Village Level Analysis of the Factors Affecting Households' Participation in Rural Labor Markets in Tanzania

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1. Motivation

While agricultural income still constitutes the backbone of the rural economy in developing countries, incomes from wage labor and other non-farm activities have increasingly become significant (Bright *et al*. 2000; Lanjouw and Shariff. 1999; Zucula and Massinga 1992). It has been shown that participation in rural labor markets has been an important strategy for poverty alleviation and food security (Ruben and Berger 2001; FAO 1998; Lanjouw 1998). However, most of the analyses done so far have concentrated on individual level or household level (Isguti 2003; Bright *et al*. 2000). Taking the analysis at individual level or household level, though has its own merits, may overlook the spatial interconnectedness of rural labor market and other markets such as credit, land, and insurance markets (Rosenzweig 1988)[1]; aspects which are crucial for rural policy targeting. Only a few studies have analyzed rural labor markets at the cluster/village level (Isguti 2003; Bright *et al*. 2000). In principle, however, most micro-policies for rural poverty alleviation have spatial scale/scope, whereby they first target particular areas/locations and then households located therein as presented in Annex I (DFID 2002, World Bank 1999; Lanjouw 1998; World Bank 1993).

Even if the interlocked transactions in rural markets are captured at the analysis of the individual level or household level, that treatment is not satisfactory because it fails to address the spatial variations in the externalities[2] of the development of one market (e.g. credit market on the other rural labor markets (Renkow, forthcoming; Bryceson 2000). For instance, households participating in rural credit finance (credit market) are more likely to increase other households' participation in rural labor markets. However, the strength of the connection of the two markets in this example is expected to diminish with distance. Moreover, accessibility to wage rural employment, credit, land, and liquidity constraints) affects not only a single households but tends to have spatial effect – affecting relatively closely located households (e.g. in the cluster/village level, in Tanzania context).

Another example is the case of market failures. Overstocking livestock due to ill-defined property rights may cause soil degradation in the village and reduce agricultural productivity. Since most rural activities hinge on the performance of the agricultural sector (DFID 2002), such market failure will slow down economic activities and halt development of the rural labor markets. These effects are by and large localized and will tend to affect not only the decisions of households, individually; but these effects are likely to have an impact on several households in the vicinity of the affected areas.

The interconnectedness of rural labor markets with other markets is spatial in nature because rural households face relatively higher transaction costs in participating in the labor markets than their counterparts in the urban areas (Rosenzweig 1988). Large transaction costs cause localization of rural labor markets because it becomes costly to

[1] Over decades, researchers in rural economics and agricultural economics have shown that failing markets/market imperfections (or non-existence of certain markets) are wide spread in rural areas (Stiglitz and Weiss 1981).

[2] Like many other externalities, these externalities are also spatially distributed.

recruit labor from or sell labor to distant places. Large transaction costs causes also to divergence between effective wage received and wage paid. However, in many studies, large transaction cost has been regarded erroneously as being behind a wide idiosyncratic price band around the market wage (De Janvry *et al*. 1991). But it is highly likely that the households in a close neighborhood would be facing similar transaction costs, rationing and entry barriers because most of these constraints are dictated by the spatial locations (Isguti 2003).

To account for the spatial variations, many researchers have included regional dummies in their regressions (Readon *et al*, 2001; Bright *et al*. 2000). Although this is a move in the right direction, it many not fully solve the problem because rural households are likely to operate in more localized areas than the administrative region boundary[3]. Even when sampling cluster dummies are used as in Woldahanna (2000) to capture the local labor market situations, this approach is bound to several problems. Econometrically, there will be limit on the number of cluster dummies to be included. For example, it is practically difficult to include all (over 500) cluster dummies in analyzing rural labor market participation in Tanzania using 2000/01 Household Budget Survey. Isguti (2003) avoids this problem by analyzing a panel data of individuals observed over sampling clusters. While panel data regression is richer methodologically in terms of usage of sample information than Dummy Variable Least Squares (DVLS) used in Woldahanna (2000), it fails to capture externalities that may exist at cluster levels.

Given that rural labor markets are interconnected with other markets in a spatial scale and that rural micro-policies start by targeting particular locations, justify the analysis of rural labor market development at some spatial scale level. We want to answer the following question: what are the factors that determine the labor market characteristics of a given village? Specifically, what determines the number of households in the village that participates in the rural labor market? This question has not been studied in detail in many rural economics literature.

The objective of this paper therefore is to analyze factors affecting the number of households in the cluster (village level) participating rural labor markets using 2000/01 Tanzania Household Budget survey. Specifically, the objective of this paper is to provide a modified model of farm household, aggregated at cluster level to analyze factor that influence cluster/rural labor market and apply it to Tanzanian case. The rest of the paper is organized as follows: Section 2 presents the theoretical framework of the agricultural household model with transaction costs and liquidity constraint. Section 3 gives the econometric models and the estimation strategies. Discussion of the results is given in Section 4 and the conclusions and outlook of the paper are presented in Section 5.

[3] Unless the household considers migrating; for household short term planning, the conditions at rural local labor market are more relevant to their decision to participate in labor markets than is the district or regional or even the national conditions. Local conditions in the cluster are by far much more relevant to the household decisions than district conditions or regional conditions. However, this does not mean that cluster level rural labor markets remain completely disconnected from those regional or national conditions. Unless the household considers migrating; for household short term planning, the conditions at rural local labor market are more relevant to their decision to participate in labor markets than is the district or regional or even the national conditions.

2. Theoretical framework

We consider household economics as the starting point. When dealing with economics of households, there are options of choosing collective or unitary model of the households (Chiuri 2002). The paper opts for unitary household model instead of collective household model because the later is relevant when dealing with intra-household allocation (Aronsson *et al*., 2001). The aspects of intra-household resource allocations are outside the scope of this paper. Moreover, the collective household model may not hold in many Tanzanian rural societies where men dominate the decision-making processes accepts in a small proportion of female headed households. Besides that, the information needed for estimation of this model is not available and is costly to collect in large surveys.

Under the unitary model[4], we choose non-separable model instead of separable model because the later overly simplify the rural economy by assuming existence of perfect markets (Singh *et al*., 1986). Also, the non-separable model is preferred to separable model in this paper because the available facts do not support the notion that the rural household in Tanzania in fully integrated to the market (Ferreira 1996) and it is expected that most of the production decisions are not independent from the consumption decisions.

As in many studies of rural economy (Lofgern and Robinson 1999; Taylor and Adelman 2003), the starting point in our theoretical framework is the Agricultural Household Model (AHM). The model is flexible enough to analyzing aspects ranging from purely subsistence household, to where the household is a commercial farmer (Woldahanna 2000). The point of departure is where the analyst makes assumptions on the environment in which the rural households operate. It has been shown that the markets in which the rural households operate are incomplete in many respects (Stiglitz and Weiss 1988). Moreover, households differ in their accessibility to rural labor markets and other off-farm activities due to differences in transaction costs, rationing and entry barriers depending on their respective locations (Sorton *et al*. 1994). This kind of rural labor market fragmentation according to location needs to be analyzed in a systematic manner[5]. However the standard form household models in Singh *et al*., (1986) can not handle these aspects and need some modification to include aspects of transaction cost, and rural labor market rationing and credit/liquidity constraints. Most of the economic studies of rural labor markets, however, assumed that these rationing and transaction cost apply to each household, differently (Woldehana 2001). Such assumptions are clearly another over-simplification because households in the same village (in the context of Tanzania) are likely to be rationed in wage labor markets by their access to infrastructure, information, and credit. This is particularly important when modeling rural labor market in Tanzania

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[4] Choosing unitary model is equivalent to taking axiomatically that the distribution of resources within the household is governed by social norms and culture and is given exogenously for the household.

[5] Differential labor market integration across household in different location (clusters) means that there differential response to policies that affect the market wage; transaction costs, liquidity constraints, and rationing in rural labor market (Waldahanna 2002).

because farmers in Tanzania's villages are not fully integrated into wage labor markets. The strategy followed in this paper is to track down labor market segmentation as far down as the cluster level.

The paper extends the non-separable AHM (with transaction cost, rationing in labor markets, and credit constraints) used in Woldahanna (2001) by emphasizing on the cluster conditions affecting participation in rural labor markets. The household in a representative cluster can be a seller or a buyer or both in the rural labor markets. However, the decision to participate in rural labor markets is taken in consideration with transaction cost and rationing in the rural labor markets. For expository purposes, the model presented here does not include aspects of risk and uncertainty.

Consider rural household's preference that can be captured by a utility function *U*. The arguments of *U* are the vector of consumption goods (*c*); leisure (*H*); and test shifters (*a*) such as age, education and other household characteristics. The standard assumptions that the function *U* is quasi-concave, twice continuously differentiable, and non-decreasing in *c* and *H* apply[6]. In line with Woldahanna (2000), the model assumes that farm production technology set is given by equation (1)

$$(1)\quad Q\left(q\ ; x\ , Lh\ , A\ , K\ , Lf\ ; \Omega\ , Z\right) \geq 0$$

where *Q(.)* is a closed, bounded convex production possibility set; q is the vector of agricultural outputs; x represent a vector of farm variable inputs such as fertilizers; Lh is hired farm labor; Lf is vector of own household farm labor; K is other fixed capital; A is vector of agricultural land under various crops; Z is vector of farm characteristics such as soil type and location; and Ω is household characteristics (because of non-separable HH model).

Household that hires in labor pays a wage rate (*wh*) and incurs supervision cost (*sp*). It is assumed in equation (2) that supervision cost has two components: the value of time needed in the supervision (*sph*) and direct cash need for supervision (*spc*), both of which are non-decreasing functions of amount of hired in labor (*Lh*). At this stage of the paper, we consider a constant proportion relationship as shown in the Lagrangian equation later.

$$(2)\quad sp = sph + spc$$

Because the focus is on the spatial link between rural labor markets and other markets and credit markets in particular, it is assumed that land market does not exist and land available to the household is fixed. If the household cultivates *I* number of crops,[7] the land constraint is give by equation (3).

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[6] *U* is maximized, as shall be shown, subject to household's resource endowment, cash (liquidity) constraint, farm production technology, household time, rationing in the labor market, and the equilibrium condition of the commodity allocation (recall: this is non-separable AHM).

[7] We exclude intercropping, though, including it may not change our conclusion.

(3) $A = \sum_{i=1}^{I} A_i$

Total on-farm labor (*Lf*) supplied by the household is given by

(4) $Lf = \sum_{i=1}^{I} Lfi$

As stated earlier, it is assumed that the household has the option of selling labor for off-farm work at market wage rate (*wm*). Note that *wm* is not equal to *wh* because of market imperfections that cause the wedge between wage paid and effective wage received. For simplicity, the model rules out the case where wage is dependent on hours worked and assumes that the market wage for off-farm labor is determined by Mincerian wage equation (5):

(5) $wm = W(ED, SK, LC, \Omega).$

where: *ED* is the education indicator; SK is the indicator of skills and experiences; LC is local labor market conditions which partly depend on spatial factors; and as defined early, Ω is household characteristics.

As is the case for hiring in labor, hiring out labor also involves some transaction costs (*tc*), which can be decomposed into two major components as well. The first component is the commuting/search/time cost (*tch*), and cash transaction cost (*tcc*). For simplicity again at this stage of the paper, we assume fixed proportion function form of each component. Moreover the household faces rationing in the off-farm labor markets such that the level of labor allocated to off farm work is truncated from above. In this case, the observed labor in the rural labor market (*Lm*) may fall short of the desired amounts. If *Lmp* gives the maximum rationed quota, this constraint is given in equation (7) as:

(7) $Lm \leq Lmp$

such that the entire household time[8] allocation is given by.

(8) $T = \sum_{i-1}^{I} Lfi + Lm + Lh.Sph + Lm.tch + H.$

In deriving the cash constraint, it is assumed that the household also faces transaction costs in selling agricultural produces and purchasing consumer goods. Formally, let us

[8] The total household time endowment *T* depends on the household size and the dependency ratio and the health status of its members. We do not include the health aspect in the theoretic framework, though was included in the earlier stages of the estimation process.

denote P_i as the price of the i^{th} farm output and P_j as the price of the j^{th} consumption good, both of which are exogenous to the household. Let v be the vector of non-labor income and d be marketing cost such as transport, information costs in the sales and purchase of commodities. Suppose further that S_i is the quantity of farm output sold and b_j is the quantity of consumption goods purchased. Let P_x be the price of renewable farm inputs (apart from labor). Then the cash constraint could be specified as

$$(9) \quad \sum_{i-1}^{I}\left[Pi*Si-di*Si\right]+wm*Lm+v-\sum_{j=1}^{J}\left[Pjbj+djbj\right]-$$
$$P_xX-wh*Lh-tcc*Lm-spc*Lh\geq 0$$

Then, by combining commodities production, sales/purchases, and consumption, the commodity equilibrium condition requires that, for each commodity equation (10) holds.

$$(10) \quad c_n = q_n + b_n - S_n$$

As usual the non-negativity constraints apply:

$$(11) \quad C_j \geq 0;\ b_j \geq 0_j\ q_I \geq 0;\ si \geq 0;\ A_I \geq 0;\ Lf_i \geq 0;\ H \geq 0;\ L_h > 0 \quad x \geq 0.$$

Subject to all these constraints, the problem of the household is then to choose the level of consumption goods, purchase of consumption goods, on farm labor, off-farm labor, leisure time, quantity of inputs and outputs in order to maximize equation (12).

$$(12) \quad U = U(c, H; a)$$

which gives the following lagrangian equation:

$$(13) \quad L = \mathrm{U(c, H; a)} + \psi\left[\, Q\left(q_i;x_i,Lh_i,A_i,K_i,Lf_i;\Omega_.,Z;\Omega\right)\right]$$
$$+\lambda\left[\ \sum_{i-1}^{I}\left[PiSi-diSi\right]+wmLm+v-\sum_{j=1}^{J}\left[Pjbj+djbj\right]-PxX-whLh-tcc.Lm-spc.Lh\right]$$
$$+\delta\left[\ A-\sum_{i=1}^{I}A_i\right] + \gamma\left[\ T-\sum_{i-1}^{I}Lfi+Lm+Lh.Sph+Lm.tch+H\right]$$
$$+\mu\left[\mathrm{Lmp - Lm}\right] + \sum_{n=1}^{N}\eta_n\left[\mathrm{qn + bn - Sn - cn}\right]$$

The first order Kuhn-Tucker condition for maximization of the lagrangian equation are:

$$(14) \quad \frac{\partial L}{\partial C_j}=\frac{\partial U(.)}{\partial C_j}-n_j=0$$

(15) $$\frac{\partial L}{\partial H} = \frac{\partial}{H} - \gamma = 0$$

(16) $$\frac{\partial L}{\partial q_i} = \eta_i + \psi Q_i^{'}(.) \leq 0$$

$$q_i \geq 0 \ and \ q_i^{*}(\eta_i + \psi Q_i^{'}(.)) = 0$$

(17) $$\frac{\partial L}{\partial s_i} = \lambda(P_i - d_i) - \eta_i \ \leq 0$$

$$s_i \geq 0 \ and \ s_i^{*}(\lambda(P_i - d_i) - \eta_i) = 0$$

(18) $$\begin{cases} \frac{\partial L}{\partial b_j} = -\lambda(P_j + d_j) + \eta_i \geq 0 \end{cases}$$

$$b_j \geq 0 \ and \ b_j^{*}(-\lambda(P_j + d_j) + \eta_i) = 0$$

(19) $$\begin{cases} \frac{\partial L}{\partial A_i} = 0 \Rightarrow \psi \frac{\partial Q(.)}{\partial A_i} - \partial \leq 0 \end{cases}$$

$$A_i \geq 0 \ and \ A_i^{*}\left(\psi \frac{\partial Q(.) - \partial}{\partial A_i}\right) = 0$$

(20) $$\frac{\partial L}{\partial X_i} = \psi \frac{\partial Q(.)}{\partial X} - \lambda P_x = 0$$

(21) $$\begin{cases}\dfrac{\partial L}{\partial L_{fi}} = \psi \dfrac{\partial Q(.)}{\partial L_{fi}}\gamma \le 0 \\ L_{fi} \ge 0 \ and \ L_{fi}^{*}\left(\psi \dfrac{\partial Q(.)}{\partial L_{fi}}\gamma\right) = 0\end{cases}$$

(22) $$\begin{cases}\dfrac{\partial L}{\partial L_h} = \psi \dfrac{\partial Q(.)}{\partial L_h} - \lambda(w_h + spc) - \gamma sph \le 0, \\ L_h \ge 0 \ and \ L_h^{*}\left\{\psi \dfrac{\partial Q(.)}{\partial L_h} - \lambda(w_h + spc) - \gamma sph\right\} = 0\end{cases}$$

(23) $$\begin{cases}\dfrac{\partial L}{\partial L_m} = \lambda(w_m - tcc) - \gamma(1 + tch) - \mu \le 0, \\ L_m \ge 0 \ and \ L_m^{*}(\lambda(w_m - tcc) - \gamma(1 + tch) - \mu) = 0\end{cases}$$

(24) $$\frac{\partial L}{\partial \mu} \ge 0 \quad \mu \ge 0 \ and \ \mu\frac{\partial L}{\partial \mu} = 0$$

(25) $$\frac{\partial L}{\partial \lambda} = \sum_{i=1}^{1}[P_i s_i - d_i s_i] + w_m L_m + v - \sum_{j=1}^{J}[P_j b_j + d_j b_j] - P_x Z - w_h L_h - tcc.L_m - spc.L_h = 0$$

(26) $$\frac{\partial L}{\partial \gamma} = T - \sum_{i=i}^{1} L_{fi} - H - L_h.sph - L_m.tch = 0$$

(27) $$\frac{\partial L}{\partial \psi} = Qq_i, X, L_h, A, K, L_f, Z) = 0$$

(28) $$\frac{\partial L}{\partial \eta_n} = q_n + b_n - s_n - C_n = 0$$

(29) $$\frac{\partial L}{\partial \delta} = A - \sum_{i=1}^{I} A_i = 0$$

Given the assumptions made on the utility function, farm production technology set, linearity of the constraints, and the non-negativity restrictions; the Kuhn-Tucker first order conditions are both necessary and sufficient condition for the maximization of the Lagrangian equation. But for our analysis of the spatial inter-linkage between rural labor markets and other markets, the focus is on equation 23. If the inequality holds in equation 23, the household would not participate in paid work in the rural labor markets. However, if equality holds, then the household will participated in rural labor markets. After some manipulation, equation 23 gives:

Equation 30 shows that, the wage that the household is ready to accept is affected by marginal value of time (γ, +); the liquidity constant (λ , -); the rationing in the labor market (μ , +), transaction cash cost (*tcc*, +)[9]; and transaction time cost (*tch*, +). This shows clearly that the wage that the household is ready to accept to sell its labor is not

$$W_m^* = \frac{\lambda.tcc + \gamma(1+tch) + \mu}{\lambda} \quad (30)$$

equal to the shadow value of on-farm labor. As in Waldehenna (2000), the participation in wage employment does depend not only on marginal value of household time and income but also on transactions costs, the marginal value of liquidity constraint, and labor market rationing. It is here where the influence of spatial interconnectedness of rural labor markets and development in other markets comes into play[10]. Thus one important question to ask is: what are the factors that determine number of households in a cluster that participate in rural labor markets?

Like in the Microeconomics foundation of Macroeconomics in any standard Macroeconomics text book, the starting point is the household behavior and variables. Thus most of the factors at household levels, when aggregated, are expected to influence the participation rate at the village level. However, unlike in the traditional labor market participation models, some of the household variables may have neutralizing effects when aggregated at the village level, and misguide policies that start by clustering their implementation strategies. This is evident if we look from demand side of the rural labor markets. If a non-corner solution to hire-in labor, manipulating equation 22 gives:

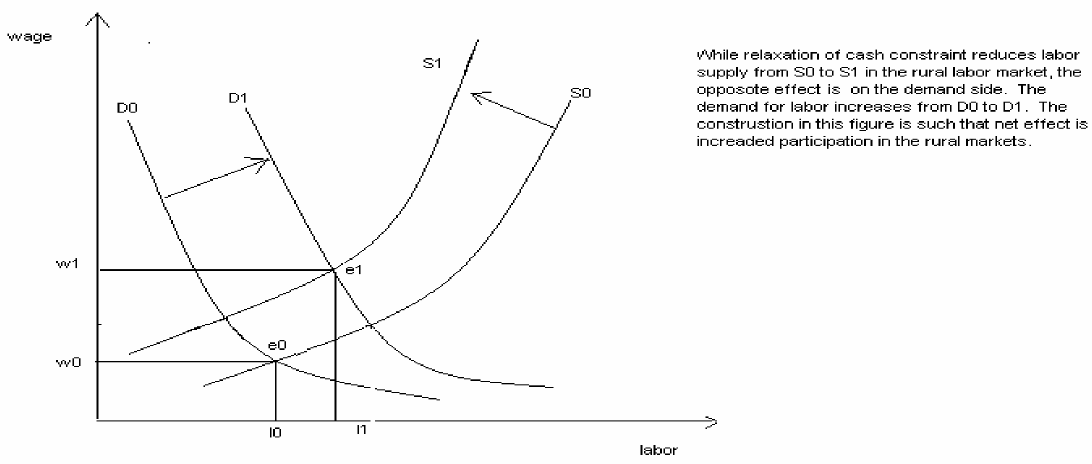
[9] From the supply point of view, the transaction cost reduces participation and the amount of labor supplied in distant labor markets. However, from the demand point of view, high transaction costs will make most hired-in labor to be recruited form neighboring households. These two forces work in the same direction and make rural labor markets more localized than their counterpart in the urban areas.

[10] Since the solution to the fist order condition of a large model like this may not always be analytically tractable, we follow the option of taking the reduce form of the model and single out variable that could be used in the estimation process (Jacoby 1993, De Janvry 1992). By so doing our model directly gives us the spatial variables as candidates in determining the participation in the rural labor markets.

$$(31) \qquad w^{*}_{h} = \left(\psi \frac{\partial Q(.)}{\partial L_h} - \lambda * spc - \gamma sph \right) * \lambda^{-1}$$

Clearly equation 31 shows that tightening the liquidity constraints reduces the demand for labor, which is opposite of the conclusion derived from equation 30. In equation 30, the liquidity constraint will always force the household to look for wage employment. However, at the cluster level, households that are not (less) liquidity constrained are likely to offer opportunities for wage employment to other households. Figure 1 shows one of the possible equilibria in the village labor market following a non-idiosyncratic cash liquidity constraint shock. This kind offsetting effects may send wrong signal to policies that start first by targeting the village and then the individuals, unless careful analysis is done at the village level.

Figure 1. Effects of Relaxing Cash Contraint Rural Labor Market Equilibrium



3. Econometric Models

The theoretical framework in the preceding section has shown what variables would explain the households' participation in rural labor markets. It has also been shown how decision of one household is likely to be influenced by constraints in others households in the vicinity (for example, due to the demonstration effects)[11]. What this implies is that there is spill over effects from one household to the others with respect to rural labor markets. For example, households with high proportion of its member with higher education may employ more cluster-mates (and vise versa). Thus, clusters with relatively educated members will have high rate of participation in the rural labor markets. To capture this interconnectedness, we consider 519 villages (the enumeration areas used in

[11] Clusters which have households of some characteristics may have different orientation to rural labor markets. In this respect, the number of households participating in the rural labor market will shows systematic variation from clusters to cluster according to different spatial characteristics.

the 2000/01 Household Budget Survey) as the units of analysis. The clusters contain several households; but for econometric analysis, cluster variables are generated variables from the household variables in a manner explained in subsequent sub-section.

3.1. Variables

As dependent variable we measure the development of the rural labor markets at cluster level by the number of households in the cluster who reported that at least one of its member earned wage income (ACT_W) in the survey year. Other indicators (such as the proportion of labor incomes in total income) could be used but their reliability is highly questionable. Thus we consider the count of the number of households, which have had at least one member participating in wage employment in the survey year to more reliable indicator of the development of rural labor markets at the village level.

To capture the rural labor market interconnectedness with other markets we focus on the rural credit as it affects the cash constraints at the cluster level. The indicator of the cluster cash constraint is measures by the proportions of households, which has at least one member who participated in formal financial institutions and/or informal financial arrangements (BANK). As derived in the theoretical framework, relaxation of the cash constraint reduces participation in rural wage employment at household level. But there is opposing force also. Participating in rural finance reduces the cash constraints and increases hired in labor in those households at the cluster level. The square of this variable is included to capture this complex relationship.

The participation in wage employment is likely to be affected by land availability. Per capita cultivated land (PER_LAND) is used as the proxy of land availability[12]. But since land is both wealth variable and production factor, it is expected to have multiple effects in participation of rural labor markets. First as wealth indicator, land may induce people who have large land to heve confidence on their land – and what they can produce from it and reduce their participation in wage employment in the rural areas. Some studies have shown that land has insurance-effect and thus reduce incentives of looking for wage employment. In this case the square of this PER_LAND is expected to have negative coefficient.

On the other hand, land as a factor of production can be either complimentary to labor or substitute for it[13]. The complimentary nature of land and labor is more expected to have dominant effect due to poor technology used in small scale farming in rural Tanzania. Most households in Tanzania still depend on hand hoes as their main tool of cultivation. In this case then large land availability in the cluster makes households with large land to hire wage labor to cultivate the land. In this respect, the sign the square of PER_LAND is indeterminate. The model also include the change in cultivated land (FARMC)

[12] Later in the development of the paper, alternative proxy could be some index of land inequality in the village. We hypothesize that land inequality increases of participation in the rural labor markets.

[13] We do not think land is substitute for labor in Tanzanian rural household. But if land is substitute for labor, then large land could displace labor to other non-agricultural activities.

between the survey year (2000/01) and one year before the survey (1999/2000) to see if labor moved in or out of rural wage employment because of such changes.

Livestock (number of cattle) per household in the cluster (PER_CATO) is included in the model to account for those who will be employed by this sub-sector and displace because of the soil/land degradation. Since land is the largest employer, the more it is degraded the more it is likely that crop production will fail to employ more and more people. Thus, the expected sign of the square of livestock variable is negative. However, this variable was dropped in the course of estimations.

To capture the marketing/transaction/rationing/an information cost, infrastructure variables are included. The proxies used are average distance to the major/essential centers, such as shops, roads, and health centers reported by each household in the cluster. In the survey the variables were measured as travel time (DHOUR) and distance in KM (DKM). Both proxies are expected to be highly correlated, but travel time is considered to be more appropriate because it is able capture the differences in terrain and the quality of the paths/roads.

Another variable related to the development of infrastructure is access to adequate and safe water. We generated a series of proportions of households with different sources of drinking water. We created the proportions of the households whose main sources of drinking water is in-house and outside-house private tape as well as protected and unprotected private wells (PR_WATE). We also created another proportion of the household in the cluster, whose sources are in the community, public protected and unprotected wells (PU_WATER). The rest of water sources were taken as control group.

These water indicator variables were, however, dropped in course of estimation. Instead, proportion of households in the cluster that have access to safe water (SAFEWATE) was included. The safe water in many rural Tanzania is associated with low time need to fetch it, which releases some labor resources. In so doing it is expected to increase participation in the rural labor market. The square of this variable is included to capture non-linearity relationship.

Related to these infrastructures is the electricity connection. We included the proportions of the households in the cluster that are connected to the national power grid (ELEC). It is expected that the clusters with high proportions of its household connected to the national power grid will have relatively high rate of participation in the rural labor markets.

We wanted to capture other time consuming rural activities such as firewood collection. We therefore included the proportions of households in the clusters whose main source of fuel is firewood (F_WOOD), which is expected to reduce the participation in the rural labor markets. However, the variable F_WOOD was dropped from the estimation due to mutlicolinearity.

For education indicators, at individual level, we first created the dummy (SEC_ED) if the individual has a secondary school education level and another dummy (COL_ED) if the individual has any college after his/her secondary school education. Primary school level and bellow was taken as reference group. At the cluster level, these dummies were converted to proportions of individuals in the cluster that have these levels of education in the population of 15 years old and over. The square of this variable has also been included to capture non-linearity of the relationship.

Average time used per week on the primary (HOUR1) and the secondary activities (HOUR2) in the cluster are included as measure of rural economy diversification. As the cluster diversifies to other activities (mainly, non-agriculture), it is expected that more and more wage employment will be created.

As dictated at household level, we include the average age (AGE) of the population between 15 and 65 year in the cluster. But as expected at cluster level, it may not have significant effect (unlike in HH level). Moreover, the average household size (LHHTOTAL) in the cluster was included as indicator of the available labor resources in the cluster. However, to account for non-working population in the cluster, we also included average dependency ratio (DEPRATIO) in the cluster, which is expected to reduce the rate of participation in rural labor markets. The dependency ratio was computed as the ratio of (below 5 plus above 65) to the population aging between 15 and 65 years. To further control on the available labor resources at the cluster level, we also included the proportion of the household that reported at least one member who suffer from malaria (MALARIA) and diarrhea (DIAREA).

Per capita income in the cluster (PER_Y) was also included to control for differences in wellbeing of the people over clusters in the same spirit as using per capita GDP in cross-country regressions.

3.2. Estimation Techniques

As the nature of this dependent variable suggest, ordinary least squares (OLS) could be used but the preponderance of zeros (clusters which has zero households in the sample participating in the rural labor markets) and small values of the dependent variable posed econometric problems. Equally formidable problem in using OLS is the discrete nature of the dependent variables.

We can improve our analysis by using Poisson Regression Model. The model assume that the number (Yi) of households participating in wage employment in the clusters is generated by Poisson distribution with parameter λi, which is related to a vector of regressors X_i. According to Green (2001), the Poisson probability process can be presented as in equation 1, where λi is assumed to take the form given in equation 2

It has been shown that in this simple formulation of the Poisson process, the mean and the variance are equal. That is

(32) $\Pr ob(Y_i = Y_i) = \frac{e^{\lambda_i}}{y_i!} \lambda_i^{y_i}$; $y_i = 0,1,2,3,......$

(33) $ln\lambda_i = \beta^1 X_i$

(34) $E(y_i / x_i) = \text{var}(y_i / x_i) \quad = \lambda_i$

The marginal effects of the vector of regressor X_I is given by equation 4, where β is the vector of parameters estimated from the data.

(35) $\frac{\partial E(y_i / x_i)}{\partial x_i} = \lambda_i \beta$

There are three measures of goodness of fit used in the Poisson Regression model, namely R^2_p, G^2, and R^2_d. R^2_r statistic is computed as follows:

(36) $R_p^2 \ = 1 - \sum_{i=1}^{n} \left[\frac{y_i - \hat{\lambda}_i}{\sqrt{\hat{\lambda}_i}} \right]^2 * \{ \ \sum_{i=1}^{n} \left[\frac{y_i - \overline{y}}{\sqrt{\overline{y}}} \right]^2 \}^{-1}$

which compares the fit provided by the model with that with only the intercept term. R^2_p, however, has problems because it can be negative and declines with reduction in regressors. As a result, G^2 given in equation 6 has been suggested.

(37) $G^2 = 2\sum_{i-1}^{n} y_i \log(y_i / \hat{\lambda}_i)$

G^2 equals zero if there is perfect fit. G^2 has also been modified to R^2_d , which is given as:

(38) $$R_d^2 = \ 1 - \frac{\sum_{i=1}^{n} \left[y_i \log(\frac{y_i}{\hat{\lambda}_i}) - (y_i - \hat{\lambda}_i) \right]}{\sum_{i=1}^{n} \left[y_i \log(y_i / \overline{y}) \right]}$$

R^2_d has been preferred to R^2_p and G^2 because it measures model improvement over one with only the constant term and is bounded in the unit interval. The results of the Poison Model are given in Table 1

Table 2: Estimation Results of the Poisson Model

	Coeff.	t-ratio	P-value
ONE	-7.01	-3.02	0.00
AGE1	0.12	1.23	0.22
DIAREA	0.00	-0.67	0.50
SEC_ED	3.84	4.85	0.00
COL_ED	2.01	1.54	0.12
DEPRATIO	-0.38	-0.20	0.84
ELEC	0.57	0.82	0.41
BUSNES1	2.51	4.35	0.00
BANK	2.53	2.95	0.00
SAFEWATE	1.82	3.88	0.00
LHHTOTAL	0.44	2.17	0.03
SQAGE1	-0.002	-1.42	0.15
SRHOUR1	0.18	2.77	0.01
LHOUR2	0.00	-0.80	0.43
PER_Y	0.17	2.38	0.02
PER_LAND	0.06	1.63	0.10
PER_LAND2	-0.06	-1.64	0.10
LDHOUR	-0.0002	-1.70	0.09
DEPRATIO2	0.01	0.01	0.99
FARMC2	-0.04	-1.86	0.06
ELEC2	-1.01	-0.92	0.36
SEC_ED2	-4.04	-2.82	0.00
COL_ED2	-1.87	-1.62	0.11
BUSNES12	-2.54	-4.57	0.00
BANK2	-3.24	-1.96	0.05
SAFEWATE2	-1.54	-3.42	0.00
R^2_p		0.35	
$R^2_{d.}$		0.33	

Diagnostic checks

One restriction of Poisson model is that it forces the expected value and variance of the dependent variable to be equal. Oftentimes, this restriction may not agree with sample data and may cause what is known as "over-dispersion"[14]. The strategy that is commonly followed in the empirical literature to test for the existence of over-dispersion is is the regression based test. This procedure tests the null hypothesis that the mean and variances of are equal against the alternative that variance equal to mean plus some function of mean. That is

$$H_o: \quad var\,(y_i) = E(y_i)$$

[14] Over dispersion is a situation where the *E(yi) # var(yi)* in a Poisson process

H_1: $var(y_i) = E(y_i) + \alpha \; g\,(E[y_i])$

If the null is rejected, it implies that there is over-dispersion in the data, which then needs to be accounted for.

The results of the regression-based test of over-dispersion are in Table 2. The test shows that there is over-dispersion (the t-ratio highly significant). This calls for extension to the standard Poisson model to account for this over-dispersion.

Table 2: Results of Regression Based Test of Over-dispersion

	Coeff.	Std.Err.	t-ratio	P-value
WI1	0.99	0.00	13164.30	0.00
WI2	0.99	0.00	11918.60	0.00

The First Extension of the Poisson Model: the Negative Binomial Model

In case of over-dispersion in the standard Poisson model, it has been suggested that the Negative Binomial could improve the model fit (Green 2001). The Negative Binomial model is capable of taking heterogeneity arising from cross sectional differences in unit in the samples. However, this approach introduces individual unobserved effects into the condition mean such that:

(39) $log \; \mu_i = \quad log \; \lambda_i + log \; u_i = \quad \beta^l x_i + e_i$

where e_i reflect either specification error or cross-sectional heterogeneity (variations across clusters, in the context of this paper). Assuming that the density for u_i follows a gamma distribution, Green (2001) shows that that the resulting distribution is negative binomial with conditional mean λi and conditional variance λ_i $(1+ (1/\theta)\; \lambda_i$. Thus, to test for heterogeneity is equivalent to testing the hypothesis that θ=0, whereby over-dispersion rate can therefore be expressed as in equation 9 below. The results of the Negative Binomial are shown in Table 3.

(40) $$\frac{\mathrm{var}(y_i)}{E(y_i)} = 1 + \alpha E(y_i)$$

Table 3: Estimation Results of the Negative Binomial Model

	Coeff.	t-ratio	P-value
ONE	-7.52	-2.50	0.01
AGE1	0.14	1.09	0.28
DIAREA	0.00	-0.61	0.54
SEC_ED	3.92	3.91	0.00

	Coeff.	t-ratio	P-value
COL_ED	2.09	1.41	0.16
DEPRATIO	-0.36	-0.15	0.88
ELEC	0.65	0.63	0.53
BUSNES1	2.48	3.79	0.00
BANK	2.65	2.55	0.01
SAFEWATE	1.80	3.32	0.00
LHHTOTAL	0.45	1.81	0.07
SQAGE1	-0.002	-1.23	0.22
SRHOUR1	0.19	2.45	0.01
LHOUR2	0.00	-0.01	0.99
PER_Y	0.18	1.96	0.05
PER_LAND	0.06	1.42	0.15
PER_LAND2	-0.06	-1.43	0.15
LDHOUR	-0.0002	-1.45	0.15
DEPRATIO2	-0.01	0.00	1.00
FARMC2	-0.04	-1.20	0.23
ELEC2	-1.14	-0.46	0.65
SEC_ED2	-4.18	-2.14	0.03
COL_ED2	-1.94	-1.44	0.15
BUSNES12	-2.51	-3.95	0.00
BANK2	-3.57	-1.85	0.06
SAFEWATE2	-1.52	-2.93	0.00
Alpha	0.09	1.59	0.11

Although the regression base test of over-dispersion indicated the presence of over-dispersion, the Negative Binomial model weakly supports this claim. Therefore, another reason may explain the earlier accusation that there is over-dispersion. We extended the Poisson model to what is known as Zero Inflated Poisson (ZIP) model.

Second Extension of the Poisson Model: the Zero Inflated Model

At this stage we extend the Poisson Model, by assuming that the there are two underlying regimes, which produces zero outcome in our model. In the first regime, it might be the observed zero reflects that the cluster sampled (is too remote and) has not developed the minimum (formal or informal) institutions required for wage employment. In the second regime, zeros are generated simply because the cluster sample did not capture those employed in wage employment. In the second scenario, repeated samples from this cluster could result in some positive numbers, while this possibility is ruled out in the first regime. Formally, suppose that z is binary indicator of the two regimes, such that:

$$(41) \qquad z = \begin{cases} 1 & if \quad regime = 2 \\ 0 & if \quad regime = 1 \end{cases}$$

then the Zero Altered (Inflated) Poisson model could be presented as

(42) $Prob\ (Z_i = 1) = F(w, \gamma)$

(43) $$\Pr ob(y_i = j / z_i = 1) = \frac{e^{\lambda_i} \lambda_i^j}{j_i}.$$

where $F(.)$ is cumulative logit or normal distribution. By this formulation the mean and variance of the poison model are no longer equal.[15] According to Green (2001), to test whether the ZIP model give better fit to the data better than standard Poisson Model, we suppose that $f_j(y_i / \mathbf{x}_i)$ is the predicted probability that the random variable Y equal y_i under the assumptions that the distribution is $f_j(y_i / \mathbf{x}_i)$ in regime j = 1, 2. Let m_i be given by:

(44) $$m_i = \log\left[\frac{f_1(y_i / x_i)}{f_2(y_i / x_i)}\right]$$

The Vuong's statistic (which has a limiting standard normal density) for testing the suitability of ZIP model against Standard Poisson model is:

(45) $$v = \left[\sqrt{n} * \frac{1}{n}\sum_{i=1}^{n} m_i\right] * \left(\sqrt{\left(\frac{1}{n}\sum_{i=1}^{n}(m_i - \overline{m})^2\right)}\right)^{-1}$$

If $|v| < 2$, the test is inconclusive. Otherwise large positive values favor the ZIP model and large negative value favor the standard Poisson model. The results of the ZIP model are shown in Table 4:

Table 4: Estimation Results of the ZIP Model

	Coeff.	**t-ratio**	**P-value**
ONE	-3.80	-2.50	0.01
AGE1	0.08	1.24	0.21
DIAREA	0.00	-0.04	0.97
SEC_ED	2.19	3.80	0.00
COL_ED	1.37	1.72	0.08
DEPRATIO	-0.48	-0.38	0.70
ELEC	0.81	1.26	0.21
BUSNES1	0.87	2.79	0.01

[15] This induced over-dispersion then can not easily be distinguished from the one originating from the data, thus we need to distinguish between over-dispersion which originate from the data heterogeneity and that which is included by the ZIP model formulation that is the regimes splitting mechanism. The test is not direct because the standard Poisson and ZIP model are not nested.

	Coeff.	t-ratio	P-value
BANK	1.61	2.75	0.01
SAFEWATE	0.73	2.46	0.01
LHHTOTAL	0.20	1.49	0.14
SQAGE1	-0.001	-1.33	0.18
SRHOUR1	0.09	2.28	0.02
LHOUR2	0.00	-0.01	0.99
PER_Y	0.11	2.33	0.02
PER_LAND	0.04	1.78	0.07
PER_LAND2	-0.04	-1.78	0.08
LDHOUR	0.00	-1.42	0.16
DEPRATIO2	0.08	0.08	0.93
FARMC2	-0.01	-0.44	0.66
ELEC2	-1.10	-0.69	0.49
SEC_ED2	-1.97	-1.61	0.11
COL_ED2	-1.09	-1.57	0.12
BUSNES12	-0.90	-2.83	0.00
BANK2	-2.13	-2.07	0.04
SAFEWATE2	-0.63	-2.13	0.03
Tau	-4.73	-4.97	0.00
Vuong statistic		4.48	

These results (Vuong statistic) support the ZIP model over the standard Poisson Model. To see whether there is middle ground between regime splits and cluster heterogeneity, the ZIP variant of the Negative Binomial is run. The results are presented in Table 5.

Table 5: Estimation Results of the Binomial ZIP Model

	Coeff.	t-ratio	P-value
ONE	-3.79	-2.49	0.01
AGE1	0.08	1.25	0.21
DIAREA	0.00	-0.02	0.99
SEC_ED	2.17	3.70	0.00
COL_ED	1.37	1.71	0.09
DEPRATIO	-0.50	-0.40	0.69
ELEC	0.82	1.25	0.21
BUSNES1	0.85	2.64	0.01
BANK	1.61	2.72	0.01
SAFEWATE	0.71	2.35	0.02
LHHTOTAL	0.20	1.46	0.15
SQAGE1	-0.001	-1.32	0.19
SRHOUR1	0.09	2.23	0.03
LHOUR2	0.00	-0.01	0.99

	Coeff.	t-ratio	P-value
PER_Y	0.11	2.31	0.02
PER_LAND	0.04	1.76	0.08
PER_LAND2	-0.04	-1.76	0.08
LDHOUR	-0.0001	-1.38	0.17
DEPRATIO2	0.09	0.10	0.92
FARMC2	-0.01	-0.38	0.70
ELEC2	-1.11	-0.68	0.50
SEC_ED2	-1.93	-1.52	0.13
COL_ED2	-1.08	-1.55	0.12
BUSNES12	-0.87	-2.66	0.01
BANK2	-2.16	-2.06	0.04
SAFEWATE2	-0.61	-2.04	0.04
Alpha	0.02	0.33	0.74
Tau	-4.89	-4.31	0.00
Vuong statistic		0.0148	

The results ZIP variant of Negative Binomial model show that after accounting for cluster heterogeneity, the regime splitting is no longer significant. Since the regime split favored the ZIP model over standard Poisson model but not under Negative Binomial, it can be concluded that there is a mixture of both regime split and cluster heterogeneity.

4. Some Discussion of the Results

Model diagnostics shows that both Poisson and Negative Binomial regressions (as well as their ZIP variants) fit the data fairly well. Given that this is a cross-sectional data, the R^2_p and $R^2_{d.}$ are fairly high (over 0.33). The regression-based test for over dispersion shows that there is significant over dispersion and ZIP model is favored by Vuong statistic (4.48) over the standard Poisson model. The Negative Binomial regression shows very weak over-dispersion, though. However, after controlling the over dispersion in the Negative Binomial model, the Vuong statistics (0.0148) no longer favor splitting mechanisms.

As expected rural finance variable (BANK) is positively and significantly related with the number of households participating in rural labor markets. This is counter-implication of the household model used in Woldahanna (2000). The square liquidity constraint (BANK2) is, however, negative. The negative coefficient in the square of this variable could indicate that they recruited labor from outside their respective clusters because they were able to overcome some of the transaction costs in hiring-in labor.

The infrastructure variables: These included distances to the nearest centers such as main roads, markets and shops, given in time and KM. Although the two indicators were supposed to be highly correlated, distance in KM was highly noisy and was dropped in the estimation. As expected, travel time (LDHOUR) to these centers has negative effect, which is marginally significant (at 10%) only in the standard Poisson model.

The safe water availability (SAFEWATER) is significantly related to number household in the cluster participating in rural wage employment. The square of this variable also is negative and significant, indicating that wage employment and safe water availability are not necessarily linearly related. However, indicator of power connections (ELEC) is not significant.

Agricultural land availability (PER_LAND) is positively and significantly related to the number of households participating in rural wage employment. However, the square of this variable is negative indicating that at higher levels of land per capita, most people will be tied to their respective lands. Nevertheless, a change in cultivated land between the two years is not significant.

As expected, clusters with high average household income per capita income (PER_Y) is associated with high number of households participating in the rural wage employment.

The dependency ratio (DEPRATIO) has the correct sign but was not significant in all specified models. Moreover, age (AGE1) and its square are not significant. Furthermore, as expected, there is significant positive association between participating in rural labor markets and the average household size (LHHTOTAL) in the cluster but the indicator of disease (DIAREA) is not significant.

Diversification variables (hours worked in the main activity HOUR1, in secondary activity LHOUR2) do not have expected sign, even though LHOUR2 is not significant. It was expected that diversifying activity to other (non-agriculture) could stimulate participation in rural labor markets. But the square of this variable is negative and significant in all model specifications, only indicated that the relationship in non linear. The off-farm self-employment (BUSNES) is however significantly related to participation in rural labor markets

Education indicators (SEC_ED and COL_ED) have the correct signs and SEC_ED is significant in all specifications. However, college education (COL_ED) is only significant in ZIP variant of the models. Similar pattern of significance appear with respect to the square of these indicators.

5. Conclusion and Outlook

At this stage, we hope that there are rooms to improve on our analysis. For variables like per capita agricultural land, need to have land inequality measure of land holding to be able to come up with conclusive results.

Reference

Aronsson, T. et al (2001). Estimating intrahousehold allocation in a collective model with household production. *Journal of Population Economics*, 14 (4)569-584

Bright, H. et al (2000). Rural Non-Farm Livelihoods in Central and Eastern Europe and Central Asia and the Reform Process: A Literature Review. Natural Resources Institute Report No. 2633, (DFID)/World Bank. Available on http://www.nri.org/work/rnfl-transition.htm

Bryceson D (2000). 'Rural Africa at the crossroads: Livelihood practices and policies'. ODI Natural Resources Perspective 52. www.odi.org.uk/nrp

Chiuri, M.C. (2002). The Unitary vs. the Collective Model of Household Labor Supply with Child Care: An Empirical Test on a Sample of Italian Households. Discussion Papers, Department of Economics, University of York.

De Janvry, A. et al. (1991). Peasant Household Behavior with Missing Markets: Some Paradoxes Explained. *The Economic Journal* 101: 1400-1417.

DFID (2002). Non-Farm Income in Rural Areas: Policy Planning and Implementation. Keysheets No. 14. Department for International Development (DFID). www.keysheets.org

FAO (1998). The State of Food and Agriculture. 'Part 3: Non-farm income in developing countries'. www.fao.org/docrep/w9500e/w9500e12.htm

Ferreira, L. (1996). "Poverty and Inequality During Structural Adjustment in Rural Tanzania". *World Bank Policy Research Working Paper* 1641, August 1996.

Green, W. (2001). *Econometric Analysis*. Prentice-Hall, New Jersey

Isgut, A. (2003). Nonfarm income and employment in rural Honduras: Assessing the role of locational factors. Department of Economics, Wesleyan University, Middletown. Available on http://aisgut.web.wesleyan.edu/papers/Hnd98.v5.pdf

Janvry, A. and E. Sadoulet (1995). Household Modeling for the Design of Poverty Alleviation Strategies. *Revue d'Economie du Développement*, Vol.3, (1995), pp. 3-23.

Lanjouw, P. (1998). "Rural Nonfarm Employment and Poverty: Evidence from Household Survey Data in Latin America." World Bank, Development Research Group, Washington, DC.

Lanjouw, P. and Shariff, A. (1999). Rural poverty and non-farm employment in India: evidence from survey data. Mimeo. Department of Development Economics. Amsterdam: Free University of Amsterdam.

Lofgren, H. and S. Robinson (1999). To Trade or not to Trade: Non-separable Farm Household Models in Partial and General Equilibrium TMD Discussion Paper No. 37, International Food Policy Research Institute.

Reardon, T., J. Berdegué, and G. Escobar, 2001, 'Rural Nonfarm Employment and Incomes in Latin America: Overview and Policy Implications', *World Development*, Vol.29, No.3, pp.395-409.

Renkow, M., forthcoming, 'Rural nonfarm employment and spatial economics', in P. Hazell, S. Haggblade and T. Reardon (eds.), *Rural nonfarm employment in developing countries*, New York: Oxford University Press.

Rosenzweig, M.R. (1988). "Labor Markets in Low Income Countries". In H. Chenery and T.N. Srinivasan (eds), *Handbook of Development Economics, Volume* 1, Amsterdam: Elsevier Science Publisher B.V. pp 713-762.

Ruben, R. and M. van den Berg, 2001, 'Nonfarm employment and poverty alleviation of rural farm households in Honduras', *World Development*, Vol.29, No.3, pp.549- 560.

Singh, I., L. Squire, and J. Strauss (1986). *Agricultural Household Models: Extensions, Applications, and Policy.* The Johns Hopkins University Press, Baltimore and London.

Sorton, S.; R. Kenbur, and D. Mazumdar (1994). *Labor Markets in an Era of Adjustment, Volume I Issues Paper*. Economic Development Institute of the World Bank, Washington, DC.

Stiglitz, J. and Weiss, A. (1881). Cridit Rationing in Markets with Imperfect Information. *American Economic Review* 71(3) 392-410.

Taylor, J. E. and I. Adelman (2003). Agricultural Household Models: Genesis, Evolution, and Extensions. Review of Economics of the Household, Volume 1, Issue 1-2

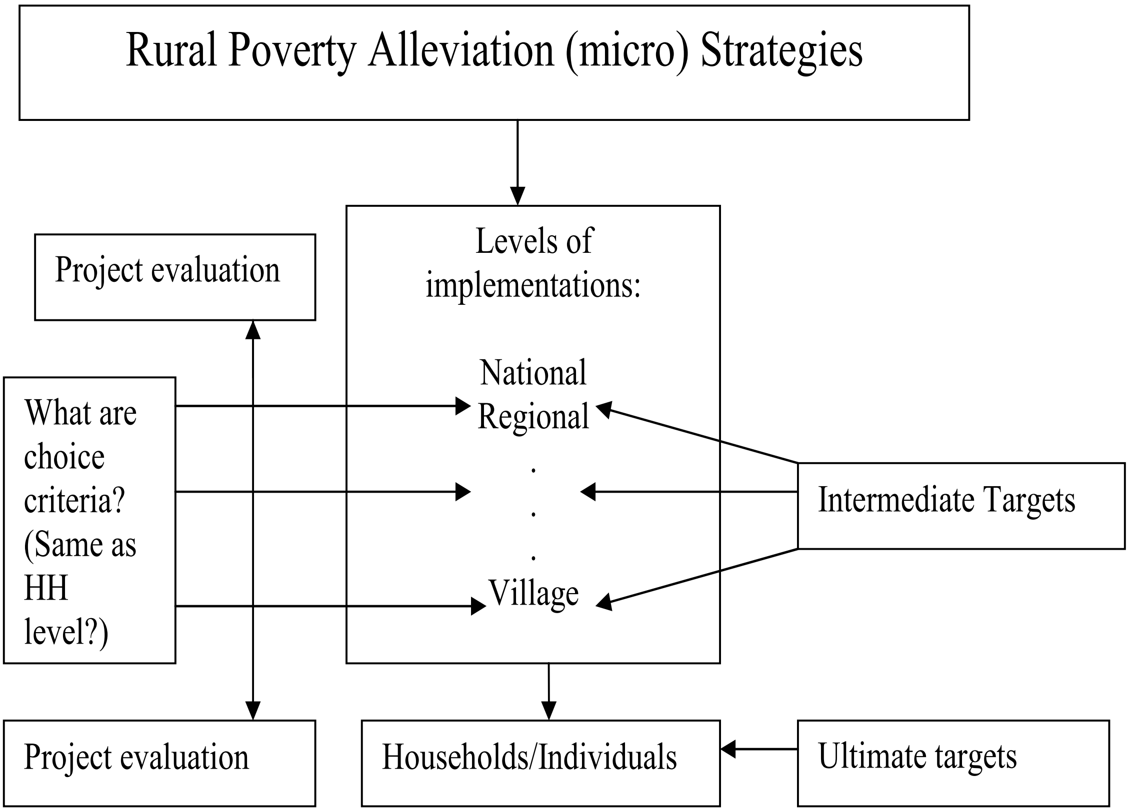
World Bank (1999). Policy Options for Employment in the Rural Non-Farm Sector. Rural Development Note No. 4, November.

World Bank (2003). Reaching the Rural Poor. Washington D.C.: World Bank

Woldehanna, T.(2000). Economic Analysis and Policy Implications of Farm and Off-farm Employment: A Case Study in the Tigray Region of Northern Ethiopia PhD thesis, Wageningen University.

Zucula, P.F and Massinga, J. (1992). The Determinants of Household Income and Consumption in Rural Nampula Province: Implications for Food Security and Agricultural Policy Reform. Working Paper N0. 6, MOA/MSU/UA Research Team, Maputo

Annex I: Rural Policy Targeting



Annex II: Comparison of the Different Models

	poisson		Poisson-ZIP		Neg_b		NEGB-ZIP	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
ONE	-7.0124	0.00	-3.7992	0.01	-7.5242	0.01	-3.78996	0.01
AGE1	0.1231	0.22	0.0803	0.21	0.1382	0.28	0.08037	0.21
DIAREA	-0.0003	0.50	0.0000	0.97	-0.0003	0.54	-0.00001	0.99
SEC_ED	3.8394	0.00	2.1856	0.00	3.9234	0.00	2.16533	0.00
COL_ED	2.0127	0.12	1.3707	0.08	2.0938	0.16	1.36874	0.09
DEPRATIO	-0.3816	0.84	-0.4775	0.70	-0.3620	0.88	-0.49836	0.69
ELEC	0.5700	0.41	0.8087	0.21	0.6506	0.53	0.82395	0.21
BUSNES1	2.5086	0.00	0.8746	0.01	2.4837	0.00	0.84673	0.01
BANK	2.5318	0.00	1.6102	0.01	2.6458	0.01	1.61105	0.01
SAFEWATE	1.8231	0.00	0.7341	0.01	1.7973	0.00	0.71267	0.02
LHHTOTAL	0.4427	0.03	0.1992	0.14	0.4464	0.07	0.19610	0.15
SQAGE1	-0.0016	0.15	-0.0010	0.18	-0.0018	0.22	-0.00097	0.19
SRHOUR1	0.1822	0.01	0.0883	0.02	0.1926	0.01	0.08680	0.03
LHOUR2	-0.0006	0.43	-0.0003	0.99	-0.0006	0.99	-0.00033	0.99
PER_Y	0.1730	0.02	0.1117	0.02	0.1791	0.05	0.11235	0.02
PER_LAND	0.0563	0.10	0.0375	0.07	0.0610	0.15	0.03720	0.08
PER_LAND2	-0.0565	0.10	-0.0375	0.08	-0.0611	0.15	-0.03714	0.08
LDHOUR	-0.0002	0.09	-0.0001	0.16	-0.0002	0.15	-0.00008	0.17
DEPRATIO2	0.0091	0.99	0.0784	0.93	-0.0052	1.00	0.09168	0.92
FARMC2	-0.0432	0.06	-0.0059	0.66	-0.0402	0.23	-0.00518	0.70
ELEC2	-1.0107	0.36	-1.0974	0.49	-1.1429	0.65	-1.11143	0.50
SEC_ED2	-4.0376	0.00	-1.9731	0.11	-4.1842	0.03	-1.93133	0.13
COL_ED2	-1.8674	0.11	-1.0887	0.12	-1.9387	0.15	-1.08136	0.12
BUSNES12	-2.5369	0.00	-0.9019	0.00	-2.5069	0.00	-0.87415	0.01
BANK2	-3.2387	0.05	-2.1278	0.04	-3.5724	0.06	-2.15965	0.04
SAFEWATER2	-1.5396	0.00	-0.6332	0.03	-1.5164	0.00	-0.61393	0.04
Tau			-4.7296	0.00			-4.88672	0.00
Alpha					0.0935	0.11	0.01635	0.74
Vuong Statistic			4.4813				0.0148	