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# Off-farm Employment and Income Poverty in Favourable Agro-climatic Areas of Tanzania: Evidence from Kilombero Valley

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## Abstract

Income poverty in Tanzania as elsewhere in developing countries is predominantly a rural phenomenon and affects largely households relying on subsistence farming. This is despite the fact that poverty reduction strategies have devoted increasing attention on the role farm employment in enhancing household income. This paper argues that, off-farm employment may have potential to contribute to reduction of rural households' income poverty. Hence the main objective of the paper is set to examine effects of off-farm employment on income poverty. Data was collected from a random sample of 309 households in the first quarter of 2014 in five villages of Kilombero Valley, Tanzania using a structured questionnaire. Income poverty was analysed using the Foster-Greer-Thorbecke (FGT) poverty index and two stage least square (2SLS) regression. Households with off-farm employment income were found to be less poor based on all the three FGT parameters which are incidence, depth and severity of poverty. Similarly, estimations from the 2SLS model showed that holding other factors constant, engagement in off-farm employment led to increased total households income, and hence a significant predictor of households' poverty status. Other variables which were significant are; crop shock, farmland location and land ownership. It is thus recommended that, rural development policies should be broad based to consider the diversity of households' income strategies including engagement in rural off-farm employment activities. Increasing opportunities for off-farm income generation may be a route out of poverty among rural households.

**Keywords:** off-farm employment, off-farm income, FGT poverty measure, Kilombero Valley

## 1. Introduction

Magnitude of rural poverty is overwhelming among developing countries that are reliant on agriculture as their mainstay of the economy (Jatta, 2013). The agricultural sector not only fails to employ surplus rural labour but also its income stream is subjected to high risks resulting from agro-climatic and market related factors (Barret et al., 2001; De Janvry et al., 2005). Consequently, income poverty is a common feature for households that rely on subsistence farming alone. It is however a well established fact that rural households have highly diversified income sources combining farm and off-farm activities in their portfolio of livelihood strategies (Ellis, 2000; Barret et al., 2001; Urassa, 2009). Off-farm employment, has been recognised to play a great role in raising rural households income and reducing poverty (Lanjouw and Murgai, 2009; Himanshu et al., 2011) and provides a buffer against income fluctuation (Lanjouw and Lanjouw, 2001). These roles are achieved because of substantial contribution of off-farm employment to household's income in the developing countries. For example, by mid 2000s, non-farm income<sup>1</sup> as a share of total household income averaged 35% for Africa and 50% for Asia and Latin America (Haggblade et al., 2007). This shows that off-farm employment substantially complement rural household income in Africa economies Tanzania included.

The Tanzanian economy is largely characterized by rural, mostly subsistence based agriculture which sustains the livelihoods of more than 70% of the population (URT, 2011a & 2011b). Despite the impressive historically high economic growth (GDP) of 7% in over the past 6 years (Wuyts and Kilama, 2014), the income poverty has declined very slightly over the same period and poverty levels remain notoriously high. In addition, this decline is marked by a significant rural-urban disparity. Recent data from the 2012 household survey, show that the incidence of poverty (headcount ratio) was 33.3% and 21.7% for rural and urban areas respectively (NBS, 2014a). These statistics depict just a minor decline from the rates of 39.4% (rural) and 22.7% (urban) (NBS, 2014a) reported in 2007. Other poverty indicators such as inequality still reflect an increasing poverty trend as the Gini coefficient has increased from 0.36 in 2008/9 to 0.39 in 2012/13 (NBS, 2014b). While the inequality rate in urban areas has remained constant at 35% between 2008/9 to 2012/13, the Gini coefficient in

<sup>1</sup>This share of the contribution reported by the author excludes farm wages which is considered as part of 'off-farm' employment in this study

rural areas has increased from 31% to 34% in the same duration (NBS, 2014b).

The above statistics suggests a steady increase in inequality, particularly in rural areas indicating that reported high GDP growth is not broad based and the growth effect does not trickle down to the rural poor. The implications that one draws from these poverty statistics is that, the agricultural sector which is the mainstay of the economy, employing the majority (about 70%) of the workforce is associated with poverty.

It is with this understanding of the poverty profile described above that this study was carried out in the rural area of Kilombero Valley, which is regarded as one of favourable agro-climatic region in Tanzania. Unveiling potentials of off-farm employment in addressing relevant parameters of income poverty is thus of considerable interest. Hence, to achieve this purpose three specific objectives were set: first, to compare the incidence, depth and severity of poverty for households groups with different off-farm income sources in the study area; second, to examine the distribution of incidence, depth and severity of poverty across study villages; and third, to estimate the contribution of the different categories of off-farm employment, i.e wage employment, non-farm self-employment and other individual and household capital assets on a household's total income. For a clear empirical strategy, a hypothesis stating: 'engagement in off-farm employment has a positive income on household total income' was developed based on the third objective.

The rest of the paper is organized as follows: Section 1.2 provides a literature review focusing on the relational aspect between off-farm employment and poverty with emphasis on poverty measures used in different studies. Description of the study area and methodology is presented in section 2 whereas the results and discussion are covered in section 3. Lastly, Section 4 presents the conclusions.

## 1.2 Off-Employment and Poverty

This section provides an overview of studies that have explored the link between off-farm employment as a diversification strategy and poverty. But first and foremost, the two main concepts used in the paper are defined; Definition and conceptualization broad and multidimensional concepts such as poverty and off-farm employment is of relevance as definitions determine empirical measures to be used. Generally, the paper's conception of poverty is based on monetary terms and is defined as a state of having an income shortfall or low income. By this conception, income poverty line is employed as a benchmark to distinguish poor from non-poor households. Further measurement issues are described in detail in subsection 2.3. On the other hand off-farm employment is defined as activities from which households engage and generate income apart from their 'own' farm work. These activities include i) farm wage jobs on plantations or other people's farms, ii) non-farm wage-employment and ii) non-farm self-employment in trading, construction, transport, and services sector. In the same vein off-farm income is thus obtained when the household heads or spouses work off-the farm in one or all of the three off-farm activities described above.

Studies that have explored the off-farm–poverty link can broadly be put into two dimensions; these are those which treat off-farm employment as having disaggregated functional categories as described in the definition above (e.g. Lanjouw and Shariff, 2004; Reuben and van den Berg, 2001) and those that consider off-farm employment as a single homogeneous sector (e.g. Portocarrezo *et al.*, 2006; Akaakohol and Aye, 2014; Katega and Lusupilo, 2014).

Treating different functional off-farm categories separately and using country representative data in India, Lanjouw and Shariff (2004) show that, generally, off-farm employment does not benefit the poor in terms of income accumulation because they are simply pushed to low earning casual agricultural wages for survival needs. Another related study by Reuben and Van den Berg (2001)<sup>1</sup> shows that it is non-farm self-employment and not farm wage that contributes to reduction of income poverty by enhancing agricultural production and income.

Among studies that have not separated off-farm categories, Akkakahol and Aye (2014) provide empirical evidence from Nigeria that diversification into off-farm activities is associated with increased level of welfare. The authors, though, could not explicitly state the welfare measure used. De Janvry *et al.* (2005) used a detailed household survey from rural China to simulate counterfactual data of rural households' income, poverty and inequality without non-farm income. The authors found that without non-farm employment, rural poverty would be much higher and deeper, and that income inequality would be higher as well.

In another perspective of associating poverty and off-farm employment, a micro level study of 10 rural sub-villages conducted in Tanzania, Ellis and Mdoe (2003) concluded that rural poverty was attributed to lack of non-farm alternatives. In another related study Katega and Lufulilo (2014) concluded that off-farm employment has an income poverty reducing effect in less productive agricultural areas of central Tanzania. In contrasting evidence, Portocarrezo *et al.* (2006) found that non-farm self-employment was not an important sector for jobs and income among rural populations because of predominance of low earning marginal activities in which

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<sup>1</sup> The authors used the term non-farm employment and not of off-farm employment. However, similar to the present study they also included farm wage category in their conceptualization of 'non'- farm employment.

people are engaged. As a result of these contradicting views of poverty effect of off-farm employment there is no conclusive evidence.

Using a decomposable poverty measure, Foster-Greer-Thorbecke (FGT) developed in Foster *et al.* (1984) which is the approach that this paper adopts, Mat *et al.* (2012) found that when non-farm income and unearned income are added to households income there is reduction of poverty incidence and depth by about 55% and 63% respectively. These findings provide evidence that not only does off-farm employment have an effect on head count ratio (poverty incidence), but more importantly it also reduces the extent to which households fall into poverty (depth), implying an inequality reducing effect.

Literature on Tanzania (e.g. Dercon and Krishna 1997; Ellis and Mdoe 2003; Katega and Lufulilo 2014) shows that the specific contribution of off-farm employment on income poverty has not been based on decomposable poverty measures. This calls for the need for a more nuanced approach that considers decomposable income poverty measures such as FGT index. Furthermore, two additional important conclusions can be made based on the literature reviewed so far; First, the effect of poverty depends very much on, and needs to be disaggregated by categories. This is based on the fact that off-farm employment itself according to Van de Berg and Reuben (2001) is very heterogeneous largely in terms of capital and skills requirement. Secondly, for a targeted and guided poverty policy, identification of extent and depth of poverty using different population subgroups based on their income sources is relevant. The study thus intended to address the Tanzania specific knowledge gap related to the impact of off-farm employment on income poverty reduction and at a much broader perspective to enrich off-farm-poverty literature. Hence, conducting a location specific micro level study such as the present one was of empirical and policy relevancy.

## **2. The Study Area and Methodology**

The Study was conducted in Kilombero Valley which is a swath of fertile lowland spreading across Kilombero and Ulanga Districts in Morogoro region. The study area is located about 300km southeast of the Tanzanian commercial city of Dar es Salaam. The area contains the largest freshwater wetland at low altitude (<300 m above sea level) in East Africa and one of the largest flood plains in Africa (Kangalawe and Liwenga, 2005). This feature implies favourable agriculture productivity of the area. Subsistence farming is the main source of income, with paddy being the main crop. Other crops grown include maize, sesame, banana and sugarcane. Despite being a productive wetland, farming opportunities are severely affected by unreliable rainfall, poor infrastructure leading to poor crop income among farming households in Kilombero Valley compared to other wetlands (McCartney *et al.*, 2010). It has further been reported that due to the influx of agro-pastoralists migration into the Valley, farming, which is the main income earner has been affected by serious land scarcity problem (Nindi *et al.*, 2013). Consequently, this contributes to income poverty for farming households in the area.

### **2.1 Data Collection**

Data used for this paper originated from a survey conducted in two phases. During the first phase, a reconnaissance survey was conducted in August 2013 to glean a broader understanding of the off-farm activities and poverty status in the study areas. During this exploratory survey, discussions were held with different stakeholders including farmers, village leaders and district community development officers in Ulanga and Kilombero Districts. Participatory wealth ranking (PWR) was also conducted in two villages (Malinyi and Lupilo) out of five study villages. This preliminary survey also involved pre-testing of the questionnaire. The findings from this stage were used to refine the study objectives, sampling methods and the survey instrument. The second phase involved actual household survey which was undertaken from February 2014 to May 2014. The questionnaire was administered to household heads by a team of three trained enumerators who were trained prior to the survey and the researcher. Questionnaires captured salient aspects of socio-economic and demographic attributes of households. Information of household members' engagement in and type of off-farm income was also captured. PWR for the other three villages was also conducted during this phase.

Household was used as the unit of analysis whereby questionnaire was administered to the household head. By asking a household's head on behalf of other members the unitary household modeling is evoked. Based on this model, decision making on engagement in off-farm employment is vested on the household head. In absence of the head, a spouse or any adult member was interviewed. Other members of the households were also encouraged to be around during the interviews to assist in items that needed recalling of information. A household was defined based on Tanzania's household budget survey (NBS, 2014a) in which a household is referred to as people who live together and share income and other basic needs and maintain the same centre of production and consumption.

### **2.2 Sampling**

Based on observation prior to the survey and discussion with key informants at the districts and village levels a

total of 5 villages representing two attributes of interest (Table 1) were purposively selected. These attributes were endowment with agricultural resources, which is farm land, and accessibility in terms of presence of an asphalt road connecting a village to other urban areas. Mwaya and Lumemo villages were considered as being well connected in terms of infrastructure but poor in resources where as Mngeta, Lupilo and Malinyi were regarded as less connected and resource rich villages. These two attributes of resources and accessibility were set as selection criteria because they were expected to influence both households engagement in off-farm employment and poverty status as detailed in the discussion section.

**Table 1. Location and Sample Size Selection by Study Villages**

Village	Accessibility	Agriculture potential	No. of households	Sample size
Mwaya	Accessible	Poor in resources	1 135	56
Lumemo	Accessible	Poor in resources	1 487	74
Lupilo	Remote	Rich in resources	1 389	69
Mngeta	Remote	Rich in resources	1 211	60
Malinyi	Remote	Rich in resources	1 307	65
Total			6 529	324

Source: Household numbers were obtained from five study villages' registers. The sampling intensity was 5% for each village.

Since the study's interest was on farming households, the analysis considered households who possessed some land under cultivation in 2012/13 agriculture season. Accordingly, a total of 324 households were selected using stratified random sampling. However there were incomplete information for 15 households, and thus the analysis worked with sample size of 309. Based on Gray (2014) a sample of 30 or more is recommended in experimental researches. In each village, households were stratified into three wealth categories. This stratification was conducted through participatory (PWR) with the aid of 4 selected key informants in each village. These were four individuals (1 sub-village leader and three villagers) who are knowledgeable of the poverty status of most households in the village. Based on the PWR households were randomly picked in proportion to each stratum. In carrying out the random process all the names of eligible households were written on piece of paper and thereafter random picking was done to obtain the required sample for each village. For the household survey a sampling intensity of 5% for each village was found adequate (Table 1). In addition, purposive sampling was employed in selection of key informants in the study area. These included 2 district community development officers, 1 village executive officer (VEO), and 3 villagers from each study village. These 3 villagers were chosen based on their familiarity with the socio-economic status of other villagers (Households) which is a useful criteria for PWR.

### 2.3 Data analysis and Measurement

Data was analysed using descriptive statistics, Foster, Greer and Thorbecke (FGT) poverty index and a two stage least square (2SLS) regression. Descriptive statistics were used to describe households' socio-economic profiles and included means and percentages. These analytical procedures were employed to address specific objectives set as described in the subsequent sections that follow. STATA statistical software package version 13 was used to carry out analysis.

The first and second objectives were analysed using the Foster-Greer-Thorbecke (FGT) decomposable poverty index. FGT measures are useful to assess the overall level of poverty by subgroups of populations e.g. groups defined by income sources or village boundaries on which this analysis focuses. Subgroups of sampled households in the current paper constitute households with different income sources with the main interest being off-farm sources. FGT poverty measures have been used in a number of studies such as Sanusi (2011) and Mat *et al.* (2012) to ascertain the relative importance of off/non-farm income.

To obtain the income subgroups the sampled households were disaggregated by income sources and poverty measures were assigned to each group. Three FGT poverty indices (measures) examined were incidence, depth and severity of poverty. Based on Foster *et al.* (1984), the FGT index is given by;

$$P_{\alpha} = \frac{1}{n} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^{\alpha}$$

Where: n= total number of households in a population

q = number of poor households living under the poverty line

z = the poverty line for the population

y<sub>i</sub> = households total income per adult equivalent

$\frac{z-y_i}{z}$  = proportion shortfall in income below the poverty line.

$\alpha$  = a parameter that indicate sensitivity of the index to poverty, which takes the value of, 0, 1 and 2 to measure incidence, depth and severity of poverty respectively. Larger values of  $\alpha$  represent increase in the relative weight

on the poorest among the poor population.

When  $\alpha$  is 0 the measure becomes poverty incidence ( $P_0$ ), which simply measures the proportion of households that are poor. This measure pays no particular attention in describing the poor, as they are regarded as all being below the poverty line. When  $\alpha$  is set at 1, the measure becomes poverty depth or poverty gap index ( $P_1$ ).  $P_1$  measures the extent of poverty for those households which are below the poverty line. It considers the distance to which the poor are from the defined poverty line. The last parameter when  $\alpha$  is set to 2 is poverty severity ( $P_2$ ) an FGT parameter that gives more weight to the poorest households. Poverty severity is a sensitive measure for income distribution of the poor in that a unit income increase of the poorest households has more effect on poverty than the same unit increase in a less poor household.

One of the inputs in the construction FGT poverty measures described in the equation above is a poverty line which basically serves to distinguish the poor from non-poor households using a particular welfare indicator. It is defined as the minimum threshold of consumption on food or per capita income below which an individual or household is described as poor. While consumption is a more preferred welfare measure in household surveys, and has been extensively used in off-farm diversification and the poverty studies, the analysis in this paper is based on the income approach and henceforth income is used as a general poverty indicator and in defining poverty line. Income approach has been used in other studies on defining poverty line, for example, Sanusi (2011) and as a poverty indicator e.g. Reuben and van den Berg (2001), Yunez-Naude (2000) and Kassier *et al.* (2011).

Since there is no established household income poverty line in the study area, the paper adopts a basic needs poverty line of 36 482 Tanzanian shillings (Tshs) per adult equivalent (AEU) per month (or 437 784Tshs per AEU per annum) as set and used by NBS (2014a). This poverty line was then adjusted to consumer price index (CPI)<sup>1</sup> of the year (2014) to which data for this paper was collected to obtain a value of 581 510Tshs. So households in the total sample earning more than this value (581 510Tshs) per adult equivalent per annum were regarded as non-poor and those earning below this value were considered as poor.

Income is a preferred poverty indicator in this analysis because of three main reasons. Firstly, the focus of this paper is on the relative importance of off-farm employment on household's poverty status. Thus, use of the income provides a room for description of the direct effect of off-farm income on poverty using decomposable poverty indicators. Secondly, for livelihood analysis income is comparably more relevant than consumption in understanding how households diversify their livelihood strategies (Ellis, 2000). Thirdly, the use of the income approach emanates from the assumption of non-separability of consumption and production among most rural households observed in developing countries. For households which depend much on their own production, Cavendish (2000) argues that income and consumption are rather similar in magnitude. For households in the Kilombero Valley, paddy is the main cash and food crop, and largely contributes to their total income. This being the case what they basically consume (trade) is what they produce from their own farms. Furthermore, because the analysis aims at comparing poverty between households with different income sources, then measuring income was more relevant than consumption.

*Total household income:* As in the NBS (2014b), total household income is conceived as composing of farm income, off-farm income and income collected from other sources (i.e. remittances and rentals). Hence, the overall income and its components (Particularly those obtained from off-farm activities) can be comparatively analysed and their relative poverty impacts be assessed. Total households income is based on annual cash earnings of the households from farm and off-farm activities and includes remittances and pension. Off-farm income includes net profit generated from self-employment activities and cash earnings from wage employment. Thus, monthly earnings from these activities were summed to get annual incomes for each employment category. Farm income is computed from the market value of produced crops less the cost of production. Labour cost is not included in the household income computations due to difficulties in accounting for the labour shadow price. Remittance includes transfer income from migrated household members where as other income includes pensions and rentals received by households by renting out land, housing or any other household asset. For the purpose of comparability across households in the study area, total household income is based on the adult equivalent units (AEU). The conversion of income to AEU is based on the weighted household members sex and age scale adapted from the NBS (2014b). The questionnaire used in the household surveys included questions on income based on recall of the previous year (2013). Data based on recall of the previous year may not always be reliable (Ellis, 1998). Nonetheless, an attempt was made to ensure the presence of both the head and the spouse wherever possible in order to at least improve recall and hence the reliability of these income data. In addition as suggested by Angelsen and Lund (2011) for one-shot surveys the income data was appropriately decomposed by individual income sources/activities to minimise recall errors.

<sup>1</sup>Consumer price index (CPI) account for the cost of acquiring goods and service at the year interval (between 2012-2014). CPI for Tanzania was 112.7 and 149.7 for the years 2012 and 2014 respectively (WB, 2015)

## 2.4 Estimation Method

To address the third objective data was analysed using a two stage least square regression (2SLS). This model was found appropriate since the dependent variable has a continuous scale value and non zero observations for all respondents. The potential threat of endogeneity which will be described in latter also determined the selection of the model. The dependent variable was total household income per adult equivalent. The specification can simply be described as;

$$q_{it} = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + \beta_5 x_{5t} + \beta_6 x_{6t} + \beta_7 x_{7t} + \beta_8 x_{8t} + \beta_9 x_{9t} + \beta_{10} x_{10t} + \beta_{11} x_{11t} + \beta_{12} x_{12t} + \beta_{13} x_{13t} + \beta_{14} x_{14t} + \varepsilon$$

where  $q_{it}$  = Total household income per adult equivalent

$x_{1-14}$  = Vector for explanatory variables

$\beta_{1-14}$  = parameters to be estimated

$\varepsilon$  = error term

One of the main explanatory variable is non-farm self employment activities (NFSE). Engagement in NFSE however requires possession of start-up capital. In such a case household's wealth status may determine both their total income and their engagement in NFSE. Therefore, NFSE become endogenous because it correlates with the error term ( $u$ ). Hence the use of 2SLS in this estimation requires specification of exogenous variable ( $s$ ) or instruments that do not have a direct effect on dependent variable but correlate with the endogenous variable (Wooldridge, 2012).

Two instruments were used to control for the endogeneity of NFSE. These are a household access to electricity and distance in km to the main town (Ifakara). Theoretically, access to electricity is believed to be important for off-farm employment participation (Reardon, 1997; van den Berg and Kumbi, 2006). Statistically, access to electricity is relevant because it correlates with NFSE engagement but is very unlikely to affect total household income outcomes after controlling for other households' production assets such as farmland. Similarly, distance reduces transaction costs to urban centres (Haggblade *et al.*, 2007) and hence positively affects operation of rural trading activities which are part of the non-farm self employment. Its effect on total household income is thus via NFSE and this satisfies the condition of a valid instrument.

## 3. Results and Discussion

The results and discussion are combined and presented in three parts. In the first part the socio economic characteristics and distribution of different off-farm income sources is presented. This part includes the descriptive analysis of the variable used in the poverty estimation. The second part presents the computation of the FGT poverty indices, where effects of different off-farm income subgroups on selected FGT indices is examined and compared. The last part gives the estimation of off-farm employment effect on household poverty status.

### 3.1 Socio-economic Characteristics of Households

This section presents the socio-economic characteristics for the whole sample and as differentiated between households with off-farm and those without off-farm employment. These characteristics may determine households' poverty status. Summary statistics of these variables are presented in Table 2. Some of these characteristics are the covariates of the regression models presented further on. The results in Table 2 generally show that the income generated from off-farm employment was much higher than the farm income. Among the off-farm employment components, non-farm self-employment showed the highest income contribution followed by non-farm wage employments. As regards to ownership of land which is the most important physical asset the results shows no statistical difference between households with and those without off-farm income. The average landholdings of 1.5ha is slightly similar to the land ownership of 1.6ha reported by Balama *et al.* (2014) in another study conducted in Kilombero district. The PWR conducted earlier showed that it is land cultivated and not land owned which is the key determinant of wealth in the study area. Results in Table 2 further show that paddy as the principal crop occupied a greater share (89%) of total cultivated farm land in the 2012/2013 farm season. Sharecropping between maize and rice was observed among households.

**Table 2. Descriptive Statistics of Surveyed Households Socio-economic Status**

Variable name	All households (n=309)		Household with at least a member with off-farm employment (n=220)-A	Households without off-farm employment (n=89)-B	T-test (Mean difference, A and B)	P-Value
	Mean	Standard deviation	Mean (percent)	Mean (percent)		
Total Household income (Tshs)	1 199 072	1 927 590	1 419 717	653 658	-3.211	0.0015*
Farm income (Tshs)	494 712	729 364	481 072	519 667	0.413	0.670
NFI total (Tshs) <sup>a</sup>	1 009 816	2 051 743	NA	NA		
Farm wage income (Tshs)	134 420	89 946	NA	NA		
Non-farm self-employment income (Tshs)	1 041 851	2 212 756	NA	NA		
Non-farm wage employment income (Tshs)	1 080 440	1 854 410	NA	NA		
remittance income (Tshs)	209 267	173 200	168 235	653 658	0.434	0.671
Other incomes (Tshs)	282 660	30 301	283 638	280 216	-0.026	0.979
Landholdings under cultivation (ha per adult equivalent)	1.5	1.4	1.4	1.7	0.062	0.942
crop shock	89.0		45.5	51.6		
lowland field	71.8		72.3	70.8		
Other crop cultivation (%)	33.7		43	56.2		
Household size	5.	2	4	5	0.661	0.508
Number of dependants	3.	2	2	3	0.085	0.932
Education of household head (schooling years)	6.7	3	7	3.01	-2.342	0.019**
Male headed households	25.4		28.1	29.0		
Access to formal credit (%)	37.3		34	16.6		
Association membership	46.0		74.1	51.1		

\*, \*\*, shows that mean differences between households with and without off-farm income are statistically significant at a 10% and 5% level respectively: 1 USD =1 638 TShs during months of data collection.

<sup>a</sup> 1 USD =1 638 Tanzania shillings (TShs) during months of data collection;

Table 2 also shows that about a third (34%) of the households reported to have cultivated other crops apart from paddy. This indicates the dominance of paddy and a low level of crop diversification. Poverty implication of this reliance on one crop is that, when there is a price fall of the dominant crop (paddy) which is a regular trend in Kilombero Valley (Kato, 2007), household income is severely affected as paddy is the main cash earning crop. The seasonal price fluctuation of paddy price has been reported elsewhere in Kilombero Valley (Kato, 2007, Muhamba *et al.*, 2013). Other crops cultivated include maize, banana, sesame, cassava and sugarcane and various species of seasonal vegetables. As a proxy for household level human capital, the mean number of dependants was 3 while total household size was 5. This implies that households were populated with greater number on non-working members. It has been observed elsewhere in rural Tanzania that household's size has a negative effect on diversification strategies including off-farm diversification (Urassa, 2009). This apparently results into negative implication on household poverty as noted by Adetayo (2014) and Ibrahim and Srinivasan (2014) in Rural Nigeria. On the other hand the results further shows that the average education (actual years of schooling) of household heads was 6.7 years (with standard deviation of 3), implying that majority of the households head have primary education level.

At disaggregated level of the two employment statuses (off-farm and farm only) subgroups three



variables deserve attention as far as this section is concerned. First, total household income for households with no off-farm income sources (farm only) is significantly lower than those with any kind of off-farm income. The difference of mean income between the two subgroups is significant at 1% level as shown in Table 2. Secondly, there is a significant mean difference in education of the households head between households with off-farm income and those without off-farm income. This difference though does not mean that off-farm employment is associated with a higher level of education since there are off-farm activities such as farm wage that require very little skills and education. Lastly, results in Table 2 show that a greater proportion (about three quarters) of the households with off-farm employment are members to one or more associations compared to only about a half of households with membership in at least one association in farm only category. The difference in membership in association between household with and those without off-farm employment is significant at 1% level. This shows membership of association in social groups may be associated with engagement in off-farm employment.

This sub-section has therefore provided the main attributes that differentiate between households with and those without off-farm employment. The differences noted in this categorization may though hide specific attributes resulting from heterogeneity within off-farm employment. The next section thus discusses how income earned from each of the functional categories of off-farm employment (farm wage, non-farm wage and non-farm self employment) contribute to poverty statuses.

### 3.2 Households Poverty Profile

This subsection provides a comparative analysis of poverty rates and total income of households which is based on households' sub-populations disaggregated by off-farm and farm income sources. For the households' employment/income profile, the sampled households are classified into four occupational categories (income groups), based on their off-farm income status namely: a) households with farm income only b) household with farm income and farm wage income c) households with farm income and non-farm self-employment income and d) households farm income and farm wage income. The results are depicted in Table 3.

Table 3 displays the impact of each income sources on the three FGT poverty measures. All income sources include farm income as all households are engaged in farming and have this income in their total household income. The results generally show that off-farm income is not only associated with low poverty rates (high poverty measures) but also its inclusion to household (farm) income lead to reduction of income poverty. For example incidence of poverty is highest, (70.7%) (see the first row under  $P_0$ ) among households with farm income and lowest (24.5%) among households with non-farm self-employment. Similarly, addition of non-farm self-employment to a household farm income will reduce the poverty incidence in the study area by about 65% (see the second column in seventh row of Table 3). This impact of reduction is much higher than the impact of an addition of farm wage income and non-farm wage income to farm income which results into 57.1% and 22.5% changes in  $P_0$  respectively. The study's findings are comparable to those reported by Ibrahim and Srinivasan (2014) in a study covering rural Nigeria where it was found that self-employment reduced incidence of poverty by 5.1%. However, this reduction is relatively lower compared to the current study's findings plausibly because of the small proportion of households with off-farm (non-farm self-employment) in Ibrahim and Srinivasan's (2014) study. Nevertheless, it suggests the positive role of off-farm income in reducing the proportion of the poor households.

**Table 3. Poverty Indices by Subgroups of Households' Off-farm and Farm Income.**

Households' income category	Head count ( $P_0$ )	Poverty depth ( $P_1$ )	Poverty severity ( $P_2$ )
Farm income only (a)	0.707	0.153	0.092
Farm income+nonfarm self-employment income (b)	0.245	0.085	0.089
Farm income+farm wage income (c)	0.299	0.137	0.149
Farm income+non-farm wage income (d)	0.550	0.133	0.067
<b>Magnitude of index change</b>			
Percentage change (%) b-a/a*100	-65.4	-44.4	-54.4
Percentage change (%) c-a/a*100	-57.1	-10.4	-32.3
Percentage change (%) d-a/a*100	-22.5	-13.00	-27.02

Note: 1. The last three columns under 'magnitude of index change' show the percentage change (reduction) of each of three poverty indices as a results of addition of self-employment income(b), farm wage income (c) and non-farm wages income (d) to the farm income(a). 2. The computations of these percentage changes are shown in the last three rows of the first column.

It is important to note that the incidence of poverty simply represent the head count or proportion of

households below poverty line. However, understanding the proportion of households (poverty head count) below income poverty is less informative in terms of poverty analysis and policy measures. The measure (poverty incidence or head count) does not show how far households are deeper away from the poverty line. It is of much policy interest to understand the depth of poverty or how far the poor fall short of the income poverty line. This depth ( $P_1$ ) as described in section 2.3 has an implication for poverty targeting strategies as households close to the poverty line may need different interventions from those deep into poverty.

Column 3 of Table 3 shows absolute values of poverty measure per income group (first five rows) and proportion change of poverty depth (the last three rows). The poverty depth reflects how worse off household designated as poor, are based on the poverty line used in the analysis. In other words the measure,  $P_1$  shows the income gap of the poor households relative to the poverty lines. This measure is thus far more rich in poverty analysis as it takes into account the distribution of income shortfall of poor households. Results in Table 3 further shows that  $P_1$  is much lower when non-farm self-employment is included in farm income compared to the other two off-farm income sources. In other words one can say that engaging in non-farm self-employment leads to a lower poverty depth. The change in poverty depth when non-farm self-employment is added to household farm income is 44.4%, which is highest compared to the observed change for the other two off-farm income categories. This implies that inclusion of non-farm self employment reduces the income shortfall of the poor by 44.4%. Similarly the reduction of  $P_1$  with addition of non-farm wage and farm wages to households farm income are 10.5% and 13% respectively. The higher the absolute value for poverty depth the higher the income needed to prevent income shortfall of the poor. As expected, this value ( $P_1$ ) is highest for households with farm income only in their total income as is shown in Table 3. The study's findings in regard to poverty depth is comparable to a study by Ibrahim and Srinivasan (2014) that also used income poverty line. The similar finding of positive poverty effect of off-farm employment was also noted in another study by Adetayo (2014) that used expenditure based poverty line.

Generally, poverty severity ( $P_2$ ) compared with  $P_1$  gives more weight for households much further away from poverty line than those less poor which are much closer to the poverty line. Table 3 shows a more or less similar trend for severity as it is for poverty depth. The results in Table 3 show that non-self employment income and farm wage would reduce poverty severity by 54.4% and 27% respectively for households with those off-farm income types. Generally, the results show poverty is most severe for households with farm wage income than those with other types of off-farm income sources.

Two important observations can be noted based on results of the poverty measures presented above. First, the overall farm wage has less effect on poverty depth and severity compared to other off-farm employment categories. This can be explained by having relatively fewer individuals in the sample (about 23%) with this employment type. Thus because the index involves aggregate population measure, the effect of farm wage is likely going to be diminished. The other possible explanation of the decreasing role of farm wage in lowering poverty measure is based on off-farm diversification survival-accumulation needs argument posited by Ellis (1998) and Dimova and Sen (2010), which also reflect the prevailing situation in Kilombero Valley. This argument suggests that households in rural areas are simply pulled to off-farm employment (e.g. farm wage in this case) with a sole motive of reducing shock exposure and smoothing their consumption in an environment of risky agriculture income. This means that accumulation of income which would raise their total household income, and hence aggregate community measure cannot be realized. Second, it implies non-farm self employment has more impact in lowering poverty measures (reducing poverty). This can simply be explained by having the majority (58.6%) of households in the sample engaging in this kind of employment. In relation to policy purpose, measures that increase opportunity for non-farm self-employment activities and non-agricultural wages are more relevant. These measures will not only reduce relative poverty (poverty head count) but also improve poverty depth and severity hence reduction of social exclusion.

### 3.3 Village locational Attributes and Poverty Profile

Households location across the study villages may determine their poverty status. This is because villages covered in this analysis had some attributes that determine income poverty. It is thus of relevancy to explain poverty by village groupings, as the poverty policy also needs to recognize locational differential even for an area that may be regarded as homogenous in terms of livelihood strategies such as the study area. Table 4 presents the results of the FGT decomposable poverty measures by villages.

The results generally show that, there are differences in incidence, depth and severity of poverty across the study villages. It should be noted that Lumemo together with Mwaya represent accessible village with good road infrastructure on one hand and Lupilo which is grouped with Malinyi and Mngeta as more remote villages on the other hand. These three villages (Lupilo, Malinyi and Mngeta) are also more resourceful in terms of farmland availability. Generally, Lumemo village has lowest poverty level (high poverty measure). For example the value of poverty depth of 0.10 as shown in Table 4 for Lumemo is the lowest across all the villages. This value can simply be interpreted that 10% of the poverty line will be needed to get the poorest households in

Lumemo up to the poverty line. On the contrary, 21% of the poverty line is needed to lift the poorest households in Lupilo which has the highest (0.21) poverty depth level. One plausible explanation for this observation is that Lumemo compared to lupilo, Malinyi and Mngeta is located in a more urban location with good accessible roads, which ensure interaction with other urban areas. In this case farming households in Lumemo are likely to profit from low transaction costs assured by the connectivity of the village. The lower poverty status measure reflecting income well off in Lumemo can also be attributed to being located in an area with vibrant off-farm activities particularly those related to trading. Road accessibility attribute has been positively associated with participation in off-farm employment in Tanzania (Mduma, 2014) as it increases opportunities for these off-farm income generating activities. These off-farm opportunities have desirable effect on household's total income.

**Table 4. Relative Distribution of Poverty Indices across Study Villages**

Poverty index	Mwaya (n=54)	Lumemo (n=69)	Mngeta (n=56)	Lupilo (n=67)	Malinyi (n=63)
Poverty incidence (P <sub>0</sub> )	0.40	0.23	0.32	0.46	0.34
Poverty depth (P <sub>1</sub> )	0.17	0.10	0.12	0.21	0.13
Poverty severity (P <sub>2</sub> )	0.10	0.02	0.06	0.15	0.02

The characteristic of Lupilo are also shared by Mngeta and Malinyi although the latter are comparably less poor than Lupilo as they have lower values for poverty incidence, depth and severity. For example, Table 4. shows that the poverty incidence is 0.32 and 0.34 for Mngeta and Malinyi respectively which are lower compared to absolute value of 0.46 in Lupilo. Field observations revealed that Lupilo is less productive in terms of paddy production which is the main marketable crop compared to the other two villages with the similar status. Accordingly, households' total income may be lower in Lupilo leading to higher incidence of poverty because of its implied lower farm (paddy income). This may be explained by theoretical view point of production linkage between farm and off-farm activities as described by Reardon and Taylor (1996), and Haggbalade *et al.* (2007). This view point suggests that farm income may be used as input (capital) for off-farm activities start up. These off-farm activities have a direct effect on income poverty.

In conclusion, the discussion in this sub-section has revealed that there is a wide disparity in terms of poverty even for an area that may seem to be homogenous in terms of their livelihood activities. These differences across the villages have largely been shaped by availability of road infrastructure and agricultural resources in terms of farm land. These attributes are key ingredients for growth of off farm employment (De Janvry and Soudulet, 2001; Mathenge and Tchirley 2014) and reduction of income poverty.

### 3.4 The Effect of off-farm Employment on Poverty

A 2SLS estimation with instrumental variables (IV) are presented in the last three columns of Table 5 with the results for the OLS presented alongside. The dependent variable was log transformed to maintain normality and yield better estimation results. The post estimation test for multicollinearity was run for the OLS regression. The mean variance inflation factor (VIF) of the test was 4.3, which was well below the level in which the variables would be considered as having multicollinearity. The Durbin-Wu Hausman test statistics to check whether NFSE is truly endogenous was carried out. This test confirmed the appropriateness of the IV estimation approach. To check for validity of both instruments The Sagan overidentification test was performed. The null hypothesis for the test state; the instruments are jointly valid. The result of the test was insignificant (as shown in Table 5), thus confirming validity of the instruments used.

Although both results are displayed the analysis focuses on the instrumented results ( last three columns of Table 5). 2SLS results show all three main explanatory variables i.e non-farm self employment (NFSE), farm wage (FW) and non-farm wage (NFW) are positive and significant. This suggests that households that engage in any of the off-farm employment gain more total income. For example, coefficient for NFSE is significant at 0.01 level. This suggests that engagement in NFSE leads to an increase in total income by 33%, keeping other variables constant. The increased contribution is much higher than engagement in farm wage and NFW with 8% and 10% respectively. It can thus be said of the three categories of off-farm employment, NFSE is the strongest predictor of household income and thus income poverty. This finding is generally consistent with Sanusi's (2012) study which used income poverty measure and Obisesan (2012) which employed expenditure data as a proxy for household monetary poverty. Both of these studies reported strong positive association between NFSE and household wellbeing.

Results for other control variables behaved largely as expected. Variables that were significant are crop shock, Low land field, land cultivated and land owned. Crop shock is negative and significant at 0.05. This suggest that households that experienced crop loss in the 2012/2013 farming season had a 3.9% more reduction in their total income compared to households which suffered no shocks. Similarly, the 2SLS results in Table 5.5, show that low land field cause decline in total household income by 2.8% compared to upland fields. Lowland fields are usually flooded leading to considerable crop failure. The loss was largely caused by floods which were

reported and affected households with paddy fields close to water sources.

As a control for household assets endowment, both land cultivated and land owned are both positive and significant at 0.05. The interpretation is that; an increase in cultivated land leads to a 0.6% increase in total household income whereas amount of land owned had 0.5% increased effect. For households in the Kilombero valley, cultivated area is dominated by paddy which is not only an important crop for food but also a valuable cash crop. Thus, the large area under cultivation is translated to more farm income and thus a household's total income. This income earning has an implication on determining a household's poverty status. As a household asset, land is a very important for the rural poor and determines their income poverty status. This finding supports the evidence by De Janvry and Sadoulet (2001) in rural Mexico arguing that farm land owned (both irrigated and rain fed) is positively associated with increased household income.

To conclude, the results in this sub-section shows that, off-farm employment is a significant predictor of total households' income with an effect on a household's welfare status. The estimation method applied has enabled analysis in this paper to described causality between off-farm employment and income poverty at a fairly high degree of certainty. However, the problem of endogeneity cannot completely be ruled out. Other variables in the model for example land owned as an assets may be endogenous. But as long as this is not the main explanatory variables in the model, its effect in terms of interpretation of the results is not significant.

**Table 5. OLS and 2SLS Results for Effect of Off-farm Employment on Total Household Income**

Independent Variables	Dependent variable : log transformed total household income per adult equivalent					
	OLS			2SLS		
	Coefficient t	Standard error	t values	Coefficient	Standard error	Z values
Non farm self employment	0.845***	0.169	5.01	3.320***	0.873	3.8
Education of the head	0.034**	0.026	1.31	0.042	0.020	2.09
Female head	-0.315**	0.190	-1.65	-0.361	0.148	-2.44
Number of dependent	0.006	0.052	0.12	0.053	0.039	1.36
Access to credit	-0.011	0.170	-0.07	0.177	0.122	1.45
Crop shock	-0.393***	0.176	-2.23	-0.227**	0.130	-1.74
Lowland field	-0.286**	0.178	-1.60	-0.323*	0.139	-2.33
Other crops	-0.029	0.166	-0.18	-0.148	0.125	-1.18
Group membership	0.086	0.153	0.56	0.057	0.119	0.48
Female head	-0.315**	0.190	-1.65	-0.361	0.148	-2.44
land cultivated	0.190**	0.081	2.34	0.150**	0.062	2.40
land owned	0.172***	0.068	2.52	0.105**	0.050	2.08
Non-farm wage	1.491***	0.331	4.50	0.817***	0.186	4.40
Farm wage	1.928***	0.345	5.59	1.061***	0.137	7.69
Mwaya/lumemo	-0.256	0.157	-1.63	-0.239	0.122	-1.95
Constant	13.4	0.48	27.8	12.4	0.69	17.92
R <sup>2</sup>		0.36				
Durbin –Wu-Hausman test					14.72***	
Sagan overidentification test					0.8	

Notes: \*\*\*, \*\*, \* represent significance levels at 0.01, 0.05 and 0.1 respectively; total household income is in adult equivalent units.

#### 4. Conclusion

While farming is still the major income generating activity, results in this paper underscore the role of off-farm income and employment on income poverty among rural households in Kilombero Valley. Three households' off-farm income groups which are non-farm self-employment, nonfarm wages and farm wages were identified and their poverty effect analysed.

Results from the FGT poverty index suggest that off-farm income generally helps to reduce income poverty among farming households. This was ascertained from lower poverty levels for FGT measures namely incidence, depth and severity of poverty for households with any of the three sources of off-farm income. This shows welfare improvement occurs not only in the proportion of households' poverty level but also in the extent

to which households fall below the poverty line. However, the reduction is not uniform across all the three off-farm categories. Non-farm self-employment has much desirable effect compared to farm wage and non-farm wage income.

Evidence based on the estimated effect of engagement in any of three off-farm employment has generally revealed the direct positive effect of engagement in non-farm self-employment or non-farm wage and farm wage employments on total household income. Other individual and household attributes that significantly predict total household income were education, sex, crop shock, and farmland ownerships and location.

From the policy perspective, the role of off-farm employment as a key to rural livelihood diversification should be reinforced in the long term development strategies and policies. Such a particular strategy of relevance in this context is Tanzania development vision 2025. It is recommended that, the review process of the vision, which aims to achieve a middle income country by 2025, should consider and integrate the off-farm sector in agricultural development programmes. In the same vein, specific strategies that will promote infrastructure development in the study area whether carried out by national level government or local government authority will not only enhance off-farm opportunities but also enhance households' income earning potential and reduce income poverty. This will also have effect in reducing income inequality and social exclusion. To have more comprehensive poverty strategies it is recommended to conduct more location specific studies to unveil the potential of off-farm employment in different rural areas in Tanzania. This is in recognition of agro-ecological and socio economic heterogeneity and diversity of rural communities. For example it will be more informative to consider off-farm employment in areas with poor agro-climatic conditions.

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