Gender Differences in Rural Off-farm Employment Participation in Tanzania: Is Spatial Mobility an Issue?

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Abstract

This paper investigates gender differences in spatial mobility with respect to participation in off-farm employment in rural Tanzania. The mobility issue arises because the recent increase in women participation in off-farm employment is likely to saturate the local labor market/off-farm opportunities and dampen the rural wages/profit among women if it is not accompanied by increased geographical mobility. The results show that, despite the recent increase in their participation, women do not have significant geographical mobility, thus tends to operate more locally as compared to men. The results of decompositions of gender differences in participation in off-farm employment show that a substantial portion of the gender differences is not explained by individuals' endowments. However, policy interventions that could narrow the education gap between male and female are likely to narrow the existing gender gap. Likewise, policies that increases access to water (reduce time needed to collects water) have the potential of reducing the observed gender differences. Since geographical mobility among women is likely to be dictated by cultural factors that tend to have policy inertia, in the short run, there is need to create diversified off-farm opportunities for women within the rural areas in order to reduce unnecessary competition among them.

Key words: Gender, off-farm employment, geographical mobility, rural areas, Tanzania.

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1.0 Introduction

The importance of off-farm employment in the livelihoods of the rural households is now widely acknowledged both in academic circles and development debates (Lanjouw 1998; Lanjouw and Shariff 1999; Reardon *et al*. 2001). This recognition came as a result of accumulated empirical evidence, which shows increasing share of off-farm income in the household total in recent years and the positive role that off-farm employment plays in the reduction of poverty in Asia (Sanchez 1991), Africa (Woldehanna 2000; Bigsten and Shimeles 2003; Okidi and McKay 2003), and Latin America (Davis *et al*. 2004). It has also been observed that off-farm employment is important in reducing income inequality and polarization because incomes derived from rural off-farm employment exhibit equalizing effect on rural income distribution. In this respect, off-farm employment is thought to offer better opportunities of realizing equity objectives of development (Davis *et al*. 2004; Felkner and Townsend 2004). Other studies show that it is this equalizing-effect of off-farm employment on income distributions that helped to offset the imbalance in agricultural incomes versus other sectors in many East Asian countries (cf. Sanchez 1991).

For Tanzania, the National Employment Policy stipulates the need to facilitate rural households in their efforts to diversify income sources and reduce exclusive reliance on agriculture (MLYD 1998). This view has been shared by many other policy documents in Tanzania such as the Rural Development Strategy, the Agricultural Sector Development Strategy, and most recently, the Poverty Reduction Strategy Paper (Mduma 2006). In fact, participation in off-farm employment is seen as the best option because the excess rural labor cannot easily be absorbed by the urban sector where the unemployment rate is already 32% (Diyamett*et al*. 2001; URT 2002a).

Despite these policy 'decrees', rural households' participation in off-farm employment is still relatively low, exhibiting significance spatial and gender variations (URT 2002a; NBS 2002; Mduma 2006). Recent statistics show that most Tanzanians in rural areas still depend on agriculture and there has been only a marginal diversification to other off-farm activities in the last decade. For example, despite rapid economic liberalization in the 1990s, 70 percent of the rural people still relied mainly on agriculture in 2000/2001 as compared with 75 percent in 1991/92. However, the 2000/2001 Household Budget Survey (HBS) report shows the rate at which women participate in off-farm employment increased faster than that of men, indicating some reduction in gender imbalances in this sector (NBS 2002).

Since the reduction in gender imbalances in accessing income sources is generally considered as a step in the right direction (Khan *et al*. 1996; Araujo 2003), it is therefore imperative to assess the factors that are likely to have contributed to the phenomenon. More important is to answer the question of whether or not this increase in women's participation in off-farm employment is sustainable. This question arises from the evidence that women are likely to be less geographically mobile as compared to men (Carnicer*et al*. 2003). The spatial immobility is particularly important among rural women in Sub-Saharan African where traditions/cultural norms tend to restrict female mobility as discussed in Mitullah (2004). Given their low mobility, increased participation will soon drive profitability down or exhaust off-farm employment opportunities in the local geographical location (Brown 2003). That is, if the participation of women is so localized (less spatial diversification); there will be tendencies to saturate the local labor markets/off-farm employment opportunities (Schultz 2002; Wunder 2001). The low spatial mobility would also imply low social networks, thus limited flow of information; the aspect which plays a tremendous role for a successive participation in any job markets or self-employment enterprises (Fernandez and Celina 2004). Thus, our working hypothesis is that, despite the increase in women's participation in off-farm employment in the 1990s, women are likely to saturate their respective local labor markets/off-farm employment because they are less geographically mobile as compared to men.

Using data from 2000/2001 Tanzania's Household Budget Survey (HBS), we investigate these aspects by analyzing factors which determine male and female[2] participations in rural off-farm employment in rural Tanzania using a Bayesian probit model with spatial dependence à la Smith and LeSage (2004). This approach enables us to assess the differences in spatial mobility across gender. To examine the gender differences in the participation rate, we then decompose the effects of factors included in the first stage of estimation using the method developed by Jones and Makepeace (1996) as Oaxaca decomposition could not be used in a non-linear model. Since the theoretical distributions of these decompositions are not generally known, we resort to bootstrapping technique to establish their empirical distributions.

This paper is organized as follows. Section 2 presents the basis of the estimation strategy and is followed by definition of variables in Section 3. Section 4 presents the results and discusses their policy implications. Section 5 concludes.

2.0 Empirical framework and estimation strategy

2.1 Empirical framework

As in Smith and LaSage (2004), we begin by motivating the model of participation in off-farm employment in terms of an explicit choice-theoretic context involving individual behavior, which may well exhibit spatial interactions. The spatial interaction is the vehicle for assessing geographical mobility in that individuals located at similar points in space (locations which are geographically close to each other) may tend to exhibit similar choice behavior. As the focus of this study is on rural-rural short distance interactions, issues of rural-urban migrations are not covered as these entail models that capture higher fixed costs associated with decisions (Hillel 2002). In this setting, therefore, the gender that exhibit high geographical mobility will tend to have strong spatial correlation than the gender that has low geographical mobility.

To model the rural-rural spatial interactions in off-farm employment in the context of rural areas in Tanzania, we suppose that the (male or female) individual $i,\ (i=1,2,3,...,n)$ in a rural village $g,(g=1,2,3,...,m)$ can choose whether to participate in off-farm employment ($Y_{ig}=1$) or not ($Y_{ig}=0$). Note that theoretically there are three possible regimes: (i) locating all labor exclusively on the farm; (ii) locating all labor exclusively to off-farm employment; and (iii) working partly on-farm and partly off-farm. In the context of rural areas of Tanzania, the second scenario is very unlikely due to the customary land ownership (here almost every rural household has access to some amount of land and very few are landless). Consequently, there is likely to be very few rural individuals who exclusively work off-farm. Thus, for this analysis, the individual is considered to have participated in off-farm employment if regime two or three apply (that is $Y_{ig}=1$); otherwise $Y_{ig}=0$. Obviously, this framework satisfies the requirements of the discrete choice model that the alternatives be mutually exclusive, exhaustive, and finite (Greene 2001). We further assume that the choice of anyone of this alternative is based on the principle of utility maximization (rational behavior) and let utility level derived from participation in off-farm employment (U_{ig1}) and that from not participating (U_{ig0}) be presented as:

[2] The choice between using individual or household as a unit of analysis has mainly been determined by research objectives. Those interested in the welfare of the household as a whole have used households as unit of their analysis (Rozelle, Taylor, and de Brauw 1999; Woldehanna 2000). Those interested in differentiating the welfare across individuals in the households have used individuals as the basis of their analysis (Knight, Song, and Jia 1999). In order to thoroughly discuss the gender imbalances, this study is based on individuals' participations.

$$U_{ig0} = \boldsymbol{\gamma}'\mathbf{w}_{ig0} + \boldsymbol{\alpha}'_0\mathbf{s}_{ig} + \theta_{g0} + \varepsilon_{ig0}$$
$$U_{ig1} = \boldsymbol{\gamma}'\mathbf{w}_{ig1} + \boldsymbol{\alpha}'_1\mathbf{s}_{ig} + \theta_{g1} + \varepsilon_{ig1} \quad (1)$$

where $\mathbf{w}_{iga}$ (a= 0, 1) is a w -dimensional vector of observed attributes of community that affect local labor markets and off-farm self-employment opportunities such as distance to the markets (i.e. factors which are thought to affect the transaction costs of participation in the rural labor markets), and $\mathbf{s}_{ig}$ is and s −dimensional vector of observed attributes of individual i such as age, sex, and human capital stock. $\boldsymbol{\alpha}$ and $\boldsymbol{\gamma}$ are vector parameters that like the individual and community characteristics to the utility level. θ_{ga} captures the extent the level of utility is affected by the opportunities to interact and network. Given the cultural/traditional norms in rural Tanzania and other infrastructural development, it plausible is to assume that opportunities to interact and network are open to all members is the village. ε_{iga} is the unobserved individual heterogeneity, which is assumed to be conditionally independent given $\mathbf{w}_{iga}$, $\mathbf{s}_{ig}$, and θ_{ga}. Given these assumptions, the difference in the utility level from these alternatives for an individual i can be expressed as:

$$\begin{aligned} z_{ig} &= U_{ig1} - U_{ig0} \\ &= (\boldsymbol{\gamma}'\mathbf{w}_{ig1} + \boldsymbol{\alpha}'_1\mathbf{s}_{ig} + \theta_{g1} + \varepsilon_{ig1}) - (\boldsymbol{\gamma}'\mathbf{w}_{ig0} + \boldsymbol{\alpha}'_0\mathbf{s}_{ig} + \theta_{g0} + \varepsilon_{ig0}) \\ &= \boldsymbol{\gamma}'(\mathbf{w}_{ig1} - \mathbf{w}_{ig0}) + (\boldsymbol{\alpha}'_1 - \boldsymbol{\alpha}'_0)'\mathbf{s}_{ig} + (\theta_{g1} - \theta_{g0}) + (\varepsilon_{ig1} - \varepsilon_{ig0}) \\ &= \mathbf{x}_{ig}'\boldsymbol{\beta} + \theta_i + \varepsilon_{ig} \end{aligned} \quad (2)$$

Where $\boldsymbol{\beta} = (\boldsymbol{\gamma}', [\boldsymbol{\alpha}'_1 - \boldsymbol{\alpha}'_0])'$; $\mathbf{x}_{ig} = [(\mathbf{w}'_{ig1} - \mathbf{w}'_{ig0})', \mathbf{s}_{ig}']'$; $\theta_g = (\theta_{g1} - \theta_{g0})$, $\varepsilon_i = (\varepsilon_{ig1} - \varepsilon_{ig0})$. From the principle of utility maximization, it follows that

$$\Pr(Y_{ig} = 1) = \Pr(U_{ig1} - U_{ig0}) = \Pr(z_{ig} > 0) \quad (3)$$

In this model spatial interactions across villages is measures by the spatial correlations of θ_g; these correlations are assumed to be a non-increasing function of geographical distance. That is individuals in a given village g will tend to have more interactions with individuals in neighboring villages j. In spatial econometric sense (cf. Anselin 1988), this interdependence could be characterized by first order spatial autoregressive scheme [SAR(*1*)] given as:

$$\theta_g = \rho\sum_j^m \omega_{gh}\theta_h + u_j; \quad \forall\, g, h = 1, 2, 3, ..., m \quad (4)$$
$$\boldsymbol{\theta} = \rho\mathbf{W}\boldsymbol{\theta} + \mathbf{u} \qquad (\textit{in matrix form})$$

where nonnegative elements of the weights, ω_{gj} are taken to reflect the degree of interactions between village $g$and j and that $\omega_{gj} = 0, \ \forall\ g = j$; and as noted earlier, ρ is a measure of the spatial mobility

(interconnectedness) which is assumed to be stronger for male as compared to female; and noise $u_j \sim iidN(0,\sigma^2)$ (Smith and LeSage 2002). We also assume that

$$\boldsymbol{\theta} \mid \rho \sim N(\mathbf{0}, \sigma^2[\mathbf{B}'\mathbf{B}]^{-1}) \quad (5)$$

Which implies that $\mathbf{B} = \mathbf{I}_m - \mathbf{W}$ has full rank. Furthermore, to allow for the possibility of heteroscedasticity, it is also assumed that conditional on the observed covariates and θ_g then $\varepsilon_{ig} \sim iidN(0, v_g)$, $\forall$ *i and g*. Thus, given this framework, the likelihood of the data can be presented as in equation 6 where ***I***is an indicator function in the appropriate probability space.

$$\Pr(Y = y \mid \mathbf{x}) = \prod_i \prod_g \{I(y_{ig} = 1) I(z_{ig} > 0) I((y_{ig} = 0) I(z_{ig} \le 0)\} \quad (6)$$

2.2. Estimation Strategy

While this model could be estimated using maximum likelihood (ML) technique, Smith and LaSage (2002) show that estimations based on ML are not robust to the assumed underlying assumptions. Instead, they propose the use of Bayesian approach and show that it is robust and offers many more statistics about the distribution of the parameters of interests. Thus, we follow a Bayesian estimation technique as developed by Smith and LeSage (2004). To simplify the computation burden, we give conjugate priors to all model parameters as follows:

$$\boldsymbol{\beta} \sim N(\mathbf{c}, \mathbf{T}) \quad (7)$$

$$r / v_i \sim ID\ \chi_r^2 \quad (8)$$

$$1/\sigma^2 \sim \Gamma(\alpha, v) \quad (9)$$

$$\rho \sim U(\lambda_{\min}^{-1}, \lambda_{\max}^{-1}) \quad (10)$$

$$r \sim \Gamma(m, k) \quad (11)$$

Where we have introduced a hyper parameter r in equation (8) which follows a gamma distribution as specified in equation (11). As discussed in LeSage (1997), low mean of r (around r = 4) reflects the prior belief of possible heteroscedasticity in the model. Thus, in this study we set the mean of r to 4 in order to allow for sufficient divergence of the individual variances v_i from unity to accommodate the non-constant variance and robustify the estimated results.

Given the priors for the model parameters, priors for the model variables ($\boldsymbol{\theta}, \boldsymbol{\varepsilon}, \mathbf{z}$) follows immediately and have been omitted to save space (the reader is referred to full derivations in Smith and LeSage 2004).

It is important to note, however, that for the parameter that measures the spatial mobility and interconnectedness ρ, we have assigned uniform prior that is diffused over the relevant range measured by reciprocal of the minimum and maximum of the eigenvalues of the spatial weight matrix **W** (LeSage 1999). The use of diffused prior in this case ensures that we give all the weight to data in establishing the differences in geographical mobility between men and women. Likewise, in order to give enough weights to data, we have chosen diffused prior for $\boldsymbol{\beta}$ by setting $\boldsymbol{\alpha}$ in equation (7) to zero and the diagonal elements of the covariance matrix **T** to 1.0×10^{12}. All off-diagonal elements of **T** were set to zero as we have no prior knowledge of how the covariance of β is.

The posterior density of this model is non-standard (i.e. unknown distribution). However, Smith and LaSage (2004) show that all the complete conditional densities have standard distributions with the exception of ρ parameter. Thus, to estimate the models, we use a hybrid of Gibbs sampler for all other variables and Metropolis-Hastening for ρ parameter. We carry 45,000 draws and use 20,000 of the earlier draws as burn in. The number of draws and burn-in were set relatively high to ensure that the chain attains a steady state. We also test the convergence in the chain by using Geweke Chi-squared test on the means from the first 20% of the sample versus the last 50% in the chain (Geweke 1992). At any conversion significant level, the test could not reject the null hypothesis that the two samples have the same distribution.

2.3. Decompositions of gender differences

Although the main objective is to investigate the differences between males and females in their propensities to participate in off-farm employment as influenced by their differences in spatial mobility, we first estimate the model for all individuals to set a platform for comparisons. We then run separate estimation for male and for female and make comparison of the propensities to participate using the methods suggested by Jones and Makepeace (1996) and adapted to the probit model by Pagan (2002). We do not use the standard Oaxaca decomposition due to the nonlinearity in the model analyzed here. As adapted for the case of probit model by Pagan (2002), this decomposition is presented as:

$$\overline{P}_m - \overline{P_f} = [\Phi(\overline{\mathbf{X}}_m\widehat{\boldsymbol{\beta}}_m - \Phi(\overline{\mathbf{X}}_f\widehat{\boldsymbol{\beta}}_f)] + [\Phi(\overline{\mathbf{X}}_f\widehat{\boldsymbol{\beta}}_m - \Phi(\overline{\mathbf{X}}_f\widehat{\boldsymbol{\beta}}_f)] \qquad (12)$$

where $\overline{P}_m$ and $\overline{P_f}$ are the mean propensity to participate in off-farm employment for male and female, respectively; $\overline{\mathbf{X}}_m$ and $\overline{\mathbf{X}}_f$ are the vectors of mean values of regressors for male and female, respectively; $\widehat{\boldsymbol{\beta}}_m$ and $\widehat{\boldsymbol{\beta}}_f$ are the estimated coefficients for male and female, respectively; and Φ is the cumulative normal distribution.

Since there are differences among individuals in both gender (e.g. in terms of their education levels) and some factors are of more policy interest than others, we further decompose the gender difference in equation (12) along some selected variables and their respective coefficients. This decomposition is presented in equation (14) for the contribution of covariate x_j on the gender differences and equation (15) for the contribution of coefficient $\boldsymbol{\beta}_j$ (where ∂x_j and $\partial\beta_j$ denote the j*th* component of first and second part of equation 12, respectively).

$$\partial x_j = [\Phi(\overline{\mathbf{X}}_m\widehat{\boldsymbol{\beta}}_m) - \Phi(\overline{\mathbf{X}}_f\widehat{\boldsymbol{\beta}}_f)][(\overline{\mathbf{X}}_{mj} - \overline{\mathbf{X}}_{fj})\widehat{\boldsymbol{\beta}}_{mj}]/[(\overline{\mathbf{X}}_m - \overline{\mathbf{X}}_f)\widehat{\boldsymbol{\beta}}_m] \quad (13)$$

$$\partial \beta_j = [\Phi(\overline{\mathbf{X}}_m\widehat{\boldsymbol{\beta}}_m - \Phi(\overline{\mathbf{X}}_f\widehat{\boldsymbol{\beta}}_f)][(\widehat{\boldsymbol{\beta}}_{mj} - \widehat{\boldsymbol{\beta}}_{fj})\overline{\mathbf{X}}_{fj}]/[(\widehat{\boldsymbol{\beta}}_m - \widehat{\boldsymbol{\beta}}_f)\overline{\mathbf{X}}_f] \quad (14)$$

Since the theoretical distribution of any of these components is not known, we use bootstrap technique to establish the empirical distribution of all these components. We draw *n* bootstrap samples for male and female categories, where *n* is the largest sample size between male and female sample. In drawing the bootstrap samples for the estimated coefficients, we rely on the variance-covariance matrix of the estimated parameters from the Bayesian techniques explained in section 2.2.

3.0Variable Definitions and Data Sources

As in many studies of individuals' participation in off-farm employment (cf. Woldehanna 2000; Reardon et al. 2001; Pagan 2002) and on the basis of the framework presented in section 2.1, the determinants of the individuals' decision to participate in off-farm employment are individual and household characteristics (e.g. time endowment vs. other capital stock in the household such as land and livestock) and the characteristics of the local (community) labor markets (which determines the wage rates and the search and other labor market transaction costs). In this section we define and operationalize these variables in the context of Tanzania's rural areas. The main sources of the data used are the Tanzania 2000/01 Household Budget Survey (HBS) and IFPRI spatial (GIS) data.[3]

The 2000/01 Household Budget Survey (HBS) was a nationally-representative survey which included 22,178 households. Households interviewed were selected from the regional sample of the National Master Sample (NMS). Fieldwork was conducted between May 2000 and June 2001, where between 12 and 24 households were surveyed in each sampled area. Since the focus of this paper is on rural off-farm employment, the analysis is limited to only those individuals from the survey clusters classified as rural or mixed (the later category refers to clusters which share both rural and urban characteristics). In total therefore we are analyzing 30,525 individuals from 10,473 households located in 660 villages distributed throughout Tanzania Mainland. For more details of this survey the reader is referred to NBS (2002).

As pointed out in Section 2, the dependent variable is a dichotomous variable taking the value of one if the individual participated in rural off-farm employment, which includes paid labor and/or off-farm self employment (Pagan 2002; Jeong and Townsend 2002; Kaboski and Townsend 2002). From the theoretical analysis in Section 2, the explanatory variables have been generally grouped into individual characteristics, household characteristics, and attributes of the community (location) characteristics. Each of these categories is explained as follows:

a) Individual characteristics

1. Education: In deciding whether or not to participate in off-farm employment, education level and other human capital acquired by a particular individual are among important factors to be considered (Woldehanna 2000; Reardon *et al*. 2001). It has been shown in many other studies that years of schooling increase the likelihood of an individual to participate in off-farm employment. Huffman and Feridhanusetyawan (2003) argue that human capital is an important factor determining whether a household would take a non-farm job because it shifts the wage offer curve upward and increases access

[3] The original source of the GIS database on Tanzania is Mud Spring Geographer (MSG) Inc. However, most of the data used in this study has already been modified by IFPRI researchers to suit their poverty and malnutrition mapping project in Tanzania. We would like to thank Todd Benson at IFPRI for providing the data and technical assistance.

to off-farm self-employment. Edriss*et al*. (2004) argue, however, that the effect of education is likely to reduce participation in rural wage employment. However, since most of the rural off-farm employment takes the form of self-employment, the argument of Huffman and Feridhanusetyawan (2003) is likely to hold in Tanzania than that of Edriss et al. (2004). Thus, the coefficient for education is expected to have positive sign. While the formal years of schooling of an individual in all these levels could potentially be known, the survey collected information only on the highest level of education the individual has attained. However, using the highest level of education the individual attained in deriving the number of years of schooling could not give reliable estimates because of the frequent repetition, especially in lower classes. This study, therefore, adopts the dummy variable approach as used in Pagan (2002), where the dummy for education (*educ*) is one if the highest education level attained by the individual is above primary education and zero otherwise.

2. Age of the individual: Age is primarily used as a proxy for labor market experience, although admittedly, it also captures changes in employment outcomes over the life cycle (Pagan 2002). In this analysis, we only consider participation of those individuals aged between 15 and 65 years. The choice of this age interval is based on the definition of labor force in Tanzanian context, whereby, individuals below 15 years of age are considered to be in their compulsory primary school period. Also, individuals aged 65 and over are considered to have retired from the labor force. The retirement age in the formal sector is 60.

3. Household head, sex, marital and health status: Other individual characteristics that are included in the estimation are sex, marital status, health status, and household headship. Studies in both developed (cf. Lee 1998 on rural off-farm employment in Germany) and developing countries (cf. Woldehanna 2000; Pagan 2002; Reardon *et al*. 2001) show that the households tend to favor male participation more than female. Likewise, the marital status and whether the individual is the head of the household are expected to affect participation rates because of the responsibility associated with these statuses. Thus, this study includes the following dummy variables: *sex* equal to one if the individual is male and zero if female; *head* equal to one if the individual is a head of the household and zero otherwise; and *marital* equal to one if the individual is married and zero otherwise. Moreover, individuals who are sick can not participate fully in the labor force (see a recent study on Tanzania by Arndt and Wobst (2002). Thus, we have also included the health status of the individual in the regression. The proxy for this is the dummy variable illness, which is equal to one if the individual had fallen sick in the past thirty days preceding the interview.

b) Household characteristics

1. Land and cattle endowments: Land and cattle are among the assets considered important in influencing the decision to work off-farm (Singh *et al*. 1986). Members of households endowed with relatively large amount of land are likely to participate less in the rural off-farm employment because most of its labor will be required to work on the household farm. This also applies to the number of cattle the household has. Thus, household with large head of cattle will tend to retain its labor within and therefore reduces their participation in the rural off-farm employment. To operationalize household land endowment, this study takes total pasture and crop land that the household has in relation to the workforce of the household. The workforce of the household is defined as the number of individuals in the household of the age between 15 and 65 years. Thus, we include per capita household land (*pland*) as one of the explanatory variables and its expected sign is negative. For the case of cattle, we also take per capita number of cattle in the household (*pcattle*), where again the expected sign is negative.

2. Household size: It is generally argued that large household size increases the likelihood of participating in off-farm employment because large household size means more labor supply, some of which can then be allocated to work off-farm (Woldehanna 2000). However, to ensure that the household size reflects the available labor force in the household, the study includes the number of individuals in the household whose age lie between 15 and 65.

4. Other labor intensive activities: We have also included other labor intensive activities that characterizes the rural households, namely water fetching and firewood collections. Both of these activities have been observed to consume a significant proportion of household time in other rural settings (Madulu 1995). As in these two cited studies, the present study uses a dummy (*wood*) equal to one if household's main source of energy is firewood and zero otherwise. This is a reasonable proxy for the time consumed while collecting firewood because of the low development of firewood and wood charcoal in the rural area (Madulu 1995).

For the time used in fetching water for domestic use, the study develops two dummy variables as follows: *prwater* equals one if the household has private water connection and zero otherwise. The study also includes another dummy; *puwater*, which equals one if the household has access to private/public tap water from its neighboring household/public tap; and zero otherwise. The rest of the water sources are taken as reference group[4]. Thus, it is expected that households that have access to these two types of water source have more time to participate in the off-farm activities. Thus the two water availability dummies are expected to have positive influence in the participation in the rural off-farm activities.

c) Community variables:

In this category of explanatory variables we define and opreationalize the community variables that reflect the rationing, search and transaction costs in participation in the rural off-farm employment (Woldehanna 2000). We use current socio-economic conditions in the community of residence that have the bearing on the household perception of and participation in the rural employment. Other studies (cf. Pagan 2002) use the number of inhabitants in the locality of residence, regional dummies, and an agricultural sector dummy as the proxies for local labor market and economic conditions. We have included the proportion of individuals with education level above the primary education in the village (*educ_v*). Due to externality of education, the increase in these variables in the village is expected to be associated with increased participation in the off-farm employment (Huffman and Feridhanusetyawan 2003). As in Pagan (2002), we have also included population density (*pop_d*) at the village level as proxies for urbanization. As the population increase, it is expected to increases urbanization features which are likely to promote off-farm employment.

The easiness with which households may obtain information regarding off-farm business and wage employment from the neighborhood depends on the performance of the transport network and closeness to the trading centers. Thus, we also include three distance measures to reflect (as proxies of) search and transaction cost in the participation in the rural off-farm activities. The first one is the distance to the road (*dist_rod*) and the second is the distance to the regional headquarters (*dist_re*). We also include *dist_da* which is the distance to Dar es Salaam, the commercial headquarter, as done in Tanzania poverty mapping exercise (Benson 2002).

[4]The HBS included 12 sources of water, but we consider private tape water in the house or outside the house and public water and water access in the neighboring households as the most labor saving sources compared to other sources such as river, lake, etc.

4.0 Discussion of the results[5]

4.1. General overview

Table 1 present the regression results of the probit model with spatial dependence as discussed in section 2. Since one of the objectives of this paper is to investigate the gender differences in spatial mobility, we first discuss this aspect of the model before moving to the decomposition of other factors.

Spatial mobility

The parameter that measures spatial interconnectedness is *rho* (which appears in the last row of Table 1). It is apparent that in the pooled sample of all men and women, the spatial interconnectedness is statistically significant (in the sense that the 95% Highest Posterior Density Interval (HPDI) does not include zero). However, estimating the participation of women and men separately, it turned out that the spatial interconnectedness only applies to men. The 95% HPDI for women contains zero while that of men does not. This finding thus confirms our hypothesis that despite the increased participation of women in the off-farm activities, they still lack geographical mobility as compared to men. Assaad and Arntz (2004) and Mituhall (2004) also observed similar phenomenon in Egypt an in Kenya and attributed it to the low commuting rates among women as compared to those of men.

In general, it can be argued that there is danger that the increased women participation is likely to derive down the wage rates or exhaust other off-farm opportunities as they fail to explore opportunities outside their localities. Schultz (2002) observes the repressed return as results of lack of geographical mobility even though the focus of Schultz was explaining rural-urban wage differential in selected African countries. Wunder (2001) has emphasis in showing the role geographical mobility has on poverty alleviation. Since much of the women's immobility is culturally determined (cf. Fletschner and Michael Carter 2003) and since changing cultural factors takes time, in the short run, effects should be directed to make rural off-farm employment among women as diverse as possible. This will not only increase the women opportunity to participate but it will also reduce unnecessary competition among them.

Individual characteristics:

Table 1 shows that all individual characteristics, for which expected directions of effects are known (namely sex, age, sickness, and education), have their expected signs and are all significant, in the sense that the 95% highest posterior density interval (95% HPDI) does not include zero. Marital status is also significant but positively increases the participation of male and reduces that of women. Being head of the household also increases male's as well as female's propensity to participate. Education has positive and significant influence in the propensity to participate while illness (diseases) reduced participation. Since education turned to have positive effects on off-farm employment participation, our results support the argument that education shifts the wage offer curve upward and increases access off-farm self-employment (Huffman and Feridhanusetyawan 2003). As we argued earlier this indicates the predominance of off-farm employment in the form of self-employment. Furthermore, regarding marital status and headship of the households, the results show that non-married women who are heads of household tend to have increased participation in off-farm employment as compared to married women who are not heading the households. This finding tallies well with recent increase in the proportion of female headed households in Tanzania (NBS 2002); although it can not be said conclusively which one causes the other (Mduma and Mushi 2005).

[5] Note that, because we are dealing with fairly large sample, we have chosen that in all hypotheses/tests the decisions are based on 5% significant level or 95% Highest Posterior Density Interval (HPDI).

Household characteristics

In the general model, household size has negative effects on males' participation but a positive effect for the participation of women (the effects are significant as the 95% HPDI does not includes zero). These alternative effects point to a probable explanation that large household sizes, from the women viewpoint, are likely to reduce the probability of inheriting lands, thus increase involvement in off-farm employments (Mduma 2006). This argument is based on the fact that till now, most household land is passed (bequeathed) to sons as compared to daughters except in few matrilineal societies (Mduma and Mushi 2005). The other household asset that has significant effects on the propensity to participate in off-farm employment is land. However it turned out that cattle has no significant effects. As expected, reduction in the time used to collect water and firewood is associated with increased participation in off-farm employments. Thus, our findings support the view that time used to collect firewood reduces both male and female participation. In general, these results imply that policies that reduce time used in the collection of firewood and water will increase the participation of women in the off-farm employment (Adam *et al*. 2004; Madulu 1995).

Table 1. Determinants of participation in off-farm employment across gender

	Whole sample			Male sample			Female sample		
Variable	Coeff	HPDI		Coeff	HPDI		Coeff	HPDI	
		lower	upper		lower	upper		lower	upper
constant	-17.6	-20.19	-14.90	-21.45	-25.70	-17.43	-20.92	-25.25	-16.72
sex	0.27	0.21	0.33						
age1	8.69	7.22	10.16	10.90	8.67	13.26	10.60	8.16	13.11
age2	-1.17	-1.38	-0.97	-1.45	-1.78	-1.14	-1.47	-1.83	-1.12
head	0.67	0.59	0.74	0.43	0.30	0.55	0.76	0.63	0.89
marito	-0.01	-0.07	0.05	0.14	0.03	0.24	-0.15	-0.26	-0.04
educ	1.05	0.98	1.12	0.98	0.90	1.07	1.24	1.13	1.36
hhsize	0.00	-0.02	0.01	-0.03	-0.04	-0.01	0.02	0.00	0.03
illness	-0.19	-0.25	-0.12	-0.13	-0.21	-0.04	-0.29	-0.40	-0.17
prwater	0.22	0.12	0.32	0.25	0.12	0.39	0.25	0.07	0.43
puwater	0.05	-0.04	0.15	0.15	0.03	0.27	-0.06	-0.22	0.11
wood	-0.66	-0.73	-0.60	-0.66	-0.74	-0.57	-0.81	-0.93	-0.69
pland	-0.06	-0.09	-0.04	-0.08	-0.11	-0.05	-0.06	-0.11	-0.01
lcatle	-0.03	-0.07	0.00	-0.02	-0.06	0.03	-0.05	-0.12	0.02
educ_v	1.59	1.13	2.03	1.60	1.08	2.13	1.68	1.12	2.27
lpopd	-0.09	-0.21	0.04	-0.06	-0.20	0.08	-0.12	-0.28	0.03
popd2	0.11	-0.17	0.40	0.01	-0.31	0.34	0.28	-0.09	0.65
ldist_ro	-0.04	-0.08	-0.01	-0.06	-0.10	-0.01	-0.03	-0.08	0.02
ldist_re	-0.04	-0.10	0.03	-0.07	-0.14	0.01	0.04	-0.03	0.10
ldist_da	-0.06	0.13	0.02	-0.04	-0.12	0.04	-0.08	-0.15	0.01
rho	0.67	0.51	0.82	0.64	0.47	0.79	0.21	-0.45	0.78

Community characteristics

The results of these variables is somewhat mixed. For example, effects of population density on the estimates of the whole sample show a quadratic pattern. As the population density increase, its impact is reflected on the increased competition in the rural off-farm employment, resulting in a decline in the propensity to participate (Pagan 2002). However, after some point, as population density increases, the location acquires some urban features which favor the growth and participation in off-farm activities. Despite this clear pattern in using the whole sample, the effects of population density is no longer significant in separate estimation of male and female.

Education level in the village has positive and significant effects on the participation of male and female. All distance measures have the expected sign, but it turned out that only distance to the nearest roads was significant for both male and female. Distance to the regional capitals is only significant for male, again reflecting the low geographical mobility among women as compared to men (that, the distance to the regional capitals is already too far for women). The distance to Dar es Salaam is not significant, reflecting the fact that Dar es Salaam is too far for most individuals in the rural areas (except few villages surrounding the city) to be considered for decisions about off-farm employment. Of course, when it comes to the migration decisions, even distance to Dar es Salaam city is likely to be an important factor because Dar es Salaam offers immense job opportunities as compared to other regional capitals (World Bank 2002). .

4.2. Factor decompositions across gender

In this section we present the Jones-Makepeace decompositions of factors affecting participation in off-farm employment across gender. The results are based in Bootstrapping techniques as discussed in Section 2. Table 2 shows that overall off-farm employment is still biased in favor of men despite the modest increase in women participation in the 1990s (NBS 2002). Overall, in 100 individual women participating in off-farm employment, there will be nearly 104 men participation also. This inequality is relatively lower compared to those reported in other rural studies (e.g. Pagan 2002 reports 16 men in excess of women for every 100). Furthermore, our results show that the differences due to endowments and other factors included in the estimation (which we name as 'justified' or 'explained') is different from those reported by Pagan. The 95% confidence interval (the last two columns in Table 2) does not contain the estimate of Pagan of 58%. However, we cannot compare further these results with Pagan's estimates because Pagan's study does use neither delta method nor bootstrapping to provide the distribution of the estimates.

Table 2: Decomposition analysis of gender differences in the participation in off-farm employment in rural Tanzania

	mean	std	min	max	95% CI	
					lower	upper
Justified (*in 100s*)	2.41	0.46	0.74	4.51	1.69	3.21
Unjustified (*in 100s*)	1.10	0.35	-0.06	2.66	0.57	1.71
Total (*in 100s*)	3.51	0.79	0.70	7.09	2.28	4.89
% of total inequality						
Justified	68.57	58.18	105.15	63.65	73.93	65.62
Unjustified	31.43	44.28	-8.46	37.55	24.97	35.04

Figure 1 portrays the empirical distributions of the explained (justified) and unexplained (unjustified) and the sum of the two. To ease comparison, the three graphs used the same basis of the kernel. The curves were drawn using Gaussian kernel with the bandwidth of 1.06 * std(x) * n^(-1/5) as suggested by Silverman (1986).

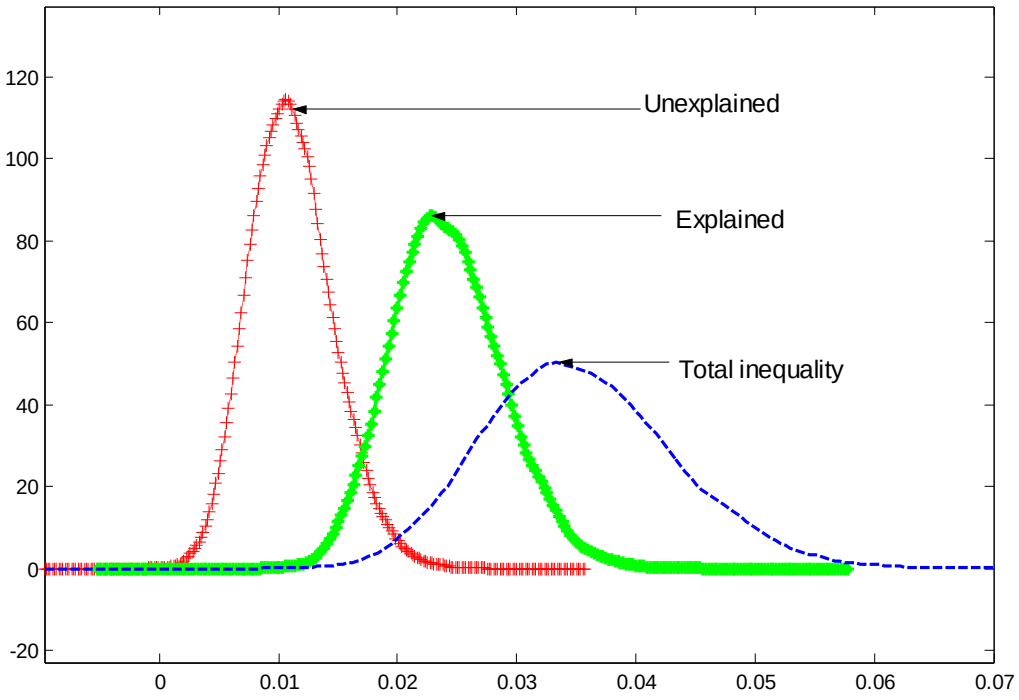


Figure 1: Overall decompostion of gender inequality in participation in off-farm employment in Tanzania

The graphical analysis reveals that much of the variations in the observed gender inequality come from the variations in the endowment and other observed factors and that the unexplained gender differences seem to have relatively small variations than the explained inequalities. This implies that the underlying 'structural-cultural' factors that influence gender inequality seem also to be relatively invariant/stable. In fact this was to be expected because most of the unobserved factors that influence participation in off-farm employment are cultural in nature and should not be expected to vary significantly in relatively homogenous rural societies, particularly with respect to women's participation in off-farm employment (Mitullah 2004). However, we note that a cross-time comparison study is likely to reveal more interesting pattern of dynamic path of the changes in these factors.

More insight are also obtained if we decompose further the explained (justified) and unexplained (unjustified) into contributions from each of the factors and parameter of model results presented in section 4.1. We note however that we need to focus only on factors that turned out to be statistically significant. Also we limit the analysis to the effects of headship of the households, marital status, education, health status, time saved from water collection, education level in the village. The choice of variables such as headship and marital status is based on the need to assess how the recent increase in proportion of female headed households (without necessarily increase in widowhood) might have affected the participation in off-farm employment (Mduma and Mushi 2005). The choice of the rest of variables is

based on their policy relevance as opposed to sheer model calibrations. The results of this analysis are summarized in Table 3 and Table 4.

Table 3: Comparison of the contributions of selected factors to gender differences in the participation in off-farm employment

	mean	std	95% CI	
Explained as % of total differences			lower	upper
hh_headship	49.47	5.15	41.03	57.68
married	-1.60	0.89	-3.20	-0.31
education	17.79	2.19	14.59	21.71
illness	2.02	0.84	0.70	3.46
water time	-0.43	0.42	-1.17	0.15
village_education	-0.13	0.54	-1.04	0.73
unexplained as % of total differences				
hh_headship	-4.49	1.63	-7.31	-2.02
married	14.56	5.65	6.33	24.63
education	-2.48	0.82	-3.88	-1.21
illness	4.14	2.30	0.59	7.99
water time	0.08	2.78	-4.40	4.72
village_education	-1.46	9.97	-17.19	15.08

Table 4 presents the contributions of the selected factors to the total gender differences. Thus, the results in Table 4 show that much of the gender differences can be attributed to headship in the household. However, the unexplained difference that could be associated with household headship is negative showing that for some reasons not captured in the model, female heads of households will tend to narrow the gender differences. Probably, this could be explained by some credit programs that purposefully target the female heads of households (Temu *et al*. 2001; Mduma and Mushi 2005).

Table 4: Contribution of selected factors to explained and unexplained gender differences in the participation in off-farm employment

	mean	std	95% CI	
			lower	upper
Contribution explained differences (%)				
hh_headship	71.39	5.14	62.43	79.25
married	-2.35	1.37	-4.82	-0.44
education	25.84	3.96	20.33	33.00
illness	2.93	1.25	1.01	5.08
water time	-0.62	0.62	-1.72	0.22
village_education	-0.19	0.80	-1.53	1.06
Contribution unexplained differences (%)				
hh_headship	-14.87	23.77	-24.56	-6.91
married	49.35	99.54	20.21	89.09
education	-8.40	21.81	-13.80	-3.90
illness	14.23	57.41	1.85	28.20
water time	0.41	19.86	-14.94	15.83
village_education	-4.02	76.00	-58.04	51.84

In general, the results show that under the current status quo, education still explains a substantial part of the observed gender differences in the participation in the off-farm employment. However, there is an unexplained effect associated with education that tends to narrow the gender differences. This implies that education policies that increase the level of education of women can potentially reduce the gender differences. It is interesting to note that education level in the village in general tends to reduce the gender differences, which again support the need for general education in order to reduce the gender difference.

Likewise, observed individual health status also in reducing gender differences. Furthermore, unexplained effects associated with individuals' health status are by far the major source of the observed gender differences as compared to observed health status (the proportion of women who fell sick was large that of men). The results also show that reduction in time needed to collect water is likely to narrow the gender differences. This reflects the typical gender division of labor in many rural households in

Tanzania, where male labor is less used in water collection. Thus, the availability of water in the household releases more female labor than male labor. However, the effect is quit modest as compared to other factors.

5.0 Conclusions

This paper has investigated the gender differences in the participations in off-farm employment in rural Tanzania in two respects. First, it looked at the gender differences in spatial interconnectedness/mobility; secondly, it decomposed the observed gender difference in participation in off-farm employment into explained and unexplained differences. The first aspect was motivated by the recent increase in women participation in off-farm employment. But the argument was: if the increased participation is not accompanied by increased geographical mobility, then there is danger that it will soon saturate the local labor market/off-farm opportunities and dampen the rural wages among women as compared to men (who are generally geographically mobile). The second aspect was motivated by the need to understand underlying factors in the observed gender differences in off-farm employment.

The results show that generally women do not have significant geographical mobility, thus tends to operate more locally. Thus, unless there are purposeful efforts to diversify their activities, women's increased participation is likely to saturate the local markets quickly as compared to men's participation. The results of decompositions of gender differences indicated that a substantial portion of the gender differences is not explained by individuals' endowments. However, policy interventions that could narrow the education gap between male and female are likely to narrow the existing gender gap. Likewise, policies that increases access to water (reduce time needed to collects water) have the potential of reducing gender differences.

In generally this study shows that gender imbalance is still an issue. Since geographical mobility among women is likely to be dictated by cultural factors that tend to have policy inertia, in the short run, there is need to create more opportunities for women within the rural areas. In the long run, factors that make women immobile and sticky to localized markets as compared to men should also be addressed.

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