional activities by a factor of 1.3 and 3.1, respectively.

Households that experience crop failure due to bad weather conditions are also likely to increase members in this activity by a factor close to 2.

For sending kids to school, like the case of skilled professional activities, regional characteristics are hindering factors. The factor changes show that regional factors hinder schooling even more than it hinders participation in skilled professional activities. Other factors that affect sending kids to school negatively are being ethnic Oromo (ETHNICIT) and having adult male between the ages of 24-44 (AGM4). These can be justified by the fact that the ethnic oromos are located in the fertile agricultural areas of the country and the opportunity cost of sending kids to school is high for these group compared to other groups. The adult male proportion in a household also shows comparative advantage for agricultural activities than other occupations. One fact that reinforces this justification is the returns to schooling in the country and the need for the subsistence food production. High return to schooling requires an average of 12 or 13 years of schooling, if at all the labor market is absorbing the graduates. However, subsistence food and cash requirement for daily activities puts households in a situation to vote for current consumption needs. Loan (LOANV94), agricultural risk factors (HBAFFCR), number of household members who can read and write (NURWLHH) and income from *belg* season (VBCROPS), on the other hand promotes households to send kids to school by a factor greater than and equal to 1.

It is traditionally believed that households tend to send more male kids to school compared to females. The reason often given is that males can easily succeed and get better job with better pay. However, in rural areas one more factor that households consider to decide on whom to send to school is the opportunity cost of male on farming activities. These two factors may cancel out each other or one may outweigh the other depending on other characteristics of the households. In this study, the result shows that increasing male and female between the ages of 8-14, households increase the number of kids they send to school by factor of 1.22, and 1.20, respectively. Here it seems households don't discriminate between the males and females. One other result also shows that increasing male adults between ages of 24-44 lowers the numbers of kids that households send to school by a factor of 0.84. Competition for working male adult is the main reason here. The same is not true for the case of female adults.

5. CONCLUSIONS

The aim of this study is to investigate household occupation diversification through allocation of household members to different occupational choices. The question that this paper seeks to answer is that what motivates or constrains a household to choose one occupation over another. What are the social, demographic and economic factors that affect occupation choice of a household? As most governments of developing countries are struggling to modernize their agricultural sector and at the

same time to promote small-scale rural non-farm activities, the results of this study may provide useful insight to policy makers.

Diversification index of the six occupation categories is constructed and determinants of overall occupation diversification model is estimated using Heckman two-stage technique to correct for the suspected selectivity bias. Given the fact that household allocation decisions are made jointly, joint estimation of all occupation categories are also made by seemingly unrelated regression model. Finally to take advantage of the count nature of the data, appropriate count data models are estimated for each occupation category separately. The results of the study show that most demographic factors except number of male adults and working adults lower the numbers of family members engaged in farming. Similarly, for domestic activities, except number of female adults and family size, most demographic factor lowers number of members in this activity. Regional factors are the major determinants of schooling, trading and skilled professional activities. Number of family members who can read and write and agricultural risk factors promote households to engage in skilled professional activities and to send more kids to school. There is also evidence that agricultural activities compete for family labor in trading, schooling and skilled professional activities. The traditional argument that households tend to send more males than females to school is not supported in this study.

Policy Implications: Given the finding that demographic factors play significant role in decision process to allocate family labor to different occupations, government should respond to demographic issues in the long run so that family size should not be a hindrance to expansion of non-agricultural and agricultural activities. In the short-run, given the composition of household members, activities that suite the potential and capability of females should be taken as a priority. Competition of agricultural and non-agricultural activities over the household labor should be addressed through increased productivity on farm by using technologies so as to transfer the redundant labor to other non-agricultural activities. As region specific factors imply the role that infrastructure and other institutional setup play in affecting households opportunity and access to non-agricultural activities, government should meet at least the minimum necessary infrastructure and institutional requirements to help households get access to and opportunity of wage or self-employment activities.

Extensions: This study can be extended by pooling subsequent rounds of the Ethiopian rural socio-economic survey to study the dynamic nature of occupation diversification in rural Ethiopia. Since in most estimation models, unobserved regional factors are significant determinants of occupation diversification, regrouping of the sample into different sub-sample with closely related characteristics may give even more revealing results about the determinants of different occupation categories. Future research should also address the role of institutions and infrastructure in affecting household decision process.

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APPENDIX

Table 1: Summary Statistics of Model Variables

Variable	Description	Mean	Sd. Dev.
AGEHHH	Age of Household head	46.44	16.26
FEHHH	Female headed Households	0.224	0.417
NUADW	Number of adults engaged in domestic work	1.348	0.951
NURWLHH	Number of Household member who can read and write a letter	1.50	1.76
AGF1	Number of females in household in age group<=8	0.79	0.93
AGF2	Number of females in household in age group>8 and <=14	0.48	0.70
AGF3	Number of females in household in age group>14 and <=24	0.61	0.79
AGF4	Number of females in household in age group>24 and <=44	0.71	0.68
AGM1	Number of males in household in age group<=8	0.79	0.96
AGM2	Number of males in household in age group>8 and <=14	0.48	0.73
AGM3	Number of males in household in age group>14 and <=24	0.60	0.82
AGM4	Number of males in household in age group>24 and <=44	0.60	0.71
FAMSZ	Family size	6.01	3.04
AEQU	Family size adjusted by adult equivalent scales	4.77	2.51
TOTLAND	Total area under cultivation in *meher*, or *meher* and belg	1.95	8.03
VMCROPS	Value of output of all crops in *meher*	1112.44	1999.67
VBCROPS	Value of output of all crops in *belg*	281.31	1833.34
HBAFFCR	How badly were crops affected, 1= moderately, 2= severely	0.63	0.86
BULLS	Number of bulls owned and present at farm in 1994	0.59	0.89
RADIO	Number of radios or tape players owned by households	0.07	0.28
LOANV94	Value in loan(s) taken out in 1994 including amount in kind	38.58	210.90
LIVESTOY	Revenue from sale of livestock products (i.e. live animals, hides and skin, etc.)	52.43	162.99
SKILLPRO	Number of skilled workers (craft worker, potter, etc) and professional (teachers, etc)	0.07	0.32
TRADER	Number of traders in the household including food sellers	0.11	0.44
TFARM	Total number of farm workers in the household	1.23	0.92
TSTUD	Number of students in the household in all age group	0.48	1.01
TUNEMP	Number of household members unemployed both voluntarily and involuntarily	0.07	0.33
ETHNICIT	Dummy variable for ethnicity (1= Oromo, and 0 otherwise)	0.23	0.42
RELIG	Dummy variable for religion (1=Orthodox and 0 otherwise)	0.21	0.41
REGIO3	Dummy variable for region 3	0.32	0.47
REGIO4	Dummy variable for region 4	0.27	0.45
REGIOSO	Dummy variable for southern regions (region 7, 8, and 9)	0.30	0.46

Table 2: Determinants of Diversification Index: Heckman two stage and OLS

DIVINDEX	Probit		Heckman 2nd stage		OLS	
	Coef.	t-ratio	Coef.	t-ratio	Coef..	t-ratio
AGEHHH	-0.022***	-5.95	0.001	0.191	-0.001	-0.051
FEHHH	-0.764	-0.821	-0.137***	-9.832	-0.139***	-9.853
NURWLHH	0.917**	2.303	0.02***	6.290	0.02***	6.196
AGF1	-	-	-0.008	-1.022	-0.008	-1.084
AGF2	-	-	-0.006	-0.555	-0.007	-0.699
AGF3	0.536	0.328	-0.01	-1.073	-0.011	-1.133
AGF4	0.766	0.811	0.002	0.174	0.001	0.080
AGM1	-	-	-0.001	-0.092	-0.001	-0.166
AGM2	-	-	-0.014	-1.304	-0.015	-1.386
AGM3	0.087	0.119	0.003	0.258	0.002	0.164
AGM4	3.935*	1.802	0.016*	1.675	0.015	1.587
FAMSZ	0.698	0.633	-0.015	-1.107	-0.014	-1.094
AEQU	-0.119	-0.067	0.038**	2.247	0.04**	2.308
TOTLAND	-0.056***	-4.333	0.001	0.868	0.001	0.895
VMCROPS	0.012***	3.704	0.001	-1.053	-0.001	-0.961
VBCROPS	-	-	-0.001	-0.019	-0.001	-0.135
HBAFFCR	-0.208**	-2.09	0.009	1.602	0.009	1.599
BULLS	-0.401	-0.866	0.007	1.591	0.008	1.627
RADIO	-	-	0.002	0.117	0.001	0.098
LOANV94	-	-	-0.001	-1.283	0.000	-1.269
LIVESTOY	-0.001***	-4.188	0.001*	1.954	0.001*	1.942
ETHNICIT	-	-	-0.029	-1.231	-0.031	-1.300
RELIG	-	-	-0.02	-1.611	-0.023*	-1.858
REGIO3	-0.460	-0.637	-0.013	-0.714	-0.014	-0.772
REGIO4	-0.938	-1.254	0.004	0.144	0.006	0.200
REGIOSO	-	-	-0.01	-0.553	-0.011	-0.611
Cons.	0.754***	2.87	0.381***	15.076	0.383***	14.966
Wald Chi2 (14)			35.86***			
Lamda			-0.164***			
Wald test (rho=0)			37176***			
F-test					18.42***	
Adjusted R-square					0.29	

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively. Lamda is test for the presence of selectivity bias and rho is the correlation between the error terms of the probit model and the selection bias corrected (Heckman 2nd stage) model.

Table 3. Joint Estimation of Determinants of Occupation Categories: Seemingly Unrelated Regression

VARIABLES	NUADW		TFARM		TSTUD		TUNEMP		SKILLPRO		TRADER	
	Coef.	-ratio	coef.	-ratio	coef.	ratio	coef	.-ratio	coef.	-ratio	coef.	- T ratio
AGEHHH	-0.001	-0.900	-0.001	-1.452	-0.001	-0.103	0.001***	5.340	0.001	0.460	0.001	0.853
FEHHH	0.112***	7.975	-0.212***	-15.810	0.006	0.571	0.018***	3.252	0.025***	4.544	0.052***	6.229
NURWLHH	-0.032***	-7.893	-0.044***	-11.286	0.061***	19.714	0.008***	4.838	0.007***	4.140	0.001	0.322
AGF1	-0.004	-0.374	-0.008	-0.879	0.017**	2.240	-	-	-0.006*	-1.960	-	-
AGF2	-0.028**	-2.187	-0.016	-1.351	0.036***	3.655	-0.001	-0.307	-0.004	-0.856	0.013**	2.034
AGF3	0.068***	5.803	-0.043***	-3.829	-0.024**	-2.624	0.003	0.856	-0.01**	-2.583	0.006	1.045
AGF4	0.036***	2.944	-0.033**	-2.774	-0.01	-1.093	0.001	0.187	-0.002	-0.550	0.008	1.242
AGM1	-0.01	-1.028	-0.020**	-2.144	0.024***	3.064	0.003	0.946	-	-	0.003	0.741
AGM2	-0.006	-0.452	-0.026*	-1.963	0.047***	4.444	-0.001	-0.137	-0.008*	-1.728	-0.007	-0.958
AGM3	-0.054***	-3.818	0.06***	4.391	-0.009	-0.849	0.005	1.145	-0.003	-0.745	0.002	0.254
AGM4	-0.031**	-2.466	0.042***	3.436	-0.044***	-4.471	0.008*	1.867	0.019***	4.524	0.006	0.854
FAMSZ	0.067***	4.114	-0.016	-1.025	-0.037***	-2.984	0.003	0.559	-0.004	-0.717	-0.013	-1.364
AEQU	-0.077***	-3.479	0.032	1.534	0.031*	1.871	-0.008	-0.961	0.008	0.901	0.013	1.034
TOTLAND	-0.001	-1.470	0.002**	2.410	0.000	-0.874	0.001*	1.777	-0.001	-0.807	-0.001	-0.940
VMCROPS	0.001**	2.073	0.001***	3.284	-0.001**	-2.721	-0.001	-1.166	-0.001	-1.555	-0.001***	-3.168

...Table 3 continued

VBCROPS	-	-	-0.001***	-3.737	0.001**	2.518	0.001	1.154	0.001	1.305	0.001	0.853
HBAFFCR	-0.01	-1.255	0.001	0.102	0.006	1.022	0.001	0.122	0.002	0.700	0.001	0.165
BULLS	0.001	0.016	-0.005	-0.825	0.009*	1.775	-0.002	-0.905	-0.001	-0.020	-0.001	-0.332
RADIO	-0.003	-0.187	-	-	-0.002	-0.109	-0.004	-0.431	-0.006	-0.698	0.015	1.252
LOANV94	0.001	-0.752	-0.001	-0.129	0.001**	2.489	-0.001	-0.416	-0.001*	-1.845	-0.001	-0.220
LIVESTOY	0.001	-0.428	0.001	0.943	-	-	-0.001	-0.827	0.001	1.031	-0.001	-0.889
ETHNICIT	0.008	0.293	0.03	1.091	-0.041*	-1.909	-0.011	-1.009	0.004	0.372	0.011	0.639
RELIG	-0.026*	-1.748	0.01	0.701	-0.018*	-1.645	0.011*	1.884	0.002	0.316	0.021**	2.433
REGIO3	-0.025	-1.227	0.072***	3.663	-0.059***	-3.814	0.003	0.406	-0.024***	-2.989	0.033**	2.691
REGIO4	-0.055	-1.627	0.064*	1.974	-0.002	-0.066	0.009	0.650	-0.034**	-2.588	0.018	0.913
REGIOSO	-0.047**	-2.157	0.048**	2.326	-0.036**	-2.155	-0.003	-0.292	-0.032***	-3.740	0.068***	5.285
Cons.	0.506***	18.735	0.427***	16.520	0.108***	5.260	-0.029**	-2.803	0.023**	2.285	-0.035**	-2.271
R^2	0.28		0.32		0.34		0.06		0.08		0.08	
Chi-square	556.2***		673.14***		764.9***		105.56***		134.8***		122.1***	

Breush Pagan test of error independence = 1034.5***

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively

Table 4: Determinants of Number of Household Members Engaged in Farming

TFARM	NBRM			ZINB		
	raw coef.	t-ratio	factor change	raw coef.	t-ratio	factor change
AGEHHH	0.001	0.719	1.001	0.002	1.142	1.002
FEHHH	-0.535***	-7.166	0.585	-0.251***	-3.387	0.778
NURWLHH	-0.081***	-5.111	0.922	-0.074***	-4.682	0.928
AGF1	-0.104**	-2.433	0.901	-0.102**	-2.381	0.903
AGF2	-0.16***	-2.996	0.852	-0.148**	-2.796	0.862
AGF3	-0.079*	-1.642	0.924	-0.072	-1.496	0.93
AGF4	-0.018	-0.368	0.982	-0.012	-0.252	0.987
AGM1	-0.143***	-3.382	0.866	-0.13***	-3.055	0.878
AGM2	-0.175***	-3.059	0.839	-0.163***	-2.839	0.849
AGM3	0.173***	3.019	1.188	0.152**	2.649	1.164
AGM4	0.073	1.362	1.075	0.054	1.005	1.055
FAMSZ	-0.003	-0.041	0.997	0.008	0.122	1.008
AEQU	0.207**	2.244	1.23	0.178*	1.927	1.194
TOTLAND	0.003	1.467	1.003	0.003	1.106	1.002
VMCROPS	0.001**	2.085	1.00	0.001**	2.000	1.00
VBCROPS	-0.001**	-2.173	1.00	-0.001**	-2.029	1.00
HBAFFCR	-0.007	-0.209	0.993	-0.015	-0.451	0.985
BULLS	-0.021	-0.770	0.979	-0.023	-0.831	0.977
RADIO	-0.075	-0.882	0.927	-0.034	-0.398	0.966
LOANV94	-0.001	-0.062	1.00	0.001	0.007	1.00
LIVESTOY	0.001	1.076	1.00	0.001	0.573	1.00
ETHNICIT	-0.043	-0.359	0.957	-0.001	-0.008	0.999
RELIG	-0.034	-0.514	0.966	-0.007	-0.105	0.993
REGIO3	0.243**	2.300	1.274	0.23**	2.169	1.258
REGIO4	0.307**	1.992	1.359	0.215	1.400	1.24
REGIOSO	0.129	1.188	1.137	0.085	0.787	1.088
Cons.	-0.647***	-4.934		-0.575***	-4.349	
McFadden's adj. R2	0.11			0.14		
Maximum Likelihood R2	0.28			0.35		
Log- Likelihood chi2 (26)	484.14***			327.78***		
Alpha/Vuong test	107.64***			-		

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively

Alpha test compares Poisson Regression Model (PRM) and Negative Binomial Regression Model (NBRM); its significance implies over-dispersion and favors NBRM. Vuong test compares NBRM (PRM) and Zero Inflated Negative Binomial Model (ZINB) (Zero Inflated Poisson Model (ZIP). Significant value of Vuong test favors ZINB or ZIP.

Table 5: Determinants of Number of Household Members Engaged in Domestic Activities

NUADW	NBRM			ZINB		
	raw coef.	t-ratio	factor change	raw coef.	t-ratio	factor change
AGEHHH	-0.001	-0.469	0.999	-0.001	-0.152	0.999
FEHHH	0.007	0.110	1.006	0.006	0.095	1.005
NURWLHH	-0.043***	-2.905	0.958	-0.042**	-2.832	0.959
AGF1	-0.153***	-3.882	0.858	-0.157***	-4.012	0.854
AGF2	-0.179***	-3.618	0.835	-0.174***	-3.528	0.84
AGF3	0.139***	3.238	1.148	0.138***	3.224	1.148
AGF4	0.092**	2.092	1.096	0.087*	1.973	1.091
AGM1	-0.171***	-4.504	0.842	-0.173***	-4.554	0.84
AGM2	-0.151**	-2.853	0.859	-0.141**	-2.652	0.868
AGM3	-0.112**	-2.059	0.893	-0.108**	-1.993	0.897
AGM4	-0.112**	-2.317	0.894	-0.104**	-2.159	0.901
FAMSZ	0.25***	4.233	1.284	0.269***	4.489	1.308
AEQU	-0.088	-1.096	0.915	-0.12	-1.487	0.886
TOTLAND	-0.001	-0.320	0.998	-0.001	-0.407	0.998
VMCROPS	0.001	0.834	1.00	0.001	0.675	1.00
VBCROPS	0.001	0.265	1.00	0.001	0.403	1.00
HBAFFCR	-0.006	-0.188	0.994	0.016	0.499	0.99
BULLS	0.025	0.985	1.025	0.019	0.742	1.019
RADIO	-0.127	-1.475	0.88	-0.126	-1.465	0.881
LOANV94	-0.001	-0.814	0.999	-0.001	-0.796	0.999
LIVESTOY	-0.001	-0.248	1.00	-0.001	-0.386	0.999
ETHNICIT	-0.043	-0.349	0.958	-0.029	-0.238	0.971
RELIG	-0.074	-1.141	0.928	-0.075	-1.160	0.927
REGIO3	-0.057	-0.633	0.944	-0.033	-0.368	0.967
REGIO4	-0.041	-0.285	0.959	-0.034	-0.238	0.966
REGIOSO	-0.051	-0.556	0.949	-0.042	-0.479	0.958
Cons.	-0.304**	-2.674		-0.287**	-2.519	
McFadden's adj. R2	0.13			0.10		
Maximum Likelihood R2	0.32			0.29		
Log- Likelihood Chi2 (26)	556.15***			497.6***		
Alpha/Vuong test	117.21***			-		

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively

Alpha test compares Poisson Regression Model (PRM) and Negative Binomial Regression Model (NBRM); its significance implies over-dispersion and favors NBRM. Vuong test compares NBRM (PRM) and Zero Inflated Negative Binomial Model (ZINB) (Zero Inflated Poisson Model (ZIP). Significant value of Vuong test favors ZINB or ZIP.

Table 6: Determinants of Number of Household Members Engaged in Trading Activities

TRADER	NBRM			ZINB		
	raw coef.	t-ratio	factor change	raw coef.	t-ratio	factor change
AGEHHH	0.001	0.029	1.00	0.025**	2.600	1.024
FEHHH	0.955***	3.814	2.599	0.449*	1.930	1.566
NURWLHH	0.043	0.716	1.044	-0.008	-0.135	0.992
AGF1	-0.511***	-2.842	0.599	-0.197	-1.137	0.821
AGF2	0.059	0.304	1.061	0.035	0.197	1.036
AGF3	-0.133	-0.759	0.875	0.08	0.496	1.082
AGF4	-0.051	-0.270	0.95	-0.169	-0.946	0.844
AGM1	-0.202	-1.152	0.817	-0.083	-0.500	0.92
AGM2	-0.485**	-2.148	0.615	-0.105	-0.445	0.9
AGM3	-0.025	-0.114	0.974	-0.106	-0.499	0.899
AGM4	-0.025	-0.123	0.974	0.16	0.827	1.173
FAMSZ	-0.062	-0.186	0.939	-0.097	-0.282	0.907
AEQU	0.507	1.193	1.659	0.218	0.499	1.243
TOTLAND	-0.811***	-4.097	0.444	-0.732***	-3.754	0.481
VMCROPS	-0.001*	-1.944	0.999	-0.001*	-1.832	0.999
VBCROPS	-0.001	-1.398	0.999	0.001	0.821	1.00
HBAFFCR	0.099	0.796	1.104	0.059	0.462	1.06
BULLS	0.160	1.164	1.173	0.122	0.915	1.13
RADIO	0.436	1.286	1.546	0.92***	2.848	2.508
LOANV94	-0.001	-0.351	0.999	0.001	0.346	1.00
LIVESTOY	-0.002	-1.115	0.998	-0.002	-1.365	0.998
ETHNICIT	-1.14**	-2.209	0.319	-1.98***	-3.857	0.138
RELIG	0.001	0.001	1.00	0.008	0.032	1.007
REGIO3	2.043**	2.636	7.712	1.884**	2.439	6.577
REGIO4	2.904***	3.360	18.248	4.014***	4.639	55.394
REGIOSO	2.773***	3.698	16.01	3.562***	4.694	35.242
Cons.	-5.673***	-6.801		-5.613***	-6.625	
McFadden's adj. R2	0.19			0.22		
Maximum likelihood R2	0.15			0.20		
Log- Likelihood chi2 (26)	236.18***			117.69***		
Alpha/Vuong test	15.63***			6.04***		

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively

Alpha test compares Poisson Regression Model (PRM) and Negative Binomial Regression Model (NBRM); its significance implies over-dispersion and favors NBRM. Vuong test compares NBRM (PRM) and Zero Inflated Negative Binomial Model (ZINB) (Zero Inflated Poisson Model (ZIP). Significant value of Vuong test favors ZINB or ZIP.

Table 7: Determinants of Number of Household Members Engaged in Skilled Professional Activities

SKILLPRO	Poisson			ZIP		
	raw coef.	t-ratio	factor change	raw coef.	t-ratio	factor change
AGEHHH	-0.013	-1.516	0.986	-0.005	-0.547	0.995
FEHHH	0.863***	3.485	2.369	0.142	0.518	1.152
NURWLHH	0.382***	5.568	1.464	0.285***	3.974	1.329
AGF1	-0.491**	-2.669	0.612	0.071	0.346	1.073
AGF2	-0.212	-0.940	0.809	-0.072	-0.302	0.93
AGF3	-0.744***	-3.986	0.475	-0.714***	-3.325	0.489
AGF4	-0.196	-0.994	0.821	0.162	0.813	1.175
AGM1	-0.391**	-2.348	0.676	-0.331**	-1.846	0.718
AGM2	-0.479**	-1.995	0.619	0.238	0.885	1.268
AGM3	-0.212	-0.941	0.808	-0.162	-0.695	0.85
AGM4	0.387*	1.818	1.472	0.197	0.892	1.217
FAMSZ	0.439	1.436	1.551	0.406	1.329	1.50
AEQU	-0.165	-0.399	0.848	-0.428	-1.043	0.651
TOTLAND	-0.11	-0.898	0.895	0.057	0.424	1.058
VMCROPS	-0.001**	-2.605	0.999	-0.001**	-2.006	0.999
VBCROPS	0.001**	2.692	1.00	0.001	0.747	1.00
HBAFFCR	0.28*	1.740	1.323	0.57***	3.347	1.769
BULLS	0.224*	1.862	1.25	0.146	1.121	1.157
RADIO	-0.451	-1.353	0.637	0.153	0.448	1.165
LOANV94	-0.002	-1.402	0.998	-0.001	-0.369	0.999
LIVESTOY	0.001	1.589	1.001	0.001	2.179	1.001
ETHNICIT	-0.191	-0.351	0.826	-0.374	-0.632	0.687
RELIG	0.137	0.454	1.147	1.141***	3.282	3.129
REGIO3	-1.089**	-2.733	0.336	-2.11***	-4.779	0.121
REGIO4	-1.367**	-2.228	0.254	-2.061***	-3.042	0.127
REGIOSO	-1.555***	-3.703	0.211	-2.054***	-4.745	0.128
Cons.	-2.698***	-5.834		-1.276***	-2.453	
Pseudo R2	0.32			-		
McFadden's adj. R2	-			0.26		
Maximum Likelihood R2	-			0.19		
Log- Likelihood test	251.08***			126.08***		
Alpha/Vuong test	0.25			5.98***		

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively. Alpha test compares Poisson Regression Model (PRM) and Negative Binomial Regression Model (NBRM); its significance implies over-dispersion and favors NBRM. In this case the alpha test is obtained from NBRG and the result shows that no problem of over-dispersion. Vuong test compares NBRM (PRM) and Zero Inflated Negative Binomial Model (ZINB) (Zero Inflated Poisson Model (ZIP). Significant value of Vuong test favors ZINB or ZIP.

Table 8: Determinants of number of household members sent to school

TSTUD	NBRM			ZINB		
	raw coef.	t-ratio	factor change	raw coef.	t-ratio	factor change
AGEHHH	0.002	0.515	1.002	-0.004	-0.872	0.996
FEHHH	-0.021	-0.167	0.979	-0.088	-0.669	0.915
NURWLHH	0.455***	14.352	1.575	0.297***	11.001	1.345
AGF1	0.119	1.461	1.126	0.075	1.016	1.078
AGF2	0.269**	2.782	1.308	0.181**	1.958	1.197
AGF3	-0.164*	-1.762	0.848	-0.081	-0.947	0.921
AGF4	-0.059	-0.589	0.942	-0.119	-1.349	0.887
AGM1	0.208**	2.432	1.23	0.109	1.330	1.114
AGM2	0.282**	2.805	1.326	0.203**	2.197	1.225
AGM3	-0.029	-0.271	0.971	0.023	0.233	1.023
AGM4	-0.346***	-3.461	0.707	-0.174*	-1.871	0.84
FAMSZ	-0.314**	-2.053	0.73	0.012	0.080	1.012
AEQU	0.338*	1.771	1.402	-0.084	-0.456	0.919
TOTLAND	-0.008	-0.676	0.992	-0.008	-0.333	0.992
VMCROPS	-0.001	-1.768	1.00	-0.001	-0.626	1.00
VBCROPS	0.001	1.209	1.00	0.001*	1.960	1.00
HBAFFCR	0.074	1.178	1.077	0.146**	2.487	1.157
BULLS	0.142***	3.101	1.152	0.058	1.344	1.06
RADIO	-0.001	-0.002	0.999	-0.028	-0.233	0.972
LOANV94	0.001*	1.668	1.00	0.001*	1.904	1.00
LIVESTOY	0.001	0.485	1.00	0.001	0.842	1.00
ETHNICIT	-0.455**	-2.263	0.634	-0.291*	-1.669	0.747
RELIG	-0.215*	-1.613	0.806	-0.207	-1.527	0.813
REGIO3	-0.634***	-3.331	0.53	-0.604**	-2.869	0.546
REGIO4	0.045	0.173	1.045	-0.026	-0.106	0.974
REGIOSO	-0.288	-1.505	0.749	-0.371*	-1.829	0.69
Cons.	-1.644***	-6.687		-0.284	-1.013	
McFadden's adj. R2	0.23			0.26		
Maximum Likelihood R2	0.36			0.42		
Log- Likelihood test	659.2***			249.03***		
Alpha/Vuong test	38.04***			38.46***		

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively

Alpha test compares Poisson Regression Model (PRM) and Negative Binomial Regression Model (NBRM); its significance implies over-dispersion and favors NBRM. Vuong test compares NBRM (PRM) and Zero Inflated Negative Binomial Model (ZINB) (Zero Inflated Poisson Model (ZIP). Significant value of Vuong test favors ZINB or ZIP.

Table 9: Determinants of Number of Unemployed Household Members

TUNEMP	NBRM			ZINB		
	raw coef.	t-ratio	factor change	raw coef.	t-ratio	factor change
AGEHHH	0.026**	2.815	1.026	0.008	0.801	1.008
FEHHH	0.553*	1.941	1.738	-0.661**	-1.957	0.516
NURWLHH	0.401***	5.720	1.493	0.494***	6.915	1.639
AGF1	-0.081	-0.374	0.921	-0.016	-0.076	0.984
AGF2	-0.226	-0.892	0.798	0.437*	1.725	1.548
AGF3	-0.017	-0.075	0.983	0.253	1.163	1.288
AGF4	-0.047	-0.202	0.954	0.126	0.547	1.135
AGM1	-0.073	-0.336	0.929	-0.258	-1.167	0.772
AGM2	-0.333	-1.192	0.717	-0.435	-1.587	0.648
AGM3	0.059	0.212	1.06	0.274	0.992	1.316
AGM4	0.016	0.061	1.016	0.069	0.276	1.071
FAMSZ	-0.05	-0.126	0.951	0.136	0.350	1.146
AEQU	0.173	0.335	1.189	-0.323	-0.637	0.724
TOTLAND	0.013	1.497	1.013	-0.001	-0.031	1.000
VMCROPS	-0.001*	-1.773	0.999	-0.001	-0.427	1.000
VBCROPS	0.001	0.484	1.00	0.001	0.914	1.000
HBAFFCR	0.146	0.953	1.157	0.293*	1.911	1.341
BULLS	-0.109	-0.794	0.896	-0.106	-0.762	0.900
RADIO	-0.374	-0.997	0.688	-1.237***	-3.118	0.290
LOANV94	-0.001	-0.410	0.999	0.001	0.953	1.001
LIVESTOY	0.001	-0.226	0.999	0.002**	2.330	1.002
ETHNICIT	-0.325	-0.686	0.722	-0.07	-0.146	0.933
RELIG	0.402	1.369	1.495	0.261	0.871	1.298
REGIO3	-0.353	-0.755	0.702	0.461	0.959	1.586
REGIO4	-0.141	-0.230	0.868	-0.986	-1.509	0.373
REGIOSO	-0.415	-0.846	0.66	-1.556**	-2.820	0.211
Cons.	-5.053***	-8.062		-2.42***	-3.428	
McFadden's adj. R2	0.13			0.19		
Maximum likelihood R2	0.10			0.16		
Log- Likelihood chi2 (26)	153.12***			88.18***		
Alpha/Vuong test	4.75**			5.73***		

*, **, *** Significant at 10%, 5% and 1% level of significance, respectively

Alpha test compares Poisson Regression Model (PRM) and Negative Binomial Regression Model (NBRM); its significance implies over-dispersion and favors NBRM. Vuong test compares NBRM (PRM) and Zero Inflated Negative Binomial Model (ZINB) (Zero Inflated Poisson Model (ZIP). Significant value of Vuong test favors ZINB or ZIP.