Determinants of Farm and Non-Farm Activities as Sources of Income amongst Rural Households: Evidence from Kahama District in Tanzania.

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Abstract

The paper has been set to determine the factors influencing farm and non-farm activities as sources of household income in Kahama District in Tanzania. Two villages (Bunasani and Kinamapula villages) of Kahama district were sampled for the study and a sample of 207 farmers had been drawn randomly from the population. A double-censored regression model, in particular a two-limit tobit model was applied to analyze the determinants of income share from farm and non-farm income sources among the households. Results reveled that, farm size increases, the share of income from farm income source would also increase. However, the marginal effect for farm size is 4.16 which is significant at 1% level of significance. Male-headed households derive a large share of their income from farming activities as compared to female-headed households where the marginal effects are about 3.5 percentage points. To promote the farm and non-farm sector income and strengthening its potential linkages between them, the study mainly recommends increasing efforts on two fronts: first, reforming the institutions responsible for rural development and second, development activities and projects that would enhance farm and non-farm income and the linkages between them.

Keywords: Determinants, Income, Farm, Non-Farm, Household

1.0 Introduction

The rural labour force in most of developing countries is growing very rapidly, but employment opportunities are not growing in the same rapidity (Senadza, 2012). According to (Scharf & Rahut, 2014) as land available for farming activities becomes increasingly scarce, non-farm activities must expand in order to reduce rural poverty in developing countries. Non-farm activities in the rural households has a great potential to upsurge rural employment, improving income distribution, contributing to economic growth, and poverty reduction (Katega & Lifuliro, 2014). Therefore it is important to determine how non-farm activities can be promoted, given the importance of non-farm income as a mechanism whereby rural households can sustain and improve their living standards and as a possible path out of poverty (FAO, 2002)

Nevertheless, in most developing countries, farm activities has been considered as the most important income generating activities of the population living in rural areas. This unquestionable fact on rural economies and livelihood has led to the neglect of non-farm activities as another source of rural income and play a significant role in the socio-economic development process of rural households (Senadza, 2012).

The World Bank (2008) claimed that, in developing countries, the traditional image on rural households has been that of focusing almost solely on farming and neglecting rural non-farm activities. Policy debate still tends to equate farm income with rural incomes. This situation has led to a tendency of most development experts and decision makers interested in rural development to neglect the rural non-farm activities as sources on income in the rural households.

Apart from this affinity, there is growing evidence that in developing countries, rural non -farm activities offer employment to a significant share of rural households and income derived from rural non-farm activities is an important resource for farm and other rural households, including the landless poor as well as rural town residents (Scharf & Rahut, 2014). According to (Badariah & Nathan, 2016) the share of the non-farm sector in rural employment in developing countries varies from 20 to 50 percent. Ellis & Allison, (2004) notes that the typical rural household in Africa has more than one member employed in a non-farm enterprise and the average share of rural non-farm incomes as a proportion of total rural incomes is about 42 percent. Moreover, (Reardon, 2010) note that the rural non-farm sector accounts for roughly 25 percent of full time rural employment and 32-40 percent of rural incomes across the developing world. Based on the potential role of income diversification in stabilizing incomes and alleviating rural poverty, governments in several developing countries have devoted increasing attention to output diversification policies (Scharf & Rahut, 2014).

In Tanzania non-farm activities in rural areas has not been very helpful since these activities are small scale in nature and they face constraints that limit them to grow. As such, efforts are required to turn them into viable sources of livelihoods ((Woldenhanna & Oskam, 2001) However, because of limited research undertaken on the contribution of farm and non-farm activities, and therefore lack of empirical data and information on the role of farm and rural non-farm sectors, the government and other development practitioners, tend to neglect the contribution non-farm activities to the overall development process of rural areas (Babatunde & Qaim, 2010). This situation in turn has resulted in lack of clear policy on the promotion of rural non-farm activities and suffocation of these activities despite their great potential in poverty alleviation in rural areas. The neglect also cripples the likely economic linkages of these activities to the under-performing agricultural activities. These linkages which include income for purchasing agricultural inputs have big potential of boosting production in the agricultural sector. As such the problem that this study investigate the determinants of household participation in farm and off-farm employment and the factors influencing the magnitude of incomes from different sources. This is important to identify potential entry barriers and constraints for certain household types, which have been shown to exist in other African countries (e.g. Woldenhanna and Oskam, 2001). If off-farm employment is to increase household income and reduce risk and inequality, it is important to overcome such constraints. We use different econometric techniques and disaggregate farm activities and non-farm sources of income (activities) and non-farm. The result of the study may also be helpful for the farmers in making right decisions regarding the selection of any profitable sector (farm or non-farm sector) which will ultimately help them to allocate their scarce resources accordingly.

2.0 Theoretical Considerations

Our empirical approach focuses on the significance of factors other than household's behavior towards risk in explaining the household's resource allocation over time. Decreasing absolute risk aversion requires that poorer households diversify their sources of income than their wealthier counterparts. However, poorer households facing various sources of risk but with little insurance mechanism to rely on, are likely to devote substantial resources to food self-sufficiency compared to their wealthier counterparts who are more likely to emphasize cash crop production (Fafchamps, Kebede, & John, 2015). If we find evidence of other constraints serving as barriers for portfolio diversification, we have also found evidence against the notion that risk aversion is the only determinant of income diversification. We now sketch out a simple model of activity choice and constraints that incorporates a number of salient features of the environment that is described above.

The most important elements of the model are that: households are assumed to have land (L) and labor (H) as production inputs; labor can either be provided by the household or hired; market for land is assumed to be missing; all households are involved in farm activities, characterized by a constant returns to scale production function, $Y = Y(L, H)$; entrance into a new activity such as non-farm activities is not cost-free and, in general requires either a minimum level of capital for investment or a specific skill; and households might work in other activities (non-farm activities) rather than specialize in farm activities in order to diversify income risk. Given these simplifying assumptions, each household is assumed to maximize a time separable utility function of the form:

$$U_t = E_t \sum_{\tau=t}^{T} \delta^{\tau-1} u(C_\tau) \tag{a}$$

Where E_t is the expectations operator given the information set at age t; δ is the subjective discount factor; C represents the consumption of the household; and T is the number of periods. In maximizing the above utility function, each household faces an intertemporal budget constraint, an endowment constraint and a non-negativity constraint. The first order conditions for labor allocation obtained from solving the above programming problem can be used to illustrate how households allocate resources across different activities. If the marginal utility of allocating labor to food cropping were greater than the marginal utility derived from other activities outside food-crop production, the household would tend to specialize in food-crop production, without any investment in other activities such as cash-crop, livestock or non-farm activities. The relationship between the expected marginal utilities can be expressed as:

$$E\left[U'(C_t)P_{tf}\frac{\delta h}{\delta H_{tf}}\right] > E\left[U'(C_t)P_{tn}\frac{\delta g}{\delta H_{tn}}\right], \text{ with } H_{tf} > 0 \text{ and } H_{tn} = 0 \tag{b}$$

where $U(C_t)$ denotes marginal utility of consumption; H_{tf} and H_{tn} denote labor allocated to food-cropping and other

activities, respectively; and P_{tf} represents output price of food crops. According to Eq. (b), the household does not need to undertake any other activity besides food-cropping, since the marginal utility of allocating labor to food-cropping is larger than the marginal utility of engaging in non-food cropping activities. However, with the near absence of credit and insurance markets, and with severe food-cropping instability, households might invest in a diverse range of activities rather than specialize in a single activity in order to diversify some of the income risk. Such measures might reduce expected income, but also reduce the variance of income. In particular, poorer households will choose activities that reduce the variance of their incomes, even though this lowers expected income. Given that nonfarm activities are normally considered less risky than crop production, a risk-averse household would engage in non-farm work relative to a less risk-averse household.

A household-level land constraint might also translate into limited food output, leading to a need for households to get involved in other income-generating activities (Reardon *et al.,* 1992). It is worth noting that only households with access to the capital for investment or specific skills for entrance into the cash-crop and non-cropping sectors might do so. If households choose to allocate labor to other activities besides food-cropping, the first-order optimal conditions for labor allocation will equalize the marginal utility of allocating labor to food-crops and the other activities. This can be formally written as:

$$E\left[U^{'}(C_t)P_{tf}\ \frac{\delta Y}{\delta H_{tf}}\right] = E\left[U^{'}(C_t)P_{tn}\ \frac{\delta g}{\delta H_{tn}}\right], \text{ with } H_{tf} > 0 \text{ and } H_{tn} > 0 \qquad \text{(c)}$$

Thus, households will allocate labor to food production as well as the other activities. Although it is the poor who need diversification mostly to defend against entitlements failure and severe food insecurity, they are least able to diversify because of incomplete markets that restrict their entry into more remunerative livestock and non-farm activities (Reardon *et al.,* 2010).

The surveyed households are observed to have a portfolio consisting of two to four activities. As noted earlier, these activities include food-crop production, cotton production, livestock rearing and non-farm work. Given that all households are engaged in food-crop production, the income diversification strategies we model include:

- participation in cotton production, since cash cropping could be a substitute for non-farm activity

- Livestock rearing;

- non-farm work.

It needs to be noted that a diversification strategy that combines all three basic elements is also possible. Wealthier households are more likely to select this strategy than poorer households, as reflected in the increasing rates of adoption of this strategy as income increases in the data.

Although location-specific characteristics such as infrastructure and climate are likely to influence the pattern of income diversification of rural households, the fact that even households living in the same villages tend to have different income portfolios suggests that household characteristics and endowments can be important determinants of portfolio diversification amongst rural households. In line with the simple model presented above, an empirical estimation of how these characteristics influence the labor supply behavior of households is undertaken in the next section.

3.0 Methodology

Kahama is located in Kahama District, in Shinyanga Region, in northwestern Tanzania, approximately 109 kilometres, by road, southwest of Shinyanga, where the regional headquarters are located. This location lies approximately 536 kilometres, by road, northwest of Dodoma, the capital city of Tanzania.

Figure 1: Map of Kahama District

3.1 Sampling Design and Data Collection

The study was conducted in Kahama District where primary data were collected. A combination of data collection tools were used in data collection such as focus group discussion, structured questionnaires and participants observation. This amalgamation of methods was used to harmonize each other because of limitations by one method and allows proof of answers. A sampling unit for this study was household which was randomly selected in 2 villages with 5 percent as the sampling intensity for households in each village. A random sample should represent 5 percent of the total population as a representative of that population (Bongole, 2014). A total of 207 households were interviewed where both qualitative and quantitative data were collected. Information such as crop production (both paddy and maize), household characteristics, land size in acreage, cost of inputs such as fertilizer pesticides, herbicides, improved seeds, quantities of yield produced, and prices of output produced and the quantity of yield sold and consumed by household and non-farm sources of income.

3.2 Data analysis

Quantitative and qualitative techniques were used to analyze the data. For more precise analysis, computer based statistical programs (STATA 13.0) was applied. Descriptive statistics, and charts and tables were used to present the results. In this section, we present the empirical specification used in the regressions, discuss the econometric methodology and describe the data. Accordingly, the share of income in specific sources Farm and non-farm income sources is used as the dependent variable in our econometric model. In terms of estimation, since the income share from different sources of income by cannot be below zero or above one, a double-censored regression model, in particular a two-limit tobit model is used to analyze the determinants of income share on farm and non-farm income sources. Income share on each income source (Farm and non- farm income sources) is specified as below:

$$S^* = \phi_0 + \phi_1 X_1 + \phi_2 X_2 + ... + \phi_n + \mu \qquad \text{d}$$

$$S^* = \begin{cases} 0 & if \quad S^* \le 0 \\ 1 & if \quad S^* \ge 0 \\ S^* & if \quad 0 < S^* < 1 \end{cases} \qquad \text{e}$$

In our model the income share on different activities is modeled as a function of farm size used as a proxy for physical capital that reflect the incentive to diversify. Education is another variable which is a key source of human capital, which offers a potentially important route into higher return non-farm opportunities. Less educated households rely instead on low paying farm wage employment or very low productivity nonfarm pursuits (Shariff, 2002). Other

variables included are land size, age, household size and sex. Therefore in the model the, $X_1, X_2,...X_n$ denote independent variables that have a bearing on source of income. S^* is a latent variable indicating the desired share of income that a household would like to acquire on each activity while S is the observed share of income share by a household in a specific type of income source in question. The relationship between the observed and latent variable is provided above and μ is an error term which is assumed to follow a standard normal distribution.

Since a Tobit model is used, a decomposition approach suggested by (Mcdonald, 1980) may be used to obtain the marginal effects of the independent variables on the outcome. That is, a change in an independent variable has two effects (i) it affects the conditional mean of S* in the part of the distribution between 0 and 1 and (ii) it affects the probability that the observation will fall in that part of the distribution. Mathematically, these effects can be displayed as below (Greene, 2002).

4.0 Results and Discussion

4.1 Socio-economic Characteristics of Household Heads

Table one summarizes the social economic behaviour of the household heads drawn from the study. The table shows that 80.8% of the total respondents were male while the rest 19.2% were female. This suggests that most of the household heads in the study area were male. The reveals that the average age of the household heads were 43.94 year with a minimum and maximum ages of 22 and 76 years respectively. This implies that nearly most of these household heads were adults and have a long experience in farm and non-farm activities. Education status of the household heads revealed that, 30.58% of the household heads have informal education while majority (66.91%) attended primary school education. The rest 1.80% and 0.72% attended secondary school and college education respectively..

4.1 Structure of household incomes

4.1.1 Composition of average household incomes

Table 1 shows the contribution of different sources of income to the total income source in the study area. It is revealed that 52.59% households derive income from farming, which is equivalent to the half of the income on average. The other 47.41% are derived from different off-farm sources. This share fits reasonably into the available recent literature from other countries (Woldenhanna & Oskam, 2001), although the definition of what exactly constitutes off-farm income slightly varies across studies. Among these, Non-farm income and especially self-employment are the most important ones. Self-employed non-agricultural activities account for almost one-quarter of total household incomes and mostly include handicrafts, food processing, shop-keeping and other local services, as well as trade in agricultural and non-agricultural goods. An average of 23.48 percent of the households derives their outside agriculture activities (Non-farm). It includes formal and informal jobs in construction, manufacturing, education, health, commerce, administration, and other services.

4.2 Factors affecting the level of farm and non-farm income

The contribution of selected factors on farm and non-farm income can be examined from the double-censored regression model, in particular a two-limit tobit model. The results have been presented in Table 2 and interpretations have been illustrated accordingly which is discussed below.

Table 2 shows that, the male-headed households derive a large share of their income from farming activities as compared to female-headed households where the marginal effects are about 3.5 percentage points. This is the implication that, male are more likely to participate in farm activities due to the fact that men are more energetic to work in the farm. However in the study area women are also participate in farm activities like weeding harvesting winnowing etc. However the results show that the major sources of income for women come from non-farm activities with a marginal effects of about 2.3 percentage points. This is due to the fact that women apart from participating in farm activities are the ones who own small business and wages from non-agriculture so that to improve the household income. This also makes the household safe when the crop fails.

It was assumed for the study that, if the farm size increases, the share of income from farm income source would also increase. The results show that the marginal effect for farm size is 4.16 which is significant at 1% level of significance. This implies that holding all other variable constant, 1% increase in farm size would lead to an increase in the household's farm income by 4.16%. This means that the income share from farming activities increase as the land size

increase. For the non- farm activities, the marginal effect was 4% and statistically significant at 5% level of significance. This implies that a unit increase of land size lead to the decrease of the non-farm activities by 4.16%.

The household size was found significant at 5 percentage similar to the household size effect, also shows the emerging role of household labour quantity in determining activity patterns. According to the estimates, households with a larger number of members are likely to be self-employed in agriculture and more likely to have large share of their income from farming activities. The marginal effect of an additional household members is a 2.13 percentage point increase in income share from farm a and a 1.29 percentage point reduction in the income share of non-farm.

Furthermore, the estimate shows that households with higher level of education have high income share from farming. This is due to the fact that education assist them to use good agronomic practices and hence increase productivity hence more income. As show in the table, a 10 percentage point increase in the level education may be expected to increase income share from on farming by about 0.079% points.

Strikingly, level of education does not show a significant effect in the non-farm model, which confirms that participation in non-farm activities as source of household income, is not primarily a response to education constraints. While it is likely that poor and small-scale farmers pursue a distress-push diversification to some extent, there also seems to be a significant element of demand-pull diversification, especially among the better-off. The off-farm sector is quite heterogeneous, and households appear to have unequal access to different parts of this sector. The analysis confirms that poor households and those who are disadvantaged in terms of education and infrastructure are particularly constrained in their ability to participate in more lucrative off-farm activities.

Working in farm and non-farm to the household age has a differential impact. Working in farm requires physical fattiness hence older people are at disadvantage (Zhu, 2006). The results show that income share from farming activities has a negative relations with age. The age of household head was not significant and negatively correlated with income share from farming activities but was significant and positively correlated with income share derived from non-farm income share at 1% level of significance. The marginal effects were 0.07 percentage and 0.06 percentage for income share derived from farming and non-farming respectively. This may be due to the fact that the older the farmer the less productive the farmers will be. This equally has implication for farm productivity.

5 Conclusion and Policy Implications

In this article, we have examined the role of off-farm income in rural Tanzania. In line with previous research from other countries, we have shown that off-farm income share is very important for the vast majority. It is revealed that 52.59% households derive income from farming, which is equivalent to the half of the income on average. The other 47.41% are derived from different off-farm sources.

This has also been shown in a number of other studies carried out in different countries of Sub-Saharan Africa. What is more surprising, however, is that the share of off-farm income also increases with farm size, suggesting that there are important complementarities between farm and off-farm income. This result challenges the widespread notion that shrinking per capita land availability is the main driving force for the growing importance of off-farm activities. Indeed, financial capital rather than land is the scarcest factor for farm households in the study region, so that cash income from off-farm activities can also help to expand farm production.

This is typical for relatively land-rich environments in parts of Sub-Saharan Africa, but is quite different from more densely populated regions in Asia. In land-scarce settings, farm households participate in off-farm activities as an alternative for shrinking farm incomes, primarily pursuing a distress-push income diversification. In contrast, in Kahama District, there seems to be a significant element of demand-pull diversification, especially among the better-off. The off-farm sector is quite heterogeneous, and households appear to have unequal access to different parts of this sector. The econometric analysis shows that households with little productive assets and those who are disadvantaged in terms of education and infrastructure are constrained in their ability to participate in more lucrative off-farm activities. Also, the magnitude of off-farm income is largely influenced by the same variables. Especially for the successful establishment and implementation of own small businesses, productive assets, market closeness, and access to electricity and pipe-borne water are the most important determinants. Against this background it is not surprising to see that off-farm income increases inequality in the region.

One policy implication is that entry barriers for disadvantaged households to participate in higher-paying off-farm activities need to be overcome. This holds true in general, regardless of whether distress-push or demand-pull diversification is pursued. Yet, in demand-pull situations, in addition to directly increasing household income, improved access to off-farm activities can also lead to positive indirect effects. Especially when rural financial markets

are imperfect, cash from off-farm income can partly be invested in agriculture, thus also increasing farm production and income.

A related policy implication for this and similar situations is that there is s till significant scope for income increases through the direct promotion of crop and livestock activities, which are currently the main income sources of the poor. Given the complementarities between off-farm and farm income and the fact that both sectors actually face similar constraints, appropriate policy instruments can actually serve both purposes. For instance, accessible credit schemes can facilitate the establishment of non-farm businesses and promote agricultural development simultaneously.

The same holds true for education. Likewise, physical infrastructure reduces transportation and transaction costs in both sectors and increases overall employment opportunities. These findings suggest that there are a lot of synergies and positive spill-over effects between agricultural and non-agricultural development. Over time, it is likely that the relative importance of the off-farm sector will further increase. Broad-based rural income growth requires that also the poor and disadvantaged will be able to benefit from this structural change. Improved opportunities in rural areas could also help re duce the massive rural-urban migration with its concomitant development problems.

Acknowledgements

References

Abdulai, A., & CroleRees, A. (2001). Determinants of income diversification amongst rural households in Southern Mali. *Food Policy*, *26*(4), 437–452. http://doi.org/10.1016/S0306-9192(01)00013-6

Babatunde, R. O., & Qaim, M. (2010). Impact of off-farm income on food security and nutrition in Nigeria. *Food Policy*, *35*(4), 303–311. http://doi.org/10.1016/j.foodpol.2010.01.006

Badariah, S., & Nathan, S. (2016). Distributional effects of non-farm incomes in a Malaysian rice bowl. http://doi.org/10.1108/IJSE-09-2013-0200

Bongole, A. J. (2016). Economic valuation of irrigation water : evidence from lower Moshi irrigation scheme in Tanzania. *International Journal of Management and Social sciences*, *Vol. 02* (2014), 16. Retrieved from https://www.academia.edu/?notification_code=iB8KjeS6

Ellis, F., & Allison, E. (2004). Livelihood diversification and natural resource access. *Organization*, (January), 41. http://doi.org/10.1016/j.worlddev.2006.02.006

Fafchamps, M., Kebede, B., & John, D. (2015). Keep up with the winners : Experimental evidence on risk taking , asset integration , and peer effects $. *European Economic Review*, *79*, 59–79. http://doi.org/10.1016/j.euroecorev.2015.07.001

FAO (2002). *The State of Food and Agriculture Agriculture and Global Public Goods After the Earth Summit*.

Greene, W. H. (2002). *ECONOMETRIC ANALYSIS Senior Media Project Manager : Victoria Anderson Production Editor : Michael Reynolds*.

Katega, B. I. B., & Lifuliro, C. S. (2014.). *Rural Non-Farm Activities and Poverty Alleviation in Tanzania*.

Mcdonald, A. (2016). British, *33*(2), 253–258.

Newman, C., & Canagarajah, S. (2000). Gender, poverty, and nonfarm employment in Ghana and Uganda. http://doi.org/10.1596/1813-9450-2367

Palmer, D., & Groppo, P. (2002). Food Insecurity in the World 2002.

Reardon, S. F. (2010). Income Inequality and Income Segregation Sean F. Reardon Kendra Bischoff, (August 2008).

Scharf, M. M., & Rahut, D. B. (2014). Nonfarm Employment and Rural Welfare: Evidence from the Himalayas. *American Journal of Agricultural Economics*, *96*(4), 1183–1197. http://doi.org/10.1093/ajae/aau040

Senadza, B. (2012). Non-farm Income Diversification in Rural Ghana: Patterns and Determinants. *African Development Review*, *24*(3), 233–244. http://doi.org/10.1111/j.1467-8268.2012.00322.x

Shariff, Z. (2002). REFLECTIONS ON PUBLIC ADMINISTRATION, *34*(1), 4–7.

The World Bank. (2008). *Agriculture for Development*. *Agriculture* (Vol. 54). http://doi.org/10.1596/978-0-8213-7233-3

Woldenhanna, T., & Oskam, a. (2001). Income diversification and entry barriers: Evidence from the Tigray region of Northern Ethiopia. *Food Policy*, *26*(4), 351–365. http://doi.org/10.1016/S0306-9192(01)00009-4

Table 3: Average composition of household income

Income source	Mean annual Income	Standard deviation	Share (%)
Crop income	958,061.9469	748148.145	21.38
Livestock income	1,399,188.629	3224840.92	31.22
Total Farm Income	**2,357,250.576**		**52.59**
Agric. wage employment	1,052,461.538	1642872.64	23.48
Non-agriculture employment	1,072,211.31	1793700.41	23.92
Total Non-Farm Income	**2124672.848**		**47.41**
Total	**4481923.424**		**100.00**

Table 2: Tobit regression model on the determinants of farm and non-farm activities

Selected variables	Farm Income			Non-farm income		
	Coefficients	Standard error	Marginal effect	Coefficients	Standard error	Marginal effect
Sex	0.1197	0.1023	0.0357	-0.0101	0.0974	0.0231
Education	0.2742*	0.0149	0.0079	0.0161	0.0142	-0.0012
Household size	0.0740**	0.0295	0.0213	-0.0024	0.0284	-0.0129
Age	-0.0023	0.0023	0.0007	0.0063***	0.0023	0.0006
Land size	0.1444***	0.0421	0.0416	-0.1002**	0.0406	-0.0461
Access to Market	0.0054**	0.0025	0.0015	0.0055**	0.0023	0.0016
Land size sq.	-0.0087**	0.0038	-0.0025	0.0052	0.0036	0.0027
Household size sq.	-0.0035**	0.0016	-0.001	-0.0003	0.0015	0.0005
Number of Observations	156			156		
Left censored (at zero)	1			1		
Uncensored	135			135		
Right censored (at one)	20			20		
Pseudo R2	0.14			0.13		
Prob > chi2						