# Participation in pro poor agro based enterprises in Malawi: do households' poverty levels change automatically?

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# Participation in Pro Poor Agro based Enterprises in Malawi: Do households' poverty levels change automatically?

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## Abstract

This paper explores factors that influence households' engagement in pro poor agro enterprises and examines the impacts of such small and medium scale enterprise on households' poverty reduction. The paper approaches the objective by estimating a multivariate and data censoring analyses on 1000 household dataset from Malawi. The paper found that fish and mushroom farming, cassava flour processing, pig and chicken rearing, rural bakeries, and other have positive effect on household poverty levels. Pro poor agro based enterprises reduced household poverty by 8-24% among poor household in Malawi. However, the data depicts that pro poor small and medium scale businesses owners are challenged by lack of credit, low bargaining power, high input costs, low product prices and lack of reliable markets. The paper recommends mainstreaming factors and market based barriers that affect participation in agro based enterprises in Malawi. The paper also suggests that pro poor programs ought to be gender responsive at all levels of their operations.

**Key Words:** Households, Multivariate Analysis; Pro poor Agro Enterprises; Malawi

## 1. 1 Introduction

The 21st century has largely been characterized by economic shifts of paying significant attention to addressing poverty as articulated in the Millennium Development Goals whereby the poor are intentionally moved out of dire food and income poverty. In the 21st century, food production has slowed down by 7% due to factors such as low soil productivity, changing climates and other related factors (Rosenzweig and Parry, 1994). Poverty has further and recently deepened in southern Africa as compared to colonial eras (Pangapanga, 2011). In Southern Africa, food production and income has reduced by 30% and increased food and income insecure households from 160 million in 1996 to over a 200 million in the 2000s (Parry, 2007). Climatic change related and other market oriented factors have deepened poverty intensity among most agricultural dependent households.

Like most developing countries, in Malawi, poverty reduction efforts have been drastically affected. This has resulted into food shortages, hunger, malnutrition and low income levels among most population (Action Aid, 2006). Worse still, market oriented factors such as increased middlemen, input prices, lack of credits and others have impeded pro poor agro enterprises (GoM, 2006). Malawi sought for food aid in 1994/5 and 2001/2 due to shortfalls in food production and high food price to access on the markets (FAO, 2011).

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Malawi has experienced severe food shortfalls and wavering income due to low soil productivity, fragmented land, high food and agricultural input prices, lack of agribusiness capital, and climatic related factors over the past decade (GOM, 2008). It is reported that in Malawi, households experience about 60% reduction in food production and over a million households become food and income insecure every year (Fewsnet, 2011). Worse still, most of such (90%) households do not have income or do not have access to credits (Mk 36, 000) to purchase food on the market. NSO, 2005 reported that 52 % of Malawians are very poor as they spend less than US$ 1.5 a day.

In order to reduce poverty levels in Malawi, a number of deliberate pro poor agribusiness interventions have been introduced to help households move out of poverty cycles. Such pro poor agro enterprises include mushroom/fish farming, social cash and food transfers, pig farming, chicken layering, cassava flour processing and rural bakery programs. They have been assumed to trickle down income to poor households. Despite efforts to promote agribusiness interventions, participation in such investments has remained very low despite households continual experiencing of food shortages, hunger, malnutrition, and low income (Action Aid, 2006). Besides, quantifiable statistics on the impacts of such pro poor interventions on household food and income security are still unclear (NSO, 2005; Pangapanga, 2011). Using survey data from 1000 randomly selected households from low[3] and highland of Malawi. This paper therefore explores factors that influence households' participation in various pro poor agro-enterprises and examines the impacts of such enterprises on food/income security.

## 1.2 Rationale of the Paper

Malawi, with a population of 14 million people and a gross domestic product of about US$5.00 billion, is one of the third world countries that is heavily dependent on agriculture (International Monetary Fund, 2011). 90% of the population depend on agriculture as a source of livelihood. 52% of the population is poor and 36% is ultra poor. Presently, food productivity does not meet the food demand due to, in part, high population growth, low investments in agricultural activities and deteriorating soil productivity exasperated by climatic change and weather related factors (Action Aid, 2006).

In order to move poor population out of poverty, government and several development partners have designed a number of pro poor agribusiness programs to help households become food and income secure (GoM, 2008). Alternatively, agriculture sector, of which 70% is dominated by subsistence farming, forms the foundation of the national economy. According to World Bank (2010), the sector employs 85% of the labour force and contributes about 35% of gross domestic product and 85% of total export revenues. In addition, approximately 85% of household food and nutritional security is derived from agricultural sector.

[3] Lowland areas have altitude below 80 meters and situated along ($16^0 16' 08.80'' S\ 34^0 58' 33.01'' E$) where as highland areas have an altitude above 80 metersand above and situated along ($15^0 57' 14.06'' S\ 34^0 45' 53.92'' E$ (Google Earth, 2011).

On the other hand, pro poor interventions such as agribusiness interventions in Malawi are still minimal (GoM, 2004). This is despite, about 1.1 million people becoming food insecure due to low yield and lack of income to purchase food from the market. Sadly, little is known about what factors influence households' participation in pro poor agribusiness actions with regards to household food and income security. This is in spite of several studies in other countries indicating that pro poor agro interventions such as chicken/pig rearing improved food availability by 32% and 15% between the low and high rainfall areas, respectively. This paper therefore investigates factors that influence participation in pro poor agribusiness interventions and examines statistical impacts of such interventions on household food and income security in Malawi.

## 2.0 Research Methodology

### 2.1 Household participation model in pro poor agro enterprises

**Theoretical and Empirical Frameworks**

The paper adapts a theoretical framework that follows a random utility theoretical structure. Random utility model describes a participation or choice decision in which an individual $i$ has a set of pro poor agro enterprises $j$ from which to participate in(McFadden, 1978). It is assumed that each action has its attributes which also influence individual's participation in the other action. Random utility model helps us address how households participate in various pro poor agro enterprices (i.e. mushroom farming (MFP), pig rearing (PRP) and chicken rearing (CRP), cassava four processing (CFPP), and rural bakery (RBP) programmes). The model is based on the notion that an individual derives utility by choosing a number of alternatives.

The utilities $U_i$ are latent variables, and the observable preference indicators $y_{ij}$ are manifestations of the underlying utilities. In other words, preference indicator $y_{ij}$ is observed and determined by the utility that households derive in various participations. The utilities are functions of a set of explanatory variables$Z_i$, which describe the decision-maker $i\ (i = 1,2, \dots, N)$ and the pro poor agro enterprises $j(j = 1,2,..,J)$ and its attributes $q_j$. $j$ is a vector that represents pro poor agro enterprises . It is noted that on the ground, households participate in more than one pro poor agro enterprises to averse food shortages, hunger and malnutrition.

The utility (level of food and income secure) $(U_{ij})$ that an individual $i$ derives from participating in strategy $j$, from a set $(C)$ of pro poor agribusiness interventions can be described as:

$$U_{ij} = V_{ij}(q, Z, \emptyset) + \psi_{ij} \qquad [1]$$

In expression 1, $q$ is a vector of attributes of each pro poor agro enterprices$j\ (j = 1,2,3, \dots J)$ as participated by an individual $i$ $Z$ is a vector of household specific characteristics. $\psi_{ij}$ is the error term and $\emptyset$ is described as a vector of unknown parameters. An individual $i$ jointly participate in pro poor agro enterprise $j$ from a set of various pro poor agro enterprises . A pro poor agro enterprise is assumed to be participated in from an overall set of pro poor agro

enterprises only if the expected utility $(U_j)$ is greater than the actual utility $(U_i)$ of all other bundle of pro poor agro enterprises $(C)$.

In most participation or choice models, the random components of the utilities are assumed to be independent and identically distribution (IID) with a type I extreme value distribution and this assumption results into a MNL model. The MNL model has a simple and elegant closed form mathematical structure, making it easy to estimate and interpret. It is also saddled with independence of irrelevant alternatives' (IIA) property at the individual level (Ben-Akira & Leman, 1985). Hence, the multinomial logit imposes the restriction and its IIA assumption cannot capture the interactive participation that households make on the ground (Stopher et al., 1981; McFadden, 1980). The IIA assumption is relaxed by removing the IIA on the random components of the utilities. In this paper, the IIA is removed by allowing the random component to correlate while maintaining the identically distributed assumption (Daly and Zachary, 1979). The probability density and the cumulative distribution functions of the random component for the $j$ th alternative is illustrated as:

$$F_i(.) = \int_{\psi_i=0}^{\psi_i=N} f(\psi_i)\delta\psi_i = e^{-e^{-\psi_i/\theta_i}} \quad [2]$$

where $F_i(.)$ is the probability density function. Indeed, households participate in an alternative that gives the highest utility over the other alternatives. However, in practice, households participate in more than one alternatives/pro poor agro enterprises . Mathematically, participation or choice probabilities can be presented as follows:

$$P_i = Prob(U_i > U_j), \text{ for all } j \neq i, j \in C$$
$$= \int_{\psi_i=-\infty}^{\psi_i=\infty} \Pi_{j=i, j\in C} \Lambda\left[\frac{(U_i > U_j)}{\theta_j}\right] \frac{1}{\theta_i} \lambda\left(\psi_i/\theta_i\right) \delta\psi_i \quad [3]$$

$\lambda(.)\ and\ \Lambda(.)$ are the probability density and cumulative distribution functions, respectively which are functions of the standard type I extreme value distribution and can be specified as:

$$\lambda(.) = e^{-t}e^{-e^{-t}} \text{ and } \Lambda(.) = e^{-e^{-t}} \quad [4 \& 5]$$

The random component has the density function $f(\psi_{in}) = f(\psi_{i1}, \psi_{i2}, \psi_{i3}, .. \psi_{iJ})$.
The participation probability of alternative strategy $j$ can also be specified as:

$$P_i = \int_{\psi_i=-\infty}^{\psi_i=\infty} \prod_{j\neq i, j\in C} \Lambda\left[\frac{V_i - V_j + \psi_i}{\theta_j}\right] \lambda(w)dw \quad [6]$$

If the participation probability, given in equation [6], adds up to one over all alternative pro poor agro enterprises , then the variance of all pro poor agro enterprises equals 1 and the probability of equation [6] collapse to a multinomial logit model. On the other hand, there are a number of models such as Nested Logit,

Random Parametric Logit and Multivariate or Conditioned Multivariate Analysis which assume heteroskedasticity for the random component.

However, the main drawback is that multivariate normal integrals must be evaluated to estimate the unknown parameters. Such models are estimated using a maximum likelihood estimator (McFadden, 1978). According to Bhat (1995), the generalized models allow the utility of alternatives to differ in the amount of stochasticity and are flexible to allow differential cross elasticities. A small change in utility of various pro poor agro enterprises can be illustrated as:

$$\frac{\partial P_i}{\partial V_j} = \int_{w=-\infty}^{w=+\infty} -\frac{1}{\theta_j} exp\left[\frac{V_i - V_j + \theta_{iw}}{\theta_j}\right] \prod_{j \neq i, j \in C} \Lambda\left[\frac{V_i - V_j + \theta_{iw}}{\theta_j}\right] \lambda(w) dw \quad [7]$$

The cross elasticity for alternative $j$ with respect to a change in the $ith$ alternative can be obtained as follows:

$$\eta_{V_j}^{P_i} = \left[\frac{\frac{\partial P_i}{\partial V_j}}{P_i}\right] * \beta * V_j(.) \quad [8]$$

where $\beta$ is the vector of unknown parameters. The corresponding own elasticity for alternative $i$ with respect to a change in $V_i$ can also be illustrated as follows:

$$\eta_{V_i}^{P_i} = \left[\frac{\frac{\partial P_i}{\partial V_i}}{P_i}\right] * \beta * V_i(.) \quad [9]$$

The model in equation [1] is associated with the following log likelihood function:

$$\mathcal{L} = \sum_{n=1}^{n=N} \sum_{i \in C_n} y_{ni} \log \left\{\int_{w=-\infty}^{w=+\infty} \prod_{j \neq i, j \in C_n} \Lambda\left[\frac{V_{ni} - V_{nj} + \psi_{ni}}{\theta_j}\right] \lambda(w) dw\right\} \quad [10]$$

A theoretical framework discussed beforehand derives a participation model empirical framework for this paper. Attributes of various pro poor agro enterprises are assumed to have influence over the participation made by households. In this paper, a multivariate analysis is chosen because it accommodates both correlations and heteroskedasticity that may exist in the model (Train, 2002 and Greene, 2003). The Conditioned Multivariate Analysis works quite well where we cannot specify the tree for the nested model.
In addition, the model does not lose the characteristics of the random utility structures of

$$U_i = V_i(q, Z) + \psi_i \quad [11]$$

According to Greene (2003), the CMA model relaxes equal variance notion as follows:

$$[Var\psi_{ij}] = \sigma_i = 1.0 \quad [12]$$

In this paper, Conditioned Multivariate Analysis is generally specified as follows:

$$y_{ij} = \varphi Z_i + \xi q_j + \psi_{ij} \quad [13]$$

where $y_{ij}$=1 if individual $i$ participate ins adaptation alternative $j$ and $y_{ij} = 0$ if otherwise. It should be known that $y_{ij}$ takes on a multiple adaptation participation that households $i$ adapt, $Z_i, q_j$ and $\psi_{ij}$ are household characteristics, adaptation attributes and error term, respectively. $\xi$ and $\phi$ are unknown parameters (Greene, 2003). Since we cannot observe attributes of each pro poor agro enterprises as researchers, we specify our Conditioned Multivariate equation to take the following form:

$$\Pr(y_i = 1/Z) = \Phi(\varphi Z) = \varphi Z_i + \psi_i \quad [14]$$

where $y_{ij}, Z_i, q_j$ and $\psi_{ij}$ are denoted as pro poor agro enterprises chosen by a household, vector of household characteristics, error term and unknown parameter, respectively. $\Phi(.)$ is the cumulative distribution function of the standard normal distribution. The unknown parameters have the following asymptotic distribution:

$$n^{1/2}(\hat{\varphi} - \varphi) \xrightarrow{d} N\left(0, \left(E\left[\frac{\varphi^2(Z'\varphi)}{\Phi(Z'\varphi)(1-\Phi(Z'\varphi))} ZZ'\right]\right)^{-1}\right) \quad [15]$$

Equation 14 can be cast in a joint log likelihood function as follows:

$$\ln L(\varphi) = \sum\left(y_i \ln \Phi(\varphi Z) + (1 - y_i) \ln\left(1 - \Phi(\varphi Z)\right)\right) \quad [16]$$

### 3.2 Contribution of pro poor agro enterprises on household wellbeing

### Theoretical and Empirical Frameworks

Pro poor programs tackle risk, vulnerability and wellbeing (food and income) in several ways. First, they directly protect consumption, enabling households to better cope with both shocks and chronic poverty. In addition, they mitigate the worst downside consequences of high-risk investments, promoting more productive activities. Pro poor programs support investments in health, nutrition and education that help to break the inter-generational transmission of poverty (Michael, 2009). In this paper, household food and income security is a situation where all household members have adequate income or food that can be consumed throughout the year.

In Malawi, households are considered food secure if each household member has at least 275 kg of food or a minimum of Mk16, 000 per year (GoM, 2008). Firstly, it assumes that 275 kg per year person of the food crop produced is a threshold. In terms of income, it assumes an internationally agreed threshold of US$ 1.5 per day consumption per individual. Any household that has more or equal to 275 kg per person per year is food secure and not otherwise. This threshold assumption allows us to adopt a censored data-modelling criterion.

One of the censoring regressions is a Tobit model which illustrates the relationship between non negative variable $Q_{ih}$ and independent variables $H_{ih}$. This model assumes that there is a latent dependent variable. Mathematically, a latent model can be simplified as follows:

$$Q_i = f(H_i, M_i) + \kappa_i \quad [17]$$

where $\mathrm{Q_i}$ is the total food or income availability at household level. $\mathrm{Q_i}$is equal to zero if the household has total food (income) available of less than 275 kg (Mk16, 000) per person per year. $\mathrm{Q_i}$ equals the actual total food (income) available amount if the household has food of more than or equal to 275 kg (Mk16, 000) per person per year. $\mathrm{H_i}$ and $\mathrm{M_i}$ are vectors of household specific characteristics and adaptation strategies. $M_i = 1$ if the household adapt to changes in climate and $M_i = 0$ if otherwise. $\mathrm{k_i}$ is a vector of non observable characteristics. Since equation [25] censors some data, it is called a Tobit model. A Tobit Model has the characteristics of assessing the contribution of pro poor agro enterprises on food and income security. In other words, each person at household level is food and income secure if they have at least (T) 275kg per year. $\mathrm{Q_i}$ is a censored dependent variable that is presented as follows:

$$\mathrm{E[Q_i/(H)]} = \Phi(\Delta)\mathrm{T} + \big(1 - \Phi(\Delta)\big)\big(\Delta\mathrm{H} + \sigma\lambda(\varrho)\big) \quad [18]$$

where $\varrho = \frac{(\mathrm{T}-\Delta\mathrm{H})}{\sigma}, \lambda(\varrho) = \frac{\phi(\Delta\mathrm{H})}{(1-\Phi(\Delta\mathrm{H}))}$. $\Phi(.)$ and$\phi(.)$ are standard normal distribution and density functions, respectively (Greene, 2003). T is a vector for 275kg (Mk16, 000) per person per years. $\lambda(\varrho) = \frac{\phi(\Delta\mathrm{H})}{(1-\Phi(\Delta\mathrm{H}))}$is called an inverse mills ratio. A Mill ratio indicates how one unit change in exogenous variables alters the latent dependent variable. Marginal effects of a tobit model is represented as follows:

$$\frac{\delta\mathrm{E}[\mathrm{Q_i}^*/\mathrm{H}]}{\delta\mathrm{H}} = \Delta\Phi((\Delta\mathrm{H} - \mathrm{T})/\sigma) = \Delta\left\{1 - \lambda(\varrho)\left[\frac{\Delta\mathrm{H}}{\sigma}\right] + \lambda(\Delta\varrho)\right\} = \Delta \quad [19]$$

where T is a censoring point that has a numeraire of 275kg (Mk16,000) /person/year. For censored data, the marginal effects are as follows:

$$\frac{\delta\mathrm{E}(\mathrm{Q_i})}{\delta\mathrm{H}} = \Phi\big({}^{\Delta\mathrm{H}}/_{\sigma}\big)\Delta \quad [20]$$

Furthermore, we derive the log likelihood expression for the censored regression model as:

$$\ln\mathrm{L} = -\tfrac{1}{2}\textstyle\sum_{\geq 275\mathrm{kg}}(\ln(2\pi)) + \ln(\sigma^2) + \left(\left(\mathrm{Q_{i_i}} - \Delta\mathrm{H}\right)^2/\sigma^2\right) + \sum_{<275kg}\ln\big(1 - \Phi(\Delta\mathrm{H}/\sigma)\big) \quad [21]$$

Where $\sum(.)$is a sum over the non censored and censored observations. From the theory above, we derive and illustrate our empirical model as follows:

$$Q_i = \Delta H_i + \zeta M_i + \kappa_i \quad [22]$$

where $\Delta$ and $\zeta$ are vectors of unknown parameters. Other variables are as described above in equation 26. Our censored Tobit model considers two categories. Firstly, there is information on both independent variables and dependent variable. Secondly, it has limited information on dependent variable and is specified as follows:

$$Q_i(x) = \begin{cases} 0, \ Q_i^* = Q_i = \Delta H_i + \zeta M_i + k_i < 275\ kg\ (T) \\ \text{actual \#}, \ Q_i^* = Q_i = \Delta H_i + \zeta M_i + k_i \geq 275\text{kg (T)} \end{cases} \quad [23]$$

Where $Q_i^*$ is equal to zero [0] if food (or income) available at the house is less that 275kg (or Mk16, 000) /person/year. On the other hand, $Q_i^*$is equal to the actual food (income) quantity if food is at least 275 kg (Mk16, 000) /person/year. In other words, expression [23] can be illustrated as follows:

$$P(\text{censored}) = P(Q_i^* < T) = \Phi\left(\frac{T-\Delta H}{\sigma}\right) = 1 - \Phi\left(\frac{\Delta H - T}{\sigma}\right) \quad [24]$$

$$P(\text{uncensored}) = 1 - \Phi\left(\frac{T-\Delta H}{\sigma}\right) = \Phi\left(\frac{\Delta H - T}{\sigma}\right) \quad [25]$$

The log likelihood function for the censored normal distribution can be rewritten as follows:

$$L = \prod_i^N \left[\frac{1}{\sigma}\phi\left(\frac{Q_i - \Delta H}{\sigma}\right)\right]^{d_i} \left[1 - \Phi\left(\frac{\Delta H - T}{\sigma}\right)\right]^{1-d_i} \quad [26]$$

It can also be extended as:

$$\ln L = \sum_{i=1}^N \left\{d_i\left(-\ln\sigma + \ln\phi\left(\frac{Q_i - \Delta H_I}{\sigma}\right)\right) + (1-d_I)\ln\left(1 - \Phi\left(\frac{\Delta H_i}{\sigma}\right)\right)\right\} \quad [27]$$

Equation 36 is made of two components. The first correspond is a classical regression for the uncensored observations. The second part corresponds to relevant probabilities that an observation (food or income availability) is censored on.

## 3.0 Results and Discussion

### 3.1.1 Descriptive Statistics

This paper asks a question whether benefits from pro-poor agro enterprises could be automatically harvested. In order to answer the question, the paper assesses the effects of socioeconomic characteristics on pro-poor intervention participations. It is widely discussed that household characteristics such as education and gender of the household head are vital and influence the level of understanding and application of poverty reduction strategies (Edris, 2003; Pangapanga, 2011). For instance, Gueye & Gauci, 2003 argued that education in particular, has been increasingly recognized as a key element in the reduction of poverty whether it is defined in terms of potential provision of income earning assets or production of public goods. Pro poor growth cannot be measured by economic results alone, it must also result in improved social conditions for the poor. The endowment of educational assets renders poor people more equipped and capable participation in modern economies.

In the case of Malawi, it is shown that on average 60% of the households in low and highland of Malawi have attended primary school. In terms of gender, about 41 % and 47 % of the households in both low and highland areas of Malawi district are headed by female heads, respectively. Conversely, male heads about 59% and 53% of the lowland and highland households. The mean age of household head in Malawi is 38, i.e most household heads are still in their economic active age group.

Furthermore, Table 1 shows most households in Malawi district have five members that is among low and highland areas. The paper average household size is in line with NSO (2008) report that household members in Malawi are five. Additionally, the results revealed that low and highland areas have 1.7 acres (0.69 ha) and 1.4 acres (0.57 ha), respectively. The mean value of household annual income for lowland households is MK 46,202 (US $ 308) and highland households have MK45, 466 (US$ 303). This qualifies what literature says that most households in rural areas in Malawi live below a poverty line of US$ 1.5 a day.

### 3.1.2 Pro poor agro enterprises

Pro poor programs such as social safety nets are emerging in many developing countries as a lead social protection initiative tackling poverty. Importantly, increasing evidence is suggesting that such programs (i.e. social cash transfers) can contribute to pro-poor growth by providing an effective risk management tool by empowering poor households to lift themselves out of poverty (Michael, 2009).Households have participated in a number of pro poor agro enterprises to improve their food and income security needs. Seventy two percent (72 %) and 66% of low and highland households received and grow free improved varieties, respectively (Appendix B). A focus group discussion reported that households have received for free improved varieties such as DK5083, locally known as *kanyani* (for maize) and *kapire* (for millets). Pig rearing is practised by 32% of the lowland and 9% of the highland households. Thirty two (32%) percent of the lowland and 15% of highland households engaged in rural bakery enterprise.

Furthermore, a substantial ($p < 0.05$) disparity over mushroom farming is depicted between lowland and highland household (see Appendix B). The paper results depict that 84% of the lowland households participated in mushroom farming whereas only 47% of the highland households engaged in a similar enterprise. Chicken (layer) rearing is statistically different between low and highland areas ($p < 0.05$). Chicken (layer) rearing is practised by 69% of the highland and only 9% of the lowland households as a source of income to purchase food during food shortages (see Appendix B).

### 3.1.3 Other social safety nets/pro poor actions in Malawi

Social safety nets are non-contributory transfer programs seeking to prevent the poor or those vulnerable to shocks and poverty from falling below a certain poverty level. In Malawi, the most vulnerable include the elderly, the chronically sick, orphans and other vulnerable children, persons with disabilities, and destitute families. These categories of people are vulnerable to risk and lack resilience. In order to bell them out of poverty, a number of assistance have been initiated to engage vulnerable people in higher economic return activities.

Some of the benefited social safety nets include food-based, cash and education based safety net programs. They differ from other safety net programs in that they are tied to the provision of food, either directly or through cash-like instruments that may be used to purchase food. In general, it is revealed that 15 percent of the population in Malawi benefit from school feeding programme. By gender of household heads, a slight higher proportion of female headed households (16%) benefits from school feeding programmes than male headed households (15%). By education related safety nets, 3% of the population in Malawi benefits from bursary for secondary schools, 4 percent benefits from scholarship for high education and 2% benefited from tertiary loan scheme.

### 3.1.4 Duration of benefiting some of the social safety nets

Given the negative effect of poverty on growth, the focus shifted to the design of targeted anti-poverty interventions in the form of 'social safety nets' that tackle poverty (Gueye& Gauci, 2003). The objective of this strategy was to reach those groups that remain marginalized by the process of growth. But the debatable question is by how long the poor will benefit from such interventions. This paper therefore assesses duration of which households benefit from such pro poor interventions. It is found that the longest time that people have benefited from safety nets such as school feeding programme in Malawi is on average 8 months, followed by 4 months of benefiting from school bursaries. Furthermore, people that benefit from free maize seeds do so for 3 months only (see Appendix B).

## 3.2 Empirical Estimations

### 3.2.1 Factors that influence households' participation in pro poor agro enterprises

The paper examines factors that influence household participation in various pro poor agro enterprises. Household characteristics, climatic variables and extreme events are modelled to assess whether they have influence on household participation in pro poor agro enterprises. A Conditional Multivariate Analysis (CMA) is used to assess factors that influence participation in pro poor agro enterprises among low and

highland areas of Malawi. The presence of heteroskedasticity is remedied by application of CMA (Greene, 2003). Results from a CMA are as discussed below and presented in Appendix A. Log likelihood $\chi^2$ showed that the multivariate model had strong goodness of fit on assessing household participation in pro poor agro enterprises in Malawi.

The paper found that household characteristics such as education and age have significant influence on low and highland household participation in agribusiness farming where households receive and grow improved varieties for businesses (see Appendix A). Statistically, education increased the prospect of participation in improved crop varieties programmes (free seeds) by 89% in lowland area. Age of the household head increased the likelihood of participating in free seed programme by 61% in lowland area while reduced similar likelihood by 6% in highland areas. Similarly, pig rearing was found to be influenced ($p < 0.05$) by factors such as education, age and water availability. Statistically, the paper found that water availability enhanced the likelihood of engaging in pig rearing program by 2% and 5% in low and highland areas (see Appendix A).

Furthermore, prospect of participation in rural bakery program was also influenced by factors such as age, education, income, rainfall, droughts and floods at 5% significant level. Gender of the household head enhanced the prospect of practising rural bakery by 79% and 38% in low and highland areas, respectively. Households have practise mushroom farming to complement rain fed agriculture harvests. In this paper, it is revealed that labour, age and rainfall have significant influence on household participation of mushroom farming at 5% significant level (see Appendix A). Labour increased the prospect of engaging in mushroom farming by 19% and 76% in low and highland areas, respectively. Age of the household head enhanced the likelihood of engaging in mushroom farming by 1.3% and 5.04% in low and highland areas, respectively. Households have also participated in chicken (layer) rearing programs. The paper found that household engagement in rearing chicken (layers) is influenced by factors such as age, rainfall and temperature.

### 4.2.3 Contributions of pro poor agro enterprises on household food security

The study analyzed the contribution of pro poor agro based enterprises (PPAE) on household food and income security. Contributions of PPAE on household food and income security are captured through application of a normalized Tobit model (Appendix C-Table 4). A tobit model shows strong and goodness of fit to capture the food and income security scenario at household level as indicated by the $\chi^2$. From Table 8, area of crop field positively affected household food and income security by 33%. Land increased food availability/year/ person by 9% and 4% in low and highland areas. The study found that factors such as education and sex did not have substantial effect on household food and income security in both areas at any significant level.

In this study, mushroom farming (MFP), pig rearing (PRP) and chicken/layer rearing (CRP), cassava four processing (CFPP), and rural bakery (RBP) programmes significantly influence household food and income security in both areas. MFP improved food availability/income by 24% and 19% in low and highland areas,

respectively. PRP enhanced food availability (income) by 26% and 5% in low and highland areas, respectively. Likewise, it is indicated that CRP boosted food availability by 24% and 20% in low and highland areas, respectively. On the other hand, RBP reduced household food and income security by 21% and 10.4% in low and highland areas, respectively. CFPP negatively affected food and income security. FDGs reported that CFPP may not automatically translate into more food due to time lag involved in farming cassava.

It is reported through a focus group discussion that households simultaneously participate in various PPAE to cushion themselves from food insecurity. From Table 4, the study findings depicted that combination of MFP with FDIVP increased food availability by 20% and 7% in low and highland areas, respectively. On the other hand, Mixture of CRP with MFP and FDIVP reduced food availability by 72% and 16% in low and highland areas, respectively. A focus group discussion reported that combination of some PPAE (such as simultaneous implementation of MFP and CRP) resulted into reduced food availability because of resource diversion between these two agro-enterprises.

## 4.0 Conclusion and Policy Implications

This paper has analysed household participation in pro poor pro poor agro enterprises. A conditioned multivariate analysis (CMA) was applied on data from 1000 households from low and highland areas of Malawi. In order to be food secure, households participate in various pro poor agro enterprises such as mushroom farming, cassava flour processing, pig and chicken rearing, rural bakeries, and other social cash transfer programmes. The paper found that gender, education and age of the household head, rainfall and temperature, floods and drought occurrence significantly affect household engagement in pro poor agro enterprises. Based on results from the tobit function, the study concludes that pro poor agro enterprises such as MFP, CRP, CFPP and rural bakery programmes have significant contributions on household food and income security. It however, fundamental to integrate factors that affect household participation in various pro-poor agricultural based interventions. Particularly, gender of the household should be sensitively incorporated in pro-poor agribusiness interventions to move marginalized women headed households out the dire food and income insecurity.

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## Appendixes

### Appendix A: Conditioned Multivariate Results.

| | Free Seeds | | Pig Farming | | Rearing | | Bakery | | Mushroom farming | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | Low | High | Low | High |
| | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx |
| Education (Yrs) | 0.898* | 0.749 | 0.54** | 0.828 | 0.876* | 0.191 | 0.725* | 0.992 | 0.339 | 0.996 |
| Land (acre) | -0.092 | -0.493 | -0.139 | -0.151 | 0.17 | -0.486 | 0.072 | -0.46 | 0.47** | 0.682 |
| Labour(manday | 0.011 | -0.138 | -0.061 | -0.271 | 0.093 | 0.399 | -0.103 | 0.037 | 0.18** | 0.759* |
| Gender | 0.534 | 0.521 | 0.716 | 1.059 | 0.094 | 0.91** | 0.79** | 0.375 | 0.80** | 0.691 |
| Income (MK) | -0.216 | 0.86** | -0.003 | -0.647 | 0.352* | 0.182** | 0.232 | 0.001 | -0.012 | -0.881 |
| Age (Yrs) | 0.609* | -0.865 | 0.524* | 0.044* | 0.43** | 0.977 | 0.286 | -0.21 | 0.250* | 0.049* |
| Extension | -0.974 | 0.723 | -0.914 | 0.075 | -0.464 | 0.08* | -0.449 | 0.013 | -0.876 | 0.047 |
| Rainfall | -0.386 | 0.791* | 0.054* | 0.194* | 0.00** | 0.825** | -0.415 | 0.73* | 0.018** | 0.93* |
| Temperature | -0.197 | -1.175 | 0.174 | -0.457 | 0.384 | 0.16* | 0.204 | -0.44 | 0.221 | -0.543 |
| Pest | 0.499* | 0.1598* | 0.362 | 0.1594 | 0.656* | 0.685 | -0.168 | 0.49* | 0.468 | 0.1608* |
| Drought | 0.26** | 0.2229* | 0.830* | 0.1358* | 0.433 | 0.3172* | 0.37** | -0.20 | 0.562* | -0.987 |
| Floods | 0.246 | 0.3412* | -0.527 | 0.2174* | 0.433 | 0.3172* | -0.8** | 0.38* | -0.178 | 0.32* |

| | Lowld | Highlnd | Base outcome: Information on pro poor business |
|---|---|---|---|
| LR | -279.8 | -108.97 | |
| Chi-s | 90.72* | 12.63* | |

### Appendix B: Descriptive Statistics

TABLE 1: HOUSEHOLD CHARACTERISTICS

| Variable | | Lowlands (500) | | Highlands (500) | | |
|---|---|---|---|---|---|---|
| | | Mean | Std. E. | Mean | Std. E. | t-test |
| Gender | Female | 41 | 0.035 | 47 | 0.053 | *1.019* |
| | Male | 59 | 0.035 | 53 | 0.053 | |
| Household head Age | | 39.29 | 0.997 | 34.66 | 1.426 | *1.315* |
| Family Size | | 5.902 | 0.190 | 5.269 | 0.245 | *0.971* |
| Labour (People>15yrs) | | 3.073 | 0.120 | 3.136 | 0.182 | *-0.294* |
| HHD Education | | 3.784 | 0.260 | 4.652 | 0.382 | *-1.483* |
| Educ. levels | None (%) | 28.35 | | 22.47 | | |
| | Prim (%) | 58.25 | | 62.92 | | |
| | Second(%) | 12.37 | | 13.48 | | |
| | Terti(%) | 01.03 | | 01.12 | | |
| Total Land (acres) | | 1.703 | 0.069 | 1.429 | 0.098 | *1.122* |

Table 2: Duration of benefiting from social safety nets

| Safety nets programs | Male | Female | Total |
|---|---|---|---|
| Free maize seeds | 2.8 | 2.8 | 2.8 |
| Free food | 2.6 | 2.9 | 2.7 |

| | | | |
|---|---|---|---|
| Food for work | 1.7 | 1.5 | 1.6 |
| Input for work | 2.3 | 1.2 | 1.9 |
| School feeding | 7.8 | 7.5 | 7.7 |
| School bursaries | 4.2 | 3.6 | 4.1 |

NSO-2010-2011 MIHS data

TABLE 3-HOUSEHOLDS AND PRO POOR AGRO ENTERPRISES

| Pro poor agro enterprises | Lowland (500) | | Highland (500) | | |
|---|---|---|---|---|---|
| | % | Sd. E. | % | Std.E. | t.test |
| FDIVP(Free Seeds) | 72 | 0.032 | 70 | 0.027 | *1.002* |
| PFP(Pig farming) | 32 | 0.035 | 09 | 0.031 | *4.26** |
| RBP(Bakery) | 32 | 0.035 | 15 | 0.038 | *3.10** |
| MFP(Mushroom) | 84 | 0.027 | 47 | 0.053 | *6.79** |
| CRP(Chicken | 09 | 0.020 | 69 | 0.050 | *-13.2** |
| CFPP(Information) | 87 | 0.025 | 06 | 0.025 | *20.3** |

*,significant at 1%

Appendix C: Contribution of pro-poor agro enterprises on household food and income security

TABLE 4: NORMALIZED TOBIT REGRESSION ESTIMATES

| | Lowland | | Highland | |
|---|---|---|---|---|
| | dy/dx | Std. E. | dy/dx | Std. E. |
| HHD_Gender | 0.136 | 0.356 | 0.042 | 0.551 |
| HHD_Education | 0.227 | 0.214 | 0.159 | 0.376 |
| HHD_Labour | 0.008 | 0.118 | 0.035 | 0.173 |
| Land holding size | 0.078* | 0.020 | 0.042** | 0.027 |
| CRP | 0.239* | 0.033 | 0.198* | 0.028 |
| MFP | 0.242* | 0.090 | 0.185* | 0.082 |
| RBP | 0.206* | 0.102 | 0.104 | 0.084 |
| FDIVP | 0.235* | 0.187 | 0.047 | 0.084 |
| PFP | 0.264* | 0.083 | 0.052 | 0.059 |
| CFPP | 0.479* | 0.185 | 0.151* | 0.073 |
| MFP*RBP | 0.213 | 0.110 | 0.123 | 0.105 |
| FDIVP*MFP | 0.204* | 0.137 | 0.007 | 0.119 |
| MFP*CFPP | -0.209 | 0.213 | -0.40** | 0.255 |
| FDIVP*PFP | 0.487* | 0.195 | 0.033 | 0.124 |
| FDIVP*MFP*PFP | -0.716* | 0.220 | -0.158* | 0.028 |
| Area(Highland=1) | | | | |
| $LR$ | -1213.23 | | -570.06 | |
| $\chi^2$ | 27.45* | | 17.78* | |

*;** siginificant at 1% and 5%.